

**Burroughs Corporation**  
TERMINAL SYSTEMS GROUP  
PLAINFIELD, NEW JERSEY 07061 U.S. AMERICA



SHEET

OF

DWG NO.

1691 6256

REV

CLASS CODE

TITLE

ENGINEERING SPECIFICATION:  
TD730/830 SERIES TERMINALS

RELEASE  
DATE

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LTR	REVISION
-----	----------

TABLE OF CONTENTS

1. SCOPE .....	7
1.1 GENERAL .....	7
1.2 BASIC CAPABILITIES .....	7
1.3 OPTIONAL CAPABILITIES .....	10
2. APPLICABLE DOCUMENTS .....	11
2.1 EXTERNAL DOCUMENTS .....	11
2.1.1 Product Safety .....	12
2.1.2 UL Approval .....	12
2.1.3 CSA Approval .....	12
2.1.4 BPO Approval .....	12
2.1.5 VDE Compliance .....	12
2.1.6 Other Standards .....	12
2.2 BURROUGHS CORPORATION DOCUMENTS .....	13
2.3 NEW DOCUMENTATION .....	13
2.3.1 Terminal Support .....	13
2.3.2 System Configurator .....	14
2.3.3. Unit Test Plan .....	14
2.3.4 Acceptance Test Procedure .....	14
2.4 ORDER OF PRECEDENCE .....	14
3. PHYSICAL DESIGN CHARACTERISTICS .....	15
3.1 GENERAL PHYSICAL CHARACTERISTICS .....	15
3.1.1 Maximum Characters .....	15
3.1.2 Compatibility With Other Terminal Families .....	15
3.1.3 Packaging .....	15
3.1.4 Marking .....	15
3.1.5 Component Standardization .....	15
3.1.6 Cooling .....	15
3.2 SPECIFIC PHYSICAL CHARACTERISTICS .....	18
3.2.1 TD730 Display Unit .....	18
3.2.1.1 Dimensions and Weight .....	18
3.2.1.2 Controls and Alarm .....	18
3.2.1.3 Display Subsystem .....	19
3.2.1.4 Display Panel Assembly .....	21
3.2.2 TD830 Display Unit .....	23
3.2.2.1 Dimensions and Weight .....	23
3.2.2.2 Controls and Alarm .....	23
3.2.2.3 Display Subsystem .....	24
3.2.2.4 Display Monitor .....	28
3.2.3 Microprocessor .....	30
3.2.4 TD730/830 Memory .....	30
3.2.4.1 ROM/PROM Memory .....	30
3.2.4.2 RAM Memory .....	30
3.2.4.3 Memory Page .....	31
3.2.5 Power Supply .....	33
3.2.6 Communications Interface .....	33
3.2.6.1 Terminal Interface .....	33
3.2.6.2 Electrical Interface Circuits .....	34
3.2.6.3 Concatenation Connection .....	37
3.2.6.4 Interface Data Rates and Data Sets .....	38
3.2.6.5 Options to RS232 and CCITT Interfaces .....	40
3.2.6.6 Modem Expanders .....	41

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LTR	REVISION
-----	----------

TABLE OF CONTENTS (CONT)

3.2.6.7	Two-Wire Direct Interface (TDI) Communications .....	41
3.2.6.8	Burroughs Direct Interface (BDI) .....	43
3.2.7	Standard Keyboard Unit .....	43
3.2.7.1	Keyboard Unit Characteristics .....	44
3.2.7.2	Auxiliary Numeric Keypad .....	45
3.2.7.3	Keyboards for International Use .....	45
3.2.7.4	Alphanumeric Typewriter Keyboard .....	45
3.2.7.5	Optional Terminal with No Keyboard .....	45
3.2.7.6	Security Lock (Option, Factory Installed) .....	45
3.2.7.7	Automatic Key Repeat .....	45
3.2.8	Configuration Control .....	46
3.2.8.1	Configuration Options .....	46
3.2.8.2	Field Engineer Initiated Configuration Changes .....	47
3.2.8.3	Remote Controller Initiated Configuration Changes .....	48
3.2.9	Status Line .....	48
3.2.9.1	Page Number .....	48
3.2.9.2	Special Messages .....	49
3.2.9.3	Error Conditions .....	49
4.	FUNCTIONAL DESIGN CHARACTERISTICS .....	50
4.1	GENERAL FUNCTIONAL CHARACTERISTICS .....	50
4.1.1	MPU Board .....	51
4.1.2	Display Board .....	51
4.1.3	Interface Board .....	52
4.2	SPECIFIC FUNCTIONAL CHARACTERISTICS .....	53
4.2.1	Format Functions .....	53
4.2.1.1	Form .....	53
4.2.1.2	Search Mode .....	55
4.2.1.3	Tabulation .....	55
4.2.1.4	Programmable Cursor Position .....	56
4.2.1.5	Page Roll Up/Down .....	56
4.2.1.6	Display Scroll Up/Down .....	56
4.2.1.7	Variable End of Page Alarm .....	57
4.2.1.8	Wrap-Around Inhibit .....	57
4.2.2	Edit Functions .....	57
4.2.2.1	Character Insert by Line or Page .....	57
4.2.2.2	Character Delete by Line or Page .....	57
4.2.2.3	Line Insert/Delete .....	58
4.2.2.4	Clear to End of Line/Page .....	58
4.2.2.5	Line Movement Up/Down .....	58
4.2.2.6	Lower Case Lockout .....	58
4.2.3	Standard Keyboard Unit .....	59
4.2.3.1	Keyboard Unit Controls and Indicators .....	59
4.2.3.2	Keyboard Function Keys and Definitions .....	61
4.2.3.3	Keyboard CTRL Sequences .....	64
4.2.4	Terminal Control Characters .....	67
4.2.5	Software Control (ESC) Sequences .....	70
4.2.6	Communications .....	73
4.2.6.1	Modes of Operation .....	73
4.2.6.2	Communications Control Characters .....	74
4.2.6.3	Illegal Characters .....	76
4.2.6.4	Data Transmission Features .....	76





SHEET NO. 174	DWG. NO. 1691 6256	REV A
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LTR	REVISION
-----	----------

TABLE OF CONTENTS (CONT)

4.2.7	Communications Procedures .....	77
4.2.7.1	Multipoint Communications Procedures (1284 9006) .....	77
4.2.7.2	Point-to-Point Communications Procedures (1284 9006) .....	94
4.2.7.3	Options to Communications Procedures .....	98
4.2.8	Look-Alike Procedure .....	99
4.2.8.1	Bisynchronous (BSC) Multipoint Procedure (IBM 3270 Look-Alike) .....	99
4.2.9	Point-to-point Procedures for Operator Display Terminal (ODT) .....	108
4.2.9.1	Read Message (Poll) .....	108
4.2.9.2	Write Message (Select) .....	108
4.2.9.3	Configuration .....	108
4.2.9.4	Optional ODT Communications Procedure .....	108
5.	OPTIONAL PERIPHERAL INTERFACES TO THE TD730/830 TERMINAL .....	111
5.1	GENERAL .....	111
5.2	MAGNETIC TAPE CASSETTE INTERFACE .....	111
5.2.1	Dedicated and Shared Operation .....	111
5.2.2	Interface Operation .....	113
5.2.2.1	Message Formatting .....	113
5.2.3	Character Formatting .....	115
5.2.3.1	Error Detection .....	115
5.2.4	Cabling .....	116
5.3	MAGNETIC CARD READER INTERFACE .....	116
5.4	AUXILIARY PRINTERS .....	116
5.4.1	20/60 mA Printer Interface .....	116
5.4.2	A9249 (ODEC) Printer Interface .....	117
5.4.2.1	Shared Operation .....	117
5.4.2.2	Message Formatting .....	117
5.4.2.3	A9249 Printer Cabling .....	118
5.4.3	TC 4000 RO Auxiliary Printer Interface .....	119
5.5	OPTIONAL KEYBOARD .....	123
5.5.1	Specification .....	123
5.5.2	Keyboard Layout .....	123
6.	ENVIRONMENTAL CHARACTERISTICS .....	125
6.1	TEMPERATURE AND HUMIDITY RANGE .....	125
6.1.1	Operating Environments .....	125
6.1.2	Non-Operating Environments .....	125
6.2	BAROMETRIC PRESSURE RANGE .....	125
6.3	ATMOSPHERIC POLLUTANTS .....	125
6.3.1	Dust (Non-Conductive and Non-Corrosive) .....	125
6.3.2	Corrosion and Rust .....	125
6.4	VIBRATION AND SHOCK .....	125
6.5	RFI REQUIREMENTS .....	127
6.6	ELECTROSTATIC INTERFERENCE PROTECTION .....	127
6.7	ACOUSTICAL NOISE LEVEL .....	127
6.8	RELIABILITY .....	127
6.8.1	Definition of Terms .....	127
6.8.2	General .....	127
6.8.3	Reliability Demonstration Test .....	127
6.8.4	On-Going Quality Assurance .....	127

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LTR	REVISION	DATE	DATE	DATE	DATE	DATE
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**TABLE OF CONTENTS (CONT)**

6.9	MAINTAINABILITY .....	128
6.9.1	General .....	128
6.9.2	Maintenance Philosophy .....	128
6.9.3	Personnel Requirements .....	128
6.9.4	Maintenance Equipment and Tools .....	128
6.9.5	Special Test Equipment .....	128
6.9.6	Preventive Maintenance .....	128
6.9.7	Maintenance Test Routine (MTR) .....	128
6.9.7.1	Areas of Confidence Testing .....	129
6.9.7.2	Peripheral Tests .....	129
6.9.7.3	Resident Character Set Readout .....	130
6.10	TESTING .....	130
6.10.1	Unit Tests .....	130
6.10.2	Acceptance Tests .....	131
6.10.3	Systems Tests .....	131
6.10.4	Field Tests .....	131
6.10.5	Static Electricity Susceptability Test .....	131
6.11	QUALITY ASSURANCE PROVISIONS .....	132
6.11.1	Responsibility for Testing .....	132
6.11.2	Qualification Inspection .....	132
6.11.3	Quality Conformance Inspection .....	132
6.11.4	Rejection and Retest .....	132
6.11.5	Preparation for Delivery .....	132
6.11.6	Evaluation of Shipping Container .....	132
7.	NOTES .....	133
7.1	ILLUSTRATIONS, KEYBOARD .....	133
APPENDIX I.	COMPATIBILITY .....	166
APPENDIX II.	T-SCAN INTERFACE .....	167

**LIST OF FIGURES**

Figure 3-1.	TD730 UNIT AND KEYBOARD .....	16
Figure 3-2.	TD830 UNIT AND KEYBOARD .....	17
Figure 4-1.	FUNCTIONAL LAYOUT .....	50
Figure 5-1.	TYPICAL TERMINAL/CONTROLLER OPERATING CONFIGURATIONS .....	112
Figure 5-2.	A9249 DEDICATED AND SHARED CONNECTION .....	118
Figure 5-3.	TC 4000 RO PRINTER, DEDICATED AND SHARED CONFIGURATIONS .....	119
Figure 5-4.	OPTIONAL KEYBOARD LAYOUT .....	124
Figure 6-1.	TEMPERATURE VS ALTITUDE CHARACTERISTICS OF THE TD730/830 TERMINAL .....	126
Figure 7-1.	CHARACTER CODING, USASCII .....	134
Figure 7-1A	MODIFIED USASCII CHARACTER CODING .....	135
Figure 7-2.	CHARACTER SETS .....	136
Figure 7-3.	U.S. TYPEWRITER KEYBOARD, ASCII .....	137
Figure 7-4.	AUXILIARY NUMERIC KEYPAD .....	138
Figure 7-5.	FRANCE AND BELGIUM TYPEWRITER KEYBOARD .....	139
Figure 7-6.	FRANCE AND BELGIUM TYPEWRITER KEYBOARD (OPTION) .....	140
Figure 7-7.	GERMANY, AUSTRIA, AND SWITZERLAND TYPEWRITER KEYBOARD .....	141
Figure 7-8.	ITALY TYPEWRITER KEYBOARD .....	142
Figure 7-9.	NORWAY AND DENMARK TYPEWRITER KEYBOARD .....	143
Figure 7-10.	PORTUGAL AND BRAZIL TYPEWRITER KEYBOARD .....	144
Figure 7-11.	SOUTH AFRICA TYPEWRITER KEYBOARD .....	145
Figure 7-12.	SPAIN AND LATIN AMERICA TYPEWRITER KEYBOARD .....	146



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LTR	REVISION
-----	----------

LIST OF FIGURES (CONT)

Figure 7-13.	SWEDEN AND FINLAND TYPEWRITER KEYBOARD .....	147
Figure 7-14.	UNITED KINGDOM TYPEWRITER KEYBOARD .....	148
Figure 7-15.	JAPANESE (KATAKANA) CHARACTER SET .....	149
Figure 7-16.	JAPANESE (KATAKANA) KEYBOARD .....	150
Figure 7-17.	LATIN/CYRILLIC (RUSSIAN) CHARACTER SET .....	151
Figure 7-18.	LATIN/CYRILLIC (RUSSIAN) KEYBOARD .....	152
Figure 7-19.	IBM 3270 EBCDIC CHARACTER CODING .....	153
Figure 7-20.	U.S. TYPEWRITER KEYBOARD .....	154
Figure 7-21.	U.S.A. DATA PREPARATION KEYBOARD .....	155
Figure 7-22.	FRANCE AND BELGIUM DATA PREPARATION KEYBOARD .....	156
Figure 7-23.	FRANCE AND BELGIUM DATA PREPARATION KEYBOARD (OPTION) .....	157
Figure 7-24.	GERMANY, AUSTRIA, AND SWITZERLAND DATA PREPARATION KEYBOARD .....	158
Figure 7-25.	ITALY DATA PREPARATION KEYBOARD .....	159
Figure 7-26.	NORWAY AND DENMARK DATA PREPARATION KEYBOARD .....	160
Figure 7-27.	PORTUGAL AND BRAZIL DATA PREPARATION KEYBOARD .....	161
Figure 7-28.	SOUTH AFRICA DATA PREPARATION KEYBOARD .....	162
Figure 7-29.	SPAIN AND LATIN AMERICA DATA PREPARATION KEYBOARD .....	163
Figure 7-30.	SWEDEN AND FINLAND DATA PREPARATION KEYBOARD .....	164
Figure 7-31.	UNITED KINGDOM DATA PREPARATION KEYBOARD .....	165

LIST OF TABLES

Table 1.	TD730 DISPLAY CHARACTERISTICS .....	22
Table 2.	TD830 DISPLAY CHARACTERISTICS .....	29
Table 3.	DISPLAY/MEMORY CHARACTER AND PAGE COMBINATIONS .....	31
Table 4.	CONNECTOR AND PIN ASSIGNMENTS FOR COMMUNICATIONS INTERFACE CIRCUITS .....	34
Table 5.	SEQUENCE OF REQUIRED CIRCUITS .....	36
Table 6.	KEYBOARD CTRL SELECTABLE DOMESTIC DATA RATES .....	40
Table 7.	KEYBOARD CTRL SELECTABLE INTERNATIONAL DATA RATES .....	41
Table 8.	KEYBOARD UNIT CHARACTERISTICS .....	44
Table 9.	KEYBOARD UNIT CONTROLS AND INDICATORS .....	59
Table 10.	KEYBOARD FUNCTION KEYS .....	61
Table 11.	KEYBOARD CTRL SEQUENCES .....	64
Table 12.	CONTROL CHARACTERS .....	67
Table 13.	SOFTWARE CONTROL ESC SEQUENCES .....	70
Table 13a	COMMUNICATIONS CHARACTERS .....	75
Table 14.	POLLING PROCEDURE .....	78
Table 15.	SELECTION PROCEDURE .....	80
Table 16.	FAST SELECT PROCEDURE .....	82
Table 17.	MULTIPOINT CONTENTION MODE .....	84
Table 18.	BROADCAST SELECT .....	86
Table 19.	GROUP SELECT .....	88
Table 20.	GROUP POLLING .....	91
Table 21.	POINT-TO-POINT - SWITCHED PROCEDURE .....	94
Table 22.	POINT-TO-POINT - DEDICATED PROCEDURE .....	96
Table 23.	CHARACTER CONVERSION CHART .....	103
Table 24.	IBM 3270 POLLING PROCEDURE .....	104
Table 25.	IBM 3270 SELECTION PROCEDURE .....	106
Table 26.	READ MESSAGE (POLL) .....	109
Table 27.	WRITE MESSAGE (SELECT) .....	110
Table 28.	TC 4000 RO CONTROL CODES .....	120
Table 29.	TC 4000 RO POSITIONAL/FORMAT CONTROL CODES .....	121

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**1. SCOPE**

**1.1 GENERAL**

This specification defines the requirements for a family of Burroughs microprocessor-based input and display systems, the TD730/830 Terminal Series. The TD730/830 Terminal Series is capable of accepting and displaying information entered locally, and to exchange information with a central processor or another Terminal.

The TD730/830 family of Terminals is capable of operating within the system environment of other Burroughs Terminal families to the extent specified in Appendix I and paragraph 3.1.2. Communications with the TD730/830 Terminal family is accomplished in a half duplex mode, via direct wire or communications lines using certain multipoint or point-to-point communications procedures as described within this specification.

The TD730/830 Terminal family has the capability of matching all interface requirements described within the body of this specification.

**1.2 BASIC CAPABILITIES**

The TD730/830 Series Terminals have the basic capabilities listed in this section.

**TD830 Display Capacity**

- 1920 Characters
- 24 rows of 80 character's
- Status line (80 characters)
- 5 x 7 and 7 x 9 character matrix

**TD730 Display Capacity**

- 480 Characters
- 12 rows of 40 characters
- 5 x 7 character matrix

**Memory**

- 4 k Bytes of read/write memory

**Keyboard**

- Typewriter, Alphanumeric (Domestic and International)
- Auxiliary Numeric Keypad (keyboard option)
- No keyboard

**Power**

- 100-127 VAC, 50/60 Hz
- 200-240 VAC, 50/60 Hz

**Communications Interface**

- Asynchronous RS232/CCITT, to 38.4 k bps
- Synchronous RS232/CCITT, to 9.6 k bps
- Burroughs Two-Wire Direct Interface (TDI), to 9.6 k bps asynchronous
- Burroughs Direct Interface (BDI), to 38.4 k bps Asynchronous
- Concatenation, Asynchronous or Synchronous, RS232/CCITT
- Keyboard selectable data rate

**Burroughs Corporation**



ELECTRONIC COMPONENTS DIVISION  
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DATE

DATE

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## 1.2 BASIC CAPABILITIES (CONT)

### Communications Procedures

- Multipoint
- Point-to-Point
- Modified point-to-point procedures

### Data Transmission

- Forms/Non-Forms
  - Cursor to ETX
  - Home to Cursor
  - Total page in Forms-Search mode

### Cursor Control

- Programmable cursor position
- Transmission of cursor position
- Four way movement
- Blink
- Solid
- No cursor

### Lower Case Lockout

### Numeric Control Message Transmission

### Programmatic Mode Control

### Format and Edit Functions

- Tabulation
  - 1) Fixed
  - 2) Variable
  - 3) Field Identifier

### Reverse Tabulation

### Forms mode enable/disable

### Forms mode variable delimiters

### Character insert/delete

- 1) By line/field
- 2) By page

### Sound audible alarm

### Line insert/delete

### Line move

128 Character symbol generation (95 from keyboard)

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## 1.2 BASIC CAPABILITIES (CONT)

### Format and Edit Functions (CONT)

#### Clear

- 1) To the end of a line/field
- 2) To the end of a page/form
- 3) Total page Non-Forms/unprotected data Forms
- 4) Forms mode and data

#### Data Highlight

- 1) Negative video (TD830 only)
- 2) Forms negative video (TD830 only)
- 3) Blink
- 4) Secure
- 5) Underline (TD830 only)
- 6) Bright

Roll up/down by page

Right justification

Variable end of page alarm

Carriage return/line feed

Page clear and home cursor

Page home cursor

Page control

Field overflow inhibit

Search fixed or variable character

Transmit only Forms field



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**1.3 OPTIONAL CAPABILITIES**

The TD730/830 Series Terminals have available the options described in this section.

**Extended Memory**

- 1) 8 k bytes total
- 2) Selectable page lengths in increments of 4 lines
- 3) Scroll

**Printer Interfaces**

- 1) 20/60 mA current loop interface (selectable data rates)
- 2) A9249 Printer interface (ODEC)
- 3) TC 4000-R0 Printer interface

**Print**

- 1) Non-Forms home to cursor
- 2) Forms total page
- 3) Forms unprotected data only

**Magnetic Card Reader Interface**

**Magnetic Tape Cassette Controller Interface**

**Communications Procedures**

Bisynchronous multipoint IBM 3270 compatible

Non-display of selected characters in ASCII columns 0 and 1

**Fully featured keyboard**



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## 2. APPLICABLE DOCUMENTS

The following documents of the issue in effect on the date of this specification form a part of this specification to the extent specified herein.

### 2.1 EXTERNAL DOCUMENTS

42 CFR 78. Subpart F and Section 78.705	Standard, Department of Health, Education, and Welfare.,
RS232C	EIA Standard, Interface Between Data Processing Terminal Equipment and Data Communication Equipment, August 1969
CCITT Com Spa No. 100, Recommendation V24, V28	Functions and Electrical Characteristics of Circuits of the Interface Between Data Terminal Equipment and Data Communication Equipment, December 1972
CSA C22.2, No 0-1960	Standard, Canadian Standards Association
CSA C22.2, No 154-1975	Standard, Canadian Standards Association
BSI 3861 Part 1:1965	British Standards Institute Standard
UL 478	Underwriters Laboratories Standard, Electronic Data Processing Units and Systems (1972)
BPO Technical Guide No. 25	British BPO Memorandum, Design Requirements for the Connection of Non-Post Office Equipment to Post Office Private Circuits, June 1974
GPO Data Services NP3.4.3	Notes for Manufacturers of Data Terminal Equipment No. 2, General Requirements for Data Terminal Equipment, March 1971
VDE 0871	Limits of Radio Interference from Radio Frequency Apparatus and Installations, W. Germany, 1961
VDE 0875	Rules for the Radio Interference Suppression for Appliances, Machines and Installations, W. Germany, 1961
VDE 0804/4.65	Regulations for Telecommunications Apparatus
MIL-HDBK-217B	Military Handbook on Reliability, September 1974
NFPA 75	National Fire Prevention Association Standard for Protection of Electronic Computer Systems and System Installations, Type II. Equipment, 1968
IEC Pub. 335-1	IEC Recommendation, Safety of Household and Similar Electrical Appliances, Part I, General Requirements, 1970
IEC Pub. 380	IEC Recommendation, Electrical Safety of Office Machines
NEMKO 502.59 (508) SEV TP 212/8A	Norges Elektriske Materieell Kontroll Schweizerischen Berein



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### 2.1.1 Product Safety

This product shall comply with the requirements of the Product Safety Standard 1257 4893 for data processing equipment. Approvals shall be obtained from the safety organizations in the following countries:

- 1) U.S.A
- 2) Canada

### 2.1.2 UL Approval

The TD730/830 Terminal in the basic and optional configurations defined by this specification shall be approved and listed by the Underwriters Laboratories, Inc, (UL), per UL Standard 478.

### 2.1.3 CSA Approval

The TD730/830 Terminal in the basic and optional configurations defined by this specification shall be approved and listed by the Canadian Standards Association (CSA), per CSA Standards C22.2, No 0-1960 and C22.2, No 154-1975.

### 2.1.4 BPO Approval

The TD830 Terminal design shall have the capability to be configured to conform with BPO Technical Guide No. 25 requirements.

### 2.1.5 VDE Compliance

The TD730/830 Terminal shall meet the RFI requirements of the VDE 0871 and VDE 0875 specifications as given in Burroughs Technical Standards B2-08 and B2-09.

### 2.1.6 Other Standards

The TD730/830 Terminal in the basic and optional configurations defined by this specification is designed to conform to the requirements of other standards listed below. However, the conformance shall be by intent and design guidance and shall not be construed as necessarily requiring formal testing, approval, or listing to any or all of the other standards when those standards deviate from UL Standard 478 or CSA Standards C22.2, No. 0-1960 and C22.2, No. 154-1975. The other standards are:

- a. SEV TP 212/8A
- b. BSI 3861, Part 1:1965
- c. NEMKO 502.59 (508)
- d. IEC Pub. 335-1
- e. IEC Pub. 380
- f. VDE 0804/4.65

**Burroughs Corporation**ELECTRONIC COMPONENTS DIVISION  
PLAINFIELD, NEW JERSEY 07061 U.S. AMERICASHEET  
13 OF 174

DWS NO.

1691 6256

REV

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CLASS CODE

TITLE

ENGINEERING SPECIFICATION: TD730/830

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## 2.2 BURROUGHS CORPORATION DOCUMENTS

1284 9006	Systems Standard for Communications Procedures, March 1973
1700 3195	Specification, Two-Wire Direct Interface, August 1967
60445	Product Specification, Reliability Standards, Rev C, May 1961, Pasadena
B2-08	Technical Standard, Limits for Radio Interference Emission
B2-09	Technical Standard, EMI Interference Control Guide for Machines and DP Equipment
1257 4703	Specification, Acoustical Noise
1691 2602	General Specification, Keyboard, May 1972
2555 0203	Specification, Power Supply, September 1975
1498 5303	Specification, Burroughs Direct Interface (BDI)
1284 9022	Systems Standard for Bisynchronous Communications Procedures, January 1973
1257 5700	Technical Standard, Environmental Standards for Data Processing Equipment and Business Machines, Rev A, September 1975
2555 9410	Specification, Magnetic Tape Controller
1088 8760	ODEC Interface System Design Specification
1845 9735	Specification, TC 4000 RO Printer, September 1973

## 2.3 NEW DOCUMENTATION

New documentation to be provided for the TD730/830 Terminal is noted in this section.

### 2.3.1 Terminal Support

Documentation is provided for the support of the TD730/830 Terminal and includes the Field Engineering Technical Manual, Parts Catalog and Field Test and Reference Document, Operator Manual, and Reference Manual. The Terminal design section will provide assistance when required. This documentation is in accordance with the format and content requirements defined in the operation management section of the Field Marketing Manual and paragraph 7.0 of the Field Engineering Technical Literature Standards.



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**2.3.2 System Configurator**

The design organization shall prepare a systems configurator reflecting M&E numbers and options of each required and optional component (line controls, adapters, modem expanders, etc.). The configurator shall indicate maximum drive distances and cabling M&E numbers where applicable. The configurator shall indicate each system interface and each applicable communications interface.

**2.3.3 Unit Test Plan**

The unit test plan, as developed by the design group, shall include descriptions of equipment configurations, test methods, test procedures, and, any special or extraordinary test equipment (simulators, data processing equipment, etc.). The test plan shall be comprehensive in scope, containing the objectives of each test or series of tests along with the evaluation criteria.

**2.3.4 Acceptance Test Procedure**

Design Engineering shall prepare the acceptance test procedure which forms the basis for the acceptance test in production.

**2.4 ORDER OF PRECEDENCE**

Where a conflict exists between the requirements of this specification and any of the referenced specifications, this specification takes precedence.

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ELECTRONIC COMPONENTS DIVISION  
PLAINFIELD, NEW JERSEY 07061 U. S. AMERICA

SHEET 15 OF 174

DWG NO.

1691 6256

REV

A

CLASS CODE

TITLE

ENGINEERING SPECIFICATION: TD730/830

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### 3. PHYSICAL DESIGN CHARACTERISTICS

#### 3.1 GENERAL PHYSICAL CHARACTERISTICS

The TD730/830 Series Terminal input and display system, hereinafter called the Terminal, is designed and constructed as a free-standing, self-contained data input and display device, principally intended for but not limited to desk and table top installation. The Terminal is suitable for the exchange of coded information, in domestic and international environments, with a computer system central unit (central processor).

##### 3.1.1 Maximum Characters

The TD730 Terminal is capable of displaying up to 480 characters. The TD830 Terminal is capable of displaying up to 1920 characters plus an 80 character status line.

##### 3.1.2 Compatibility with Other Terminal Families

Through installation set-up and adjustment, the TD730/830 family of Terminals is capable at any one time, of compatible operation in the environment of any one of the following Burroughs Terminals: TD700 Design-Level-Two and upward, TD800 Design-Level-Two and upward, and TD820.

##### 3.1.3 Packaging

The TD730/830 Terminal consists of two physical units: the display unit and the keyboard unit. The two units are designed to operate as two separate units interconnected by cables. The packaging design permits the keyboard unit to be located up to six feet away from the display unit.

##### 3.1.4 Marking

The TD730 Terminal and the TD830 Terminal are marked in accordance with Figures 3-1 and 3-2 respectively.

##### 3.1.5 Component Standardization

All Terminals of the same model number and design level are identical in the card types used, the actual values and types of components mounted on these cards, and the values and types of components mounted in the chassis. Cards and components mounted within a Terminal are capable of being replaced by other cards and components of the same designation, without degradation of performance. All circuit schematics will have actual component values, tolerances, and ratings listed, and will not deviate from unit to unit.

##### 3.1.6 Cooling

The Terminal will dissipate 500 Btu per hour typical in the operational mode. The display unit of the Terminal, which includes the power supply, is forced air cooled by an internal fan while the keyboard unit is cooled by convection.

SHEET 174	DWG NO.	REV		
16 OF	1691 6256	A		
CLASS CODE	TITLE			
	ENGINEERING SPECIFICATION: TD730/830			
DRAWN BY	CHK STD & REC	CHECK FF & F	DSGN	APPROVED
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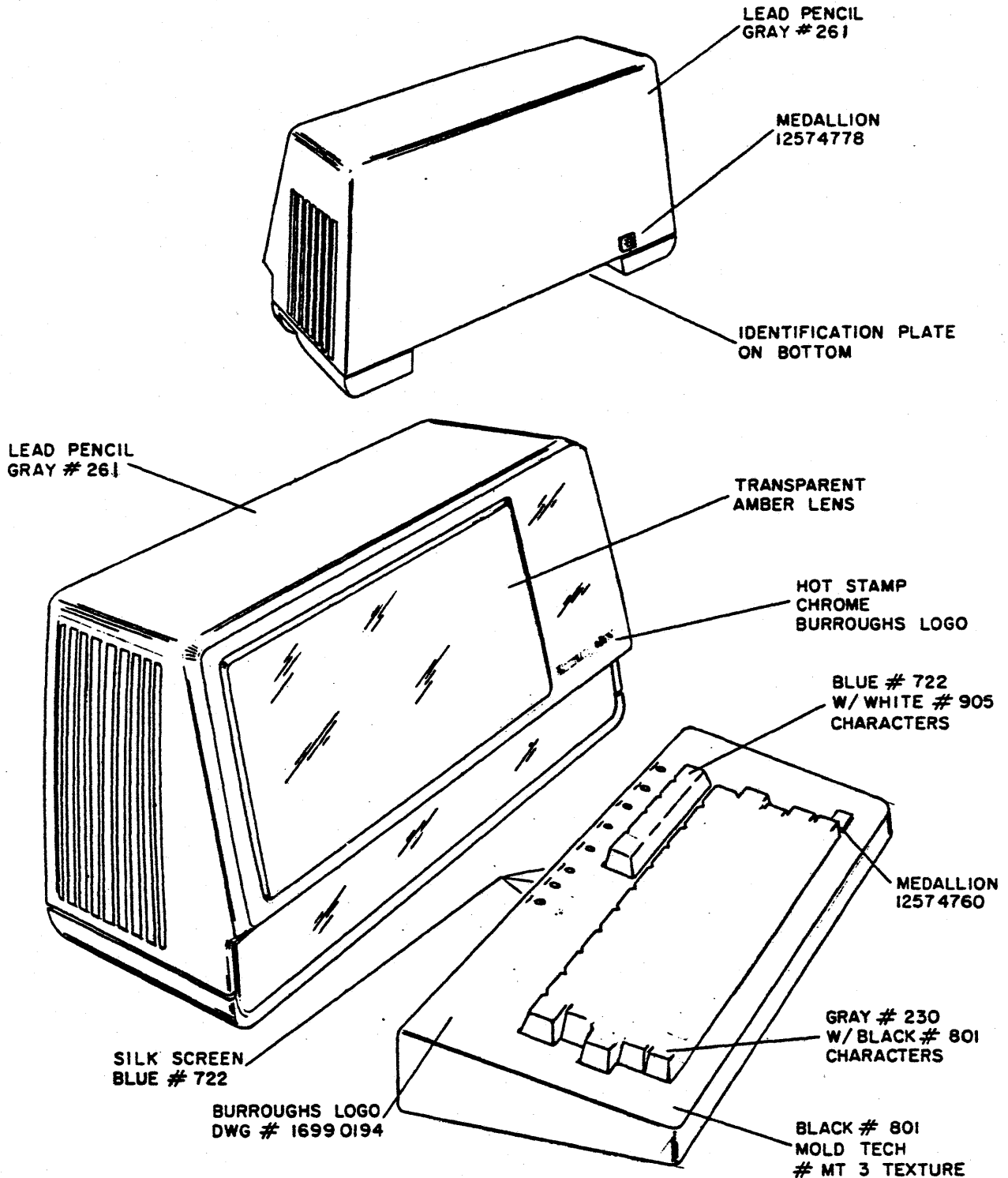


FIGURE 3-1. TD730 UNIT AND KEYBOARD

SHEET 17 OF 174	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY	CHK STD & REC	CHECK PFB F
DATE	DATE	DATE
	DSGN	APPROVED
	DATE	DATE

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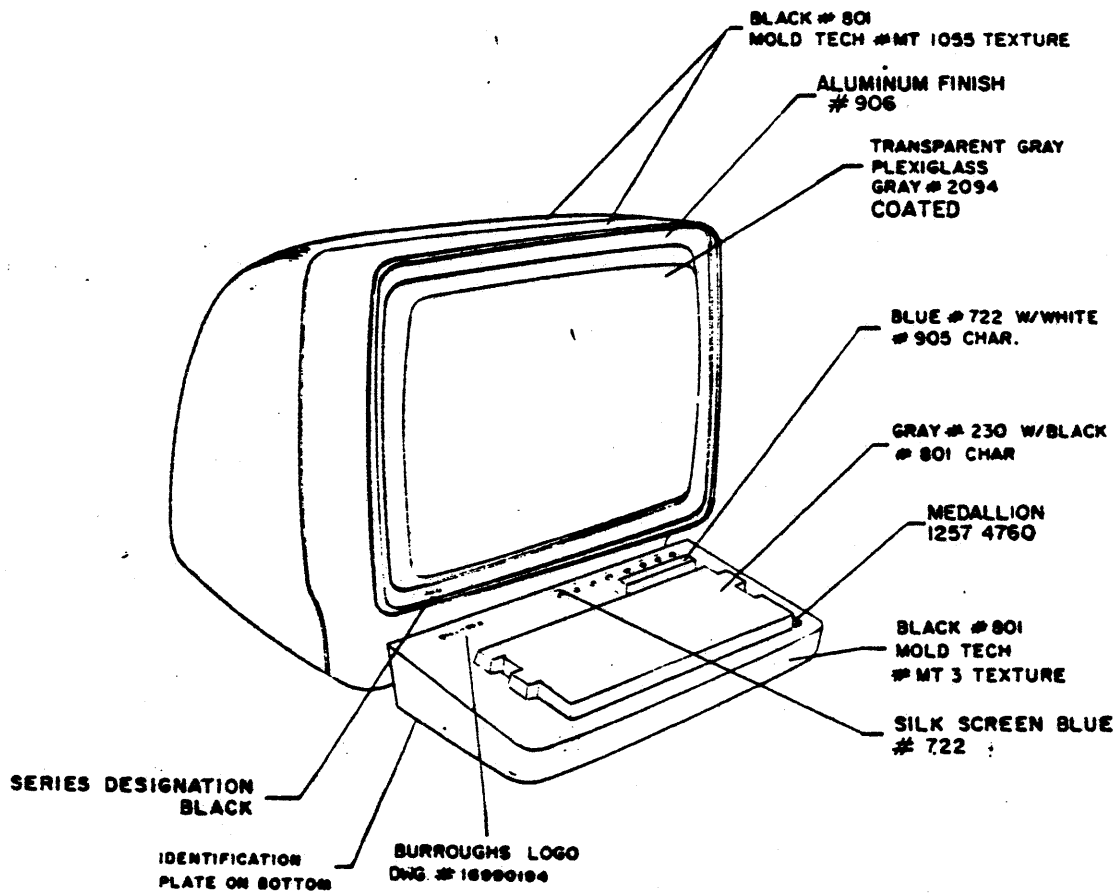
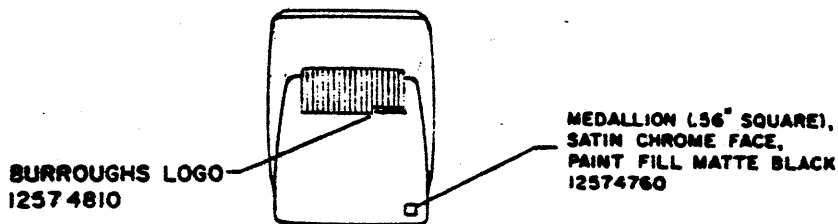


FIGURE 3-2. TD830 UNIT AND KEYBOARD



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PLAINFIELD, NEW JERSEY 07061 U. S. AMERICA



SHEET 18 OF 174

DWG NO.

1691 6256

REV A

CLASS CODE

TITLE

ENGINEERING SPECIFICATION: TD730/830

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## 3.2 SPECIFIC PHYSICAL CHARACTERISTICS

### 3.2.1 TD730 Display Unit

The TD730 display unit houses the following assemblies: display subsystem, microprocessor and associated electronics, communications interface, and power supply. The display unit is designed to work with or without the keyboard in the processing of messages between the operator and central processor.

#### 3.2.1.1 Dimensions and Weight

The dimensions and weight of the TD730 display unit are as follows:

<u>Height</u>	<u>Width</u>	<u>Depth</u>	<u>Weight</u>	<u>Shipping Weight</u>
9.4 inches (238.76 mm)	15.5 inches (393.7 mm)	6.25 inches (158.75 mm)	20 lbs (Approx) (9.1 kilogram)	44 lbs (Approx) (20 kilogram)

#### 3.2.1.2 Controls and Alarm

An audible alarm and operator adjustment controls are provided as part of the TD730 display unit.

3.2.1.2.1 Operator Controls and Audible Alarm: The operator controls are readily accessible to the operator and will not damage the Terminal if maladjusted. These operator controls and alarm are described as follows:

- (a) **Power Switch**                      The power switch provides the on/off control for activating the Terminal with AC line voltage. The power switch is located on the bottom (right side) of the display unit.
- (b) **Brightness Control**              The brightness control provides a continuous range of display brightness from maximum to nearly "off." This control is located inside the display unit and removal of the lens is required for adjustment.
- (c) **Audible Alarm**                      The audible alarm will sound momentarily whenever the Central processor attempts to transmit to the Terminal while the Terminal is not in Receive mode. The audible alarm will sound momentarily whenever the cursor is advanced to the selected variable end of page position. Selection of the character position is described in paragraph 4.2.1.7. The audible alarm will sound momentarily upon the receipt of a Broadcast or Group Select message and also upon receipt of the proper ESC or CTRL sequence (see Tables 13 and 11 respectively). The BEL code (Figure 7-1) will also activate the audible alarm. The audible alarm volume may be varied or disabled through a field engineering adjustment.

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DATE	DATE	DATE	DATE	DATE

REVISION
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**3.2.1.2.2 Maintenance Adjustment Controls:** No special maintenance adjustment controls are required.

**3.2.1.3 Display Subsystem**

The TD730 display subsystem provides a visual presentation of all or part of the data on which the operator is working. The display subsystem uses a Self-Scan® II display panel as the medium for data presentation. The following features are provided by the display subsystem: data highlights, international character sets and alternately displayable status lines.

**3.2.1.3.1 Data Highlights:** The display subsystem has the capability of highlighting selected fields of data on the display panel. Three modes of data highlighting are available to the central processor software for use on the displayed data. The highlighting is accomplished through the use of four characters: EM, SUB, CAN, and RS. SUB, EM and CAN are entered into memory from the central processor via data communications, during text, to start their respective fields of highlighting. Character RS, when entered into memory, will end any or all of the highlights prior to it. If the operator chooses, highlight characters may be overwritten in memory via keyboard action or by the central processor during selection. The operator is not able to overwrite data in the protected data fields during Forms mode. Highlight characters are not displayed and their location appears as the normal character background. The RS character is also used as the Forms right delimiter.

Data highlight modes are independent, thus allowing nesting and giving a cumulative action upon displayed data to the extent that no highlight extends beyond ascend highlight character or beyond the display line in which the highlight is used.

(a) Blink (CAN)

The display subsystem, upon reading a CAN character from memory during display refresh, commences a blinking data field at a 1.5 Hz rate, and maintains this highlight until an end highlight character is read, thereby ending all selective highlights. The blink highlight causes data to alternate with the solid background of the display.

The blink highlight field is able to highlight any area without regard to in-process highlighting or Forms mode. The blink highlight, when initiated, shall continue to the last column of that display line, or until an end highlight character is reached.

(b) Secure Data (EM)

Upon reading an EM character from memory during display refresh, the display subsystem will begin placing blanks on the display and will maintain this highlight until an end highlight character is read. These blanks consist of solid display matrix (full 7 x 7 configuration) for each secured character.

The secure highlight field is able to highlight any area without regard to in-process highlighting or to Forms mode. The secure highlight, when initiated, shall continue to the last column of that display line or until an end highlight character is reached.



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3.2.1.3.1 Data Highlights (CONT)

(c) Bright (SUB)

Upon reading an SUB character from memory during display refresh, the display subsystem will intensify all further characters displayed until an end highlight character is read. The bright highlight causes brighter characters to appear in contrast to the display's normal character intensity. The bright highlight is able to highlight any character without regard to in-process highlighting or Forms mode. The bright highlight, when initiated, shall continue to the last column of that display line or until an end highlight character is reached.

3.2.1.3.2 Cursor Generation: The TD730 display subsystem generates a visual cursor for the display. The cursor indicates the location of data entry from the keyboard. The cursor character location is stored in the cursor location counter and not in the display memory. After each character is entered into the display memory by the keyboard, the cursor advances to the next character position to the right or to the beginning of the next line when the preceding line has been filled. The cursor can also be moved in the appropriate direction on the display by a carriage return character from the communications interface or by the line feed, reverse line feed, backspace, forward space, carriage return, and home keys of the keyboard. The cursor will appear as the full 5 x 7 character dot matrix, alternately blinking with the character in the cursor location. The display subsystem has the capability of blinking the cursor at a 1.5 Hz rate or having a non-blinking cursor. The display subsystem also has the capability to totally disable the cursor so that no cursor appears on the display. Cursor blink/non-blink and no cursor are selected through keyboard CTRL or software ESC sequences as defined in paragraph 3.2.8.

3.2.1.3.3 Character Generator: The character generator is contained within the display subsystem and can produce a set of 128 display characters, including space. Basic characters consist of the 26 upper-case and 26 lower-case alphabetical letters, numbers 0 through 9, and 33 special symbols (see Figure 7-1, columns 2 through 7). In addition, the character generator produces control character symbols used in the Terminal's operation (see Figure 7-1).

The display subsystem has the capability to produce 128 display characters. This capability can be altered through factory adjustment to prevent the display of any individual character or group of characters from columns 0 and 1 of Figure 7-1.

The character generator presents characters in a 5 x 7 dot matrix format.

3.2.1.3.4 International Character Set: The display subsystem is available with character generators which produce the special characters required by international markets. Special characters are provided for those nations as described in paragraph 7.1. All U.S. lower-case characters are provide with international character sets.



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**3.2.1.3.5 TD730 Status Line:** The display subsystem has the capability of displaying a status line upon a sequential double depression of the CTRL key on the keyboard. Subsequent activation of any other key on the keyboard will cause the status line to not appear on the display. The status line will occupy the last two lines of the display in place of the data normally on those lines. Data that would normally appear on the last two lines of the display is contained within the display refresh memory and will be displayed again whenever activation of any keyboard key occurs. The types of information contained within the status line are described in paragraph 3.2.9.

**3.2.1.3.6 TD730 Display Working Data Field:** The TD730 Terminal has a variable working data field of up to 480 characters. Configurations of the data field is set during system initialization and can be changed through keyboard CTRL or software ESC sequences as defined in paragraph 3.2.8. Two basic configurations are available: 12 lines of 40 characters per line and 12 lines of 32 characters per line. The two basic configurations are alterable through use of the variable page length function as described in paragraph 3.2.4.3.

**3.2.1.4 Display Panel Assembly**

The display panel assembly contains a Self-Scan II, 480-character, display and associated solid state electronics which include phase drivers, integrated shift register-display drivers, storage latches, blanking circuitry, and high voltage drivers. The electronic circuitry is contained on a printed circuit card and is mounted in laminar fashion to the display to form the display panel assembly. The characteristics of the Self-Scan II panel assembly are listed in Table 1.

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DRAWN BY	CHK STD & REC	CHECK FF & F	DSGN	APPROVED
DATE	DATE	DATE	DATE	DATE

LTR	REVISION
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TABLE 1. TD730 DISPLAY CHARACTERISTICS

FEATURE

480-CHARACTER SELF-SCAN<sup>®</sup> II DISPLAY

Display Panel Viewing Area:

Width 8.42 inches (214 mm)

Height 4.66 inches (118 mm)

Display Format:

Line Length 40 characters/32 characters (selectable)

Lines 12

Character Size:

Width 0.167 inches (4.24 mm)

Height 0.30 inches (7.62 mm)

Display Dot Dimensions:

Width 0.017 inches (0.43 mm)

Height 0.020 inches (0.51 mm)

Character Spacing

2 blank columns of dots between each successive character

Register Spacing:

3 blank rows of dots between successive registers

Scanning Rate:

85 Hz minimum

Flicker:

None observable

Nominal Luminous Intensity:

tbd

Contrast Ratio:

tbd

Color of displayed image:

Neon Red-orange

Viewing Angle:

100° minimum

Display Dimming:

Fixed or variable to 20% or nominal luminous intensity

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**3.2.2 TD830 Display Unit**

The TD830 display unit houses the following assemblies: display subsystem, microprocessor and associated electronics, communications interface, and power supply. The display unit is designed to work with or without the keyboard in the processing of messages between the operator and the central processor.

**3.2.2.1 Dimensions and Weight**

The dimensions and weight of the TD830 display unit are as follows:

<u>Height</u>	<u>Width</u>	<u>Depth</u>	<u>Weight</u>	<u>Shipping Weight</u>
15.0 inches (381 mm)	16.12 inches (408 mm)	13.0 inches (331 mm)	35 lbs (Approx) (15.9 kilograms)	61 lbs (Approx) (27.8 kilograms)

**3.2.2.2 Controls and Alarm**

An audible alarm, operator controls and adjustment controls are provided as part of the display unit.

**3.2.2.2.1 Operator Controls and Audible Alarm:** The operator controls are readily accessible to the operator and will not damage the Terminal if maladjusted. These operator controls and alarm are described as follows:

- (a) **Power Switch**                      The power switch provides the on/off control for activating the Terminal with AC line voltage. The power switch is located on the front of the display unit.
- (b) **Brightness Control**              The brightness control provides a continuous range of display brightness from maximum to nearly "off." This control is located on the front of the display unit.
- (c) **Audible Alarm**                      The audible alarm will sound momentarily whenever the central processor attempts to transmit to the Terminal while the Terminal is not in the Receive mode. The audible alarm will sound momentarily whenever the cursor is advanced to the selected variable character position. Selection of the character position is described in paragraph 4.2.1.7. The audible alarm will sound momentarily upon the receipt of a Broadcast or Group Select message and also upon receipt of the proper CTRL or ESC sequence (Tables 11 and 13 respectively). The BEL code (Figure 7-1) will also activate the audible alarm. The audible alarm may be varied or disabled through a field engineering adjustment.

**3.2.2.2.2 Maintenance Adjustment Controls:** Maintenance adjustment controls consist of the width control, vertical size control, vertical linearity control, horizontal linearity control, focus control, and video bias control. These controls are located within the display monitor.



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**3.2.2.3 Display Subsystem**

The TD830 display subsystem provides a visual presentation of all or part of the data on which the operator is working. The display subsystem uses a CRT monitor as the medium for data presentation. The following features are provided by the display subsystem: negative video, data highlights, international character sets, and a separate status line.

**3.2.2.3.1 Negative Video:** The display subsystem is capable of displaying white characters on a black background (normal video) or black characters on a white background (negative video). At power-on time of the TD830, the mode is normal video. Upon receipt of an ESC followed by N from the data communication network during text or upon depression of the keyboard CTRL key followed by the shifted U key, the display subsystem enters the negative video mode on a page basis. Upon receipt of an ESC followed by O from the data communications network during text or upon depression of the keyboard CTRL key followed by the shifted I key, the display subsystem will return the page to the normal video mode.

**3.2.2.3.2 Negative Video During Forms Mode:** When both negative video and Forms mode are active, the unprotected data areas are displayed as normal video as follows: The GS, US or left Forms delimiter will be the start of a reverse video mode and the RS or right Forms delimiter shall end the reverse video mode. This reverse video field upon a negative video background shall appear as normal video. Any unprotected data field that continues from the last column to column 1 of the next line shall not continue the reverse video mode.

**3.2.2.3.3 Data Highlights:** The display subsystem has the capability of highlighting selected fields of data on the screen. Five modes of data highlighting are available to the central processor software for use on either the normal or negative video background modes with or without Forms mode. The highlighting is accomplished through use of six characters: SO, SI, EM, SUB, CAN, and RS. SO, SI, EM, SUB, and CAN are entered into memory from the central processor via data communications during text, to start their respective fields of highlighting. Character RS, when entered into memory, will end all of the highlights prior to it. If the operator chooses, highlight characters may be overwritten in memory via keyboard action or by the central processor during selection. The operator is not able to overwrite data in the protected data field during Forms mode. Highlight characters are not displayed and their location appears as the background would depending upon negative video mode, reverse highlight mode, and cursor position.

Data highlight modes are independent, thus allowing nesting and giving a cumulative action upon the video data to the extent that no highlight extends beyond an end highlight character or beyond the display line in which the highlight is used.

The RS character is also used as the right Forms delimiter.



SHEET 25 OF 174	DWG NO. 1691 6256	REV A
CLASS CODE:	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY	CHK STD & REC	CHECK FFS & F
DATE	DATE	DATE
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3.2.2.3.3 Data Highlights (CONT)

(a) Underline Video (SI)

Upon reading an SI character from memory during display refresh, the display subsystem will begin an underlined data highlight and maintain this highlight until an end highlight character is read. The underline highlight appears on the 9th (ninth) scan line and consists of solid video in contrast with the opposite mode background video.

The underline highlight is able to highlight any area without regard to in-process highlighting or to Forms mode. The underline highlight, when initiated, shall continue to the last column of that display line or until an end highlight character is reached.

The 1.5 Hz blink rate, if used, will aid in locating the underline cursor in an underline highlight field.

(b) Bright Video (SUB)

Upon reading a SUB character from memory during display refresh, the display subsystem will intensify the video and maintain this highlight until an end highlight character is read. The bright video highlight causes brighter characters to appear when the display is in the normal video mode. Actuation of the bright video highlight when the display is in the negative video mode causes brighter background to appear.

The bright video highlight is able to highlight any area without regard to in-process highlighting or Forms mode. The bright video highlight, when initiated, shall continue to the last column of that display line or until an end highlight character is reached.



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3.2.2.3.3. Data Highlights (CONT)

(c) Reverse Video (SO)

Upon reading an SO character from memory during display refresh, the display subsystem will commence a reverse video display and maintain this highlight until an end highlight character is read, thereby ending all selective highlight fields. The reverse video highlight causes negative video to be displayed from the initial SO character to the end highlight character provided the display is in the normal video mode. Activation of the reverse video highlight when the display is in a negative video mode causes normal video to be displayed from the initial SO character to the end highlight character.

The detection of a GS, US or left delimiter during Forms mode and negative video mode causes the reverse video to show normal video in the unprotected area. The RS or right delimiter during Forms mode and negative video mode will end the reverse video field and any other highlight fields that may be in process.

If the reverse video highlight field is not ended via RS or Forms right delimiter by the last column of the line, then the reverse video highlight shall end automatically.

Positioning the negative character cursor within this reverse field, will reverse the video at that position one more time to indicate the position. The 1.5 Hz blink rate of the cursor, if used, will aid in visually locating the cursor at negative/normal video boundaries.

(d) Blink Video (CAN)

The display subsystem, upon reading a CAN character from memory during display refresh, commences a blinking video display at a 1.5 Hz rate, and maintains this highlight until an end highlight character is read, thereby ending all selective highlights. The blink video highlight causes video data to alternate with solid background. This solid background mode is dependent upon negative video or normal video mode of display.

The blinking highlight field is able to highlight any area without regard to in-process highlighting of other types or to Forms mode. This blinking highlight, when initiated, shall continue to the last column of that line or until an end highlight character is reached.

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3.2.2.3.3 Data Highlights (CONT)

(e) Secure Video (EM)

Upon reading an EM character from memory during display refresh, the display subsystem will begin placing blanks on the display and maintain this highlight until an end highlight character is read. These blanks consist of solid video (full 70 dot matrix 7 x 10 configuration, for each secured character) in contrast with the opposite mode background video.

The secure highlighting field is able to highlight any area without regard to in-process highlighting of other types or to Forms mode. The secure highlight, when initiated, shall continue to the last column of that line or until an end highlight character is reached.

3.2.2.3.4 Cursor Generation: The TD830 display subsystem generates a visual cursor for the display. The cursor indicates the location of data entry from the keyboard. The cursor character location is stored in the cursor location counter and not in the display memory. After each character is entered into the display memory by the keyboard, the cursor advances to the next character position to the right or to the beginning of the next line when the preceding line has been filled. The cursor can also be moved in the appropriate direction on the display by a carriage return character from the communications interface or by the line feed, reverse line feed, backspace, forward space, carriage return and home keys of the keyboard. The cursor will appear as the negative image of the character at the cursor location. The display subsystem has the capability of blinking the cursor at a 1.5 Hz rate or of having a non-blinking cursor. The blink/non-blink modes are keyboard CTRL or software ESC controlled as defined in paragraph 3.2.8. A visual disabling of the cursor through keyboard CTRL or software ESC control will cause the display to show no cursor.

3.2.2.3.5 Character Generator: The character generator is contained within the display subsystem and can produce a set of 128 display characters, including space. Basic characters consist of the 26 upper-case and 26 lower-case alphabetical letters, numbers 0 through 9, and 33 special symbols (see Figure 7-1, columns 2 through 7). In addition, the character generator produces control character symbols used in the Terminal's operation (see Figure 7-1).

The display subsystem has the capability to reproduce 128 display characters. This capability can be altered through factory adjustment to prevent the display of any individual character or group of characters from columns 0 and 1 of Figure 7-1.

The standard character generator presents characters in a 5 x 7 dot matrix format (80 characters per line). This character format can be visually altered through keyboard CTRL or software ESC sequences (paragraph 3.2.8) which cause the characters to appear twice as wide (40 characters per line).

An optional character generator is available and presents characters in a 7 x 9 dot matrix format (80 characters per line). This character format is also visually alterable to twice the width (40 characters per line). This optional character generator shall be used with the USASCII keyboard (Figure 7-3) or the optional keyboard (paragraph 5.5) only.





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3.2.2.3.6 International Character Set: The display subsystem is available with character generators which produce the special characters required by international markets. Special characters are provided for those nations as described in paragraph 7.1. All lower-case U.S. characters are provided with international character sets.

3.2.2.3.7 TD830 Display Working Data Field: The TD830 Terminal has a variable working data field of up to 1920 characters. The configuration of the data field is set during system initialization and can be changed through keyboard CTRL or software ESC sequences as defined in paragraph 3.2.8. Four basic configurations are available: 12 lines of 40 or 80 characters per line, and 24 lines of 40 or 80 characters per line. The four basic configurations are alterable through use of the variable page length function as described in paragraph 3.2.4.3.

3.2.2.3.8 TD830 Status Line: The display subsystem divides the screen into two data fields: The display working field which contains data to which the operator has direct access and the status line which contains only indirectly accessed data. The status line is the 25th (twenty-fifth) line of the display screen and is 80 characters in length. Data presented within the status line will contain information as described in paragraph 3.2.9.

3.2.2.4 Display Monitor

The display monitor contains a cathode ray tube (CRT) and all associated solid-state electronics (video amplifier, high voltage rectifier, deflection circuits, etc.) required to generate a television-type display from the separate sync and video input signals. These separate sync and video signals are provided by other functional groups in the display subsystem. Characteristics of the TD830 display monitor are listed in Table 2.

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LTR	REVISION
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TABLE 2. TD830 DISPLAY CHARACTERISTICS

<u>FEATURE</u>	<u>DISPLAY MONITOR CHARACTERISTIC</u>
CRT Dimensions:	
Diagonal Size	12 inches (305 mm)
Overall Size	74 square inches (4840 square centimeters)
CRT Viewing Area:	
Width	9.0 inches (228 mm)
Height	7.5 inches (191 mm)
Display Format	5 x 7 dot matrix, 7 x 9 dot matrix (optional)
Line Length	40/80 characters
Display Character Capacity	1920 Maximum + 80 character status line
Lines (Working Field)	24 Maximum
Lines (Status Line)	1 (25th display screen line)
Character Size:	
Width	0.09 inches (Double for 40 character line length) (2.28 mm)
Height	0.20 inches (5.08 mm)
Row Spacing	3 blank rows of dots between successive rows
Refresh Rate	Input line frequency (50 Hz to 60 Hz)
Flicker	None observable
CRT Brightness	50 foot Lamberts (maximum)
Contrast Ratio	20:1 (approximate)
Color of Displayed Image	White characters on a black background (normal video)
Viewing Angle	100° (minimum)
Deflection	Magnetic
Focus	Electrostatic
X-Radiation	0.5 milliroentgen per hour (maximum)



SHEET 30 OF 174	DWG NO. 1691 6256		REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830		
DRAWN BY	CHK STD & REC	CHECK FF & F	APPROVED
DATE	DATE	DATE	DATE

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LTR	REVISION
-----	----------

### 3.2.3 Microprocessor

The Terminal contains a one-chip microprocessor which is capable of addressing up to 65 k locations of memory and interface registers. The microprocessor is an 8-bit parallel processor using a bidirectional data bus for internal data movement. Terminal control is provided through microprocessor interpretation of instructions contained within the Terminal memory (paragraph 3.2.4.1). The microprocessor also monitors the power supply subsystem for power fail or undervoltage conditions and initiates a power down routine when these conditions occur.

### 3.2.4 TD730/830 Memory

Terminal memory is implemented using up to three types of MOS devices. Read Only Memory (ROM), Programmable Read Only Memory (PROM), and Read/Write Memory (RAM). The basic Terminal configuration uses the ROM and RAM memory devices. Special Terminal configurations using PROM memories in place of, or in conjunction with, ROM memories may be implemented. The memory map of the Terminal including interface register locations is as follows:

256 Bytes	Scratch Pad	} 32 k Bytes
	Variable Length System Working Area	
	Display Refresh Memory (Variable)	
256 Bytes	PIA/ACIA Registers	
16 k Bytes	Device Firmware	
16 k Bytes	System Firmware	

#### 3.2.4.1 ROM/PROM Memory

The ROM/PROM section of the Terminal memory stores the systems operating instruction sequences (firmware). The instruction sequences include: edit functions, peripheral control, confidence tests, interrupt procedures, and initialization procedures.

**3.2.4.1.1 Electrically Alterable Read Only Memory:** The Terminal contains a 1400-bit electrically alterable read only memory (EAROM) which is separate from the primary Terminal memory. The EAROM permanently stores the Terminal's configuration data and error messages. Alteration of the EAROM shall be made by field engineering adjustment as described in paragraphs 3.2.8.2 and 3.2.9.3.1.

#### 3.2.4.2 RAM Memory

The RAM section of the Terminal memory is used for scratch pad, display refresh, and data storage. The Terminal's RAM memory provides full buffering capability for data comm entered data. No data entered from the data comm shall be acted upon until an ETX character (paragraph 4.2.6.1.3) has been received and a valid error check performed.

**3.2.4.2.1 Buffer:** The Terminal will buffer up to 1200 characters in the standard memory configuration (4 k RAM) and up to 3000 characters in the optional memory configuration (8 k RAM).

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LTR	REVISION
-----	----------

3.2.4.2.2 Display Refresh: The Terminal's basic configuration contains 2 k of display refresh memory. The Terminal has available the option of a 4 k display refresh memory. The maximum number of displayable memory locations is dependent upon the display being used (Self-Scan or CRT) and the number of pages into which the memory is divided (paragraph 3.2.4.3). The maximum number of displayable characters and pages for the available display memory combinations are listed in Table 3.

TABLE 3.. DISPLAY/MEMORY CHARACTER AND PAGE COMBINATIONS

Terminal	Line Length	Maximum Displayable Characters	Maximum Pages at 4 lines per page
TD730	32	2048 (Standard)	16
		4096 (Optional)	32
	40	1920 (Standard)	12
TD830*	80	4000 (Optional)	25
		1920 (Standard)	6
	40	3840 (Optional)	12
B9348-3	80	1920 (Standard)	12
		4000 (Optional)	25
	80	1920 (Standard)	N/A

\*The number of displayable characters and display size does not include the status line (paragraph 3.2.2.3.8) which contains 80 characters.

3.2.4.3 Memory Page

The Terminal has the capability of dividing the display refresh memory into multiple pages. A page consists of a minimum of four lines of display refresh memory and may be extended up to the limit of the refresh memory in increments of four lines. All pages within a Terminal will contain an equal number of lines. Page length (number of lines) is selected through keyboard CTRL or software ESC sequences as defined in paragraph 3.2.8. The Terminal performs all edit and format functions (excluding scroll) on a page basis, thus allowing varied data configurations on different pages.

During multiple page operation the Terminal is also able to separate the data comm pointer from the display cursor, thus allowing keyboard data to be entered on one page and external data (remote controller or peripheral data) to be entered on another. Format and edit functions that are data comm initiated will affect data on the data comm pointer page only. Format and edit functions that are keyboard entered will affect data on the display cursor page only. Transmission of data from the data comm pointer page will occur through the use of the ESC ( sequence, a read tape and transmit sequence (Table 13), or realignment of the data comm pointer and display cursor. The data comm pointer and display cursor are aligned when on the same memory page. Control of the separated display cursor and data comm pointer is given in paragraphs 3.2.4.3.1 and 3.2.4.3.2 respectively.





SHEET 174 32 of		DWG NO. 1691 6256		REV A
CLASS CODE		TITLE ENGINEERING SPECIFICATION: TD730/830		
DRAWN BY	CHK STD & REC	CHECK FF & F	DSGN	APPROVED
DATE	DATE	DATE	DATE	DATE

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LTR	REVISION
-----	----------

3.2.4.3.1 Display Cursor Paging: Moving the display cursor across refresh memory page boundaries will occur through use of any of the following functions:

- (a) Page Advance\* The page advance function is enabled through a keyboard CTRL sequence (Table 11) and will advance the display cursor to the home position of the next page.
- (b) Page Back\* The page back function is enabled through a keyboard CTRL sequence (Table 11) and will move the display cursor to the home position of the preceding page.
- (c) Scroll Up When the display cursor is located on the last line of a page the scroll up function (paragraph 4.2.1.6) will cause the cursor to appear at the same location in the first line of the next page. Initiated through a CTRL sequence (Table 11).
- (d) Scroll Down When the display cursor is located in the first line of a page the scroll down function (paragraph 4.2.1.6) will cause the cursor to appear at the same location in the last line of the preceding page. Initiated through a CTRL sequence (Table 11).
- (e) Cursor Alignment The cursor alignment function is enabled through a keyboard CTRL or software ESC sequence (Tables 11 and 13 respectively) and will move the display cursor to the location and page on which the data comm pointer is positioned. The cursor alignment function is ignored if the data comm pointer and display cursor are on the same page.

\*Page advance and page back functions shall cause 8-line forward or reverse tab when the Terminal is configured for a TD700 extended memory environment.



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LTR	REVISION
-----	----------

**3.2.4.3.2 Data Comm Pointer Paging:** Moving the data comm pointer across refresh memory page boundaries will occur through the use of the following functions:

- (a) **Select Page**                      The page select function, enabled through an ESC sequence (Table 13), will cause the data comm pointer to move to the home position of the selected page.
- (b) **Transmit**                              Depression of the XMT key on the keyboard will cause the data comm pointer to become aligned to the display cursor.

**3.2.5 Power Supply**

The power supply is contained within the display unit of the TD730/830 Terminal and provides all necessary direct current regulated voltages to the subsystems of the Terminal. The primary side is capable of being adjusted to accept a number of discrete values of AC line voltage typical in both domestic and international markets. The power supply, as part of the display unit, is forced air cooled as described in paragraph 3.1.6.

Burroughs specification 2555 0203 provides the detailed characteristics of the power supply.

**3.2.6 Communications Interface**

The types of communications interfaces used in the TD730/830 Terminal are described in the following sections. (peripheral interface is covered in section 5. The T-scan Terminal interface is covered in Appendix II:)

**3.2.6.1 Terminal Interface**

The Terminal is capable of operation in a two- or four-wire circuit with half-duplex asynchronous or synchronous data communications interfaces which conform to EIA Standard RS232C, CCITT Recommendation V24 for the international market, the Two-Wire Direct Interface (Burroughs Specification 1700 3195), and the Burroughs Direct Interface (Burroughs Specification 1498 5303) to the extent specified herein. Line protection in conformance to BPO Technical Guide No. 25, paragraph 2, is provided, as required, in the international interfaces of the TD830 Terminal.

**3.2.6.1.1 Character Format:** The Terminal is capable of operation with either asynchronous or synchronous character format.

**3.2.6.1.2 Asynchronous Data Communication:** For asynchronous data communication, each transmitted character shall utilize ten nominally equal time intervals represented by a start bit, eight bits of information, and a stop bit. The start bit will be a binary "0" (spacing polarity) and will be followed by seven bits of character code, transmitted with the least significant bit first. The ninth transmitted bit is a parity bit (selected to make the number of binary "1" or marking bits even, excluding the start and stop bits). The stop bit is a binary "1" (marking polarity).

**3.2.6.1.3 Synchronous Data Communication:** For synchronous data communication, each transmitted character utilizes eight nominally equal time intervals represented by eight bits of information. The first seven bits represent the seven-bit character code which is transmitted with the least significant bit first. The eighth bit is a parity bit (selected to make the number of binary "1" or marking bits of the eight-bit group odd).

**Burroughs Corporation**ELECTRONIC COMPONENTS DIVISION  
PLAINFIELD, NEW JERSEY 07061 U. S. AMERICASHEET  
34 of 174

DWG NO.

1691 6256

REV  
A

CLASS CODE

TITLE

ENGINEERING SPECIFICATION: TD730/830

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DRAWN BY

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CHECK FF &amp; F

DSGN

APPROVED

DATE

DATE

DATE

DATE

DATE

LTR REVISION

3.2.6.1.4 Synchronous Idle Character (SYN): The SYN character is used in the synchronous data communications mode to provide a signal for establishing and retaining synchronism in the absence of any other character. When initiating a synchronous transmission, at least four SYN characters will be transmitted prior to the transmission of any other character to permit the receiving station to acquire synchronization. The Terminal shall purge the SYN character from recognition in the normal character sequence and will not include the SYN in the summation for BCC.

The Terminal establishes character synchronization upon detection of two contiguous SYN characters and will maintain this character synchronization until the Received Data Signal is detected as being in the marking condition (1 state) for two character times. After marking for two character times, the Terminal must re-establish character synchronization upon receipt of the next two contiguous SYN characters.

### 3.2.6.2 Electrical Interface Circuits

All interface (interchange) circuits shall comply with electrical requirements of EIA Standard RS232C and CCITT Recommendation V28.

All interfaces, with the exception of the Two-Wire Direct Interface (TDI), and the Burroughs Direct Interface (BDI), shall conform to Interface Type D of signal interchange circuit. The BDI Interface requires only two data interchange circuits and one signal ground interchange circuit. The Terminal connectors for accomodating the communication interfaces are listed in Table 4.

TABLE 4. CONNECTOR AND PIN ASSIGNMENTS FOR COMMUNICATIONS INTERFACE CIRCUITS

<u>CIRCUIT</u>	<u>EIA</u>	<u>CCITT</u>	<u>CONNECTOR NO. 1</u>	<u>CONNECTOR NO. 2</u>	<u>CONNECTOR NO. 3</u>
Protective Ground	AA	101	1	1	1
Signal Ground	AB	102	7	7	7
Transmitted Data	BA	103	2	2	2
Received Data	BB	104	3	3	3
Request to Send	CA	105	4	4	4
Clear to Send	CB	106	5	5	5
Data Set Ready	CC	107	6	6	6
Data Terminal Ready	CD	108.2	20(4)	20(4)	20(4)
Connect Data Set to Line	-	108.1	-	20(4)	20(4)
Ring Indicator (9)	CE	125	22	22	22
RCV Line Signal Detector	CF	109	8	8	8

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DRAWN BY	CHK STD & REC	CHECK FF & F	DSGN	APPROVED
DATE	DATE	DATE	DATE	DATE

REV	REVISION
-----	----------

TABLE 4. CONNECTOR AND PIN ASSIGNMENTS FOR COMMUNICATIONS INTERFACE CIRCUITS (CONT)

CIRCUIT	EIA	CCITT	CONNECTOR	CONNECTOR	CONNECTOR
			NO. 1	NO. 2	NO. 3
Data Signal Rate Selector	CH	111	23(5)	23(5)	11(5)
Select Trans. Frequency	-	126	-	11(6)	11(6)
Transmitter Signal Timing Element	DB	114(7)	15	15	15
Receiver Signal Timing Element	DD	115(7)	17	17	17
Select Standby	-	116(8)	1	24	24

NOTES TO TABLE 4.

1. Connector No. 1 consists of Burroughs parts 1694 7244, 1699 4345(2) and 2471 2036, and shall be similar to the Bell connector or equivalent.
2. Connector No. 2 consists of Burroughs parts 1694 7244, 1900 2484, or 1900 2534, and shall be similar to the SEL connector or equivalent.
3. Connector No. 3 consists of Burroughs parts 1472 0635, 1473 9213, or 1257 0420(2), and shall be similar to the BPO connector.
4. "Data Terminal Ready" and "Connect Data Set to Line" shall be used as follows:
  - (a) Switched Lines - Provide positive voltage to maintain connection for duration of call.
  - (b) Leased Lines - Provide for permanent positive voltage for leased line operation.
5. The data signal rate selector lead shall provide a positive or negative voltage for data rate selection. A positive voltage on this lead shall condition the data set for the higher data rate as required for leased line operation. A negative voltage on this lead shall condition the data set for the lower data rate as required for switched line operation. Positive or negative voltage selection shall be made through field engineering adjustment. Data signal rate select shall be used with CCITT V23 and V26 data sets (paragraph 3.2.6.4.2).
6. The select transmit frequency lead shall provide a positive or negative voltage for frequency selection. A positive voltage on this lead shall condition the data set for the higher frequency. A negative voltage on this lead shall condition the data set for the lower frequency. Positive or negative voltage selection shall be made through field engineering adjustment. The select transmit frequency shall be used with the V21 data sets (paragraph 3.2.6.4.2).
7. Circuits DB and DD are used only with synchronous communications systems.
8. Circuit 116 is defined for the V26 data set in paragraph 3.2.6.4.2.
9. Circuit CE (Ring indicator) is not used by the Terminal.

**Burroughs Corporation**ELECTRONIC COMPONENTS DIVISION  
PLAINFIELD, NEW JERSEY 07061 U. S. AMERICA

SHEET 36 OF 174

DWG NO.

1691 6256

REV

A

CLASS CODE

TITLE

ENGINEERING SPECIFICATION: TD730/830

PROPRIETARY TO BURROUGHS CORPORATION-NOT TO BE REPRODUCED, NOR USED FOR MANUFACTURING PURPOSES EXCEPT ON BURROUGHS ORDER OR PRIOR WRITTEN CONSENT.

DRAWN BY

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CHECK FF &amp; F

DSGN

APPROVED

DATE

DATE

DATE

DATE

DATE

LTR

REVISION

3.2.6.2.1 Sequence of Required Circuits: The sequence of required circuits during the transmit sequence and receive sequence is given in Table 5.

TABLE 5. SEQUENCE OF REQUIRED CIRCUITS

<u>CIRCUIT</u>	<u>EIA</u>	<u>CCITT</u>	<u>NOTES</u>
<u>Transmit Sequence:</u>			
Data Terminal Ready or Connect Data Set to Line	CD	108	
Data Signal Rate Selector	CH	111	Required for certain CCITT data sets
Select Transmit Frequency		126	Required for certain CCITT data sets
Data Set Ready	CC	107	
Transmit Signal Element Timing	DB	114	Synchronous data sets
Request to Send	CA	105	
Clear to Send	CB	106	
Transmit Data	BA	103	Transmission on this lead is terminated if any of the following three circuits go "off":  1. Request to Send  2. Clear to Send  3. Data Terminal Ready/Connect Data Set to Line
<u>Receive Sequence:</u>			
Data Set Ready	CC	107	
Receive Line Signal Detector	CF	109	In the event Receive Line Signal Detector goes "off" during reception of data from a synchronous data set, the Terminal will lose synchronism and not accept data until synchronism is re-established.
Receive Signal Element Timing	DD	115	Synchronous Data Sets
Receive Data	BB	104	

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LTR	REVISION
-----	----------

### 3.2.6.3 Concatenation Connection

An optional means is available for connecting multiple Terminals to a single data set in a synchronous or asynchronous multipoint network through concatenation (series chaining) of the Terminals. The maximum cable length between the data set and the first Terminal is 1000 feet or a length specified by the manufacturer of the data set. The interface circuits will comply with paragraph 3.2.6.2. The Terminal provides within its connector an input and output set of connections. The input connections accept the interface circuits from the data set or preceding Terminal. The interface signals are utilized by the Terminal, as appropriate, and are reconstituted to specified levels by driver circuitry before being applied to the output connections for transmission to the succeeding Terminal in the string. The Terminal provides the interface signal amplification regardless of whether that signal is utilized by the Terminal within itself. The Terminal is not responsible for re-establishing timing or phasing degradations which may occur during the transit of the signals along the concatenated Terminal chain. Should the final Terminal in the chain be the TD730/830, that Terminal shall not require termination for the unused concatenation drivers. Disconnecting or removing power from any Terminal in the chain will disable all Terminals beyond the disabled Terminal. The cable connectors are configured as mating connectors in order to enable continuity of the Terminal chain when a Terminal is removed.

**3.2.6.3.1 Synthesis of "Clear-to-Send" (CB) Circuit:** There exists the possible condition in a concatenated Terminal chain which includes the Mod 1 TC Series, that the CB circuit is not propagated by that series. There also may exist the condition where the Mod 1 TC Series may loop the Request-to-Send directly back as Clear-to-Send, thereby eliminating any delay. A TD730/830 Terminal located beyond the Mod 1 TC Series Terminal will not receive Clear-to-send from the data set and shall not properly transmit its data as a result. To overcome the difficulty, the Terminal contains within its concatenation circuitry a delay circuit which synthesizes the Clear-to-Send signal when activated by the Request-to-Send signal. The delay can be adjusted by keyboard CTRL sequence (paragraph 3.2.8) up to 255 milliseconds and for both 2- and 4-wire data set configurations. The 2- or 4-wire configuration is selectable through keyboard CTRL sequences as defined in paragraph 3.2.8. Stop/Go data transmission can be accomplished through control of the Clear-to-Send line.

The Clear-to-Send circuit is capable of three modes of operation:

- (a) Complete disablement with system reliance upon the true Clear-to-Send from the data set.
- (b) The synthetic Clear-to-Send delay starting with the Terminal Request-to-Send.
- (c) The synthetic Clear-to-Send delay resulting from the loop-back and propagation of Request-to-Send by the Terminal adjacent to the data set.



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DRAWN BY	CHK STD & REC	CHECK FF & F	DSGN	APPROVED
DATE	DATE	DATE	DATE	DATE

LTR	REVISION
-----	----------

**3.2.6.3.2 Concatenation Cabling Limitations:** The number of TD730/830 Terminals in a concatenated chain composed solely of TD730/830 Terminals is not limited electrically by the delay characteristics of the chain. The number of TD730/830 Terminals in the chain is limited only by the available AD1 and AD2 addresses within the particular system.

- (a) **Asynchronous Operation** The maximum Terminal to Terminal concatenated cable length shall not exceed 1000 feet for cable 1699 3396. No limitation on cumulative cable length shall be imposed other than the available address limitation on multiple Terminal concatenation.
- (b) **Synchronous Operation** The maximum cumulative concatenation cable length permitted during synchronous operation is as follows:

9,600 bps	400 feet
4,800 bps	800 feet
2,400 bps	1600 feet
2,000 bps	2000 feet
1,200 bps	3200 feet
600 bps	6400 feet

**3.2.6.3.3 Concatenation Cables:** For concatenating the TD730/830 family of Terminals, four specific cable types are required for compliance with the various possible combinations:

- (a) **Terminal to Data Set** - A family of cable lengths (15, 25, 50, or 100 feet) which contain a plug on the data set end of Connectors No. 1, 2, or 3 (Table 4) depending on the domestic or international market being served, and a jack on the Terminal end conforming to Connector No. 1. For domestic applications, this cable type (using Connector No. 1 on both ends) is identical to the cable of (b) below.
- (b) **Terminal to Terminal** - A family of cable lengths (15, 25, 50, or 100 feet) which contain a plug and jack on the respective ends, conforming to the mating pair of Connectors No. 1 (Table 4).
- (c) **Terminal Concatenation Adapter** - A cable assembly consisting of three type No. 1 connectors and two cables in a "Y" configuration. Each cable is one foot in length with a connector on each branch. The left connector is capable of mating as a plug with the data set or next Terminal away from the data set. The right connector is capable of mating as a jack with the succeeding Terminal. The lower central connector has the capability of mating with the Terminal as a jack.
- (d) **Terminal to TC Series Terminal Adapter** - A cable (1 foot in length) which consists of a Type No. 1 jack-connector and a TC Series CLC-plug connector on the respective cable ends. This adapter cable will be supplied by Burroughs Plymouth Plant.

**3.2.6.4 Interface Data Rates and Data Sets**

The Terminal is capable of operating with both domestic and international data rates and data sets. All data rates are keyboard selectable with certain data rates being configuration changes as defined in paragraph 3.2.8.

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DRAWN BY	CHK STD & REC	CHECK F F & F	DSGN	APPROVED
DATE	DATE	DATE	DATE	DATE

LTR REVISION

3.2.6.4.1 Domestic Applications: The Terminal is capable of operating with the data sets or their equivalents in domestic applications as described below:

- (a) 150/300 bps Asynchronous - This interface is compatible with the Bell 103 data set family or equivalent.
- (b) 600/1200 bps Asynchronous - This interface is compatible with the Burroughs TA713 data set or equivalent, including the Bell 202 family.
- (c) 1800 bps Asynchronous - This interface is compatible with the Burroughs TA783 data set or equivalent, including the Bell 202 family.
- (d) 2000/2400 bps Synchronous, - This interface is compatible with the Burroughs TA734-24 data set or equivalent, including the Bell 201 data set family. The synchronous interface circuits include DB and DD (see Table 4).

The Terminal has the capability of synchronous data communication in both two- and four-wire circuits with these data sets. In four-wire circuits, the Terminal is capable of operation with the condition of continuous carrier in which the Transmit and Receive carrier circuits in the data set simultaneously remain in the "on" condition. Provision has been made for the New Sync signal in the data set interface in order to permit communications interchange at lower turn-around times in the data set.

- (e) 4800 bps Synchronous - This interface is compatible with the Burroughs TA733-48 data set or equivalent, including the Bell 208 data set family.
- (f) 9600 bps Synchronous - This interface is compatible with 9600 bps data sets which conform to the EIA RS232C interface requirements. (Bell 209 or equivalent)

3.2.6.4.2 International Applications: The Terminal conforms to the interface circuit requirements defined by CCITT Recommendation V24 and operates with the following data sets or equivalents in international applications as described below: (see paragraph 3.2.6.2 for reference to V24 signal interfaces.)

- (a) V21 Data Set - The Terminal will operate in a compatible interface with the V21 data set or equivalent, including the GPO Data 1, 2. Operation is asynchronous half-duplex at data rates of 150 or 200 bps. Circuit 126 selects the transmit frequency for the data set. A positive voltage is used to select frequency No. 1 and a negative voltage is used to select frequency No. 2. This adjustment is made by a field engineer.
- (b) V23 Data Set - The Terminal will operate in a compatible interface with the V23 data set or equivalent, including the BPO Data 1 and Burroughs TA753. Operation is asynchronous half-duplex at data rates of 600/1200 bps. Circuit 111 selects the data rate. A positive voltage is used to select 1200 bps operation and a negative voltage is used to select 600 bps operation. The Data 1 operates normally on a four-wire connection, but has the capability of being switched to two-wire standby connection. The "Request-to-Send"/"Clear-to-Send" delay in two-wire operation is 200 ms. This delay is provided internally by the TD730/830 Terminal for both 600 and 1200 bps data rates.





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DRAWN BY	CHK STD & REC	CHECK FF & F	DSGN	APPROVED
DATE	DATE	DATE	DATE	DATE

LTR	REVISION
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3.2.6.4.2 International Applications (CONT)

- (c) V26 Data Set - The Terminal will operate in a compatible interface with the V26 data set or equivalent, including the GPO Datel 7. The mode of operation is synchronous. Using the Facility 3 form of the data set, operation will be at a data rate of 2400 bps on a four-wire line with alternative channel data rates of 600/1200 bps in either direction (not simultaneously) on a two-wire line. The Standby Select (CCITT Circuit 116) will select the primary or alternative channel, and CCITT Circuit 111 (Data Signal Rate Selector) will select which of the alternative channel data rates will be used. The possible combinations are:

<u>DATA RATE</u>	<u>CIRCUIT 116</u>	<u>CIRCUIT 111</u>
2400 bps	OFF (-)	Not Enabled
1200 bps	ON (+)	ON (+)
600 bps	ON (+)	OFF (-)

3.2.6.5 Options to RS232 and CCITT Interfaces

3.2.6.5.1 Keyboard Selectable Data Rates: The Terminal has the capability to operate at data rates which are selectable through keyboard CTRL control sequences (Table 11). These sequences provide for selecting asynchronous data rates in the domestic market and for selecting asynchronous and synchronous data rates through control of data sets in international applications.

- (a) Asynchronous Domestic Systems - For asynchronous domestic applications, three data rates are selectable. The keyboard CTRL control selecting sequences and the selected data rates are listed in Table 6.

TABLE 6. KEYBOARD CTRL SELECTABLE DOMESTIC DATA RATES

<u>KEYS</u>	<u>DATA RATE</u>
CTRL, space, H, CTRL	600 bps
CTRL, space, J, CTRL	1200 bps
CTRL, space, K, CTRL	1800 bps



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LTR	REVISION
-----	----------

3.2.6.5.1 Keyboard Selectable Data Rates (CONT)

(b) International Synchronous and Asynchronous Systems: For international synchronous and asynchronous systems 3 data rates are selectable. The keyboard CTRL control selecting sequences and selected data rates for certain data sets are listed in Table 7.

TABLE 7. KEYBOARD CTRL SELECTABLE INTERNATIONAL DATA RATES

KEYS	DATA RATE	DATA SET	MODE	CCTT CIRCUIT	CIRCUIT* LEVEL
CTRL, space, H, CTRL	600 bps**	V23	Asynchronous	111	Low (-)
CTRL, space, J, CTRL	1200 bps	V23	Asynchronous	111	High (+)
CTRL, space, H, CTRL	600 bps	V26	Synchronous	111	Low (-)
CTRL, space, H, CTRL	600 bps	V26	Synchronous	116	High (+)
CTRL, space, J, CTRL	1200 bps	V26	Synchronous	111	High (+)
CTRL, space, J, CTRL	1200 bps	V26	Synchronous	116	High (+)
CTRL, space, K, CTRL	2400 bps	V26	Synchronous	111	Low (-)
CTRL, space, K, CTRL	2400 bps	V26	Synchronous	116	Low (-)

\*The circuit level voltages shall be as follows:  
 High (+) = +5 to +15 volts DC  
 Low (-) = -5 to -15 volts DC

\*\*The 600 bps asynchronous data rate selection requires selecting the Request-to-Send/Clear-to-Send delay of 200 ms (paragraph 3.2.6.3.1).

3.2.6.6 Modem Expanders

The Terminal communications interface has the capability of being connected to and operating with the TA800 Series of Burroughs Modem Expanders, or their equivalents. These are the TA800-1 (4 Terminals), TA800-2 (8 Terminals), TA800-3 (12 Terminals), and TA800-4 (16 Terminals).

3.2.6.7 Two-Wire Direct Interface (TDI) Communications

The Terminal is capable of meeting the requirements of Two-Wire Direct Interface (TDI) specification 1700 3195, with the conditions and exceptions listed in the following sub-paragraphs.

3.2.6.7.1 Conditions: The conditions under which specification 1700 3195 will be met are:

(a) Character format shall be 10 bits (asynchronous).

**Burroughs Corporation**ELECTRONIC COMPONENTS DIVISION  
PLAINFIELD, NEW JERSEY 07061 U. S. AMERICASHEET 174  
42 OF

DWG NO.

1691 6256

REV  
A

CLASS CODE

TITLE

ENGINEERING SPECIFICATION: TD730/830

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DATE

DATE

DATE

DATE

DATE

LTR REVISION

**3.2.6.7.1 Conditions (CONT)**

(b) Data transmission rates for asynchronous data shall be at the following rates:

- 1) 150 bps
- 2) 300 bps
- 3) 1200 bps
- 4) 1800 bps
- 5) 2400 bps
- 6) 4800 bps
- 7) 9600 bps

(c) The connector used for the two-wire connector on the Terminal end is specified in Table 4 of this specification as Connector No. 1.

(d) The characters of a message sequence shall be in accordance with the following Terminal multipoint communications procedures: POL (paragraph 4.2.7.1.1); SEL (paragraph 4.2.7.1.2); FSL (paragraph 4.2.7.1.3); CON (paragraph 4.2.7.1.4); BSL (paragraph 4.2.7.1.5); and GSL (paragraph 4.2.7.1.6) to the extent applicable to the Terminal.

(e) The cable used for the TDI connection shall be twisted two-wire cable and have a maximum length of 1000 feet. This cable is a single cable with multiple drops along its length. The TDI cable characteristics including gauge and shielding conform to Burroughs drawing 1110 0062. The number of Terminals in a TDI installation is limited to a maximum of nine on a 1000 foot cable.

**3.2.6.7.2 Exceptions: The exceptions to specification 1700 3195 are:**

- (a) Circuit AA - Protective Ground (reference paragraph 3.4.1 of specification 1700 3195). This conductor is electrically connected to the equipment frame. The TDI cable shield is connected through pin 1 of the RS232 connector.
- (b) Circuit AB - Signal Ground (reference paragraph 3.4.2 of specification 1700 3195). This conductor is the DC circuit ground establishing the ground reference for circuit BA. Circuit AB is not connected to circuit AA. The black conductor of the TDI cable is connected through pin 7 of the RS232 connector.
- (c) Circuit BA - Data (reference paragraph 3.4.3 of specification 1700 3195). This circuit is the half-duplex serial data interchange. The white conductor of the TDI cable is connected through pin 2 of the RS232 connector.
- (d) The ZERO (spacing) state of circuit BA shall be 0 to -3 volts when measured at the Terminal connectors (reference paragraph 3.7.7 of specification 1700 3195).
- (e) When the Terminal transmits the ONE state, circuit BA shall be more negative than -10 volts when measured at the Terminal connectors (reference paragraph 3.7.3 of specification 1700 3195). Up to 100 mA of current can be drawn for a maximum of 20  $\mu$ s (reference paragraph 3.7.4 of specification 1700 3195).
- (f) When the Terminal transmits the ZERO state, up to 500 mA of current will be supplied to circuit BA (reference paragraph 3.7.6 of specification 1700 3195).

SHEET 43 OF 174	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY	CHK STD & REC	CHECK FF & F
DATE	DATE	DATE
	D8GN	APPROVED
	DATE	DATE

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REV	REVISION
-----	----------

3.2.6.7.2 Exceptions (CONT)

- (g) When the Terminal receives the ZERO state, it will draw a maximum of 2 mA of current from circuit BA (reference paragraph 3.7.8 of specification 1700 3195).
- (h) The effective open-circuit shunt capacitance between circuit BA and circuit AB will not exceed 50 pF (reference paragraph 3.7.11 of specification 1700 3195).

3.2.6.8 Burroughs Direct Interface (BDI)

The Terminal is capable of meeting the requirements of the Burroughs Direct Interface specification 1498 5303 in serial, asynchronous connections. Data rates of up to 38.4 k bps, including 1.2 k, 1.8 k, 2.4 k, 4.8 k, 9.6 k, and 19.2 k bps, at a maximum cable distance of 15,000 feet are provided. The combination of the parameters of data rate, maximum installed cable length and cable wire size provide the limits which govern each BDI installation. The inter-relationship of these parameters is given in specification 1498 5303. The Terminal BDI interface meets the requirements of the BDI specification, but does not necessarily duplicate the circuits given in that specification. The number of Terminals in a BDI installation containing a single multipoint line is limited to a maximum of twenty.

With BDI, the connection from each customer-installed BDI cable and junction box to each Terminal in the multipoint network will be with the BDI Device Connection Kit (Plymouth No. 1537 3657).

3.2.7 Standard Keyboard Unit (Optional keyboard referenced in paragraph 5.5)

The Terminal contains a keyboard unit which provides for manual data entry into the display. The keyboard unit is comprised of a keyboard assembly which includes the decoding circuitry required to develop data codes, and an indicator assembly which contains status indicators. Keyboard entered data is simultaneously stored in the refresh memory and displayed on the Self-Scan panel or the CRT. The key characteristics (including spacing, pressure, and throw) are similar to those of an electric office typewriter. Two basic configurations of keyboard are available; the alphanumeric typewriter keyboard (paragraph 3.2.7.4) and the auxiliary numeric keypad (paragraph 3.2.7.2). With the exception of the auxiliary numeric keypad, each keyboard set contains function keys (Table 10) for editing, message formatting, and cursor control. All alphanumeric/function keys are operable in LOCAL mode. The LOCAL key, scroll, and page advance/back functions (paragraph 3.2.4.3.1) are operable in all modes. In addition to a keyboard set, the keyboard unit contains control keys and indicators for the selection and control of the various operating modes (Table 9). The dimensions and weight of the keyboard unit and auxiliary keypad conform to Table 8.

# Burroughs Corporation

ELECTRONIC COMPONENTS DIVISION  
PLAINFIELD, NEW JERSEY 07061 U. S. AMERICA



SHEET  
44 of 174

DWG NO.

1691 6256

REV  
A

CLASS CODE

TITLE

ENGINEERING SPECIFICATION: ID730/830

PROPRIETARY TO BURROUGHS CORPORATION-NOT TO BE REPRODUCED, NOR USED FOR MANUFACTURING PURPOSES EXCEPT ON BURROUGHS ORDER OR PRIOR WRITTEN CONSENT.

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DATE

DATE

DATE

DATE

DATE

LTR REVISION


### 3.2.7.1 Keyboard Unit Characteristics

The Terminal keyboard units have characteristics to the extent specified in Table 8 (See Burroughs specification 1691 2602 for detailed characteristics).

TABLE 8. KEYBOARD UNIT CHARACTERISTICS

<u>FEATURE</u>	<u>CHARACTERISTIC</u>
Keystroke	0.2 inches (approximate) (5.08 mm)
Key Pressure:	
Alphanumeric and Function Keys	3 ounces (approximate) (85.2 grams)
Mode Control Keys	9 ounces (approximate) (255.6 grams)
Output Level Compatibility	TTL
Signal Outputs	9 data and coded function key lines (6 data and 3 tagging), strobe, and 2 noncoded function key outputs
Data Line Output Voltages:	
Key Non-Operated	+2.6 volts DC minimum (Logic 0)
Key Operated	0 to +0.45 volts DC maximum (Logic 1)
Strobe Line Output Voltages	Same as data lines except that they are delayed
Function Keys	11 coded, 2 noncoded
Control Keys	5 coded
Two Key Rollover	Two key rollover maintains the data code produced when the first key is pressed and a second key is pressed before the first key is released. When the first key is released, the data code produced by the second key is applied as the output. During any multi-key action the strobe shall be Logic 0.
Shift Key Control	Electronic, non-locking
Shift Lock	Alternate action, locks shift key in shift position

	<u>HEIGHT</u>	<u>WIDTH</u>	<u>DEPTH</u>	<u>WEIGHT</u>
Keyboard Unit	3.2 inches (81 mm)	14.3 inches (363 mm)	6.9 inches (175 mm)	6 pounds (2.7 kg)
Auxiliary Keypad	3.5 inches (89 mm)	5.6 inches (142 mm)	6.6 inches (168 mm)	2 pounds (.91 kg)

<b>Burroughs Corporation</b> ELECTRONIC COMPONENTS DIVISION PLAINFIELD, NEW JERSEY 07061 U. S. AMERICA		SHEET 45 OF 174	DWS NO. 1691 6256			REV A
		CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830			
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		DATE	DATE	DATE	DATE	DATE

LTR	REVISION
-----	----------

### 3.2.7.2 Auxiliary Numeric Keypad

An auxiliary numeric keypad (Figure 7-4) is available for connection to any of the domestic or international alphanumeric keyboards to provide a format for convenient numeric inputs. This keypad contains 13 keys.

### 3.2.7.3 Keyboards for International Use

The Terminal is available with alphanumeric keyboards for international use. These keyboards provide the special characters and symbols required by various countries. Alphanumeric keyboards are available for the country groupings indicated in section 7.

### 3.2.7.4 Alphanumeric Typewriter Keyboard

The alphanumeric typewriter keyboard configured for the 95-character ASCII character set is available for the Terminal. This keyboard contains 69 keys and is configured according to the layout shown in Figure 7-3.

### 3.2.7.5 Optional Terminal with No Keyboard

The Terminal has an optional configuration which contains no keyboard. This Terminal is a receive-only Terminal which accepts data from the central processor into the display memory and presents this data on the display.

### 3.2.7.6 Security Lock (Option, Factory Installed)

A security lock is available as a factory installed option for the keyboard. The security lock electrically inhibits unauthorized use of the keyboard by disabling the MOS encoder outputs. The security lock consists of a tumbler lock with a removable key and is located on the right side of the keyboard unit. Locking the keyboard disables the keyboard and results in the Terminal being placed in the Local or Receive modes.

### 3.2.7.7 Automatic Key Repeat

Any alphanumeric key, line feed, reverse line feed, backspace, forward space, carriage return, character delete, TAB, and reverse tab key, when depressed for a period exceeding 0.5 seconds, will initiate an automatic 12 hertz repeat of that key. Automatic repeat of a key causes the repetition of that character or function in successive display and memory locations. Releasing the key terminates the repeat action. All keys are capable of repeat action except the top row: CTRL, SPCFY, LOCAL, RCV, and XMT, and the character insert key.



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DSGN

APPROVED

DATE

DATE

DATE

DATE

DATE

LTR REVISION

### 3.2.8 Configuration Control

The Terminal contains 32 bytes of permanently stored data which define the Terminal's configuration. Upon power-up, the permanently stored configuration data is written into the read/write memory for Terminal use. Permanently stored configuration data is set at the Terminal's manufacturing plant and shall be altered only by the field engineer. Configuration data written into the read/write memory may be altered through data comm ESC sequences and shall be considered temporarily stored data. Any power-down of the Terminal will erase temporarily stored data and the next power-up will rewrite the normal Terminal configuration data into the memory.

#### 3.2.8.1 Configuration Options

The configuration options available to the Terminal are listed below:

Printer and Printer Data Rate Selection

Optional Magnetic Card Reader Mode (paragraph 5.3)

Continuous Programmatic Mode Enable (paragraph 4.2.6.1.4)

Characters/Line (paragraphs 3.2.1.3.6 and 3.2.2.3.7)

Lines/Page (paragraph 3.2.4.3)

Clear to Send Delay (up to 255 ms)

Transmit to Receive Delay (up to 255 ms)

Request to Send Delay (up to 265 ms)

Two-wire/Four-wire Enable (paragraph 3.2.6.3.1)

Parity Ignore (paragraph 4.2.6.3.1)

No Cursor (paragraphs 3.2.1.3.2 and 3.2.2.3.4)

Solid Cursor (paragraphs 3.2.1.3.2 and 3.2.2.3.4)

Blinking Cursor (paragraphs 3.2.1.3.2 and 3.2.2.3.4)

12/24 Line Mode (TD830 only, paragraph 3.2.2.3.7)

Position End of Page Alarm (paragraph 4.2.1.7)

Fixed/Variable Tab (paragraph 4.2.1.3)

Forms Delimiter Specify (paragraph 4.2.1.1)

Write CR (RET) Character (Table 10)

Disable New Line on CR Function (Table 10)

Wrap-Around Inhibit (paragraph 4.2.1.8)

Field Overflow Inhibit (paragraph 4.2.1.1.1)

Tab Field Identifier Enable (paragraph 4.2.1.3.4)

Clear Key Interpretation in Forms (paragraph 4.2.1.1)

Variable Data Transmission (paragraph 4.2.6.4.4)

Terminal Address Selection (paragraph 4.2.6.2.1)

\*Enable/Disable Line Monitor (paragraph 4.2.6.2.1)

DC1 Character Interpretation (Table 12)

DC2 Character Interpretation (Table 12)

FF Character Interpretation (Table 12)

LF Character Interpretation (Table 12)

32/40 Character Per Line Mode (TD730 only, paragraph 3.2.1.3.6)

Data Rates (up to 38.4 k bps)(paragraph 3.2.6)

TD700 Extended Memory Environment (paragraph 3.2.4.3.1)

B9348 (ODT) Environment

Optional Poll/Select Characters (Figure 7-1)

A9249 Extended Line Enable (paragraph 5.4.2.4)

\*Data Comm Loop-back Through Firmware (paragraph 4.2.6.4.3)

SOH Clear 4.2.7.3.2)

\*Can be implemented as a temporary change only.



SHEET 47 OF 174	DWS NO. 1691:6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY	CHK STD & REC	CHECK FF & F
DATE	DATE	DATE
DGN		APPROVED
DATE	DATE	DATE

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LTR	REVISION
-----	----------

**3.2.8.2 Field Engineer Initiated Configuration Changes**

The field engineer shall use the following CTRL sequences to alter the Terminal configuration:

<u>KEY SEQUENCE</u>	<u>FUNCTION</u>
CTRL, RMODE	The CTRL, RMODE sequence causes the Terminal to enter an off-line mode, clears the refresh memory and enables the field engineer to make configuration changes.
CTRL, RA, "aaaa"	Entry of the CTRL, RA sequence followed by the hexadecimal memory address "aaaa" will cause the Terminal to display a 16-character ASCII message representing the 16 sequential bytes of stored data starting at memory location "aaaa." Once the 16-character message is displayed, the field engineer may alter the message from the keyboard.
CTRL, RH, "aaaa"	Entry of the CTRL, RH sequence followed by the hexadecimal memory address "aaaa" will cause the Terminal to display a 32-character hexadecimal message representing the 16 sequential bytes of stored data starting at memory address "aaaa." Once the message is displayed, the field engineer may alter the message from the keyboard.
CTRL, RC, XXXX	The CTRL, RC sequence shall be used after the CTRL, RA or CTRL, RH sequence and will cause the Terminal to write the displayed message into the 16 sequential temporary storage locations starting at memory address "aaaa."
CTRL, RP, XXXX	The CTRL, RP sequence causes the temporarily stored configuration data to be written into the permanent (EAROM) storage locations of the Terminal. In addition, the sequence forces the Terminal back into an on-line mode, thus disabling further configuration changes.

**NOTE:** Depression of the LOCAL key shall cause the Terminal to abort the off-line mode. XXXX are fill characters.



**Burroughs Corporation**ELECTRONIC COMPONENTS DIVISION  
PLAINFIELD, NEW JERSEY 07061 U. S. AMERICASHEET 174  
48 OF

DWG NO.

1691 6256

REV

A

CLASS CODE

TITLE

ENGINEERING SPECIFICATION: TD730/830

PROPRIETARY TO BURROUGHS CORPORATION-NOT TO BE REPRODUCED, NOR USED  
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APPROVED

DATE

DATE

DATE

DATE

DATE

LTR

REVISION

**3.2.8.3 Remote Controller Initiated Configuration Changes**

The Terminal configuration can be altered from the remote controller through the use of the following ESC sequences:

SEQUENCEFUNCTION

ESC, RA, (a)(b)(c)

The ESC, RA (a)(b)(c) sequence enables the data comm to enter data into any read/write memory area. The (a), (b), and (c) are interpreted as follows:

- (a) The four character hexadecimal memory address used to identify the starting address in which the data comm shall begin to write data.
- (b) The two character, hexadecimal byte count used to identify the number of bytes of data contained in part (c) of the ESC sequence.
- (c) The ASCII data to be written into the memory. This data may contain up to 255 characters.

ESC, RH, (a)(b)(c)

The ESC, RH (a)(b)(c) sequence enables the data comm to enter data in any read/write memory (RAM) area and will be interpreted as follows:

- (a) The four character, hexadecimal memory address used to identify the starting address in which the data comm shall begin to write data.
- (b) The two character, hexadecimal byte count used to identify the number of bytes of data contained in part (c) of the ESC sequence.
- (c) The hexadecimal configuration data to be written into the memory. This data may contain up to 255 characters.

ESC, RC

The ESC, RC sequence will cause the Terminal to initiate a restart program and shall be used following an ESC, RH sequence containing configuration data changes.

ESC, RP

The ESC, RP sequence shall cause the Terminal to perform the following operations:

1. Enter the off-line mode.
2. Write data, previously entered using the ESC, RA or ESC, RH sequence, into the permanent (EAROM) storage locations of the Terminal.
3. Return the Terminal to the on-line condition (Local mode).

ESC, RE, "aaaa"

The ESC, RE sequence will cause the Terminal to execute any program loaded by the ESC, RH sequence starting at memory address "aaaa."

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**3.2.9 Status Line**

The Terminal status line will contain up to 80 characters of data and will be located in the last line (TD830) or last two lines (TD730) of the Terminal's display. The types of information displayed in the status line and relative position in which they appear are given below:

TD830

Error Conditions	Special Messages	Page Number
------------------	------------------	-------------

TD730

Error Conditions	Special-
Messages	Page Number

**3.2.9.1 Page Number**

The word "PAGE" and the number of the page on which the cursor is located will be displayed in the last seven positions of the status line.

Terminals configured for single page operation shall not contain the word "PAGE" or the page number.

**3.2.9.2 Special Messages**

The special message section of the status line is used to display data comm entered data that can not be altered by the keyboard. Special messages of up to 52 characters may be displayed without overwriting other data displayed in the status line. Typical "special messages" may include computer or system status and operation notification of data entry on non-displayed pages.

The Fast Select, Group Select, and Broadcast Select Procedures (paragraphs 4.2.7.1.3, 4.2.7.1.6, and 4.2.7.1.5 respectively) shall be used in conjunction with the ESC, RA sequence (paragraph 3.2.8.3) to write special messages.

**3.2.9.3 Error Conditions**

The first 16 characters of the status line are dedicated to error messages. The Terminal contains 5 different error messages which may be tailored (personalized) by the field engineer or data comm. The Terminal shall display the given error message whenever the following errors occur:

- |                                         |                               |
|-----------------------------------------|-------------------------------|
| <u>Error Condition</u>                  | <u>Error Message Examples</u> |
| Momentary Power Loss                    | "POWER FAULT"                 |
| Block Check or Data Comm Hardware Error | "DATA COMM ERROR"             |
| Keyboard Buffer Overflow                | "KEYBD DATA LOST"             |
| Printer Hardware Error                  | "PRINTER ERROR"               |
| Power off or Faulty Cable Connection.   |                               |
| Cassette Read or Write Error            | "CASSETTE ERROR"              |
| Incomplete Tape Command or CRC Error.   |                               |

**3.2.9.3.1 Message Personalization:** The field engineer may alter any error message contained in the Terminal through CTRL, RWMODE; CTRL, RA, and CTRL, RP sequences (paragraph 3.2.8.2) The data comm may alter any error message through the use of the ESC, RA and ESC, RP sequences.



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DATE

DATE

DATE

DATE

DATE

LTR REVISION

4. FUNCTIONAL DESIGN CHARACTERISTICS

4.1 GENERAL FUNCTIONAL CHARACTERISTICS

Functionally the TD730/830 Series Terminal is comprised of five interdependent subsystems: Keyboard unit, Interface system, Display system, Microprocessor/memory unit, and the Power Supply. Each subsystem (except power supply) can be implemented in standard or optional configurations which are linked together by the control circuitry of the microprocessor to form the complete Terminal. A functional layout is shown in Figure 4-1.

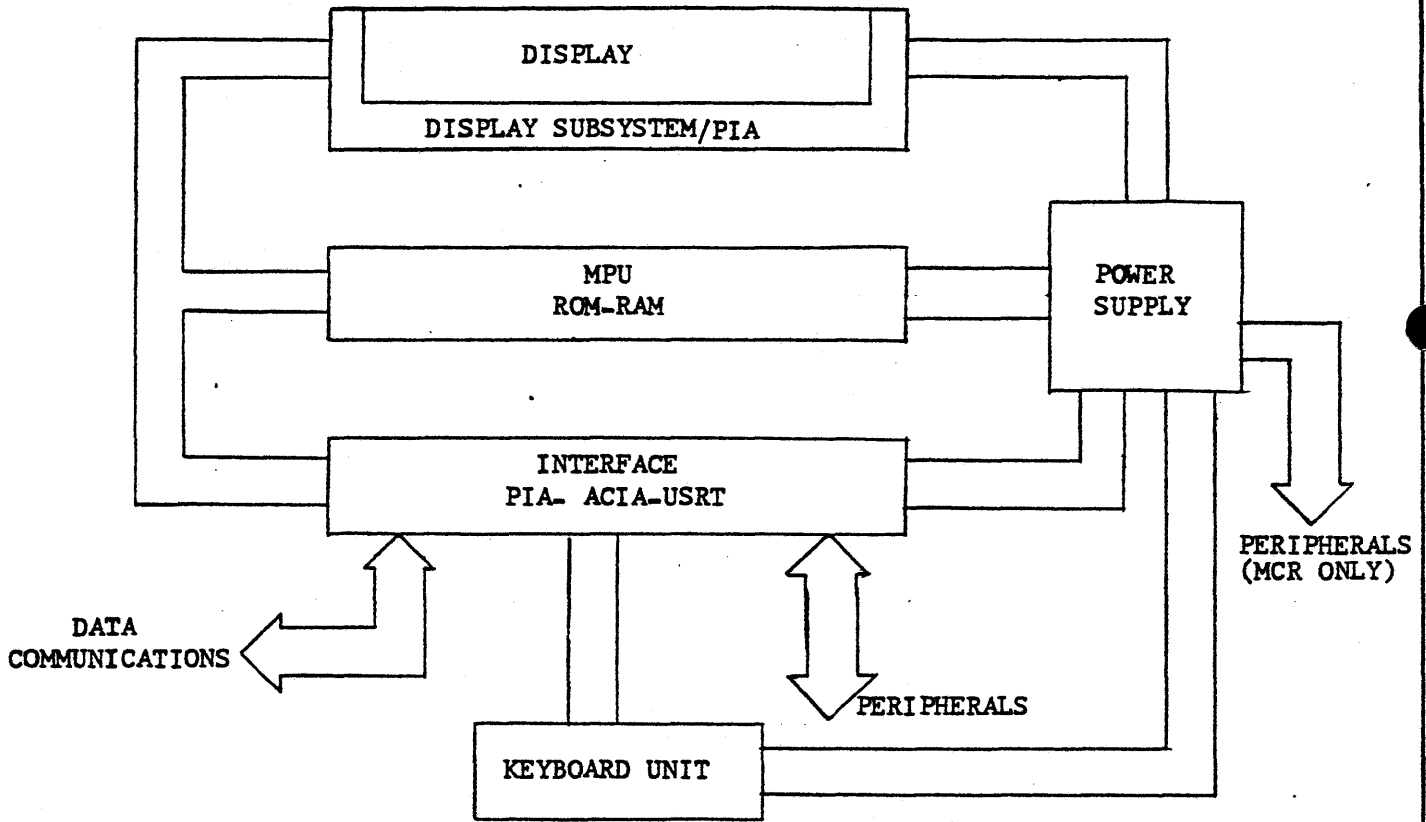


FIGURE 4-1. FUNCTIONAL LAYOUT



SHEET 174 51 OF	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY	CHK STD & REC	CHECK F P & F
DATE	DATE	DATE
DSGN	APPROVED	
DATE	DATE	DATE

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LTR	REVISION
-----	----------

4.1.1 MPU Board

The MPU board contains the Terminal's central system control hardware, primary memory elements, and buffering for signals to other interconnected printed circuit boards.

The control hardware includes the microprocessor, system clocks, memory address logic, and memory refresh logic.

The primary memory is comprised of Read Only Memory (ROM) and dynamic Read/Write Memory (RAM). The ROM memory elements may be substituted with Programmable ROM as defined in paragraph 3.2.4.1. The RAM section of the MPU board is divided into two blocks, each containing 4 k memory locations.

An address and data bus is extended to the display subsystem and interface control board from the MPU board. The signals on the bus are buffered by high current tri-state devices, located on the MPU board, which allow utilization of the bus in a party line mode.

4.1.2 Display Board

The display board is primarily an interface between the MPU board and the Terminal display (Self-Scan or CRT).

The display board contains an interface PIA, character generator, 16 character buffer, parallel to serial conversion logic and electronics for generating data highlights and display control. The PIA interface separates the control messages, such as the display's beginning memory address, the start data highlight position, cursor column address, and the display mode control codes, from the incoming data which allows shared use of the read/write memory with the microprocessor. The character generator converts the data codes into dot pattern information which is then serialized and transferred to the display. The data highlights generated on the TD730 and TD830 display boards are given in paragraphs 3.2.1.3 and 3.2.2.3 respectively.

The TD730 display board provides the following signals to the Self-Scan display: Serial data, reset, phase clock, data shift, and brightness control.

The TD830 display board provides the following signals to the CRT display: horizontal sync, vertical sync, and video which includes serial data, highlights and modes.

SHEET 52 OF 174	DWS NO. 1691 6256			REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830			
DRAWN BY	CHK STD & REC	CHECK FFS F	DSGN	APPROVED
DATE	DATE	DATE	DATE	DATE

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LTR	REVISION
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4.1.3 Interface Board

The Terminal contains an interface board which provides all connectors and electronics used to interface data and control signals from sources external to the Terminal display unit. These sources include: keyboard, data comm, and peripheral devices. The interface board also provides an EAROM which stores the Terminal configuration information. Interfaces provided by the interface board consist of the following:

- Keyboard parallel interface (paragraph 3.2.7)
- Asynchronous, serial data comm interface (paragraph 3.2.6)
- Synchronous, serial data comm interface (paragraph 3.2.6)
- Two-wire direct (TDI) serial data interface (paragraph 3.2.6.7)
- Burroughs direct (BDI) serial data interface (paragraph 3.2.6.8)
- 20/60 mA current loop printer interface, 110 bps (paragraph 5.4.1)
- TC 4000 Printer interface, 300 bps, BDI with sharing control lines (paragraph 5.4.3)
- A9249 (ODEC) parallel data printer interface (paragraph 5.4.2)
- Magnetic card reader, serial to parallel data interface (paragraph 5.3)
- Tape cassette, serial 4800 bps data interface (paragraph 5.2)
- T-scan interface (Appendix II).

SHEET 53 OF 174	DWS NO. 1691 6256		REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830		
DRAWN BY	CHK STD & REC	CHECK P P & P	DSGN
DATE	DATE	DATE	DATE
			APPROVED
			DATE

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4.2 SPECIFIC FUNCTIONAL CHARACTERISTICS

4.2.1 Format Functions

The Terminal has the capability of displaying data in various formats which are CPU or operator controllable. The format functions available for creating data formats are given in the following sub-paragraphs.

4.2.1.1 Forms

The Forms mode of Terminal operation provides the capability for the handling of protected and unprotected data by the Terminal in both message reception and transmission modes. The central processor will cause the Terminal to operate in the Forms mode by the transmission of the proper ESC sequence (shown in Table 13) in the message character stream. Upon receipt of the ESC sequence, the FORMS indicator is lit to alert the operator to the active Forms status and the cursor is placed to the right of the first left delimiter from the home position. The proper ESC sequence (Table 13) in the same message deactivates the Forms mode.

In the Forms mode, display data is divided into two classes: protected and unprotected. Protected data cannot be altered by the operator; unprotected data is available for operator data entry and edit. Unprotected data fields and ~~transmittable~~ protected data fields shall be contained within delimiters.

The TD730/830 family of Terminals, through field engineering adjustment, has the capability to accent any two characters as additional Forms delimiters. The Terminal will convert the additional "delimiters" to the US (▷) and RS (◁) symbols upon entering Forms mode. The US character (column 1, row 15 of Figure 7-1) is the delimiter preceding an unprotected data field. The GS (Δ) character (column 1, row 13 of Figure 7-1) is the delimiter preceding an unprotected, right justify data field (Table 10). The FS (◊) character (column 1, row 12 of Figure 7-1) is the delimiter preceding a transmittable protected data field. The RS character (column 1, row 14 of Figure 7-1) is the delimiter following the unprotected, transmittable protected, and right justify data fields.

When in Forms mode, all cursor movements including carriage return, line feed, reverse line feed, backspace, and cursor advance are enabled. Full cursor movement is provided for the entire page. However, data cannot be written into memory until the cursor is moved into an unprotected data field by use of either the TAB or Reverse Tab key. In the Forms mode, the Reverse Tab key moves the cursor to the first data character location of the prior unprotected data field, the TAB key advances the cursor to the first data character location of the next unprotected data field. Forward and Reverse Tab movements within an individual unprotected data field shall occur when multiple US (▷) or GS (Δ) delimiters are used prior to an RS (◁) delimiter.

During Forms mode, activation of the clear key shall cause the Terminal to erase either the unprotected data or the entire Form depending on the configuration option selected (paragraph 3.2.8). Taking a page out of FORMS shall cause the erasure of all data on that page when the terminal is configured for "total forms erase".



SHEET 54 OF	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY	CHK STD & REC	CHECK F & F
DATE	DATE	DATE
DESIGN		APPROVED
DATE		DATE

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LTR	REVISION
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4.2.1.1 Forms (CONT)

When transmitting a message to the central processor while in Forms mode, the Terminal will transmit the unprotected data and all protected data contained within the transmittable protected data fields. The qualified data that is transmitted begins at the cursor location and ends at the stored ETX character. If no ETX character is stored, then the transmission of qualified data will be from home position to the cursor position. A message transmitted by the central processor and not containing the ESC sequence for Forms is treated as a standard message by the Terminal. As a result, the Terminal will be taken out of the Forms mode. A typical Forms message from the central processor to the Terminal will have the following sequence:

STX, P...P, >, U....., <, P...P, ◇, P..., <, P...etc, ESC, W, ETX

where P is protected data characters and U is unprotected data characters. When the Terminal is not in the Forms mode, the FORMS indicator is extinguished and delimiter characters are not recognized as delimiters for data fields. In the event that the central processor transmits a message to the Terminal and the ESC W character sequence is included without at least one valid unprotected data field, the Terminal leaves the Forms mode, the FORMS indicator is extinguished and the cursor is halted at the first position of the display. The Terminal is returned to the Receive mode while in Forms by the actuation of the Receive (RCV) key.

The operator can control the status of the Terminal relative to the Forms mode with keyboard CTRL control. If the Terminal is in the Forms mode, the operator can change its status by initiating the correct CTRL control, thereby extinguishing the FORMS indicator. Conversely, the Terminal can be placed into the Forms mode by the operator initiating the correct CTRL control (provided at least one left delimiter is displayed), thereby lighting the indicator. The coordination of Forms status with the central processor shall be the operator's responsibility when the CTRL control is used. The Forms enable (DC2) character is selectable in the TD730/830 through keyboard CTRL or ESC sequences (as defined in paragraph 3.2.8) for compatibility with the TD700 and TD800 Terminals.

Forms mode operation provides for automatic cursor advancement as an unprotected data field is filled. The "Field Overflow Inhibit" function prevents this automatic advancement of the cursor. When the "Field Overflow Inhibit" function is enabled, the TAB key shall be used to advance the cursor to the next unprotected data field.

The "Field Overflow Inhibit" function is enabled through a configuration change (paragraph 3.2.8) and shall function only during the use of the Forms mode.

SHEET 55 of 174	DWG NO. 1691 6256			REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830			
DRAWN BY	CHK STD & REC	CHECK FP & F	DSGN	APPROVED
DATE	DATE	DATE	DATE	DATE

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CTR	REVISION
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4.2.1.2 Search Mode

The search mode shall be enabled/disabled through keyboard CTRL control (Table 11) or software ESC control (Table 13). If enabled, placing the Terminal in Forms mode will cause an immediate search for either the error character (') (column 7, row 12 of Figure 7-1), or an opening delimiter. If the cursor stops on an error character (') in a protected field, data can be written into that one location. Either entering data or depressing the SKIP key will cause a skip to the next field or error character. Through use of keyboard CTRL control or software ESC control, any alphanumeric character can be selected in place of the normal search character ('). Disabling the search mode cancels the selected alphanumeric search character. After correction of data, with the Terminal still in Forms mode and search mode, activation of the Transmit key will cause the total Form (protected and unprotected data) to be transmitted.

In Non-Forms, the search mode will operate the same as in Forms except that it will not recognize delimiters.

4.2.1.3 Tabulation

The display subsystem has the capability of either fixed or variable tabulation, however, both types may not be configured in the same Terminal. Variable tabulation is the standard configuration, while the fixed tabulation feature shall be obtained through keyboard CTRL or software ESC sequences as defined in paragraph 3.2.8.

4.2.1.3.1 Fixed Tabulation: The Terminal has the capability of fixed tab stops which are enabled through keyboard CTRL or software ESC sequence (paragraph 3.2.8). The first character position of each display line and every eighth character position thereafter in that line will be a fixed tab stop location. The unshifted TAB key on the keyboard or the receipt of the HT character causes the cursor to move forward to the next tab stop location of that line. When the cursor is located beyond the last tab stop position of a line, the TAB function causes the cursor to advance to the first character position of the next line.

4.2.1.3.2 Reverse Tabulation: The RTAB key of the keyboard causes the cursor to move from field to prior field or from tab stop to prior tab stop. Reverse tabulation has the capability of operating with either fixed or variable tab stops. In Forms mode, reverse tabulation will cause the cursor to be positioned at the first data entry position of the prior unprotected field.

4.2.1.3.3 Variable Column Tabulation: A variable tab position can be set via the keyboard or software in any of up to 80 column locations (Non-Forms only). The shifted TAB key will set/reset, through alternate key depressions, the cursor column position into tab stop storage. Receipt of the proper ESC sequence (Table 13) shall also cause the cursor column position to be stored in tab stop storage. The tab stop storage may also be cleared by software ESC control (Table 13). Either variable column tabulation or fixed tabulation is available through keyboard or software adjustment. However, these features are mutually exclusive.





SHEET 56 of 174		DWG. NO. 1691 6256		REV A
CLASS CODE		TITLE ENGINEERING SPECIFICATION: TD730/830		
DRAWN BY	CHK STD & REC	CHECK FF & F	DSGN	APPROVED
DATE	DATE	DATE	DATE	DATE

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LTR	REVISION
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**4.2.1.3.4 Tab Field Identifier:** The tab field identifier option is capable of operating with either fixed or variable tabulation in either Forms or Non-Forms mode. In Forms mode, the unshifted TAB key causes a field identifier (→) to be written into memory at the cursor location in non-right justify field. The cursor will then automatically advance to the next field. If the field is a right justify field, a field identifier (←) will be written into the first position following a left delimiter. During transmission, the character spaces between the field identifier and the next field will not be transmitted.

In Non-Forms mode, the unshifted TAB key will cause a field identifier (→) to be written into memory at the cursor location. The cursor shall then automatically advance to the next tab stop. During transmission, the character spaces between the field identifier and the next tab stop will not be transmitted. The writing of the field identifier character into memory can be disabled through CTRL or ESC sequences as defined in paragraph 3.2.8.

**4.2.1.4 Programmable Cursor Position**

The Terminal has the capability of accepting a cursor position preset from the central processor. This function is performed using a four character ESC control message (ESC "COLM ROW). This message will be interpreted as follows:

- 1st Character    ESC control function
  - 2nd Character    " control function is cursor preset
  - 3rd Character    COLM, any character, of which the first seven binary bits shall preset the cursor column counter:  $COLM = (32)_2 + (n)_2$  where  $0 \leq n \leq (\text{characters per line} - 1)$
  - 4th Character    ROW, any character, of which the first seven binary bits shall preset the cursor row counter:  $ROW = (32)_2 + (n)_2$  where  $0 \leq n \leq 95 \text{ max}$
- (The max value for n and the characters per line are dependent upon the display and memory option selected)

In a multipage Terminal, the page on which the cursor is to be positioned must also be indicated (paragraph 3.2.4.3).

**4.2.1.5 Page Roll Up/Down**

The Terminal has the capability through keyboard CTRL control (Table 11) or software ESC control (Table 13) of causing the data on the page to roll up or down while the cursor remains in a fixed position in relation to the page. During a roll up function, all of the data on the display is simultaneously transferred line-for-line up the page. The data transferred from the top line will appear on the bottom line causing a "wrap-around" effect. The roll down function is converse to a roll up function. In the case where more than one page is displayed on the Terminal's display, data will roll up or down within the page and the wrap-around effect will cause data to be transferred between the top and bottom of the page. The page roll function is inhibited during Forms mode.

**4.2.1.6 Display Scroll Up/Down**

The Terminal has the capability through keyboard CTRL control (Table 11) of causing the data on the display to scroll up or down while the cursor remains in a fixed position in relation to the display. During the scroll up function all the data on the display is simultaneously transferred line-for-line up the display. Data on the top line of the display will shift off the display and new data will appear on the bottom line of the display. Successive scroll up functions will continue this data shifting up through the last line of the Terminal's memory. When the last line of memory is displayed, succeeding scroll up functions will be ignored. The scroll down is converse to a scroll up function except that when the first line of memory is displayed, succeeding scroll down functions will be ignored.

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#### 4.2.1.7 Variable End of Page Alarm

The Terminal has the capability to sound an alarm when the cursor reaches a predetermined position on the page. The character position is variable through the use of keyboard CTRL or software ESC sequences as defined in paragraph 3.2.8.

#### 4.2.1.8 Wrap-Around Inhibit

The Terminal has the capability of inhibiting the cursor from advancing beyond the last character position of a page as additional keyboard data is entered. This wrap-around inhibit function is enabled through CTRL or ESC sequences (as defined in paragraph 3.2.8) and will cause character overwriting in the last character position of the page. The wrap-around inhibit function operates in Non-Forms mode only.

#### 4.2.2 Edit Functions

The Terminal has the capability to perform certain edit functions as requested by the operator or remote controller. The available edit functions are listed in the following subparagraphs.

##### 4.2.2.1 Character Insert by Line or Page

The Terminal has the capability for the character insert function. Depression of the CHAR INS key places the Terminal into a character insert mode. Subsequent depression of an alphanumeric key (including space) causes the alphanumeric character to be inserted at the cursor location. The succeeding characters within the line are moved one space to the right. Surplus characters, if any, are shifted off the end of the line and lost. If the CTRL key is activated prior to depressing the CHAR INS key, the function is performed on a page basis. The succeeding characters are moved one space to the right and down line to line. A second depression of the CHAR INS key removes the Terminal from the character insert mode.

When in the Forms mode, the insert function causes data shifting within the unprotected data field in which the cursor is located.

The Terminal also has the capability of performing the character insert function through ESC control (Table 13).

##### 4.2.2.2 Character Delete by Line or Page

The CHAR DEL key causes the erasure of the displayed character at the cursor location. The succeeding characters within the line are moved one space to the left. If the CTRL key is activated prior to depressing the CHAR DEL key, the function is performed on a page basis. The succeeding characters down the entire page are moved one space to the left and up line by line.

When in the Forms mode, the delete function causes data shifting within the unprotected data field in which the cursor is located.

The Terminal also has the capability of performing the character delete function through ESC control (Table 13).

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-----	----------

#### 4.2.2.3 Line Insert/Delete

The Terminal has the capability for line insert and delete. The line insert function causes all data in the lines below and including the line in which the cursor is positioned; to be pushed down one line. The line delete causes the erasure of the line in which the cursor is positioned and all data in the lines below to be moved up one line. The line delete/insert functions are initiated by the LINE DEL/INS key (shifted and unshifted respectively) or by ESC control (Table 13). This function is inhibited in Forms mode.

#### 4.2.2.4 Clear to End of Line/Page

The Terminal has the capability to clear data from the cursor position to the end of a line or page. In Non-Forms, the CLR EOP/EOL key (unshifted) clears all data from the cursor position to the end of a line. In Forms, the CLR EOP/EOL key (unshifted) clears all data from the cursor position to the trailing delimiter.

In Non-Forms, the CLR EOP/EOL key (shifted) clears all data from the cursor position to the end of the page. In Forms, the CLR EOP/EOL key (shifted) clears all unprotected data from the cursor position to the end of the page.

The Terminal is also capable of initiating the clear to end of line/page functions through ESC control (Table 13).

#### 4.2.2.5 Line Movement Up/Down

The Terminal has the capability through keyboard CTRL control (Table 11) or software ESC control (Table 13) of causing a line of display data to move up or down one position. The line of data to be moved is selected by placing the cursor in that line. When line movement causes data to be displaced, the displaced data will reappear in the moved line's original position. The cursor follows the moved line in all cases. An "up" line movement of the top line of a page will cause the bottom line of the page to be exchanged with the top line of that page. The same exchange will occur if a "down" movement is requested for the bottom line of a page. This function is inhibited during Forms mode.

#### 4.2.2.6 Lower Case Lockout

The Terminal has the capability through a keyboard CTRL or software ESC sequence (Tables 11 and 13) of inhibiting the display of lower-case letters. When the lower case lockout is enabled, all upper- and lower-case letters are displayed in upper case.

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**4.2.3 Standard Keyboard Unit (Optional keyboard is referenced in paragraph 5.5)**

**4.2.3.1 Keyboard Unit Controls and Indicators**

The Terminal keyboard unit contains certain controls and indicators which relate to the mode of operation and operational status of the Terminal. These controls and indicators are for use by the operator in selecting Terminal functions and determining the present Terminal status. Keyboard controls and indicators are listed in Table 9 along with their respective functions.

TABLE 9. KEYBOARD UNIT CONTROLS AND INDICATORS

<u>CONTROL/INDICATOR</u>	<u>FUNCTION</u>
<b>Keyboard Controls:</b>	
XMT key	Transmit key. Depressing the XMT key places the Terminal in the Transmit mode of operation, lights the XMT indicator, initiates a Transmit operation,
RCV key	Receive key. Depressing the RCV key places the Terminal in the Receive mode of operation and lights the RCV indicator.
LOCAL key.	Depressing the LOCAL key places the Terminal in the Local mode of operation and lights the LOCAL indicator.
SPCFY key	Specify key. Depressing the SPCFY key causes the location of the cursor to be transmitted to the central processor during the next interrogation sequence (paragraph 4.2.6.4.1).
CTRL key	Control key. In unshifted mode, activation of the CTRL key prior to striking a single or multiple alpha or numeric key(s) causes the alpha or numeric key(s) to be interpreted as a control code. In shifted mode, activation of the CTRL key will lock the system in the control mode until the CTRL key is activated in the unshifted mode.
<b>Keyboard Indicators:</b>	
XMT	The Transmit mode indicator is illuminated by the activation of the XMT key and indicates that the Terminal is Transmit ready. The indicator is extinguished when a transmission from the Terminal has been positively acknowledged by the receiving station or when the Terminal is switched to Local mode.
RCV	The Receive mode indicator is illuminated by the activation of the RCV key or by the successful completion of data transmission from the Terminal. The indicator signifies that the Terminal is prepared to receive data. The indicator is extinguished when the Terminal is switched to the Local or Transmit modes. (A successful Forms-Search transmission places Terminal in LOCAL mode.)



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LTR	REVISION
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TABLE 9. KEYBOARD UNIT CONTROLS AND INDICATORS (CONT)

CONTROL/INDICATOR

FUNCTION

Keyboard Indicators: (CONT)

LOCAL

The Local mode indicator is illuminated by the activation of the LOCAL key or by use of the keyboard when the Terminal is in the Receive mode with no data being transmitted to the Terminal. It is also illuminated following the successful completion of data transmission to the Terminal unless the programmatic mode control character (DC1) was present in the received text. The indicator is extinguished when the Terminal is switched to the Receive or Transmit modes.

FORMS

The FORMS indicator is illuminated when the Terminal is operating in the Forms mode. The Terminal shall be placed in the Forms mode either by the receipt of the DC2 character, proper ESC sequence, or by use of the CTRL, W sequence by the Terminal operator (at least one leading delimiter must be in the display data). The FORMS indicator is extinguished either by the receipt of a central processor message with no ESC control character, with an ESC control character canceling Forms, or by generating the proper CTRL control code from the keyboard. See paragraph 4.2.1.I for description of Forms mode.

CTRL

The Control indicator is illuminated upon activation of the CTRL key. The control indicator remains illuminated until such time as the control sequence is completed.

ENQ

Central processor enquiry indicator is illuminated when the Terminal detects the central processor attempting to transmit a message to the Terminal while the Terminal is not in the Receive mode. The indicator is extinguished by entering the Receive mode or by operator activation of the LOCAL key. The audible alarm sounds in conjunction with the ENQ indicator at the central processor transmission attempt.

ERROR

The ERROR indicator is illuminated when a parity or block check error in data being received is detected by the Terminal or when buffer overflow is caused by the receipt of more characters than the display capacity. The ERROR indicator is turned off by the successful receipt of a new message, or the activation of the LOCAL key.

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TABLE 9. KEYBOARD UNIT CONTROLS AND INDICATORS (CONT)

CONTROL/INDICATOR

FUNCTION

Keyboard Indicators: (CONT)

**LTAI** Line-Terminal activity indicator is illuminated whenever data is transmitted from the central processor to any Terminal on the line. Whenever the addressed Terminal responds to the central processor, that Terminal extinguishes its LTAI indicator. In normal operation, the LTAI indicator will blink due to the data line activity. An LTAI indicator which remains unilluminated indicates that the central processor is not transmitting on that line, while an LTAI indicator which remains illuminated indicates that the Terminal is not responding.

4.2.3.2 Keyboard Function Keys and Definitions

In addition to the standard alphanumeric keys, the keyboard contains function keys. These keys are described in Table 10. All locations referenced (home, bottom or top line, etc.) are page locations unless the page length is larger than the display.

TABLE 10. KEYBOARD FUNCTION KEYS

KEY

FUNCTION

↓ (Line Feed) Line feed moves the cursor down one line. When the cursor is in the bottom line, line feed causes it to reappear in the top line.

↑ (Reverse Line Feed) Reverse line feed causes the cursor to be moved up one line. When the cursor is in the top line, reverse line feed causes it to reappear in the bottom line.

← (Backspace) Backspace the cursor one character. When the cursor is at the left edge of the viewing area, backspace causes it to reappear at the right edge of the viewing area, one line higher. If the cursor is located at the home position, backspace causes it to reappear in the last position of the bottom line.

→ (Forward Space) Forward space moves the cursor one space to the right. If the cursor is at the right edge of the viewing area, forward space causes it to reappear at the left edge, down shifted one line. If the cursor is located in the last position of the bottom line, forward space causes it to reappear in the home position.

**HOME** HOME causes the cursor to be moved to the home (upper left) position. The HOME key operates in unshifted mode only.

**CLEAR** CLEAR erases all data on the page; however, when in the Forms mode, only unprotected data is erased, unless the Forms erase configuration (paragraph 4.2.1.1) has been selected. The CLEAR key operates in shifted mode only.



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TABLE 10. KEYBOARD FUNCTION KEYS (CONT)

KEY	FUNCTION
RET (▽)	<p>Depression of the return key (RET ▽) causes the Terminal to execute a combined CR-LF (carriage return/line feed) function by moving the cursor to the first column of the following line. In normal operation the Terminal writes the CR character (▽) into memory. The Terminal has the capabilities of not writing the CR character and/or interpreting the RET key as carriage return request without line feed.</p> <p>When the Terminal is in Forms mode, depression of the RET key shall cause the cursor to perform the CR or CR-LF function followed by a tab to the next unprotected data field.</p> <p>Terminal interpretation of the return key and writing of the CR character (▽) are controlled through configuration changes (paragraph 3.2.8).</p>
TAB	<p>TAB causes the cursor to move forward to the next fixed or variable tab stop location (paragraphs 4.2.1.3.1 and 4.2.1.3.3 respectively). In Forms mode, TAB causes the cursor to move forward to the first unprotected character location following the leading delimiter of the next unprotected character field. With the variable tab feature installed, alternate depressions of the shifted TAB key will set or clear the tab stop at the cursor location. If the tab field identifier feature is enabled (paragraph 3.2.8), the TAB key causes a field identifier (→) character to be written into memory (paragraph 4.2.1.3.4).</p>
ETX (X)	<p>End-of-Text. Depression of the ETX key causes the symbol (X) to be written into memory and the movement of the cursor to the home position. This symbol is interpreted as the end-of-text character.</p>
US (▷)	<p>Leading delimiter. The US key causes the symbol (▷) to be written into memory after the Terminal is placed in Forms mode. This symbol is interpreted as the leading delimiter of an unprotected data field.</p>
RS (◁)	<p>Trailing delimiter. The RS key causes the symbol (◁) to be written into memory after the Terminal is placed in Forms mode. This symbol is interpreted as the trailing delimiter of an unprotected data field.</p>
CHAR INS	<p>Character insert. The CHAR INS key places the Terminal into the character insert mode (paragraph 4.2.2.1).</p>
CHAR DEL	<p>Character delete. Depression of the CHAR DEL key causes the removal of the displayed character at the cursor location. The succeeding characters are moved one space to the left within the line or unprotected data field (Forms mode). Depressing the CTRL key prior to depressing the CHAR DEL key causes the succeeding characters on the page to be shifted one space to the left and up line to line (paragraph 4.2.2.2).</p>



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TABLE 10. KEYBOARD FUNCTION KEYS (CONT)

<u>KEY</u>	<u>FUNCTION</u>
SKIP	With search mode enabled, the SKIP key causes the cursor to skip to the next field or error character (paragraph 4.2.1.2).
RTAB	Reverse Tab. When Forms is disabled, depression of the RTAB key will cause the cursor to move to the prior tab stop. In Forms, the RTAB key causes a tab from an unprotected data field to the prior unprotected data field. The RTAB key will operate in either fixed or variable tab mode.
EOP CLEAR	Clear to End of Page. Depression of the shifted EOP key clears all data (or unprotected data in Forms) from the cursor position to the end of the page.
EOL CLEAR	Clear to End of Line. When Forms is disabled, depression of the EOL key clears all data from the cursor position to the end of that line. In Forms, the EOL key will clear all data from the cursor to the next delimiter.
DEL LINE	Delete Line. Depression of the shifted DEL LINE key causes the erasure of the line in which the cursor is positioned and all data in the lines below to be moved up one line. This function is inhibited in Forms mode.
INS LINE	Insert Line. Depression of the unshifted INS LINE key causes all data in the lines below and including the line in which the cursor is positioned to be pushed down one line. Any data that was on the bottom line is lost. This function is inhibited in Forms mode.
GS (Δ)	Group Separator. With Forms mode enabled, this symbol is interpreted as the leading delimiter of a right justified field (Table 12).





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LTR	REVISION
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4.2.3.3 Keyboard CTRL Sequences

The Terminal keyboard allows the operator and field engineer to control Terminal functions and Terminal operating configurations through the use of CTRL sequences. The operator initiated CTRL sequences are listed in Table 11.

The optional configurations available to the Terminal are listed in paragraph 3.2.8 along with the sequence used to initiate field engineer changes. The keyboard keys used in CTRL sequences shall have available field attachable, identification labels that indicate the control function performed by that key.

TABLE 11. KEYBOARD CTRL SEQUENCES

Key Sequence	Function Symbol	Function
CTRL, space, @, CTRL	---	Spare
CTRL, space, A, CTRL	---	Spare
CTRL, space, B, CTRL	---	Spare
CTRL, space, C, CTRL	---	Display resident character set
CTRL, space, D, CTRL	Terminal Test	Initiate confidence test
CTRL, space, E, CTRL	---	Spare
CTRL, space, F, CTRL	Printer Test	Initiate printer test
CTRL, space, G, CTRL	Cassette Test	Initiate cassette test
CTRL, space, H, CTRL	600 bps	Data rate, 600 bps
CTRL, space, I, CTRL	---	Spare
CTRL, space, J, CTRL	1200 bps	Data rate, 1200 bps
CTRL, space, K, CTRL	1800 bps or 2400 bps	Data rate, 1800 if asynchronous data comm, or 2400 if synchronous data comm
CTRL, space, L, CTRL	---	Spare
CTRL, space, M, CTRL	---	Memory saturation test
CTRL, space, N, CTRL	---	Spare
CTRL, space, O, CTRL	---	Spare
CTRL, !, N <sub>1</sub> *N <sub>2</sub> *N <sub>3</sub> * (Note 1)	File Search 1	Search tape 1 for file
CTRL, ", N <sub>1</sub> *N <sub>2</sub> *N <sub>3</sub> * (Note 1)	File Search 2	Search tape 2 for file
CTRL, #, M** (Note 2)	Read Page	Read page from tape
CTRL, \$, M** (Note 2)	Read Record	Read record from tape
CTRL, %, M** (Note 2)	Read Page and XMT	Read page from tape and transmit
CTRL, &, M** (Note 2)	Read File and XMT	Read tape file and transmit
CTRL, ', M** (Note 2)	Write to tape	Write data to tape
CTRL, (, M** (Note 2)	Write Form	Write unprotected data to tape
CTRL, ), M** (Note 2)	Backspace Mark	Backspace one tape record
CTRL, *	---	Spare
CTRL, +	---	Spare
CTRL, ,	---	Spare
CTRL, -	---	Spare
CTRL, .	---	Spare
CTRL, /	---	Spare
CTRL, N <sub>1</sub> *N <sub>2</sub> * (Note 1)	---	Specific numeric control message
CTRL, :	PRINT Form	Print unprotected data



SHEET 65 of 174	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY	CHK STD & REC	CHECK FF & F
DATE	DATE	DATE
	D3GM	APPROVED
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TABLE 11. KEYBOARD CTRL SEQUENCES (CONT)

Key Sequence	Function Symbol	Function
CTRL, ;	PRINT Page	Print whole page
CTRL, <, COLM, ROW, (Note 3) ---		Position cursor column/row
CTRL, =	---	TC 4000 Formatting
CTRL, >	---	Align display cursor to data comm pointer
CTRL, ?	---	Audible alarm test
CTRL, @	---	Transmit page
CTRL, A	Search On	Enable search mode
CTRL, B	Move Down ↓	Line movement down
CTRL, C	---	Spare
CTRL, D	---	Spare
CTRL, E, CHAR (Note 4)	---	Set search character
CTRL, F	---	Spare
CTRL, G	---	Spare
CTRL, H	---	Spare
CTRL, I	Negative Video Off	Disable negative video (TD830 only)
CTRL, J	---	Spare
CTRL, K	---	Spare
CTRL, L	---	Spare
CTRL, M	Roll Down ↓	Roll down function
CTRL, N	Roll Up ↑	Roll up function
CTRL, O	Clear Tab Stop	Clear all variable tab stops
CTRL, P	Set/Reset Tab Stop	Set or reset a tab stop
CTRL, Q	Forms Off	Forms disable
CTRL, R	---	Configuration control
CTRL, S	Search Off	Disable search mode
CTRL, T	Lower Case On	Enable lower case
CTRL, U	Negative Video On	Enable negative video (TD830 only)
CTRL, V	Move Up ↑	Line movement up
CTRL, W	Forms On	Forms enable
CTRL, X	---	Spare
CTRL, Y	Lower Case Off	Disable lower case
CTRL, Z	---	Spare
CTRL, [	---	Spare
CTRL, \, M** (Note 2)	Tape Mark	Write tape mark
CTRL, ]	---	Spare
CTRL, ^, M** (Note 2)	Rewind Tape	Enable tape rewind
CTRL, _	---	Spare
CTRL, `	---	Spare
CTRL, {	---	Spare
CTRL, }	---	Spare
CTRL, ~	---	Spare
CTRL, CTRL	---	Display status line (TD730 only)
CTRL, ↑	Scroll Up	Scroll up function
CTRL, ↓	Scroll Down	Scroll down function
CTRL, →	Page Advance	Page advance
CTRL, ←	Page Back	Page back



SHEET 66 of 174	DWG NO. 1691 6256		REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830		
DRAWN BY	CHK STD & REC	CHECK FF & F	DSGN
APPROVED	DATE	DATE	DATE

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TABLE 11. KEYBOARD CTRL SEQUENCES (CONT)

NOTES TO TABLE 11:

1.  $N^*N^*N^*$  etc.  $N$  is any number where  $0 \leq n \leq 9$  and is used to indicate special messages to the remote controller or to access a particular data block on a tape cassette.  
 $\begin{matrix} N^* & N^* & N^* \\ 1 & 2 & 3 \end{matrix}$
2.  $M^{**}$   $M^{**}$  identifies tape drive: 1 = tape drive 1, 2 = tape drive 2
3.  $COLM = (32)_2 + (n)_2$  where  $0 \leq n \leq (\text{characters per line} - 1)$   
 $ROW = (32)_2 + (n)_2$  where  $0 \leq n \leq 95$  max (The maximum value of  $n$  in the ROW equation is dependent upon the memory option selected, but will not exceed 95.)
4. CHAR = Insert the character for which the search is to be made.



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DATE	DATE	DATE	DATE	DATE

R	REVISION
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**4.2.4 Terminal Control Characters**

The Terminal uses certain characters to control display data format, editing functions, and I/O interfaces. The Terminal's interpretation of each control character is dependent upon Terminal programming. The Terminal programming for control character interpretation may be varied through CTRL or ESC sequences (paragraph 3.2.8) to fit the system environment in which the Terminal is used. These control characters and their possible interpretations are listed in Table 12.

TABLE 12. CONTROL CHARACTERS

<u>CHARACTER</u>	<u>IDENTIFICATION</u>
DC1	Programmatic Mode Control (paragraph 4.2.6.1.4) or Line Erase Option. The DC1 character (Column 1, row 1 of Figure 7-1) as an option, will cause the Terminal to execute a line erase function by erasing all data from and including the cursor position to the end of the line.
DC2	Forms Control Option or Space Right Option. The DC2 character (Column 1, row 2 of Figure 7-1) as an option, will cause the Terminal to execute a cursor advance function. The DC2 character as an option, will cause the Terminal to interpret the character as Forms Enable.
DC3	Reverse Line Feed. The DC3 character (Column 1, row 3 of Figure 7-1) will cause the Terminal to execute a reverse line feed function by moving the cursor one line up. When the cursor is in the top line, the reverse line feed character will cause the cursor to appear in the bottom line.
DC4	Home Function. The DC4 character (Column 1, row 4, of Figure 7-1) will cause the Terminal to execute a cursor home function by moving the cursor to the first character position of the first line (home position) of the page.
FF	Home and Clear. The FF character (Column 0, row 12 of Figure 7-1) will cause the Terminal to execute a combined home and clear function by moving the cursor to the home position and erasing all data (except protected data when in Forms mode) from the display. The Terminal also has the optional capability of interpreting the FF character as Clear and Home and Clear Variable Tab Stops.
CR	Carriage Return Character. The control character CR (Column 0, row 13 of Figure 7-1) causes the Terminal to execute a combined CR-LF (Carriage Return/Line Feed) function by moving the cursor to the first column of the following line. In normal operation the Terminal writes the CR character (▽) into memory. The Terminal has the capabilities of not writing the CR character into memory and/or interpreting the CR character as a carriage return without line feed (paragraph 3.2.8). In Forms mode, cursor tabs to next unprotected data field after performing CR function.
BEL	Bell Character. The BEL character (Column 0, row 7 of Figure 7-1) will cause the Terminal to momentarily sound the audible alarm.



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LTR	REVISION
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TABLE 12. CONTROL CHARACTERS (CONT)

CHARACTER      IDENTIFICATION

**GS**      Right Justify. This feature operates in Forms mode only. It is identified through use of a special opening delimiter; the group separator GS (Δ) followed by an RS (◁) as the closing delimiter. When a right-justify field is entered, the cursor automatically moves to the right-most position of the field. As data is entered at the cursor position, the data is shifted to the left as follows:

```

Δ - - - - 1 ▷
Δ - - - 1 2 ▷
Δ - - 1 2 3 ▷
Δ - 1 2 3 4 ▷
    
```

**US/RS**      Forms Delimiters. The US and RS characters (Column 1, rows 14 and 15 of Figure 7-1) cause the (▷) and (◁) characters to be displayed on the display. Additional pairs of Forms delimiter characters which may be set up through keyboard CTRL or software ESC sequences (paragraph 3.2.8) will be displayed as (▷) and (◁) respectively. The RS character terminates all data highlights.

**BS**      Backspace Function. The BS character (Column 0, row 8 of Figure 7-1) causes the Terminal to execute a backspace function by moving the cursor one character position to the left. When the cursor is at the first position of a line, the backspace character will cause the cursor to move to the last character position of the preceding line. When the cursor is located at the home position, the backspace character causes the cursor to appear in the last character position of the bottom line of the page.

**LF**      Line Feed. The LF character (Column 0, row 10 of Figure 7-1) causes the Terminal to execute a line feed function by moving the cursor one line down. When the cursor is in the bottom line, the line feed character will cause the cursor to appear in the top line. The Terminal will ignore an LF character if it is received immediately after a CR character. The Terminal has the optional capability of interpreting an LF character as New Line (CR-LF).

**HT**      Tab Function. In either variable or fixed tabulation (paragraphs 4.2.1.3.1 and 4.2.1.3.3), the HT character (Column 0, row 9 of Figure 7-1) will cause the Terminal to execute a tab function by moving the cursor forward to the next tab stop. In the Forms mode the tab character causes the cursor to move forward to the character position following the leading delimiter of the next unprotected data field.

**VT**      Variable Tab. As an option, the VT character (Column 0, row 11 of Figure 7-1) shall be used to set the variable tab positions.



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LTR	REVISION
-----	----------

TABLE 12. CONTROL CHARACTERS (CONT)

<u>CHARACTER</u>	<u>IDENTIFICATION</u>
ESC	Escape codes initiate the software controllable functions (Table 12)
SO	Reverse Video Data Highlight (paragraph 3.2.2.3.3(c))
CAN	Blink Data Highlight (paragraphs 3.2.1.3.1(a) and 3.2.2.3.3(d))
EM	Secure Data Highlight (paragraphs 3.2.1.3.1(b) and 3.2.2.3.3(e))
SI	Underline Video Data Highlight (paragraph 3.2.2.3.3(a))
SUB	Bright Data Highlight (paragraphs 3.2.2.3.3(b) and 3.2.1.3.1(c))

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SHEET 174  
70 OF

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REVISION

4.2.5 Software Control ESC Sequences

The Terminal has the capability of responding to remote controller generated software ESC sequences. The ESC sequences are used to set Terminal configurations (temporarily or permanently), control peripheral devices, and initiate edit functions. The ESC sequences and the functions performed are listed in Table 13. ESC sequences used for configuration changes and error message input are defined in paragraph 3.2.8.

TABLE 13. SOFTWARE CONTROL ESC SEQUENCES

<u>ESC Sequence</u>	<u>Function</u>
ESC, space, A	Spare
ESC, space, B	Spare
ESC, space, C	Display Resident Character set
ESC, space, D	Initiate confidence test
ESC, space, E	Spare
ESC, space, F	Initiate printer test
ESC, space, G	Initiate cassette test
ESC, space, H	Spare
ESC, space, I	Spare
ESC, space, J	Spare
ESC, space, K	Spare
ESC, space, L	Spare
ESC, !	Character insert by line
ESC, ", COLM, ROW (Note 3)	Position cursor, column/row
ESC, #	Clear all variable tab stops
ESC, \$, PAGE (Note 5)	Select page
ESC, %	Character delete by line
ESC, &	Align display cursor to data comm pointer
ESC, '	Spare
ESC, (	Transmit page
ESC, )	Spare
ESC, * M** (Note 2)	Read page from tape
ESC, + M** (Note 2)	Read tape file and transmit
ESC, , M** (Note 2)	Read page and transmit
ESC, -, CHAR (Note 4)	Set search character
ESC, .	Set/reset tab stop
ESC, /	Spare
ESC, Ø	Spare
ESC, 1	Spare
ESC, 2	Spare
ESC, 3	Spare
ESC, 4	Spare
ESC, 5	Spare
ESC, 6	Spare
ESC, 7	Spare
ESC, 8	Spare
ESC, 9	Spare
ESC, :	Print unprotected data



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LTR	REVISION
-----	----------

TABLE 13. SOFTWARE CONTROL ESC SEQUENCES (CONT)

ESC Sequence	Function
ESC, ;	Print whole page
ESC, <	Line movement down
ESC, =	ITC/4000 formatting
ESC, >	Line movement up
ESC, ?	Sound audible alarm
ESC, @	Character insert by page
ESC, A M** (Note 2)	Write tape mark
ESC, B M** (Note 2)	Backspace one tape record
ESC, C	Space right
ESC, D	Spare
ESC, E	Search enable
ESC, F	Search disable
ESC, G M** (Note 2)	Write receive data to tape
ESC, H M** (Note 2)	Read record from tape
ESC, I M** (Note 2)	Rewind tape
ESC, J	Clear to end of page
ESC, K	Clear to end of line
ESC, L	Line insert
ESC, M	Line delete
ESC, N	Negative video on (TD830 only)
ESC, O	Negative video off (TD830 only)
ESC, P	Character delete by page
ESC, Q M** (Note 2)	Write unprotected data to tape
ESC, R	Configuration control
ESC, S	Roll up
ESC, T	Roll down
ESC, U N <sub>1</sub> *, N <sub>2</sub> *, N <sub>3</sub> * (Note 1)	Search tape drive 1 for block
ESC, V N <sub>1</sub> *, N <sub>2</sub> *, N <sub>3</sub> * (Note 1)	Search tape drive 2 for block
ESC, W	Forms enable
ESC, X	Forms disable
ESC, Y	Lockout lower case
ESC, Z	Lower case enable
ESC, [	Spare
ESC, \	Spare
ESC, ]	Spare
ESC, ^	Spare
ESC, _	Spare
ESC, `	Spare
ESC, a	Spare
ESC, b	Spare
ESC, c	Spare
ESC, d	Spare
ESC, e	Spare
ESC, f	Spare
ESC, g	Spare





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DATE	DATE	DATE	DATE	DATE

LTR REVISION

TABLE 13. SOFTWARE CONTROL ESC SEQUENCES (CONT)

<u>ESC Sequence</u>	<u>Function</u>
ESC, h	Spare
ESC, i	Spare
ESC, j	Spare
ESC, k	Spare
ESC, l	Spare
ESC, m	Spare
ESC, n	Spare
ESC, o	Spare
ESC, p	Spare
ESC, q	Spare
ESC, r	Spare
ESC, s	Spare
ESC, t	Spare
ESC, u	Spare
ESC, v	Spare
ESC, w	Spare
ESC, x	Spare
ESC, y	Spare
ESC, z	Spare
ESC, {	Spare
ESC,	Spare
ESC, }	Spare
ESC, ~	Spare
ESC, DEL	Spare

NOTES TO TABLE 13.

- $N_1^*$ ,  $N_2^*$ , etc. N is any number where  $0 \leq n \leq 9$  and is used to indicate special messages to the remote controller or to access a particular block on a tape cassette.
- $M^{**}$   $M^{**}$  identifies tape drive: 1 = tape drive 1, 2 = tape drive 2
- COLM =  $(32)_2 + (n)_2$  where  $0 \leq n \leq (\text{characters per line} - 1)$   
 ROW =  $(32)_2 + (n)_2$  where  $0 \leq n \leq 95$  max (The maximum value of n in the ROW equation is dependent upon the memory option selection but will not exceed 95.)
- CHAR = Insert the character for which a search is to be made.
- PAGE =  $(32)_2 + (n)_2$  where  $1 \leq n \leq (\text{maximum number of pages of memory})$



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CTR	REVISION
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**4.2.6 Communications**

The communications procedures (line disciplines) utilized in the basic and optional configurations of the Terminal are given in the contents of this section. The communications procedures include, to the extent specified, the Burroughs Standard Communications Procedure (1284 9006), and the Bisynchronous Communications Procedures (1284 9022) as adapted for IBM 3270 look-alike operation.

There is one communications procedure and one electrical interface in each of the various configurations of the Terminal.

**4.2.6.1 Modes of Operation**

The Terminal operates in three modes: Local, Transmit and Receive. The operator can control the mode from the keyboard with the LOCAL, XMT, and RCV keys. Pressing the LOCAL key during either Transmit or Receive immediately transfers the Terminal to Local mode and no further data is transmitted or received.

**4.2.6.1.1 Local:** In the Local mode, the Terminal will be off-line and data is entered manually through the keyboard. If an ENQ character is received through selection or from the point-to-point calling stations, as applicable, the Terminal will automatically transmit an NAK character indicating that the Terminal is busy or not ready to Receive. If an ENQ character is received through polling, the Terminal will automatically transmit an EOT character indicating "no traffic".

The Terminal activates an audible alarm and a visual indicator to alert the operator that the central processor or calling station is transmitting. Power turn-on places the Terminal in Local mode regardless of the setting of the mode keys.

**4.2.6.1.2 Transmit:** Pressing the XMT key on the Terminal keyboard by the operator causes the Terminal to enter the Transmit mode. The Transmit mode will be cancelled prior to transmission only by actuation of the LOCAL key.

**4.2.6.1.3 Receive:** The completion of message transmission or actuation of the RCV key on the Terminal keyboard by the operator shall place the Terminal in the Receive mode\*. When in the Receive mode, the Terminal will accept data from the communication lines in accordance with the communication discipline utilized.

A transmission number (XMT#) character may be included in the message from the central processor following the character sequence SOH, AD1, AD2. The Terminal will ignore the character except for BCC calculation. Data received with the DC4 or FF characters shall cause the cursor to move to the home position, or to move to the home position and erase the previous data, respectively. Data received without a DC4 or FF character will be stored in the memory beginning at the previous ETX location. With the receipt of an SOH character, the Terminal, depending upon keyboard selectable options, may automatically clear the display of the existing message and cause the cursor to be moved to the home position.

\*Except for successful Forms-Search transmission where Terminal returns to LOCAL mode.



SHEET 74 of 174	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY	CHK STD & REC	CHECK FF & F
DATE	DATE	DATE
	DSGN	APPROVED
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LTR	REVISION
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4.2.6.1.3 Receive: (CONT)

The receiving of messages by the Terminal employs two error checks. The first is a character parity check utilizing the eighth bit of each received character as the parity bit. (See paragraphs 4.2.6.3.1 and 4.2.6.3.2 for parity definition). The second error check is a longitudinal binary sum (without carry) of each of the seven data bits of the received character following SOH or STX, and up to and including the ETX. The longitudinal sum will be contained in the block check character (BCC) which also contains the character parity bit. All received characters are included in the BCC check. If the tests for character parity within the text of the message and longitudinal redundancy are correct, the Terminal will respond with an ACK character. If either error check fails, the Terminal shall activate the ERROR indicator and respond with an NAK character. The ERROR indicator is turned off on receipt of a valid message in response to the NAK character or by the operator pressing the LOCAL key on the keyboard. The Terminal will respond to a correctly received message with an ACK character and switch to the Local mode or remain in the Receive mode if the programmatic mode control option (paragraph 4.2.6.1.4) has been implemented and activated. Any keyboard action or the activation of the LOCAL key by the operator shall place the Terminal in the Local mode; however, the keyboard will be disabled during the actual receipt of data. The LOCAL key switches the mode from Receive to Local at any time.

4.2.6.1.4 Programmatic Mode Control: The Terminal has the capability for programmatic mode control to permit the central processor to select the operating mode of the Terminal following a successful transmission from the central processor. Normally, when in the Receive mode the Terminal will switch to the Local mode at the successful completion of the transmission. Programmatic mode control consists of the insertion by the central processor of the DC1 character (column 1, row 1 of Figure 7-1) into the message between STX and ETX. The DC1 character requires no memory space. The receipt of the DC1 character causes the Terminal to remain in the Receive mode for the receipt of successive messages from the central processor. The Terminal also has the capability of programmatic mode control without receiving the DC1 character. Upon successful completion of a message transfer from the central processor the Terminal will remain in the receive mode until the activation of a keyboard key (any key except RCV and ~~AMP~~),. Continuous programmatic mode control is selected through CTRL or ESC sequences as defined in paragraph 3.2.8.

4.2.6.2 Communications Control Characters

The communications control characters listed in Table 13a are those characters which directly affect the transmission or reception of data by the Terminal using the Burroughs Standard Communications Procedures. Communications control characters used by the Bisynchronous Communications Procedures in the IBM 3270 look-alike configuration are listed in paragraph 4.2.8.1.

4.2.6.2.1 Terminal Address: The Terminal's address (AD1, AD2) will be set through keyboard CTRL sequences as defined in paragraph 3.2.8. The Terminal also has the capability to ignore Terminal address codes (line monitor) for maintenance purposes. In systems using concatenation type chaining, the line monitor function shall enable a Terminal to monitor data transfer to and from all Terminals beyond that point in the concatenation chain.

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TABLE 13a. COMMUNICATIONS CHARACTERS

<u>CHARACTER</u>	<u>IDENTIFICATION</u>
<b>Communications Control Characters:</b>	
ACK	Acknowledgement
BCC	Block Check Character
DLE/EOT (DEOT)	Mandatory Disconnect
DLE	Data Link Escape
ENQ	Enquiry
EOT	End of Transmission
ETX	End of Text
NAK	Negative Acknowledgement
SOH	Start of Heading
STX	Start of Text
SYN	Synchronous Idle (paragraph 3.2.6.1.4)
NUL	Time Fill Character
<b>Other Communications Characters:</b>	
AD1	Address 1
AD2	Address 2
BSL	Broadcast Select
CON	Contention
FSL	Fast Select
GSL	Group Select
POL	Poll
SEL	Select
XM#	Transmission Number Option (paragraph 4.2.7.3.1)
RVI (DLE <)	Reverse Interrupt (Table 14, Note 5)



SHEET 76 of 174	DWG NO. 1691 6256		REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830		
DRAWN BY	CHK STD & REC	CHECK FFB F	DSGN
DATE	DATE	DATE	DATE
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#### 4.2.6.3 Illegal Characters

An illegal character is defined as a character having incorrect parity or a legal character appearing incorrectly in a predefined sequence. The Terminal tests each character received for having the correct parity (see paragraph 3.2.6.1.1 for character format) and accepts control characters only in the sequence defined for the communications procedure being employed.

**4.2.6.3.1 Data Error Checking:** Upon receipt of a data character which is illegal because of a parity error, or invalid block check, the Terminal shall detect the error, activate the keyboard ERROR indicator and prepare to transmit the NAK character automatically to the central processor at the appropriate point in the communication procedure sequence. For a parity error in a data character, the Terminal shall, in addition to the above, insert the "question mark" character (column 3, row 15 of Figure 7-1) into the displayed message at the location of the incorrect character. The Terminal may indicate the error by placing an error message in the status line. The parity check can be disabled for maintenance purposes through CTRL or ESC sequences as defined in paragraph 3.2.8.

**4.2.6.3.2 Control Character Error:** A control character may be received incorrectly during any of the control sequences of the communications because of parity error in the character or an incorrect character in the sequence. In either case, the error will constitute an illegal character of unknown identification. The Terminal becomes unable to provide a response to the central processor because of the incomplete control sequence and will cause a time-out condition.

#### 4.2.6.4 Data Transmission Features

**4.2.6.4.1 Transmission of Cursor Position:** The Terminal has the capability of transmitting its current cursor location. The cursor position message is initiated by depressing the SPCFY key. Then, when the Terminal is polled, the Terminal will respond with its normal heading, followed by STX, ESC, ", CHAR, CHAR, ETX, BCC. The first CHAR represents the cursor column position and the second CHAR represents the cursor row position.

The column position is given in binary form as  $(32)_2 + (n)_2$  where  $0 \leq n \leq (\text{char per line} - 1)$ . The row position is given in binary form as  $(32)_2 + (n)_2$  where  $0 \leq n \leq 95 \text{ max}$ .

**4.2.6.4.2 Numeric Control Message:** The Terminal has the capability of transmitting a numeric control message whose significance shall be defined by the central processor. The control message is initiated by depressing the CTRL key, followed by a numeric code 00-99, followed by XMT. Then, when the Terminal is polled, the Terminal responds with its normal heading, followed by STX, ESC, CHAR, CHAR, ETX, BCC. The two CHAR characters are the numeric code. The numeric control message will not be displayed on the display.

**4.2.6.4.3 Data Comm Loop-back:** The Terminal has the capability to immediately transmit all received data on a character-for-character basis in the data comm loop-back mode. The Terminal will transmit each character as it is received without parity check or examination for control code meaning.

The data comm loop-back mode is entered through a temporary configuration change (paragraph 3.2.8).



SHEET 77	OF 174	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830		
DRAWN BY	CHK STD & REC	CHECK FF&F	D3GN
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4.2.6.4.4 Variable Data Transmission: The Terminal has the capability of keyboard CTRL or software ESC (Tables 11 and 13) selectable start and stop positions for the transmission of data in both Forms and Non-Forms as follows:

- FORMS:
1. Cursor to ETX or beginning of Form to cursor if no ETX (unprotected data only) - Standard TD820 Series and TD730/830 Series
  2. Beginning of Form to End of Form (unprotected data only)
  3. Entire Form in Forms - search mode
  4. Beginning of Form to cursor position (unprotected data only) - TD700 D/L 2 and above and TD800 D/L 2 and above
  5. Variable tab field identification causes skip of data in Forms

- NON-FORMS:
1. Cursor to ETX or home to cursor if there is no ETX - Standard TD820 Series and TD730/830
  2. Cursor to ETX or end-of-display if there is no ETX
  3. Home to cursor - All TD700 and TD800 D/L's

4.2.7 Communications Procedures

The Terminal has the capability for utilizing any one of the following communications procedures for transmitting and receiving data: multipoint, point-to-point, and IBM 3270 look-alike bisynchronous multipoint.

4.2.7.1 Multipoint Communications Procedures (1284 9006)

The multipoint communications procedures are Poll, Select, Fast Select, Multipoint Contention, Broadcast, Group Select, and Group Poll. Upon power-on of the terminal the multipoint contention procedure shall be in the contention mode.



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CHECK FF & F

DSGN

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DATE

DATE

DATE

DATE

DATE

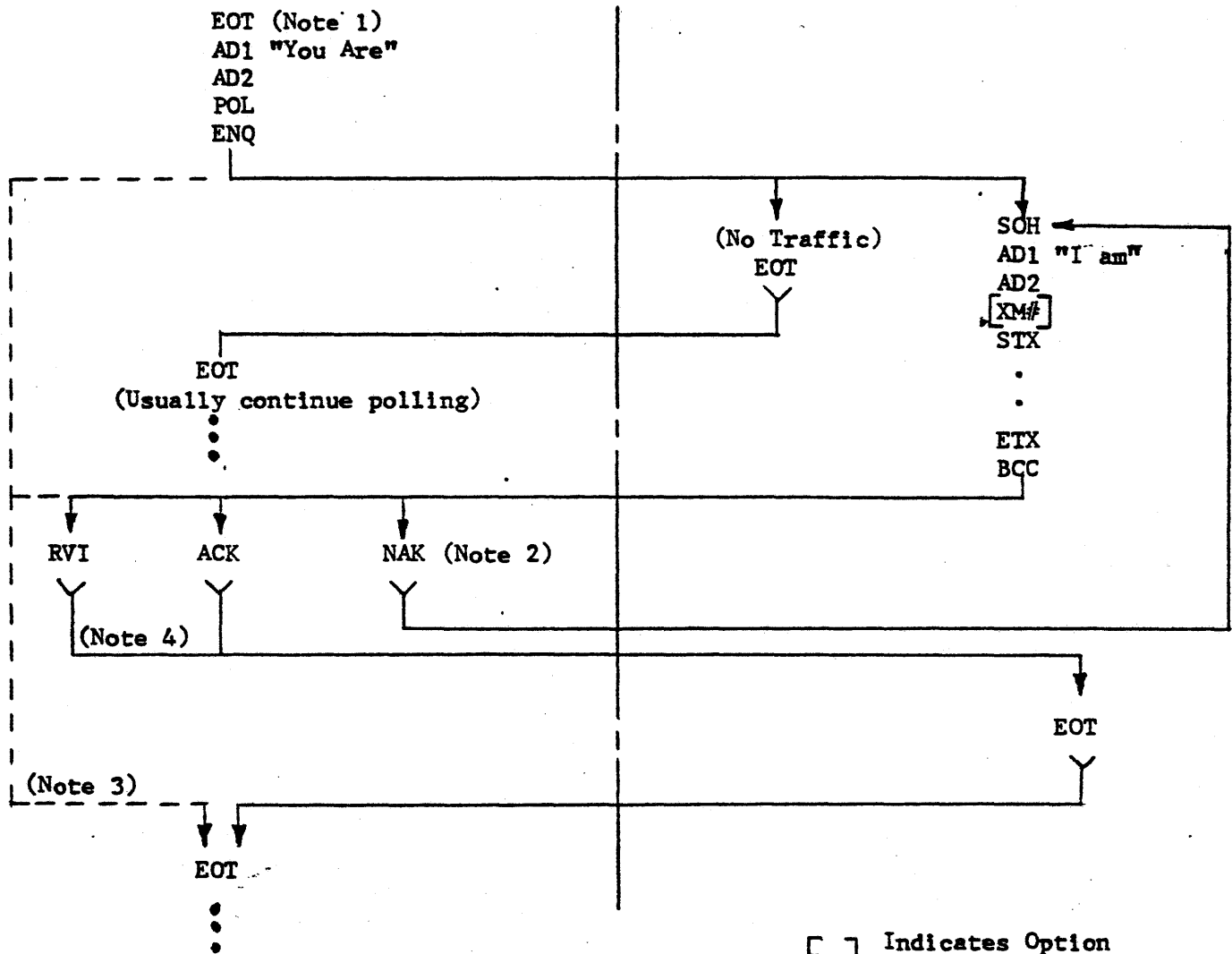
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4.2.7.1.1 Poll (POL): The polling procedure is used to transmit data to the central processor. The polling procedure and its associated notes are given in Table 14.

TABLE 14. POLLING PROCEDURE

CENTRAL PROCESSOR

TERMINAL



SHEET 79 OF 174	DWG NO. 1691 6256			REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830			
DRAWN BY	CHK STD & REC	CHECK F F & F	DSGN	APPROVED
DATE	DATE	DATE	DATE	DATE

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NOTES TO TABLE 14:

1. This EOT may have been the termination of a previous transmission sequence. To minimize the affect of noise, the polling sequence may follow immediately.
2. If the central processor receives a message for which the character parity or block check tests fail, the NAK character will be transmitted, calling for a repeat of the transmission. This action can be repeated "n" times ("n" may be equal to zero), at which time, if the test fails, an error will be recorded at the central processor and an EOT character will be transmitted, terminating the transmission sequence. The Terminal shall transmit the same message when next polled.
3. If the Terminal does not receive an ACK, NAK, or EOT character, it may retain its message and remain quiet. The central processor will time-out and transmit an EOT character, thereby terminating the transmission sequence. The message will be retransmitted when next polled.
4. Reverse Interrupt RVI may be used by the central processor only after reception of a valid message which would result in a positive acknowledgement. Instead of sending ACK the central processor will send Reverse Interrupt (DLE <).





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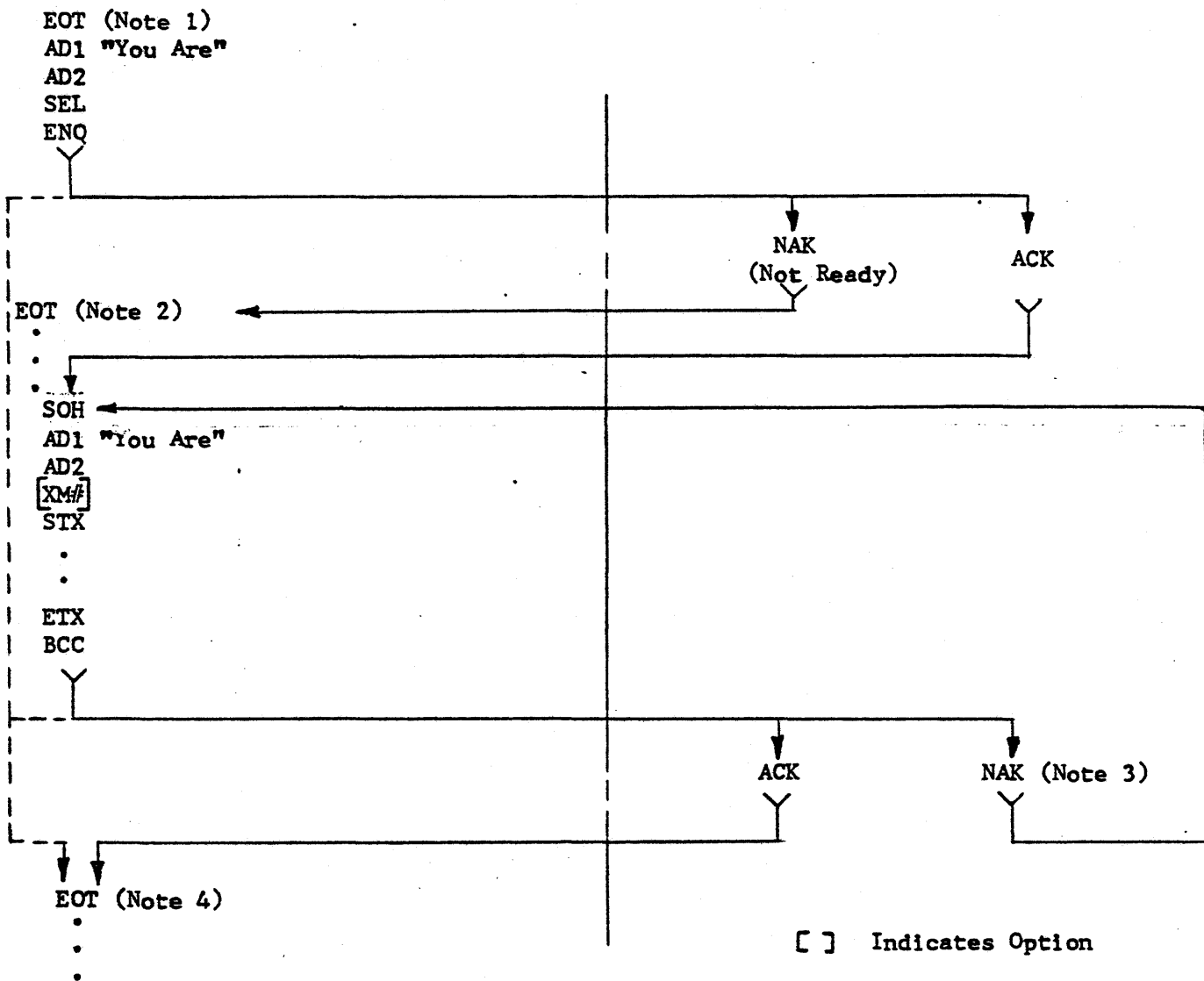
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4.2.7.1.2 Select (SEL): The selection procedure is used for receiving data from the central processor. The selection procedure and its associated notes are given in Table 15.

TABLE 15. SELECTION PROCEDURE

CENTRAL PROCESSOR

TERMINAL



SHEET 81 OF 174	DWG NO. 1691 6256			REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830			
DRAWN BY	CHK STD & REC	CHECK FFB F	D3GN	APPROVED
DATE	DATE	DATE	DATE	DATE

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NOTES FOR TABLE 15:

1. This EOT may have been the termination of a previous transmission sequence. To minimize the affect of noise, the selection sequences may follow immediately.
2. If the Terminal is not ready to receive, as indicated by transmission of the NAK character, the central processor will normally retry the selection sequence in the Terminal's proper sequence; however, for some installations it may be desired to repeat a selection sequence immediately.
3. If character parity or block check are not validated by the Terminal, it will send an NAK character. In this case the central processor will retransmit the message "n" times ("n" may be equal to zero). If the Terminal still does not acknowledge the message, the central processor will terminate the sequence with an EOT character after recording the error. The central processor will retain the message for transmission on the next selection sequence to this Terminal.
4. If the central processor does not receive a response (ACK or NAK) to its message, it may time-out and retransmit the block "n" times ("n" may be equal to zero). If there is still no response received, the central processor will time-out and terminate the selection sequence with an EOT character after recording the error. The central processor will retain the message for transmission on the next selection sequence to this Terminal.



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DRAWN BY	CHK STD & REC	CHECK FF & F	DSGN	APPROVED
DATE	DATE	DATE	DATE	DATE

LTR	REVISION
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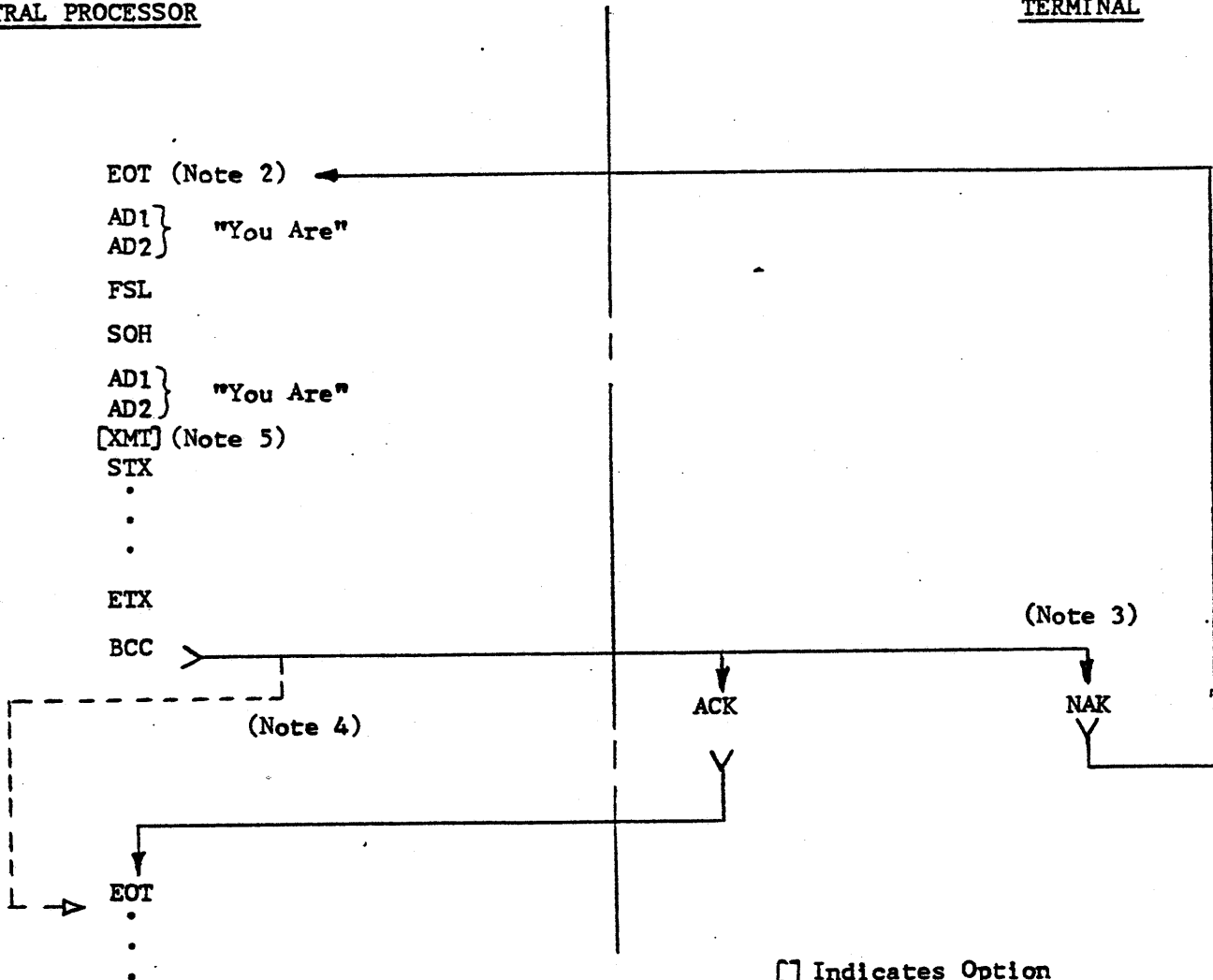
4.2.7.1.3 Fast Select (FSL): The FSL procedure enables the central processor to transmit a message to a particular Terminal without testing, as in the selection procedure, that the Terminal is ready to receive. The FSL procedure and associated notes are given in Table 16. When in the Local or Transmit modes, the FSL procedure forces the Terminal into the Receive mode causing the Terminal to accept the central processor message sequence of AD1, AD2, FSL, SOH, AD1, AD2 followed by STX and the message. If the fast select transmission is not successfully received by the Terminal, it will respond with the NAK character and the central processor will retransmit the message starting with the EOT character of the FSL sequence.

TABLE 16. FAST SELECT PROCEDURE

(Note 1)

CENTRAL PROCESSOR

TERMINAL



[ ] Indicates Option

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**NOTES TO TABLE 16:**

1. Fast selection is used when the central processor wishes to transmit a message without testing that the Terminal is ready to receive. In this case the message immediately follows the selection.
2. This EOT may have been the termination of a previous transmission sequence. To minimize the affect of noise, the fast selection sequence may follow immediately.
3. If character parity and block check are not validated by the Terminal, it will send the NAK character. In this case the central processor will retransmit the message "n" times ("n" may be equal to zero). If the Terminal still does not acknowledge the message, the central processor will terminate the sequence with an EOT character after recording the error. The central processor will retain the message for transmission on the next selection sequence to the Terminal. If both pairs of addresses do not verify against the station address, the Terminal will remain quiet.
4. If the central processor does not receive a response (ACK or NAK) to its message, it will time-out and terminate the sequence with an EOT character after recording the error. The central processor will retain the message for transmission on the next selection sequence to this Terminal.
5. Transmission numbers are ignored by the Terminal when used by the central processor, except during the calculation of BCC.



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CHECK FF & P

DSGN

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DATE

DATE

DATE

DATE

DATE

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4.2.7.1.4 Multipoint Contention Mode (CON): The CON procedure enables the central processor to terminate polling of the multipoint network after placing the system in the Contention mode. In this mode any Terminal desiring to transmit a message to the central processor will initiate the polling activity by transmitting the character sequence AD1, AD2, POL, ENQ. The central processor will respond by polling that Terminal in the normal polling procedure. The Contention mode procedure is given in Table 17.

TABLE 17. MULTIPPOINT CONTENTION MODE

CENTRAL PROCESSOR

TERMINAL REQUESTING POLL

(Note 1)

EOT (Note 2)

NUL

NUL

CON - Go To Contention

All Terminals to to Contention Mode

AD1 "I Am"

AD2

POL (Note 3)

ENQ

EOT

AD1 Poll to Requesting

AD2 Terminal

POL

ENQ

Terminal Proceeds with normal message transfer as in response to a Poll (See Table 14)

EOT (Note 4)

•  
•  
•

SHEET 85 of 174		DWS NO. 1691 6256			REV A
CLASS CODE		TITLE ENGINEERING SPECIFICATION: TD730/830			
DRAWN BY	CHK STD & REC	CHECK FF & P	D3GN	APPROVED	
DATE	DATE	DATE	DATE	DATE	

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NOTES TO TABLE 17:

1. In times of low activity, it may be desirable to terminate polling and to place all or part of the system in Contention Mode. This is accomplished by transmission of an EOT, NUL, NUL, CON character sequence which will cause the Terminals to remain quiet until they have something to transmit.
2. This EOT may have been the termination of a previous transmission sequence. To minimize the affect of noise, the "go to contention" sequence may follow immediately.
3. A Terminal can activate the polling activity by transmitting a character sequence of AD1, AD2, POL, ENQ. This action will cause the central processor to poll that Terminal. If two Terminals attempt to transmit at the same time, the garbled message will initiate general polling by the central processor.
4. Following the normal verification procedures for the receipt of a message as in Table 14, the central processor may continue polling or instruct all Terminals to go to Contention.



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CHK STD & REC

CHECK FFB F

DSGN

APPROVED

DATE

DATE

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DATE

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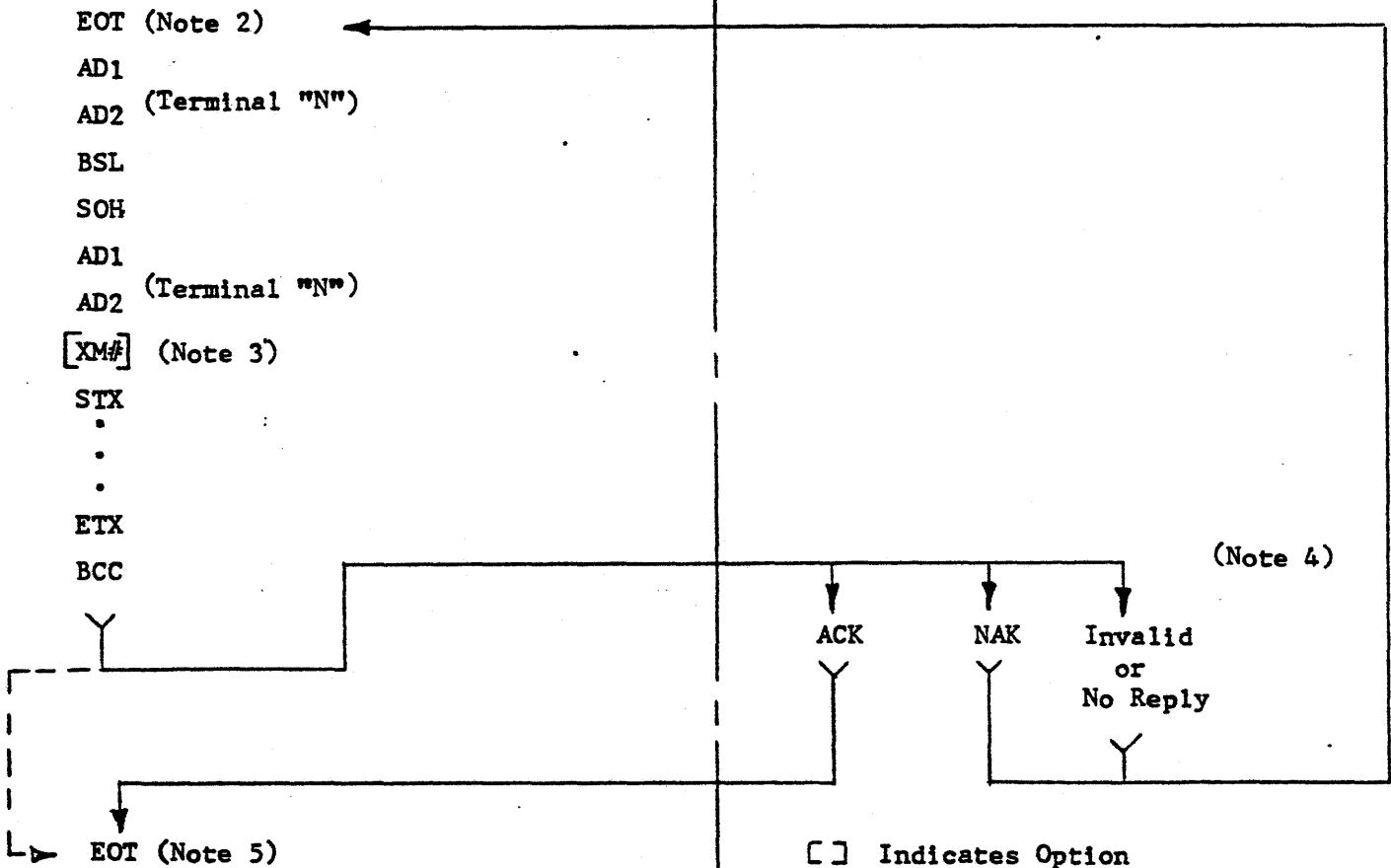
4.2.7.1.5 Broadcast Select (BSL): The BSL procedure enables the central processor to perform a fast selection of all multipoint network Terminals which contain the BSL option. The BSL procedure with associated notes is given in Table 18. The address characters (AD1 and AD2) are selected to represent the address of the Terminal that will acknowledge the central processor transmission with an ACK or NAK character. The receipt of the BSL character causes the Terminal to activate the audible alarm momentarily and will cause the Terminal, if in Local mode, to switch to Receive mode and accept the BSL message.

TABLE 18. BROADCAST SELECT

CENTRAL PROCESSOR

TERMINAL "N"

(Note 1)



SHEET 87 OF 174		DWS NO. 1691 6256		REV A
CLASS CODE		TITLE ENGINEERING SPECIFICATION: TD730/830		
DRAWN BY	CHK STD & REC	CHECK FF & F	DSGN	APPROVED
DATE	DATE	DATE	DATE	DATE

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NOTES TO TABLE 18:

1. Broadcast select is a fast selection of all Terminals. AD1 and AD2 are selected to represent a Terminal which acknowledges receipt of the message.
2. This EOT may have been the termination of a previous transmission sequence. To minimize the affect of noise, the broadcast sequence may follow immediately.
3. Transmission numbers are ignored by the Terminal when used by the central processor except during the calculation of BCC.
4. If the acknowledging Terminal does not receive a valid message (e.g., there is a parity error), the central processor will repeat the broadcast.
5. If the central processor does not receive a response (ACK or NAK) to its broadcast, it may time-out and rebroadcast the message "n" times ("n" may equal zero). If no response is received, the central processor will terminate the Broadcast mode with an EOT character after recording the error.





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CHK STD & REC

CHECK FF & F

DSGN

APPROVED

DATE

DATE

DATE

DATE

DATE

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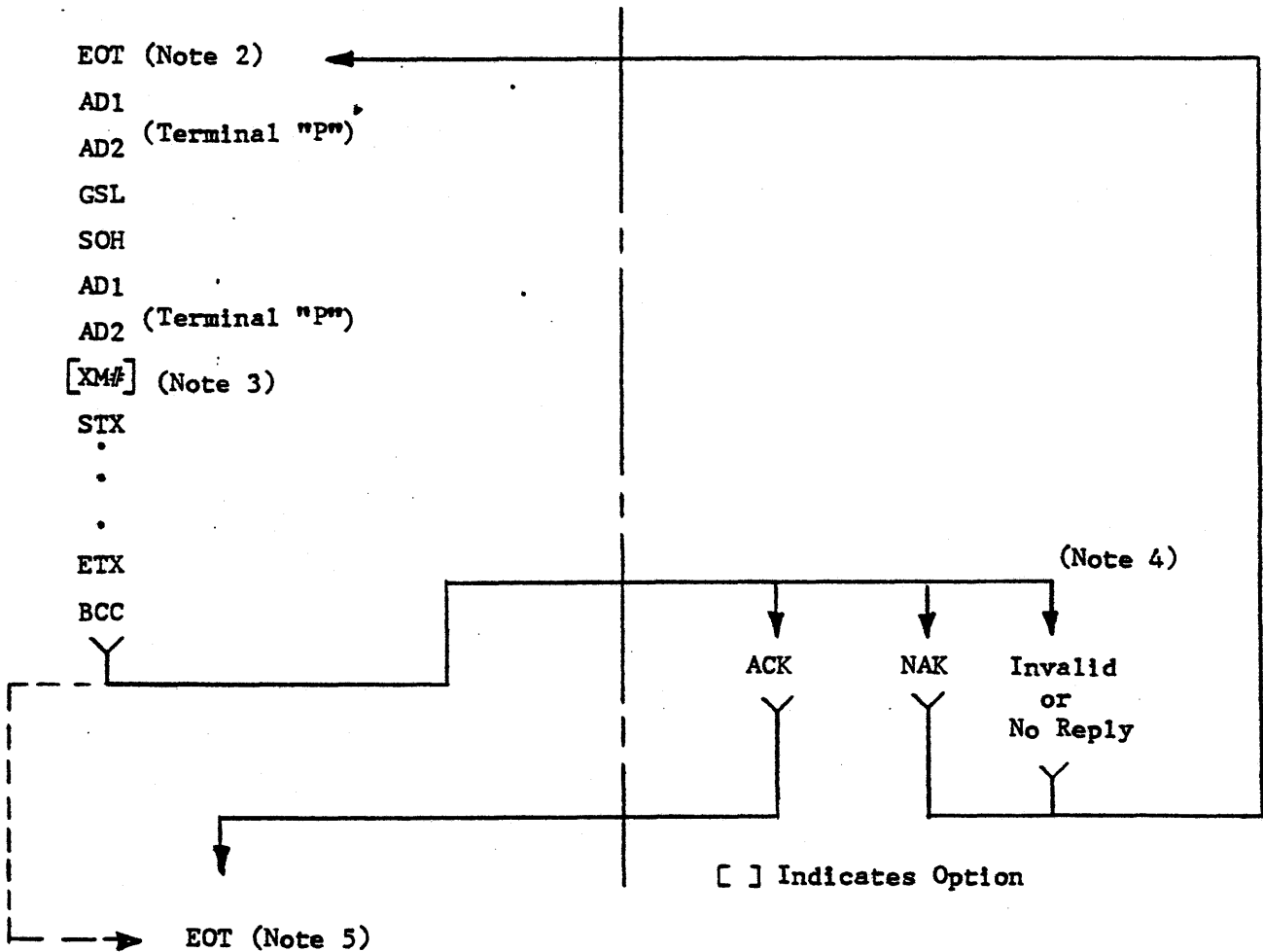
4.2.7.1.6 Group Select (GSL): The GSL procedure permits the fast selection of a particular group of Terminals in the multipoint network. Each Terminal may have a group address for which it will accept the GSL message. The GSL procedure with associated notes is given in Table 19. The address characters (AD1 and AD2) are selected to represent the address of the Terminal which acknowledges the central processor transmission with an ACK or NAK character. The Terminal has the capability through reconfiguration to recognize the character codes shown in columns 2 through 6 of Figure 7-1. The receipt of the GSL character causes the Terminal to activate the audible alarm momentarily and will cause the Terminal, if in Local mode, to switch to the Receive mode and accept the GSL message.

TABLE 19. GROUP SELECT

CENTRAL PROCESSOR

TERMINAL "P"

(Note 1)



[ ] Indicates Option

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SHEET 89 of 174	DWG NO. 1691 6256	REV A		
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830			
DRAWN BY	CHK STD & REC	CHECK FF & P	D3GN	APPROVED
DATE	DATE	DATE	DATE	DATE

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NOTES TO TABLE 19:

1. Group selection is a fast selection of a group of Terminals. Each Terminal may have a group address for which it will accept messages. AD1 and AD2 are selected to represent the address of the Terminal which will acknowledge receipt of the message.
2. This EOT may have been the termination of a previous transmission sequence. To minimize the affect of noise, the group selection may follow immediately.
3. Transmission numbers are ignored by the Terminal when used by the central processor except during the calculation of BCC.
4. If the acknowledging Terminal does not receive a valid message (e.g., there is a parity error), the central processor repeats the total group selection or any part thereof.
5. If the central processor does not receive a response (ACK or NAK) to the group selection, it may time-out and reselect the group "n" times ("n" may equal zero). If no response is received, the central processor will terminate the group select mode with EOT after recording the error.



SHEET 90 OF 174	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY	CHK STD & REC	CHECK F P & F
DATE	DATE	DATE
	DSGN	APPROVED
	DATE	DATE

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4.2.7.1.7 Group Poll (GPL): The GPL procedure with associated notes is given in Table 20. The GPL procedure is an option of the standard multipoint procedure. The Terminal has the optional capability of accepting an additional AD1, AD2 other than its Terminal address AD1, AD2. These address characters are field selectable from columns 2 through 6 of Figure 7-1. If these group addresses are decoded during the standard poll procedure (paragraph 4.2.7.1.1), the Terminal will respond by attempting to transmit an EOT character (indicating no traffic), or by transmitting a message if in the Transmit mode. Orderly transmission of data to the central processor by all Terminals having the same group address is accomplished by the following:

- (a) All Terminals with the same group addresses must be on the same concatenation (paragraph 3.2.6.3).
- (b) A Terminal with data to transmit shall block propagation of the Request-to-Send and Clear-to-Send signals over the data set interface lines until released by a successful transmission to the central processor followed by the receipt of the ACK or EOT characters from the central processor.
- (c) An EOT character will not be transmitted by any Terminal detecting a Request-to-Send signal sent by any Terminal more remote from the data set in the concatenation.
- (d) No Terminal will transmit anything until it receives, in response to its Request-to-Send signal, a Clear-to-Send signal from a Terminal closer to the data set in the concatenation.

Data received by the central processor will be in order from the group member closest to the central processor in the concatenation and ending with an EOT from the group member furthest from the central processor in the concatenation. Each message will contain the individual Terminal's address characters (AD1, AD2). Upon receipt of an NAK character, retransmission will be via the standard poll procedure. Concatenated Terminals with the same group address for group polling will be similar in their characteristics of the Request-to-Send/Clear-to-Send response time.

The central processor may terminate a group poll sequence at any time by transmitting EOT in place of ACK. The Terminals remaining in the Group shall not attempt to transmit and will retain their message until the next poll. The Terminal awaiting the ACK character will retain its message for retransmission with the same transmission number during the next poll.



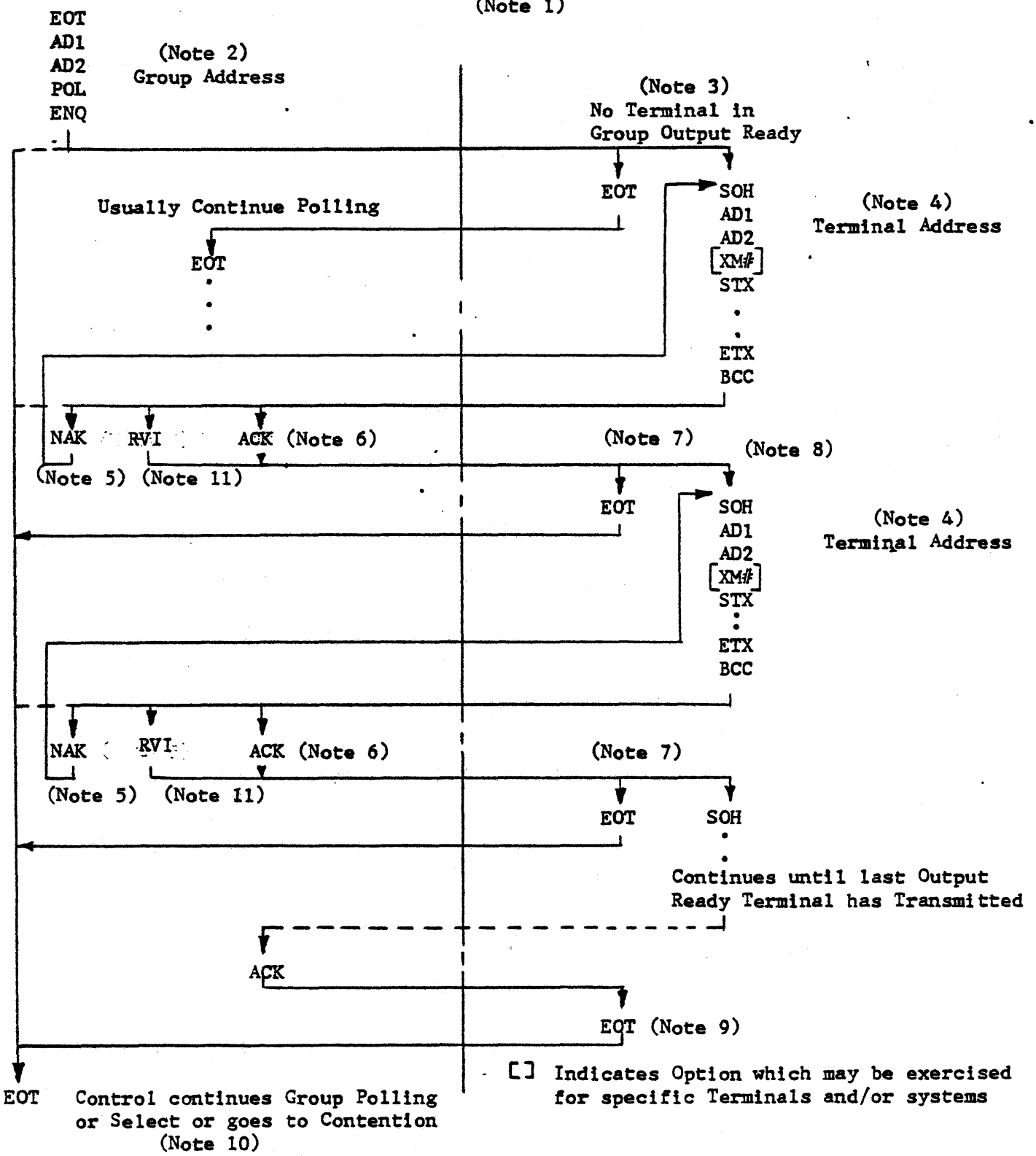
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TABLE 20. GROUP POLLING

CENTRAL PROCESSOR

TERMINAL GROUP





SHEET 174		DWS NO.		REV
92 OF		1691 6256		A
CLASS CODE	TITLE			
	ENGINEERING SPECIFICATION: ID730/830			
DRAWN BY	CHK STD & REC	CHECK FF & F	DSGN	APPROVED
DATE	DATE	DATE	DATE	DATE

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NOTES TO TABLE 20:

1. This procedure is used to reduce the overhead in a network of Terminals where several are located at one location on a common communication line. The receipt of one group poll will, if no Terminals are output ready, result in one response for the group. Thus, the control can pass to the next group. In periods of low activity, the control will be able to go through the polling list determining the output status of all Terminals with but one poll to each location, not each Terminal. Also, if multiple Terminals are output ready at a location, they are allowed to transmit, in sequence, in response to one poll. Selecting, Broadcast, Fast Select, etc., are not affected by this group polling procedure. In a concatenation of Terminals, if one of the Terminals is removed because of down time, etc., the loss of the missing Terminal will have no effect on these procedures.
2. In this procedure, the polling sequence follows the same format as a normal poll and uses the normal poll character. Group polling is controlled by addresses only. The group address is assigned to a group of concatenated Terminals. Each member of the group will respond to the group address as if the group address were its individual address.
3. When the poll is received by the addressed group, each Terminal connected to the data set via concatenation will prepare to answer the poll by raising the Request-to-Send signal line. The Terminals which have a message ready for transmission will prepare their message; the Terminals with no message will prepare to transmit EOT. In sequence, each Terminal without message traffic will sample the Request-to-Send signal line and, if a Request-to-Send signal from another Terminal is detected, the Terminal without message traffic will cancel its EOT response and will wait for the next EOT from the central processor.
4. Each message sent in response to a group poll contains the address of the individual responding Terminal. The responding Terminal will block the concatenated Request-to-Send and Clear-to-Send signals related to Terminals more remote from the data set. These signals remain blocked from the more remote Terminals until the responding Terminal has completed its transmission and received an ACK or EOT character from the central processor.
5. If the central processor detects an error in the message received in response to a group poll, the NAK character will be transmitted, thereby calling for a repeat of the transmission. This action can be repeated "n" times ("n" may be equal to zero), at which time, if the test fails, an error will be recorded at the central processor, and an EOT character will be transmitted, terminating the transmission sequence. The Terminal will transmit the same message when next polled.
6. If the Terminal does not receive an ACK, NAK, or EOT character, it may retain its message and remain quiet. The central processor will time-out and transmit an EOT character, thereby terminating the transmission sequence. The message will be retransmitted when next polled.

SHEET 93 OF 174	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY	CHK STD & REC	CHECK FF&F
DATE	DATE	DATE
	D5GN	APPROVED
	DATE	DATE

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NOTES TO TABLE 20: (CONT)

7. If no other Terminals are output ready, EOT is sent. In some systems, the number of messages allowed to be sent from a group as a result of a single poll may be limited by system agreement. In this case, EOT may be sent by the central processor in place of ACK even though other output-ready Terminals may be in the group awaiting service. The Terminal awaiting ACK will retain its message until the next group poll is received as will the remaining output-ready Terminals.
8. As soon as an ACK character is received from the central processor, the next output-ready Terminal will transmit.
9. When an ACK character is received from the central processor and no Terminals are output ready, the last Terminal in the concatenated group shall be responsible for transmission of the final EOT.
10. The same error recovery procedure outlined in Table 14 is used with this procedure.
11. Reverse Interrupt RVI may be used by the central processor only after reception of a valid message which would result in a positive acknowledgement. Instead of sending ACK the central processor will send Reverse Interrupt (DLE<).



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4.2.7.2 Point-to-Point Communications Procedures (1284 9006)

The point-to-point communications are switched and dedicated (contention).

4.2.7.2.1 Switched Procedures: The point-to-point communications procedure utilizing switched lines is given in Table 21 along with the associated notes.

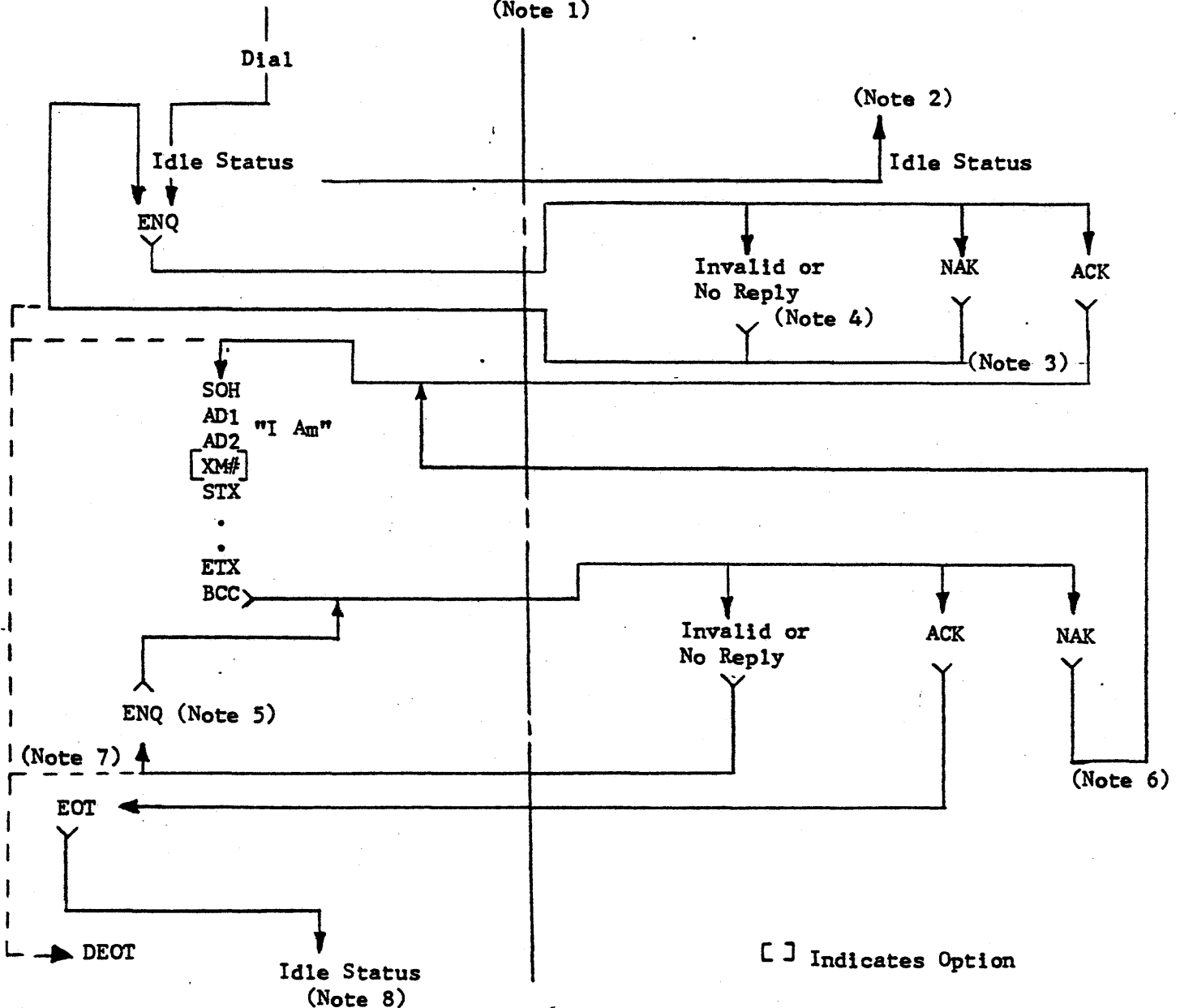
TABLE 21. POINT-TO-POINT - SWITCHED PROCEDURE

POINT A (CALLING STATION)

POINT B (CALLED STATION)

(Note 1)

(Note 2)



SHEET 95 OF 174	DWG NO. 1691 6256			REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830			
DRAWN BY	CHK STD & REC	CHECK FF&F	D3GN	APPROVED
DATE	DATE	DATE	DATE	DATE

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NOTES TO TABLE 21:

1. This procedure applies when a point-to-point link is established on the switched network.
2. When a physical connection has been made, or after a terminate function, the stations are in the idle condition. In this condition, neither station has master status, but either or both stations may bid for master status by sending ENQ. Simultaneous bids will be unsuccessful and must be reinitiated.
3. If the station is ready to receive, it sends an ACK character. The master station, detecting the affirmative reply, proceeds with message transmission. If the station is not ready to receive, it sends a NAK character. The master station will detect the NAK character as "no response" and the operator, at his option, may retransmit an ENQ character with the XMT key any number of times before proceeding to mandatory disconnect by pressing the LOCAL key.
4. If the station receives an invalid reply or no reply, it may send an ENQ character again. Any number of attempts may be made to verify the status. After these attempts, the station may proceed to the mandatory disconnect.
5. If the master station receives an invalid reply or no reply to a transmission, it may send a reply request character (ENQ). Carefully note that this use of the ENQ character may result in the loss or duplication of transmissions. If, after repeating the ENQ character "n" times (depending on system discipline) and a valid acknowledgement is still not received the master station may exit to DEOT.
6. If a slave station receives a message for which the character parity or block check tests fail, an NAK character may be transmitted, thereby requiring a repeat of the transmission. This action can be repeated "n" times, depending on the master station operator; after which, the master station may exit to mandatory disconnect.
7. Failure of the master station to receive a valid response may result in the actuation of the LOCAL key by the master station operator, thereby initiating a mandatory disconnect to clear the connection.
8. By system agreement, the operator shall, if no ENQ is sent or received within "n" seconds, send DLE/EOT or initiate a manual disconnect of the circuit by pressing the LOCAL key.



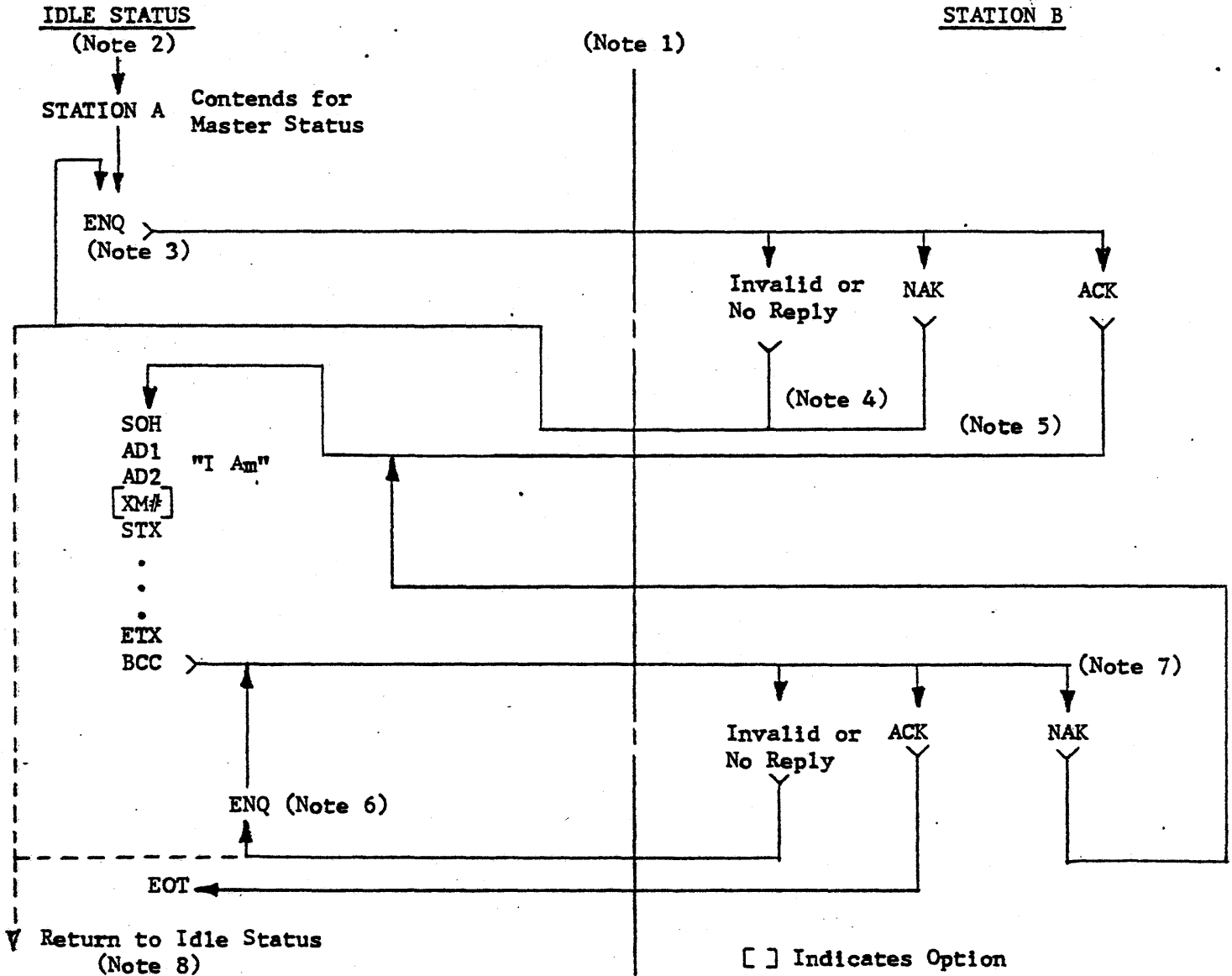


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4.2.7.2.2 Dedicated Procedure: The point-to-point communication procedure utilizing dedicated (contention) lines is given in Table 22 along with the associated notes.

TABLE 22. POINT-TO-POINT - DEDICATED PROCEDURE



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SHEET

97 of 174

DWS NO.

1691 6256

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DRAWN BY

CHK STD &amp; REC

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DSGN

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## NOTES TO TABLE 22:

1. This procedure applies when there are two stations on a dedicated point-to-point link, with neither station designated as the master station. Both stations contend for master status and may seize it under the condition that the other station is not seizing it. Staggered re-attempts to achieve master status in the event of an initial simultaneous attempt are based on the variation in the contending Terminal operator's action and response times. A contention function determines the master-slave relationship of the two stations. A terminate function returns the system to the contention condition.
2. The idle condition on the communication link is that which follows the terminate function of the previous transmission. In this condition, neither station has master status but either or both stations may bid for master status.
3. A station wishing to transmit a message bids for master status by sending the enquiry character (ENQ); after which, it begins the time-out function which is dependent on the operator. To resolve simultaneous bids by both stations, the station which takes the longest time-out interval after having bid for master status will react to a received ENQ character as though it had not bid for master status. Conversely, after having bid for master status, the station which takes the shortest time-out interval will not respond to a received ENQ character. Each station will reinitiate its bids when the designated time-out interval has expired if the master/slave relationship has not been established.
 

Upon receipt of the affirmative acknowledge response (ACK), the station bidding for master status assumes master status and proceeds with message transfer.

Upon receipt of the negative acknowledge response (NAK) character, the station bidding for master status may reinitiate a bid for master status by sending the ENQ character again. The station may reinitiate its bid for master status as many times as the operator selects.
4. In case of an invalid reply or no reply to the initial ENQ character, the station bidding for master status reinitiates the bid by sending the ENQ character again. The station reinitiates its bid for master status as many times as the operator selects.
5. If station B is ready to receive, it will send an ACK character. Station A, detecting the affirmative reply, assumes master status and proceeds with message transmission. If station B is not ready to receive, it sends an NAK character. Station A, detecting the NAK character, may again contend for master status by operator action.
6. If the master station receives an invalid reply or no reply to a transmission, it will send a reply request character (ENQ). This character may be sent "n" times ("n" may equal zero). Carefully note that this use of the ENQ character may result in the loss or duplication of transmission. If, after sending the ENQ character "n" times, a valid acknowledgement is not received, the master station may exit with an EOT character.

SHEET 98 of 174	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
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NOTES TO TABLE 22: (CONT)

7. If a slave station receives a message for which character parity or block check tests fail, an NAK character may be transmitted calling for a repeat of the transmission. This can be repeated "n" times (to be determined for each system), at which time the master station may terminate the procedure.
8. Failure of station A to achieve master status or to receive a valid response may result in transmission of an EOT character and a return to the idle state.

4.2.7.3 Options to Communications Procedures

The Terminal has available the following options to the multipoint and point-to-point procedures.

4.2.7.3.1 Transmission Number (XM#) Character: The Terminal has the option of XM# character available exclusive of the particular communications procedures utilized in that Terminal. When implemented, the XM# character will immediately precede the STX character as part of the message header. Transmission numbers are assigned by sequentially numbering transmissions alternately between two numbers on an odd/even basis. The two transmission numbers may be either the character codes for 0 and 1 (column 3, rows 0 and 1 respectively of Figure 7-1), or may be keyboard CTRL selected (para 3.2.8) to the character codes for @ and A (column 4, rows 0 and 1 respectively of Figure 7-1). Thus only a one-bit change is required to furnish messages alternately with either odd or even identification. Transmission numbers which may be received from the central processor have no significance to the Terminal, but are used in the calculation of the block check character (BCC). The Terminal will accept transmission numbers in any sequence length including 0.

4.2.7.3.2 SOH Clear: The Terminal has the optional capability, through a keyboard CTRL sequence, of treating the SOH communications character as a command to clear the Terminal display. With the option enabled, the Terminal, upon receiving the SOH character, shall clear the display of all existing data and home (first character position) the cursor.



SHEET 99 of 174	DWG NO. 1691 6256			REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830			
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4.2.8 Look-Alike Procedure

4.2.8.1 Bisynchronous (BSC) Multipoint Procedure (IBM 3270 Look-Alike)

The Terminal has available the communication capability of IBM 3270 polling (general and specific) and select procedures. Although tailored for capability with the IBM 3270, these bisynchronous procedures conform to Burroughs Standard 1284 9022 to the extent specified. These procedures are capable of operating at line speeds up to 9600 bps. The Terminal shall operate in the EBCDIC code environment as given in Figure 7-19.

4.2.8.1.1 Transparent Text Mode: The Terminal is not capable of operating in the transparent text mode. Should the Terminal receive the character sequence DLE, STX, which indicates the initiation of transparent text mode for the text following, the Terminal will be set to its idle condition. In idle condition, the Terminal is in a halted, non-operative state which may be terminated by the receipt of an EOT character. The Terminal will not be affected by the appearance of the DLE STX sequence on a multipoint network when the Terminal has not been selected.

**Burroughs Corporation**ELECTRONIC COMPONENTS DIVISION  
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100 of 174

DWG NO.

1691 6256

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4.2.8.1.2 CRC-16 - Cyclic Redundancy Checking: A sixteen bit redundant character (CRC-16) is added to the end of a transmission block for the purpose of error detection and control. All characters following STX or SOH, except SYN, are included in the CRC accumulation. A cyclic redundancy check is a division performed by both the transmitting and receiving stations using the numeric binary value of the message as a dividend, which is divided by the constant  $X^{16} + X^{15} + X^2 + 1$ . The quotient is discarded, and the remainder serves as the check character which is then transmitted as the block check character (BCC) immediately following a check-point character (ITB, ETB, or ETX). The receiving station compares the transmitted remainder to its own computed remainder, and finds no error if they are equal.

4.2.8.1.3 Bisynchronous Character Formats: The interpretation of character formats used in the bisynchronous communication procedures are as follows:

- (a) ACK0/ACK1 - Affirmative Acknowledge: These replies, in proper sequence, indicate that the previous block was accepted without error and the receiver is ready to accept the next block of the transmission. ACK0 is the positive response to selection (multipoint). The BSC procedures specify the alternate use of ACK0 and ACK1 as affirmative replies. The use of ACK0 and ACK1 provides a sequential checking control for a series of replies. Thus it is possible to maintain a running check to ensure that each replay corresponds to the immediately preceding message block. The affirmative response to a poll is the transmission of a message.
- (b) DLE - Data Link Escape: DLE is a control character used exclusively to provide supplementary line control characters such as WACK, ACK0, ACK1, RVI, and the transparent mode control character sequence DLE STX.
- (c) ENQ - Enquiry: The ENQ character is used for the following:
  1. Request for a response from a station.
  2. A valid response to WACK.
  3. Final character of a TTD sequence.
  4. Forward abort when used in the test of a select message.
- (d) EOT - End of Transmission: Used to indicate the conclusion of a communication sequence. Receipt of EOT will set the Terminal in a control state listening for a polling or selection sequence. EOT may be transmitted by the central processor to abort a transmission sequence including a general poll. To be sure that Terminals are in a control state, EOT must precede a select sequence. EOT is transmitted by a remote Terminal as a "no traffic" response to a poll. The receipt of EOT causes the Terminal to resync.
- (e) ETB - End of Transmission Block: Optionally used when messages are of sufficient length to warrant their being broken into smaller transmission blocks. ETB indicates the end of a block of data in the text. ETB requires a replay indicating the receiving station's status. (ETBs are treated as an ETX in the Terminal.)



SHEET 101 of 174	DWG NO. 1691 6256			REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830			
DRAWN BY	CHK STD & REC	CHECK FF & F	DSGN	APPROVED
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4.2.8.1.3 Bisynchronous Character Formats: (CONT)

- (f) **ETX - End of Text:** Used to indicate the end of a stream of characters identified as a text. ETX requires a reply indicating the receiving station's status.
- (g) **ITB - End of Intermediate Transmission Block:** The ITB character (Table 23) is used to divide a message (heading or text) for error checking purposes without causing a reversal of transmission direction. The block-check character immediately follows ITB and resets the block-check count. After the first intermediate block, successive intermediate blocks need not be preceded by STX or SOH.

Normal line turnaround occurs after the last intermediate block, which is terminated by ETB or ETX. When one of these ending characters is received, the receiving station responds to the entire transmission. If a block-check error is detected for any of the intermediate blocks, a negative reply is sent, which requires retransmission of all intermediate blocks. All BSC stations must have the ability to receive ITB and its attendant BCC.

- (h) **PAD Characters:** To insure that the first and last characters of a transmission are properly transmitted by the data set, all BSC stations may add a PAD character before and after each transmission. The leading PAD character is a SYN character. The trailing PAD character consists of all "1" bits. (The Terminal ignores a leading PAD character of HEX 55.)
- (i) **NAK - Negative Acknowledgement:** NAK is a negative response which indicates character parity failure for any character or a block, or, in a message, a failure of the BCC. It is also used as a response to a Temporary Text Delay message.
- (j) **RVI - Reverse Interrupt:** The RVI control sequence (Table 23) is a positive response used in place of the ACK0 or ACK1 positive acknowledgement. RVI is transmitted by a receiving station to request termination of the current transmission because of a high priority message which it must transmit to the sending station. In case of a multipoint environment, the RVI control sequence indicates that the control station, acting as a receiver, now wishes to communicate with another station on the line. Successive RVIs cannot be transmitted, except in response to ENQ.

The sending station treats the RVI as a positive acknowledgement. In a general poll, the stations waiting to transmit remain silent and await the next poll. The ability to receive RVI is mandatory for all BSC stations.

- (k) **STX - Start of Text:** The STX character is followed by text when the Terminal receives a select message. The STX is followed by POL-AD1, D-AD2 and text when the Terminal transmits a message in response to a poll.
- (l) **SOH - Start of Heading:** The SOH character may be used optionally in place of the STX. (Select only.)



SHEET 102 OF 174	DWG NO. 1691 6256		REV H
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830		
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4.2.8.1.3 Bisynchronous Character Formats: (CONT)

- (m) SYN - Synchronous Idle: The synchronizing pattern for establishing character phase consists of at least two contiguous SYN characters. The Terminal will transmit four SYN characters.

Character phase must be established for each transmission. This is accomplished by the receiving station recognizing at least two contiguous SYN characters in the bit stream. Character phase remains established at the receiving station until either a line turnaround character or the end-of-transmission character is received, or modem carrier detect is false. During the transmission of normal data, insertion of SYN permits a station that is out of step to reestablish character phase. Sync-idle characters are not included in the BCC accumulation, and are stripped from the message at the receiving station.

- (n) TTD - Temporary Text Delay: The TTD control sequence (Table 23) is sent by a sending station in message transfer state when it wishes to retain the line, but is not ready to transmit. The TTD control sequence (STX, ENQ) is normally sent if the sending station is not capable of transmitting within that time.

The receiving station responds NAK to the TTD sequence, and waits for transmission to begin. If the sending station is still not ready to transmit, the TTD sequence can be repeated one or more times.

The delay in transmission can occur when the sending station's input device has not completely filled the buffer due to inherent machine timings. TTD is also transmitted by a sending station in message transfer mode to indicate to the receiver that it is aborting the current transmission.

After receiving NAK to this TTD sequence, the sending station sends EOT, resetting the stations to control mode (forward abort).

- (o) WACK - Wait-Before-Transmit Positive Acknowledgement: WACK allows a receiving station to indicate a "temporarily not ready to receive" condition to the transmitting station. WACK is a positive acknowledgement to the received data block or to selection.

The Terminal response to WACK is ENQ. When ENQ is received, transmission will continue.

- (p) D-AD2, D-AD2 - Device Address: A two-character address (same character) established as the address of a device or a Terminal. For a Group Poll EBCDIC 7F7F is used in place of the two device address characters.

- (q) POL-AD1, POL-AD1 - Poll Address: A two-character address (same character) established as the address for a Poll operation. All Terminals with the same Poll Address are required to be in the same concatenated network. The Poll and Select Addresses cannot be the same. The first POL-AD1 is the control address AD1; the second POL-AD1 is the control address AD2.



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4.2.8.1.3 Bisynchronous Character Formats: (CONT)

- (r) SEL-AD1, SEL-AD1 - Select Address: A two-character address (same character) established as the address for a select operation. All Terminals in the same concatenated network are required to have the same Select Address. The Select and Poll Addresses cannot be the same. The first SEL-AD1 is the control address AD1; the second SEL-AD1 is the control address AD2.
- (s) Character Conversion: The chart for conversion of characters for use in EBCDIC and ASCII coding systems is shown in Table 23.

TABLE 23. CHARACTER CONVERSION CHART

Data Link Character	Code Chart Sequence	
	EBCDIC	ASCII
SYN	nc	nc
SOH	nc	nc
STX	nc	nc
ETB	EOB (ETB)	nc
ETX	nc	nc
EOT	nc	nc
ENQ	nc	nc
ACK 0	DLE '70'	DLE 0
ACK 1	DLE /	DLE 1
NAK	nc	nc
DLE	nc	nc
ITB	IUS	US
WACK	DLE ,	DLE ;
RVI	DLE @	DLE <
TTD	STX ENQ	STX ENQ

nc - no change

'70' - Indicates the hexadecimal representation (no graphic assignment)

- (t) Cursor Position (See paragraph 4.2.1.4): Cursor position value is calculated according to ASCII value and should be converted for EBCDIC.





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DATE	DATE	DATE	DATE	DATE

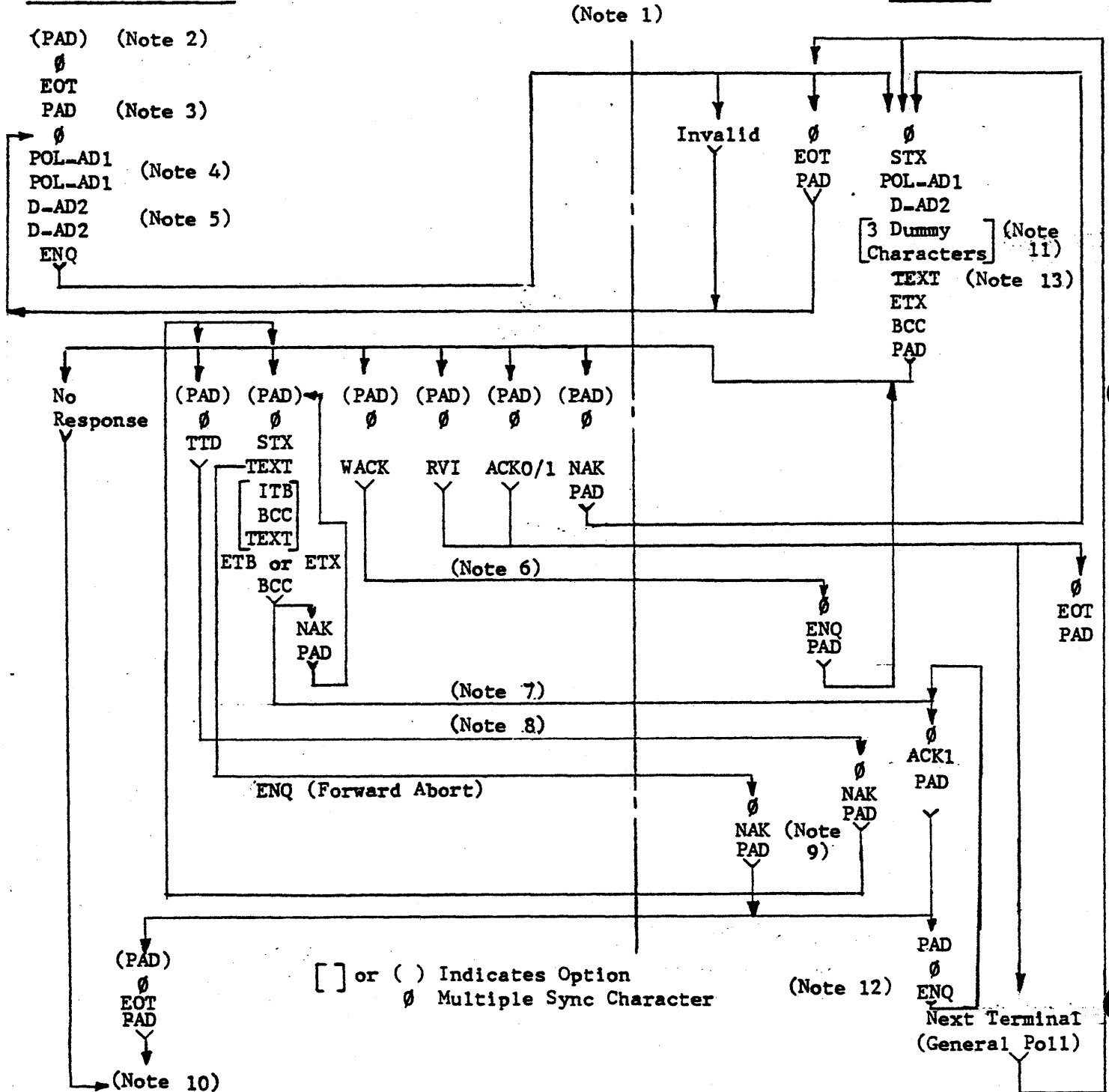
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4.2.8.1.4 IBM 3270 Polling Procedure: The polling procedure with associated notes is given in Table 24.

TABLE 24. IBM 3270 POLLING PROCEDURE

CENTRAL PROCESSOR

TERMINAL



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SHEET 174  
105 of

DWG NO.

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CHECK P F & F

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## NOTES TO TABLE 24:

1. This procedure describes Multipoint operation, where the Central Processor controls traffic in the network by polling (Specific or General) a Terminal or Terminals.
2. All received data may begin with a leading PAD character of SYN.
3. Trailing PAD characters of all "1"s are optional during reception (No trailing PAD check). The reception of EOT will resync the Terminal.
4. POL-AD1 and POL-AD2 sequence is the address for a poll operation. (The control unit address for a poll cannot be the same as for a select.)
5. D-AD2 and D-AD2 sequence is the device address. For a Group Poll, EBCDIC 7F7F is used in place of the two device address characters. Group Poll requires a concatenated connection.
6. The Terminal response to WACK (incorrect ACK 0/1 or invalid character following DLE) is ENQ.
7. Limited Conversational Mode - The Central Processor may respond with a data message after the reception of a polled message. The Terminal can accept a data message beginning with STX (or SOH) following a sequence of SYN characters (two or more). This terminates a Group Poll.
8. STX, ENQ sequence represents TTD in EBCDIC.
9. NAK is a valid response to a bad message, TTD, or Forward Abort (ENQ character in heading or test).
10. At this point, the central computer may Poll the Terminal, another Terminal, Poll all Terminals (General Poll), Select the Terminal or Select another Terminal, Selection procedure requires EOT character in Select sequence.
11. Certain programs may require an attention identification (AID) character and its parameters to be inserted (IBM "read heading"). The EBCDIC dummy characters are selected through a field engineering configuration change (paragraph 3.2.8).
12. ENQ response will result in the last ACK0/1 status.
13. Two SYN characters are inserted into text every second (typical) to maintain synchronization.



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CHECK FF & F

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4.2.8.1.5 IBM 3270 Select Procedure: The select procedure with associated notes is given in Table 25.

TABLE 25. IBM 3270 SELECTION PROCEDURE

CENTRAL PROCESSOR

TERMINAL

(Note 1)

(PAD) (Note 2)

∅

EOT

PAD

(Note 3)

∅

SEL-AD1

SEL-AD1

(Note 4)

D-AD2

D-AD2

(Note 5)

ENQ

Ignore

(Note 12) WACK PAD

ACKO PAD

No Response

(PAD) ∅ TTD

(PAD) ∅ STX

TEXT

ITB

BCC

TEXT

ETB or ETX

BCC

(PAD) ∅ ENQ

(Note 10)

ENQ (Forward Abort)

(Note 6)

(Note 7)

(Note 8)

NAK PAD

NAK PAD

ACK1 PAD

PAD ∅ ENQ (Note 11)

(PAD) ∅ EOT PAD

(Note 9)

[ ] or ( ) Indicates Option  
∅ Multiple Sync Characters

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SHEET 174  
107 OF

DWG NO.

1691 6256

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### NOTES TO TABLE 25:

1. This procedure describes multipoint operation, where the central processor controls traffic in the network by selecting a Terminal.
2. All received data may begin with a leading PAD character of SYN.
3. Trailing PAD characters of all "1"s are optional during reception. (No trailing PAD check.) The reception of EOT will resync the Terminal.
4. SEL-AD1 and SEL-AD1 sequence is the address for a Select operation. (The control unit address for a Select cannot be the same as for a Poll.)
5. D-AD2 and D-AD2 sequence is the device address.
6. The data message sent by the central processor may begin with STX (or SOH) following a sequence of SYN characters (two or more).
7. STX, ENQ sequence represents TTD in EBCDIC.
8. NAK is a valid response to a bad message, TTD, or Forward Abort (ENQ character in heading or text).
9. At this point, the central computer may Poll the Terminal, Poll another Terminal, Poll all Terminals (General Poll), Select the Terminal, or Select another Terminal.
10. The central processor may respond with an ENQ, Terminate, or Reselect.
11. ENQ response shall result in the last ACK0/1 status.
12. WACK shall be the response to a select when the Terminal is in Local or Transmit mode. The ENQ light and alarm will be activated for Local mode only.

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SHEET 174  
108 of

DWG NO. 1691 6256

REV  
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#### 4.2.9 Point-To-Point Procedures For Operator Display Terminal (ODT).

The Terminal has the capability for utilizing the point-to-point communications procedure used in the operator Display Terminal (ODT) configuration. This procedure shall be as defined for the single line control of the B6700/B7700, in Section 13, 2304 1247, B6700 Model II Multiplexor Product Specification.

The message format is a subset of the Burroughs Communication Procedure Standard, STANDARD. 1284 9006.

##### 4.2.9.1 Read Message (Poll)

The read message poll procedure shall be used to transmit data to the central processor. This procedure conforms to that given in Table 26.

##### 4.2.9.2 Write Message (Select)

The write message select procedure shall be used to receive data from the central processor. This procedure conforms to that given in Table 27.

##### 4.2.9.3 Configuration

Terminal configuration for the ODT, point-to-point, communications procedures shall be accomplished through the use of CTRL sequences as defined in paragraph 3.2.8.

##### 4.2.9.4 Optional ODT Communications Procedure

The Terminal has the capability of operating in an ODT environment using the point-to-point dedicated (contention) communications procedures defined in paragraph 4.2.7.2.2 and Table 22.



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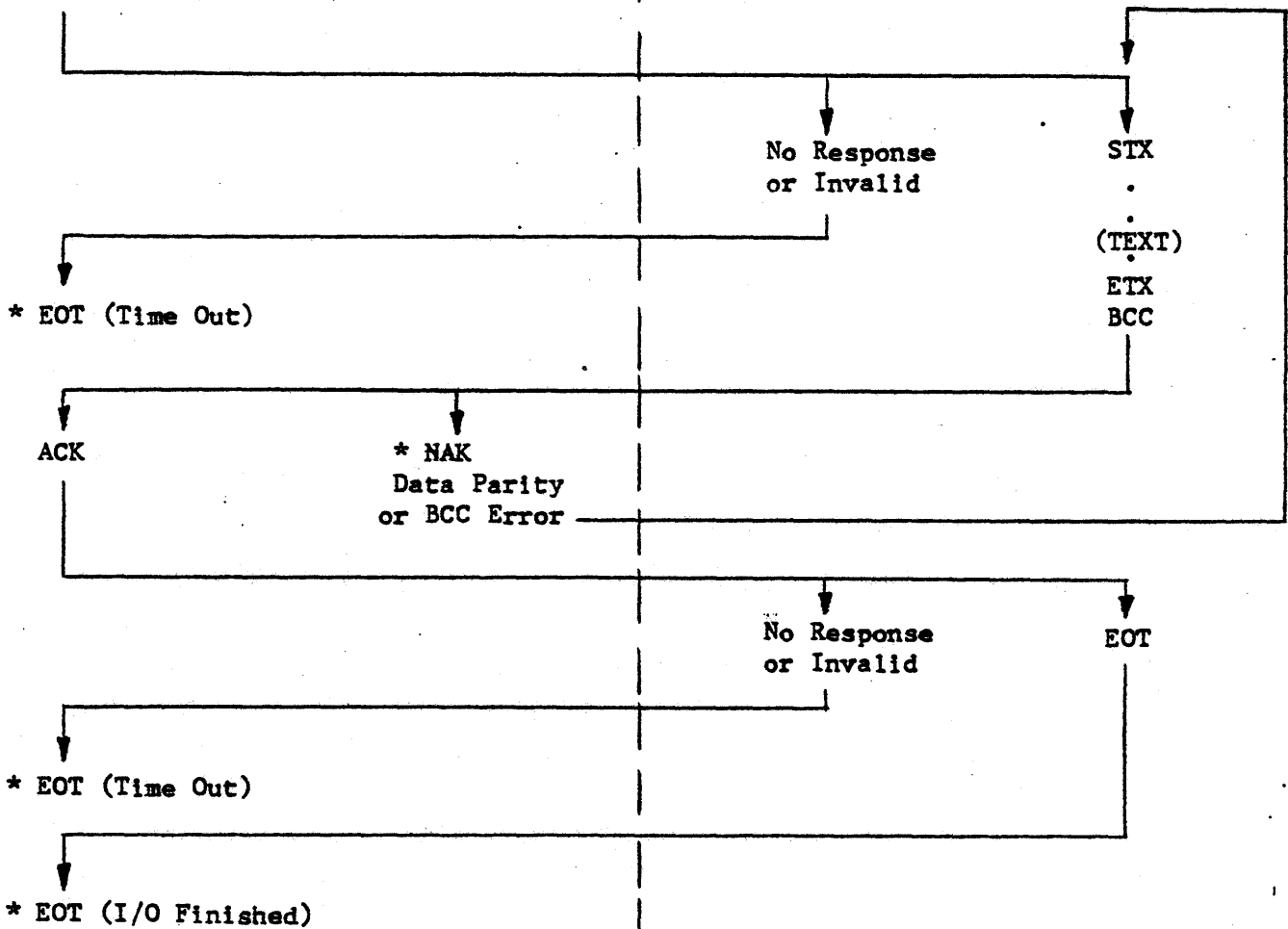
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TABLE 26. READ MESSAGE (POLL)

FROM  
CENTRAL PROCESSOR

FROM  
TERMINAL

ENABLE CTS (Clear-to-Send)



NOTE: The NAK sent to the Terminal in the event of an error conditions the Terminal to retransmit the same message in response to the next Read command.

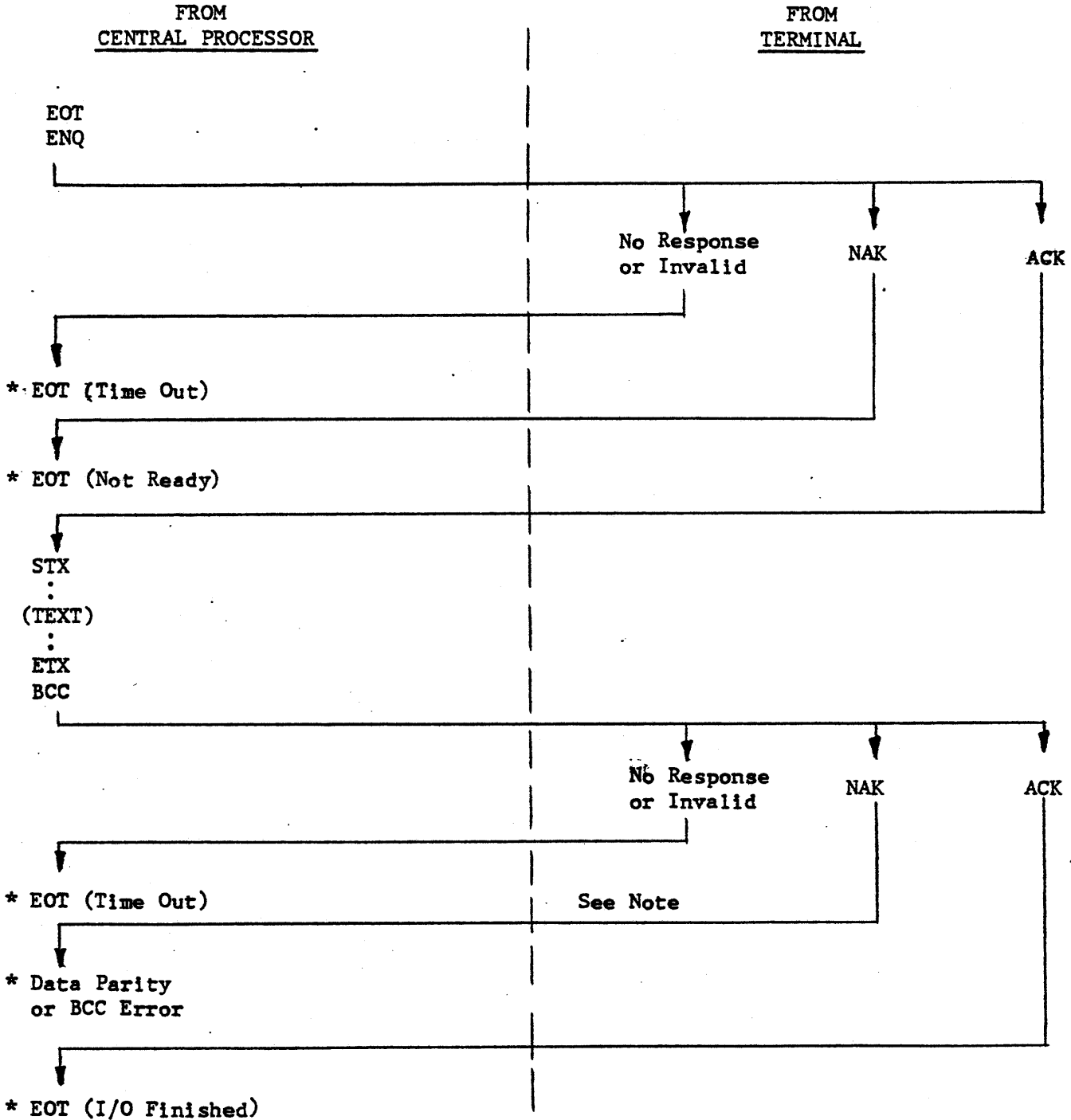
\* - Disable CTS



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TABLE 27. WRITE MESSAGE (SELECT)



NOTE: At this point the Terminal is conditioned to accept a retransmission of the message beginning with STX or a new message beginning with EOT.

\* - Disable CTS



SHEET 111 of 174	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY	CHK STD & REC	CHECK FF&F
DATE	DATE	DATE
DSGN	APPROVED	
DATE	DATE	DATE

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5. OPTIONAL PERIPHERAL INTERFACES TO THE TD730/830 TERMINAL

5.1 GENERAL

The Terminal is capable of providing input/output (I/O) interface compatibility with certain peripheral equipment or devices performing the functions of local data storage/retrieval through magnetic tape cassette recorders and magnetic card reader, as well as hard copy output of display data through several types of printers. All types of printers will operate dedicated to a Terminal, while certain types may be shared between a number of Terminals on a random-access non-priority basis. The I/O interfaces to the Terminal are provided for both local and unattended modes of operation and are achieved through the use of ACIA and PIA devices in the interface subsystem. The interface uses a bidirectional data bus for the transfer of data in both directions between the memory and all I/O interfaces. Connector space is provided in the display unit for the Magnetic Credit Card Reader, the Magnetic Tape Cassette, and one of the printer devices.

All I/O interfaces are factory installed.

5.2 MAGNETIC TAPE CASSETTE INTERFACE

The Terminal has available an I/O interface for the connection of the TD076 and TD076-1 Magnetic Tape Unit Controllers. This interface allows the Terminal to operate, through the controllers, with the A9490 or A9497-11 Magnetic Tape Cassette Drive Units providing on-site data storage and retrieval capability.

The magnetic tape controller interface consists of a serial data cable (paragraph 5.2.4) and the associated electronics required to accomplish controller "hand-shaking" routines and transmit/receive asynchronous data at a 4.8 k bps data rate.

5.2.1 Dedicated and Shared Operation

The Terminal's controller interface and TD076 controller allow the Terminal to operate with a single tape drive unit in a dedicated configuration or with two tape drive units in a shared configuration. Addition of the TD076-1 controller enables multiple Terminal configurations. Shared and dedicated configurations using individual or ganged cassette controllers are discussed in the magnetic tape controller specification 2555 9410.

In any configuration, the limit of one Terminal addressing two cassette tape drive units can not be exceeded. Typical Terminal/Controller interfacing for the dedicated and shared configurations is shown in Figure 5-1.

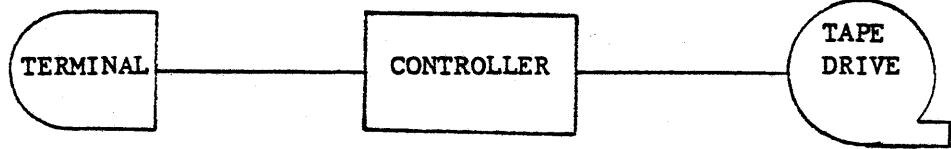




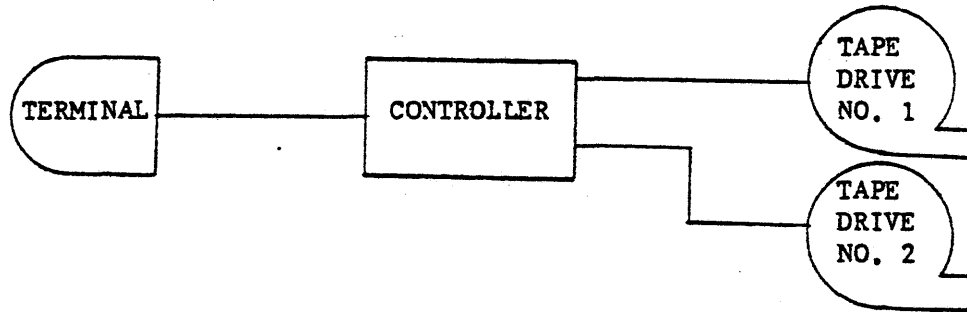
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DEDICATED CASSETTE TAPE DRIVES



SHARED CASSETTE TAPE DRIVES

TYPICAL TERMINAL/CONTROLLER OPERATING CONFIGURATIONS

FIGURE 5-1



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### 5.2.2 Interface Operation

Control of the tape cassette unit by the Terminal is accomplished through the use of tape commands. Tape commands may be initiated from either the central processor through data comm or by the operator from the Terminal's keyboard. Upon receipt of a tape command from either the data comm or keyboard, the Terminal's controller interface shall send the I character (column 4, row 9, Figure 7-1) to the controller requesting to be polled. The Terminal waits for the controller to respond with a space character (column 2, row 0, Figure 7-1) before sending the tape command. If the Terminal interface fails to respond to a controller request for data within 6 seconds the controller shall abort the "hand-shaking" routine and require operator intervention.

#### 5.2.2.1 Message Formatting

Data read/write functions, tape movement, and search operations are initiated by either data comm (ESC) or keyboard (CTRL) sequences. The commands used for data transfer and the operations they initiate are given in the following sub-paragraphs:

**5.2.2.1.1 Write Data to Tape:** The ESC G or CTRL ' sequence enables the Terminal to send blocks of 256 characters to the controller. Upon receipt of a "Write Data to Tape" command the controller will check tape status and respond with the space character (column 2, row 0 Figure 7-1), causing the Terminal to send a block of 256 characters. The first character in this block shall be a Forms status character (W for Forms mode, column 5, row 7, Figure 7-1; and space for Non-Forms mode). The Terminal shall continue to transfer blocks of 256 characters (each containing a Forms character) upon subsequent receipt of space characters. Data transferred from the Terminal shall begin with the character in the home position and continue in blocks of 255 characters until all data on the page is sent or until the end of the page is reached. The ETB character is sent by the interface when the end of data or end of page is reached.

The controller response to the "Write Data to Tape" command shall be the EM character (column 1, row 9, Figure 7-1) whenever the tape status prevents writing to the tape. The Terminal shall respond to the EM character sequence by sounding the audible alarm and displaying an error message (paragraph 3.2.9.3).

The controller shall send the NAK character (column 1, row 5, Figure 7-1) following receipt of a 256 character block whenever the controller is unable to correctly write this block on the tape. The Terminal shall respond to the NAK character by sounding the audible alarm, illuminating the error indicator, and displaying an error message (paragraph 3.2.9.3).

**5.2.2.1.2 Write Unprotected Data to Tape:** The ESC Q or CTRL ( sequence will cause the Terminal to issue a "Write Unprotected Data to Tape" command. This function is identical to the "Write Data to Tape" function except that only unprotected data will be transferred in the 256-character blocks.

**5.2.2.1.3 Write Tape Mark:** The ESC A or CTRL \ sequences cause the Terminal to request the writing of a tape mark by the controller. The controller will respond with the EM character when the tape status prevents writing to tape or the NAK character when the tape mark is not correctly written. Terminal response to the NAK and EM characters is described in paragraph 5.2.2.1.1.



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LTR	REVISION
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**5.2.2.1.4 Read Record From Tape:** The ESC H or CTRL \$ sequences will cause the Terminal to issue a "Read Record From Tape" command. The controller will transfer the next data record (one Forms status character followed by 255 display characters) to the Terminal. If the ETB character is detected, the controller shall send space characters until the 256-character block has been completed. The Terminal shall go into Forms mode, if requested by the Forms status character and will start writing data at the present cursor location.

The controller shall respond with the EM character when it is unable to read a record due to tape status or non-existence of the desired record.

The controller will respond with the NAK character whenever an error in the CRC, preamble or postamble (specification 2555 9410) has been detected. In addition, the controller will transfer the faulty record to the Terminal.

Terminal response to the EM and NAK characters is defined in paragraph 5.2.2.1.1.

**5.2.2.1.5 Read Page From Tape:** The ESC \* or CTRL # sequences will cause the Terminal to issue a "Read Page From Tape" command. The read page function is identical to the read record function (paragraph 5.2.2.1.4) except that the controller shall continue to send blocks of 256 characters until the ETB character is detected, thus preventing further data transfer. The Terminal shall begin writing data at the home position. If the end of the Terminal's page is reached prior to ETB detection, data wrap-around will occur.

**5.2.2.1.6 Read Page and Transmit:** The ESC , or CTRL % sequences will cause the Terminal to issue a "Read Page From Tape" command (paragraph 5.2.2.1.5). At the completion of this command the Terminal will enter the Transmit mode and transmit the data to the central processor.

**5.2.2.1.7 Read File and Transmit:** The ESC + or CTRL & sequences will cause the Terminal to issue a series of "Read Page and Transmit" commands. After each page of data is transmitted to the central processor, the Terminal requests a new page of data from the controller by sending the space character (column 2, row 0, Figure 7-1). The controller shall continue to respond to data requests until a tape mark is detected, causing the controller to send the ETB character. The Terminal will not erase previously written data.

**5.2.2.1.8 Backspace:** The ESC B or CTRL ) sequences cause the Terminal to issue a "backspace" command. The controller shall complete the backspace function (rewind to inter-record gap or beginning of tape) and respond with the space character (column 2, row 0, Figure 7-1).

If the controller is unable to initiate the backspace function due to tape status, it shall respond with the EM character (column 1, row 9, Figure 7-1). Terminal response to the EM character is defined in paragraph 5.2.2.1.1.

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TR	REVISION
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5.2.2.1.9 Search: The ESC U or CTRL ! sequences will cause the Terminal to issue a "Search" command for Tape Drive 1. The ESC V and CTRL " sequences will cause the Terminal to issue a "Search" command for Tape Drive 2. Each ESC and CTRL search request shall be followed by a 3-digit numeric value (000 to 999) indicating the file for which a search is to be made.

The controller will respond with the space character (column 2, row 0, Figure 7-1) upon completion of the search, enabling further data transfer from the Terminal.

If the controller is unable to initiate the search operation due to tape status, it shall respond with the EM character. Terminal response to the EM character is defined in paragraph 5.2.2.1.1.

5.2.2.1.10 Rewind: The ESC I or CTRL ^ sequences will cause the Terminal to issue a "Rewind" command. After initiating the rewind function, the controller will respond with the space character (Column 2, row 0, Figure 7-1) enabling the Terminal to issue another tape command.

If the controller is unable to initiate the rewind operation due to tape status, it shall respond with the EM character. Terminal response to the EM character is defined in paragraph 5.2.2.1.1.

NOTES to Paragraph 5.2.2.1

1. All ESC and CTRL initiated tape commands shall be followed by a numeric digit indicating which tape drive should be selected (digit 1 for Tape Drive 1, and digit 2 for Tape Drive 2).
2. The Terminal's tape controller interface may queue up to two tape commands prior to a response from the controller.
3. Depression of the Local key shall cause the Terminal to break-off operation with the tape controller and return to the Local mode.

5.2.3 Character Formatting

Each character shall utilize eleven nominally equal time intervals represented by a start bit, eight bits of information, a parity bit, and a stop bit. The start bit will be a binary "0" (low). The eight information bits will contain a 7-bit character code (least significant bit transmitted first) and a binary "0" (low) for the eighth or most significant bit. The tenth transmitted bit shall be a parity bit selected to make the number of binary "1" (high) bits odd, excluding the stop bit. The stop bit will be a binary "1" (high).

5.2.3.1 Error Detection

Upon detecting a parity error in a received data character, the Terminal's tape controller interface shall cause the display of the question mark (column 3, row 15, Figure 7-1) in place of the faulty character. In addition, after receiving the entire 256-character block containing a faulty character, the interface shall cause the display of an error message (paragraph 3.2.9.3), illuminate the error indicator, and sound the audible alarm.



SHEET 116 of 174	DWS NO. 1691 6256			REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830			
DRAWN BY	CHK STD & REC	CHECK P F & F	DSGN	APPROVED
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5.2.4 Cabling

Terminal to controller cabling shall consist of the shielded, 4-wire, serial data cable. This cable shall not exceed a length of 10 feet.

5.3 MAGNETIC CARD READER INTERFACE

The Terminal has the capability to interface to the Magnetic Card Reader. The Magnetic Card Reader is a separately contained unit which accepts magnetic cards conforming to ABA standards. Upon insertion of the card in the reader and depression of the read key on the reader, the data encoded on the magnetic stripe is read into the Terminal's memory. This data is not displayed; the Terminal is then automatically placed in the Transmit mode and the magnetic card data in the Terminal's memory is transmitted.

The Terminal also provides the capability of sending magnetic card data prior to each data transmission from the Terminal. Upon insertion of the card into the reader and depression of the read key, the data encoded on the magnetic stripe is read into the Terminal's memory and automatically transmitted to the central processor. Each subsequent transmission from the Terminal shall be preceded by the magnetic card data contained in the Terminal's memory. Removal of the card from the reader shall cause an automatic erasure of the magnetic card data contained in the Terminal's memory.

The operating mode of the Magnetic Card Reader interface shall be selected through configuration change (paragraph 3.2.8).

5.4 AUXILIARY PRINTERS

The Terminal has available I/O interfaces for connection to three classes of printers; serial, current loop; parallel, TTL voltage levels; and serial, balanced differential.

5.4.1 20/60 mA Printer Interface

The I/O interface from the Terminal for providing output data to the Burroughs B9354-6 printer is serial data, current loop of either 20 mA or 60 mA, selectable through field engineering adjustment. Other printer types which will operate compatibly on the interface are the Teletype ASR38, the Terminet 300 printers, or equivalent. The basic data rate for the B9354-6 is 110 bps; however, the interface of the Terminal is adjustable to include higher data rates including 150, 200, 300, 600, 1.2 k, 2.4 k, 4.8 k, and 9.6 k bps.

Printing of all or only unprotected data stored in the memory shall be initiated from the keyboard via the CTRL key followed by ; or :, respectively, or may be initiated automatically by receipt of the ESC character followed by the same respective characters (see Table 13). Optional DLE P and ESC 4 sequences can also be enabled to initiate a print operation in the TD700/TD800 environments. Printing will start following transmission of the ACK character to the central processor signifying that a good message was received.

Printing of data stored in the memory is from home to the position of the cursor at the time the Printer is activated. A CR, CR, LF sequence will be sent to the Printer by the Terminal at the end of each display line. The CR, CR-LF sequence will be transmitted to the Printer upon detection of a CR character in memory.

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### 5.4.2 A9249 (ODEC) Printer Interface

The TD730/830 provides an I/O interface for the connection of the A9249 (ODEC) Printer. The interface allows either the operation of a single Terminal to a dedicated A9249, or the shared operation of up to three Terminals with the A9249 Printer on a random-access, non-priority basis. The dedicated and shared Printer/Terminal layout are shown in Figure 5.2. Connection of more than three Terminals (up to 15) to a single A9249 Printer may be accomplished through special factory order.

The A9249 Printer uses an eight line, parallel data interface consisting of seven data lines and one data strobe line which provides printer status to the Terminal. The interface exchange is asynchronous by character with the printer determining when the Terminal may send the next character.

#### 5.4.2.1 Shared Operation

In the shared printer connection, each of the three Terminals has random non-priority access to the printer. Terminal requests for print service during periods of printer activity are stored in a queue in the interface allowing print service to be supplied in the order of request. Any Terminal requesting printer service shall be able to cancel it's request by being switched to local mode without disrupting other queued requests.

#### 5.4.2.2 Message Formatting

The data message can be transmitted to the A9249 Printer either by central processor access to the Terminal or through the keyboard. Two types of print commands are available:

- (a) Print whole page contents whether in Forms or Non-Forms mode (sequences CTRL ; from the keyboard or ESC ; from the central processor).
- (b) Print only unprotected data when the Terminal is in the Forms mode (sequence CTRL : from the keyboard or ESC : from the central processor). Request to print unprotected data when the Terminal is not in Forms mode will result in the printing of an empty screen equivalent.

Printing of data stored in the Terminal's memory shall be from the home position up to the position of the cursor at the time the printer is activated. Characters from columns 0 and 1 of the ASCII code chart (Figure 7-1) shall be converted by the interface and sent to the printer as spaces. The interface shall also transmit spaces for all protected data when the "print unprotected data" request is used.

When a CR (▽) is read from the Terminal's memory, the interface will send a CR-LF to the printer causing the printer to perform a carriage return/line feed operation. The interface shall also send a CR-LF to the printer whenever the last column of a display line is read. The function of automatically sending the CR-LF to the printer at the end of a display line may be disabled through a Terminal configuration change as described in paragraph 3.2.8. When the automatic CR-LF is disabled, the printer shall print 132 characters per line.



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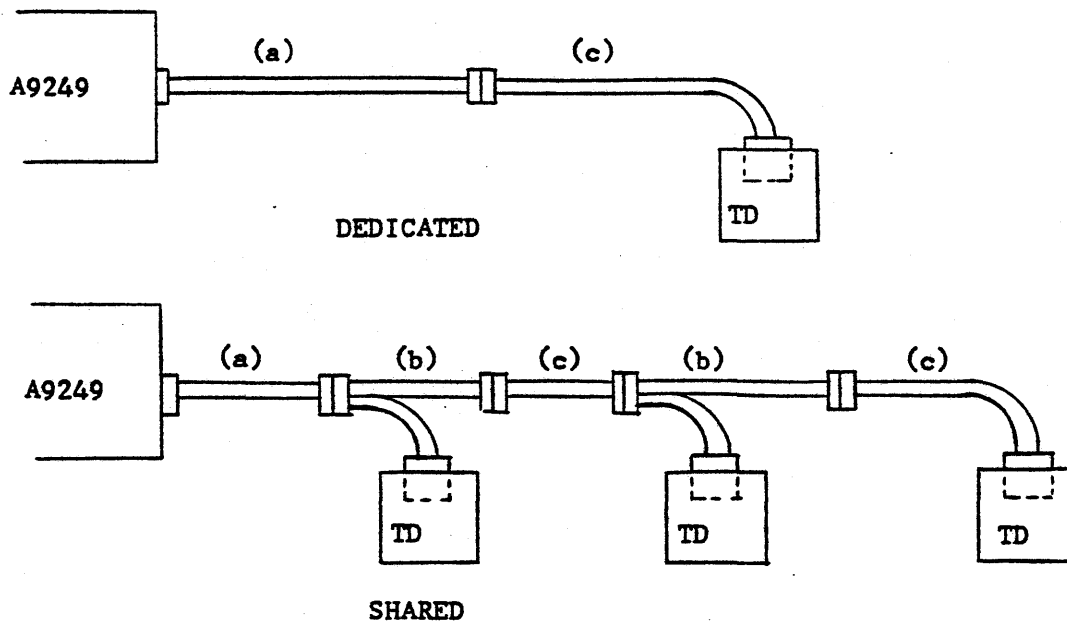
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5.4.2.3 A9249 Printer Cabling

The A9249 Printer is limited by its TTL interface to a maximum of 50 feet total cable separation from the Terminal(s) driving it. Up to three cable types shall permit the connection of the Terminal(s) in the dedicated or shared printer configuration:

- (a) TD/A9249 Interface Cable, 15 feet - This cable has mating connectors for the printer and the Terminal on its respective ends, providing a dedicated connection to a single Terminal, or the connection from the Printer to the first Terminal in the shared, multidrop configuration.
- (b) Shared A9249 Connection Cable - This adapter cable, configured to a "T" for multidrop connection of up to 3 Terminals to a shared printer, has a mating Terminal connector and two 25-pin connectors for mating with the cables connecting the preceding Terminal and the succeeding Terminal or printer. The cable length from the Terminal connector to either of the other connectors is 1 foot.
- (c) U.S. Data Set Cable, 15 feet (1696 4975) - This standard cable is used to connect adjacent Terminals in the shared configuration. The connectors on the respective ends of this cable will mate with the Terminal/Printer interface cable and the Shared A9249 Connection Cable. A secondary use of this cable shall be to extend the TD/A9249 Interface Cable up to 45 feet in a dedicated connection by the use of two sections.

Typical cabling layout is shown in Figure 5-2.



A9249 DEDICATED AND SHARED CONNECTION

Figure 5-2.



SHEET 119 OF 174	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY CNK STD & REC	CHECK FFB F	DSGN
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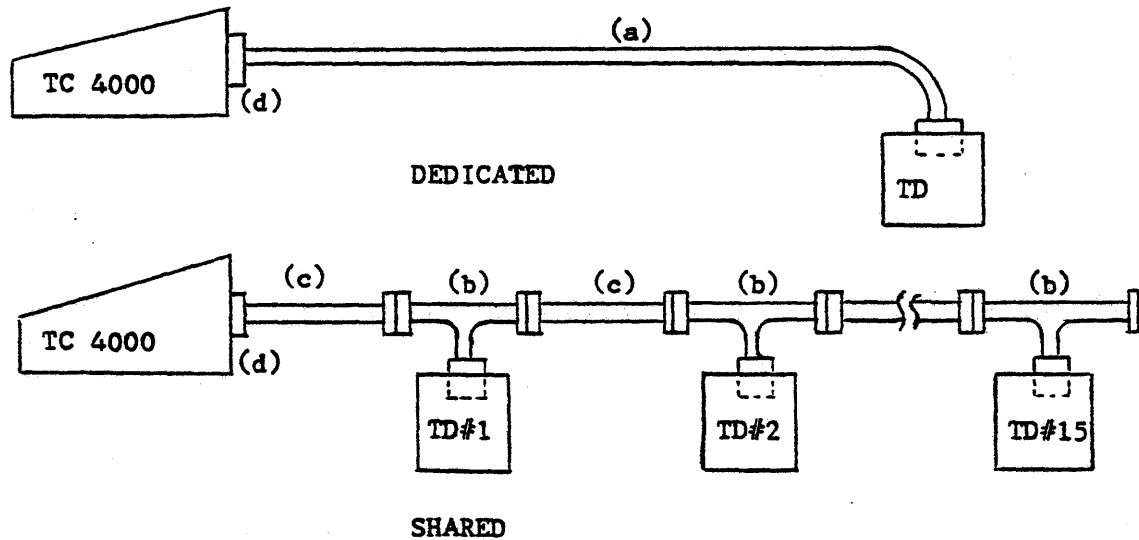
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**5.4.3 TC 4000 RO Auxiliary Printer Interface**

The TD730/830 provides an I/O interface for connection to the TC 4000 RO Auxiliary Printer. This interface permits either the operation of a single TD730/830 to a dedicated TC 4000 RO Printer, or the shared operation of up to 15 Terminals with a TC 4000 RO Printer on a first-in/first-out basis. Typical dedicated and shared configurations are shown in Figure 5-3.

The TC 4000 RO Printer uses a 300 bps, 10-bit-per-character serial data interface. The interface is a Burroughs Direct Interface (BDI), defined in paragraph 3.2.6.8. The TC 4000 RO Printer is considered to be ready at all times for Terminal access, therefore the interface consists only of data and format control characters from the Terminal to the Printer. There are no status, acknowledgement or other handshake signals provided by the Printer.

In the shared configuration, the TD-to-TD connection will use a cable consisting of 2 twisted pair sets of wires between terminals. The Printer-to-Terminal cable length can be up to 765 feet when 15 Terminals are shared.



- (a) Terminal to Printer Cable: 50 feet
- (b) TC 4000 Printer Concatenation Cable: 1 foot
- (c) TC 4000 BDI Cable: 50 feet
- (d) 50 Pin Connector:

TC 4000 RO PRINTER, DEDICATED AND SHARED CONFIGURATIONS

FIGURE 5-3





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5.4.3 TC 4000 RO Auxiliary Printer Interface (CONT)

The TC 4000 RO Printer requires printer functions, such as margins, tab stops, etc., to be set by means external to the Printer. Therefore, the Terminal I/O interface is capable of providing two classes of messages; control and data. These messages are separate and unique. Control messages can not be mixed with data messages.

The control sequences, from either data communications (ESC =) or keyboard (CTRL =), will condition the Printer interface to accept and translate the displayed characters which follow it as control codes which set Printer functions. Table 28 provides a list of the characters used for Printer functions, their translation to the Printer and the functions they initiate.

TABLE 28. TC 4000 RO CONTROL CODES

Displayed Character	Control Code	Function
1	ESC 1	Set horizontal tab stop at present carrier position, clear all previously set tab stops to the right.
2	ESC 2	Clear all horizontal tab stops and enable standard tab stops
3	ESC 3	Set left margin stop, the carrier having been moved to correct position by space codes.
4	ESC 4	Set vertical tab stops, the paper having been brought to correct position by successive paper advances using LF code.
5	ESC 5	Clear all vertical tab stops.
6	ESC 6	Synchronize the electronics with the form beginning, the paper being set manually to the beginning of the form. Also clears all vertical tab stops.
7	ESC 7	Memorize the length of the form, the paper being moved from the beginning to the end of the form by successive paper advances using the LF code. This control code is used following ESC 6 and LF characters.
8	ESC 8	Command the line feed mode to change between single and double line paper feed.
9	ESC 9	Set right margin at present carrier position.
∅	ESC ∅	Cancel right margin.
:	ESC LF	Initiate 1/2 line (1/12 inch) forward paper movement.
;	ESC VT	Initiate 1/2 line (1/12 inch) reverse paper movement.
-	ESC CR	Initiate carrier return to position zero.

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PLAINFIELD, NEW JERSEY 07061 U. S. AMERICASHEET 174  
123 OF

DWS NO.

1691 6256

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**5.4.3 TC 4000 RO Auxiliary Printer Interface (CONT)**

The Terminal has the ability to queue Printer messages to two levels. Message queuing allows the Terminal to set up a new Printer format and have data printed in this new format with only one access of the Printer by the Terminal. Bilevel queuing is accomplished, prior to Printer access, by placing the format sequence on one page of the Terminal's memory while the data to be printed is placed on another page of memory. The pages are programmatically connected through the Terminal's paging function.

The data message can be transmitted to the TC 4000 RO Printer either by central processor access to the Terminal or through the keyboard. Two types of print commands are available:

- (a) Print whole page contents whether in Forms or Non-Forms mode (sequence CTRL ; or ESC ;).
- (b) Print only unprotected data when the Terminal is in the Forms mode (sequence CTRL ; or ESC ;).

NOTE: Printing is from Home to cursor if cursor is not in Home position.

The data message to the Printer may contain certain positional/format control characters. The Terminal translates these characters into codes which cause the Printer to perform the required positional/format action. Table 29 provides a list of these characters, their translation, and the function performed.

TABLE 29. TC 4000 RO POSITIONAL/FORMAT CONTROL CODES

Terminal Character	Control Code	Function
RS (◁)	HT	Horizontal tab
CR (▽)	CR LF	Carriage return and line feed
HT (→)	HT	Horizontal tab
ETX (X)	FF, CR	Form feed to start of next form
&	VT	Vertical tab

The positional/format control codes given in the above table will cause the Printer to react to the respective codes when the Terminal is either in the Non-Forms mode, or under remote controller instruction (ESC ;) to print the total displayed data in the Forms mode. When the Terminal has been instructed by the remote controller to print only unprotected data in the Forms mode (ESC :), the control characters in the above table, shall cause the Printer to react only when characters are detected in an unprotected field. Also, while under instruction to print only unprotected data, the I/O interface shall scan all characters prior to a US (▷) or GS (△) character without sending them to the Printer. The data following US or GS shall be printed until an RS (◁) character occurs, at which time the interface returns to the search for US or GS. The ETX character shall be obeyed in all cases through its FF translation for advancing the Printer to the top of the next form. If, in transmitting data to the Printer, no CR/LF is included, a CR will be inserted following the 80th character.

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SHEET  
122, 174

DWG NO.

1691 6256

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REVISION

5.4.3 TD 4000 RO Auxiliary Printer Interface (CONT)

An extended line function, when enabled by a field engineering adjustment, will override the automatic sending of the CR control after the 80th character. The printer, in response to the extended line function, will continue printing data until the 150-character limit is reached. At the 150-character limit, the Printer will do an automatic carriage return-line feed and continue printing data.

In the shared Printer connection, each Terminal has access to the Printer on a random-access, non-priority basis. As each Terminal requests Printer service, the requests are queued and ultimately completed. A Terminal is able to cancel a Printer service request by being switched to its Local mode without disrupting the other Terminals in the queue.

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ELECTRONIC COMPONENTS DIVISION  
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SHEET 123 174  
OF

DWG NO.

1691 6256

REV  
A

CLASS CODE

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5.5 OPTIONAL KEYBOARD

5.5.1 Specification

To be determined

5.5.2 Keyboard Layout

The optional keyboard layout is shown in Figure 5-4.



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SHEET  
125 OF 174

DWG NO.

1691 6256

REV  
A

CLASS CODE

TITLE

ENGINEERING SPECIFICATION: TD730/830

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### 6. ENVIRONMENTAL CHARACTERISTICS

#### 6.1 TEMPERATURE AND HUMIDITY RANGE

The Terminal shall meet the environmental temperature and humidity requirements given in the following sub-paragraphs. Figure 6-1 shows the temperature vs altitude characteristics of the Terminal.

##### 6.1.1 Operating Environments

The Terminal shall meet or exceed the requirements of Burroughs Standard 1257 5700 for operating environments as defined in Table 1, Class 1, of Standard 1257 5700. The conditions of relative humidity shall not include condensation.

##### 6.1.2 Non-Operating Environments

The Terminal shall meet or exceed the requirements of Burroughs Standard 1257 5700, Table 1, Class 1, for non-operating environments of transportation and storage. The conditions of relative humidity shall not include condensation.

#### 6.2 BAROMETRIC PRESSURE RANGE

The Terminal shall meet or exceed the requirements of Burroughs Standard 1257 5700, Table 1, Class 1, for barometric pressure ranges.

#### 6.3 ATMOSPHERIC POLLUTANTS

The Terminal shall meet or exceed the requirements of Burroughs Standard 1257 5700, paragraphs 7.3 and 7.4 as given in the following sub-paragraphs.

##### 6.3.1 Dust (Non-Conductive and Non-Corrosive)

The Terminal shall meet the requirements for Class 1 conditions.

##### 6.3.2 Corrosion and Rust

Terminal operation and storage, in atmospheres that contain excessive concentrations of material which may cause corrosion or rust, are defined in paragraph 7.4 of Burroughs Standard 1257 5700.

#### 6.4 VIBRATION AND SHOCK

The Terminal shall meet or exceed the requirements of Burroughs Standard 1257 5700, Table 1, Class 1, for vibration and shock in both operating and non-operating environments.

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SHEET 174  
 126<sub>CF</sub>

DWG NO.

1691 6256

REV  
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(To be added)

TEMPERATURE VS ALTITUDE CHARACTERISTICS OF THE TD730/830 TERMINAL

FIGURE 6-1

SHEET 127, 174	DWG NO. 1691 6256	REV A
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**6.5 RFI REQUIREMENTS**

The Terminal shall meet the requirements of Burroughs Technical Standards B2-08 and B2-09 for suppression and control of generated radio frequency interference. Standard B2-08 is derived from VDE0875 and VDE0871.

**6.6 ELECTROSTATIC INTERFERENCE PROTECTION**

Susceptibility to electrostatic interference has been minimized within the Terminal through design precautions. These precautions include, but are not limited to, appropriate grounding provisions in the package design and the buffering of high input impedance circuits.

**6.7 ACOUSTICAL NOISE LEVEL**

The Terminal shall meet the acoustical noise level limitations specified by NR35 noise-level rating curve of Burroughs specification 1257 4703.

**6.8 RELIABILITY**

**6.8.1 Definition of Terms**

The terms used herein relative to the topic of reliability are defined in Burroughs specification 60445, Reliability Standards.

**6.8.2 General**

The standard Terminal shall have a target mean-time-between-failures (MTBF) of 1800 hours minimum. Detailed MTBF predictions shall be formulated using the parts failure rates specified in MIL-HDBK-217<sup>B</sup> or equivalent. The predictions shall state the electrical and mechanical stress ratios and temperature upon which the failure rate for each part is based. Individual MTBF estimates for the display unit, the keyboard, and each option shall also be calculated to provide reliability data relative to the individual portions of the Terminal.

**6.8.3 Reliability Demonstration Test**

A reliability demonstration test shall be conducted to demonstrate that the required reliability has been achieved in the Terminal design. The reliability demonstration test procedure shall be submitted to TIO for review and approval prior to the testing. The test results shall be provided to TIO for review and approval prior to customer deliveries of the Terminal except for units designated for approved field tests.

**6.8.4 On-Going Quality Assurance**

A plan for on-going quality assurance shall be established to insure that the product performance level is maintained as established. Units shall periodically be withdrawn from the finished goods inventory on a sample basis, to be tested by Quality Assurance. Sample quantities of Terminals shall also be subjected to continued conformance to the 1800 hour MTBF requirement. The on-going quality assurance procedures shall be employed for the duration of Terminal production.



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SHEET  
128 OF 174

DWG NO.

1691 6256

REV  
A

CLASS CODE

TITLE

ENGINEERING SPECIFICATION: TD730/830

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## 6.9 MAINTAINABILITY

### 6.9.1 General

The design and construction of the Terminal shall provide for maximum maintainability. Corrective maintenance shall utilize a repair to component level philosophy. The Terminal shall have a mean-time-to-repair (MTR) equal to or less than 120 minutes at the component level. In order to achieve this, suitable maintenance procedures shall be provided to identify the failed component.

### 6.9.2 Maintenance Philosophy.

The Terminal, excluding the display, shall consist largely of plug-in subassemblies and printed circuit board modules. On-site repair of all subassemblies to the component level (I-C chips, transistors, key switches, etc.) shall be effected by a field engineer.

### 6.9.3 Personnel Requirements

The Terminal can be serviced and maintained on site by a field engineer with an electronic background in solid-state devices, digital circuitry, Self-Scan and CRT displays, together with one week's training in servicing and programming the equipment.

### 6.9.4 Maintenance Equipment and Tools

Effective on-site maintenance of the Terminal shall require a printed-circuit board extender, spare components including microprocessor, an oscilloscope, a multimeter, and normal hand tools (pliers, screwdriver, etc.). Subject to qualification with a TD730/830, the BDM1200 Digital Meter shall be used in place of an oscilloscope.

### 6.9.5 Special Test Equipment

No special test equipment is required to maintain the Terminal.

### 6.9.6 Preventive Maintenance

Preventive maintenance for the Terminal is not anticipated.

### 6.9.7 Maintenance Test Routine (MTR)

The Terminal provides the capability of conducting a self-generated confidence test of all major subsystems within the Terminal. This type of confidence test may be initiated from any of three sources: power up, keyboard CTRL request (Table 11), and data comm ESC request (Table 13). In addition, the Terminal will conduct confidence tests of associated peripheral devices upon CTRL or ESC request. The initiation of a confidence test will cause the erasure of all data in the display refresh memory. Successful completion of the confidence test will cause the message \*\*\*\*\* to be displayed. A confidence test detecting improper operation of a subsystem area shall commence a diagnostic routine to the extent allowed by the nature of the failure. Subsequent display of hexadecimal numbers will allow the operator or field engineer to determine the nature of the failure and appropriate action to be taken. A confidence test shall continue to completion irrespective of errors located, provided said errors do not affect the confidence test itself. Errors affecting the confidence test (MPU or scratch pad RAM or control ROM errors) shall cause the Terminal to go into an idle state after an attempt to diagnose the error is made. All ESC initiated confidence tests will attempt to transmit the resultant displayed data to the controller.



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**6.9.7.1 Areas of Confidence Testing**

The MTR shall test the following areas and assure their proper operation:

**6.9.7.1.1 Power Supply:** During the MTR test, a power failure condition in the power available input will cause termination of the test and power down the Terminal.

**6.9.7.1.2 Microprocessor:** The MTR will use a series of subroutines to check the following areas of the microprocessor:

- (a) Accumulators
- (b) Incrementor
- (c) Logical Operations
- (d) Shift Operations
- (e) Branching Commands
- (f) Index Register Operation
- (g) Stack Pointer
- (h) Arithmetic Logic Unit

**6.9.7.1.3 Read/Write Memory (RAM):** The MTR checks all scratch pad and refresh memory locations. Detection of a failure will cause the display of a hexadecimal number indicating which RAM package needs replacing.

**6.9.7.1.4 Read Only Memory (ROM):** The MTR shall check all ROM locations. The ROM test will be performed by adding the contents of all locations, for the ROM chip under test, using a 16-bit CRC polynomial. The check sum thus obtained will be compared to the last two bytes in the ROM which contain the check sum characters. An error in comparison will cause the display of a hexadecimal number indicating which chip needs replacing.

**6.9.7.1.5 Data Comm:** The MTR will test the data comm hardware by transmitting characters which will be looped back into the receive section. The output of the modem shall be disabled at this time.

**6.9.7.1.6 Keyboard:** The MTR shall test the keyboard interface and indicators by sending data which will cause the keyboard indicators to remain "ON" for the duration of the confidence test.

**6.9.7.2 Peripheral Tests**

Peripheral tests are not included within the automatic testing of the Terminal subsystems, but may be initiated through separate CTRL or ESC sequences (Tables 11 and 13).

**6.9.7.2.1 Printer Test:** A rolling ASCII character set will be sent to the printer. The operator will then make a visual check of the output.

**6.9.7.2.2 Cassette Test:** A rolling ASCII character set will be sent to the cassette. This information shall then be read from the cassette and compared to the original information sent.



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6.9.7.3 ~~Resident Character Set Readout~~

The Terminal has the capability of displaying the resident character set through keyboard CTRL or data comm ESC request (Tables 11 and 13 respectively). The ESC request shall also cause the displayed resident character set to be transmitted to the remote controller.

6.10 TESTING

The tests described in the following subparagraphs are in addition to reliability and maintainability test requirements.

6.10.1 Unit Tests

Unit testing of the Terminal by design engineering shall be provided. This test shall be performed on a Terminal (or Terminals) whose design level is at least equal to that of the first units received from production. The unit test shall be used to validate the design, verify that the design objectives have been met, and that all specified functional capabilities including the data communication interfaces have been properly implemented. In addition, unit testing shall be used to establish the integrity of the design, a measure of which is the absence of undesirable or otherwise incorrect response to valid stimuli.

SHEET 131 OF 174	DWS NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY	CHK STD & REC	CHECK FF&F
DATE	DATE	DATE
	DSGN	APPROVED
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**6.10.2 Acceptance Tests**

The acceptance tests shall demonstrate during the production phase that the Terminal, as designed and demonstrated in the Unit Tests, continues to meet all of the requirements of this specification, including the functional, reliability, quality assurance, environmental and other requirements.

**6.10.3 Systems Tests**

Systems testing of the Terminal is required. These tests will be performed by the various Engineering or Systems M & E Groups. Data communications compatibility according to Burroughs Standard 1284 9006, and 1284 9022 as applicable, is required with the L8000 system DC1000 Series, B700, B1700, B2500/B3500, B4700, B5500/B5700, B6500/B6700, and B7700 systems. In addition, data communications compatibility with various Terminal concentrators, multiplexors, etc., to be specified, is required. Data communications integration tests with these devices will be required when specified. Terminal design engineering will be required to provide unit test documentation to these groups upon request. In preparation for systems testing, Terminal design engineering will provide product familiarization and training for personnel from these groups to the extent required to allow them to devise and perform systems tests and to perform routine maintenance on the Terminals during these tests at their respective facilities. Design engineering may be required to provide design level assistance and support during these tests.

**6.10.4 Field Tests**

The Terminal will be field tested. Field testing at a location to be designated by Marketing is intended to evaluate the Terminal in an applicational environment. Design engineering shall provide design level assistance and support during these tests, as required.

**6.10.5 Static Electricity Susceptibility Test**

The Terminal shall be subjected to a specific unit performance test to evaluate its susceptibility to the effects of static electricity. This special test may be conducted at a selected arid location in the U.S. where the environment is conducive to severe static electricity effects through very low humidity and high altitude. Laboratory conditions may be substituted for the natural environment if practical or preferable.



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LTR	REVISION
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6.11 QUALITY ASSURANCE PROVISIONS

6.11.1 Responsibility for Testing

The Terminal design organization, Burroughs TSG-P, shall be responsible for all inspections and testing, except for systems testing (paragraph 6.10.3) and field testing (paragraph 6.10.4). Unless otherwise specified, testing is performed at the design group's plant according to approved test procedures. The design group will maintain adequate records of all testing performed, and such records can be made available to corporate representatives upon request.

6.11.2 Qualification Inspection

The design group will specify tests to be performed for product qualification. These tests include verification of the parameters given in sections 3, 4, 5, and 6 of this specification (paragraph 6.10.2).

6.11.3 Quality Conformance Inspection

The design group shall specify tests and inspections to be performed to assure continued and uniform product quality (paragraph 6.10.3).

6.11.4 Rejection and Retest

Failure of Terminals to comply with the requirements of this specification are cause for rejection. Rejected items may be reworked and retested for acceptance.

6.11.5 Preparation for Delivery

The packaging, design, handling, and shipping requirements shall be coordinated to ensure successful distribution and safe delivery of the Terminal to world wide markets. The non-operating environment (transportation) is required to conform to Table 1, Class 1, of Burroughs Standard 1257 5700.

6.11.6 Evaluation of Shipping Container

The shipping container is required to successfully complete the following tests:

- (a) Free fall drop test as per Federal Standard 101B, Method 5007, Level B (22 inch drop on each side and each corner).
- (b) Shipping vibration test as per Federal Standard 101B, Method 5019 (one hour per each of three axes). Increase frequency until package clears table by 1/16 inch, and bounce for one hour on each axis.



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**7. NOTES**

**7.1 ILLUSTRATIONS, KEYBOARDS**

Figure 7-1 is the USASCII code chart which lists all possible characters and their data codes. Figure 7-1A is the modified ASCII code chart which lists the modified ASCII character chart. Figure 7-2 is a chart which illustrates the international variations to the modified character set.

Figure 7-3 is the USASCII keyboard. Figure 7-4 is the auxiliary numeric keypad. Figure 7-5 through 7-14 are illustrations of the various keyboards which can be used with the Terminal. Figures 7-15 and 7-16 are illustrations of the Japanese (Katana) character set and keyboard respectively. Figures 7-17 and 7-18 are illustrations of the Latin/Cyrillic (Russian) character set and keyboard respectively. Figure

Figure 7-19 is a coding chart which lists the EBCDIC codes that are used with the IBM 3270 communications procedure.

Figure 7-20 is the modified ASCII keyboard. Figures 7-21 through 7-31 are the data preparation keyboards available with the Terminal.





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COLUMN ROW	2	3	4	5
0	Sp	8	@	P
1	!	!	A	Q
2	"	2	B	R
3	#	3	C	S
4	\$	4	D	T
5	%	5	E	U
6	&	6	F	V
7	'	7	G	W
8	(	8	H	X
9	)	9	I	Y
10	*	:	J	Z
11	+	;	K	[
12	.	<	L	-
13	-	=	M	]
14	·	>	N	}
15	/	?	O	{

FIGURE 7-1A. MODIFIED USASCII CHARACTER CODING



SHEET 136 of 174	DWS NO. 1691 6256			REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830			
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**INTERNATIONAL VARIATIONS**

COUNTRY GROUP	COL. 2, ROW 3	COL. 2, ROW 4	COL. 4, ROW 0	COL. 5, ROW 11	COL. 5, ROW 12	COL. 5, ROW 13	COL. 2, ROW 1
FRANCE / BELGIUM		FR			ı		
ITALY					ç		
SPAIN / LATIN AMER.	P <sub>s</sub>				ñ		
UNITED KINGDOM	£				ı		
GER./AUS./SWITZ.			ş	ä	ö	ü	
PORTUGAL / BRAZIL				õ	ã	ç	
SOUTH AFRICA				'N	.É	ö	
SWEDEN / FINLAND	£		è	ä	ö	ä	
NORWAY / DENMARK	Æ	Å	ø		ü		ı

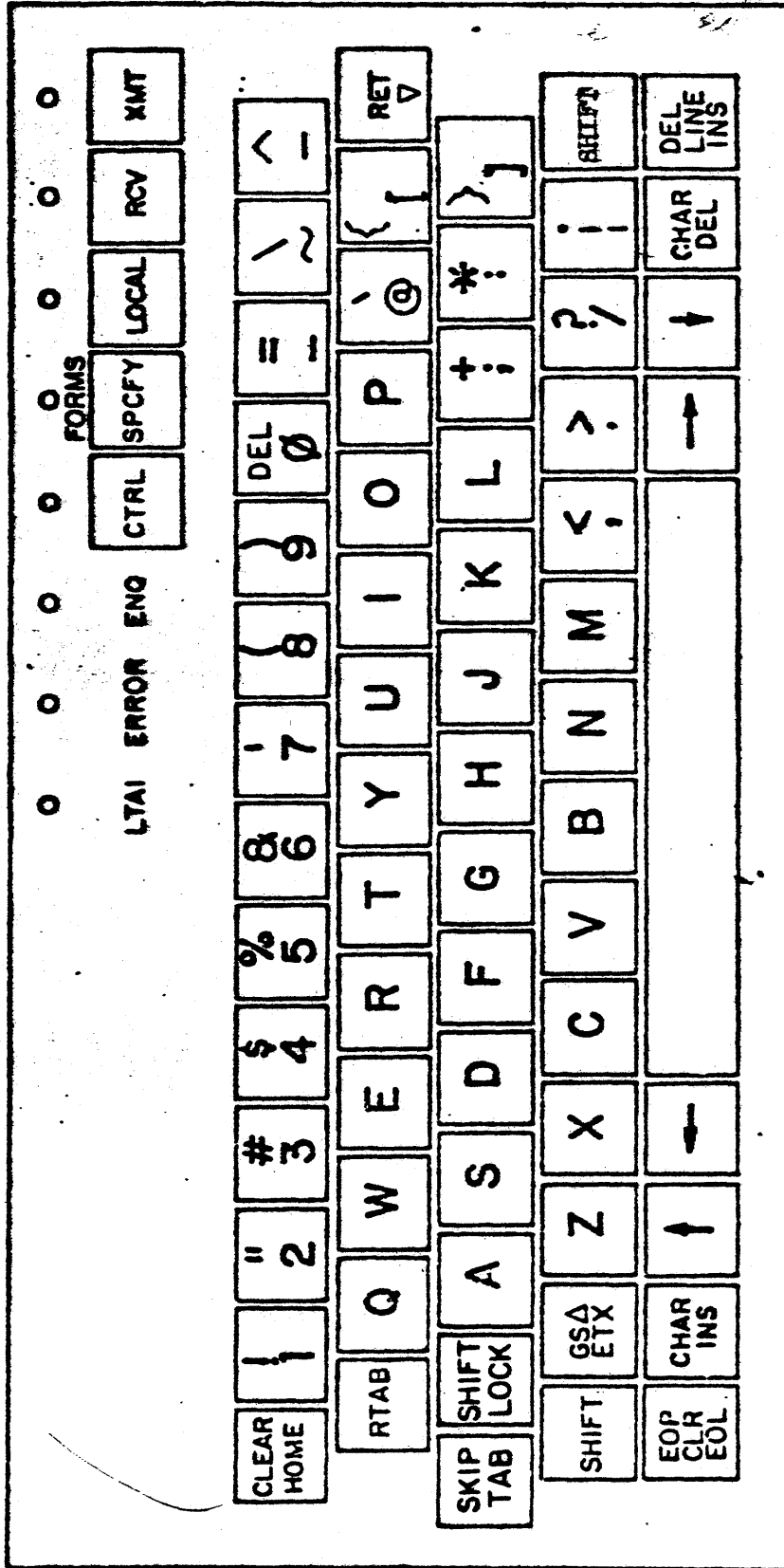
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**FIGURE 7-2. CHARACTER SETS**



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FIGURE 7-3. U.S. TYPEWRITER KEYBOARD, ASCII

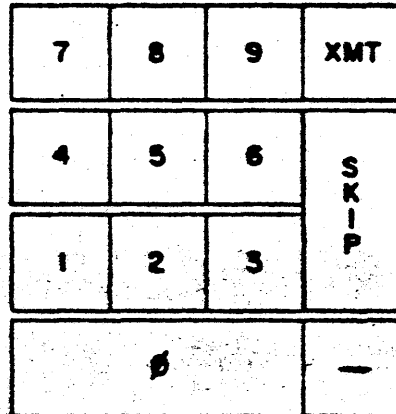
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36030

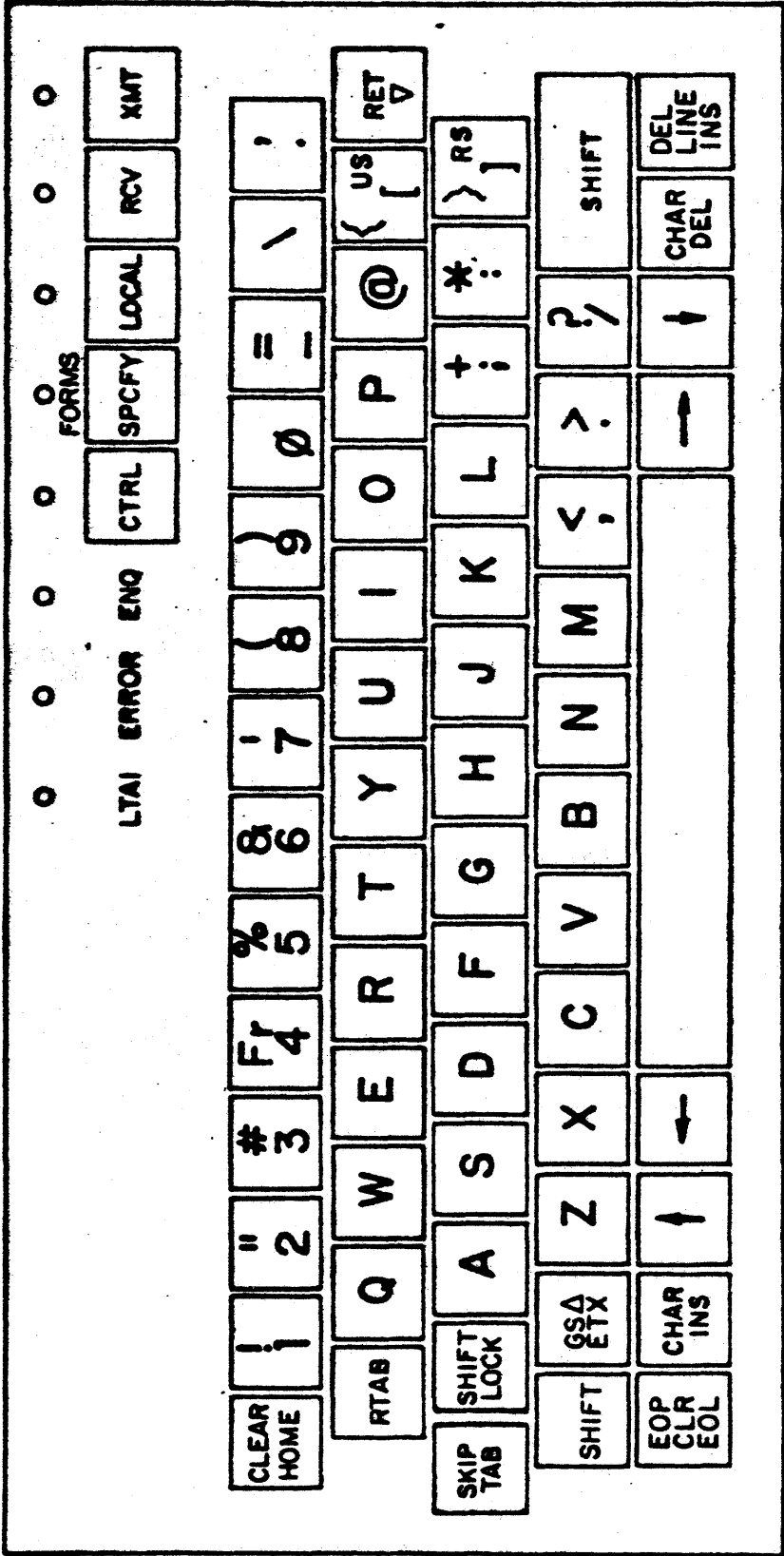
FIGURE 7-4. AUXILIARY NUMERIC KEYPAD



SHEET 139 174	DWG NO. 1691. 6256	REV A
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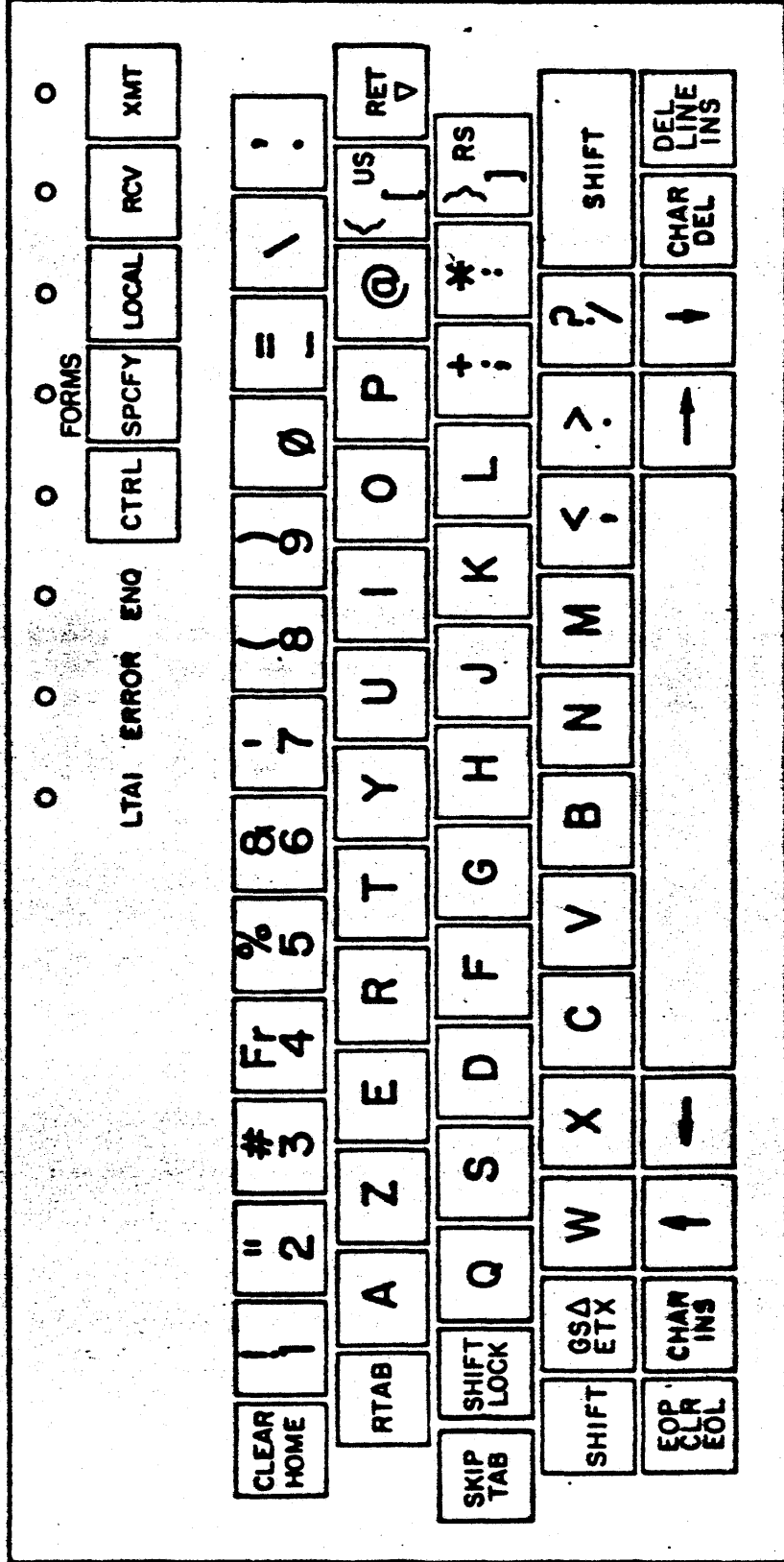
FIGURE 7-5. FRANCE AND BELGIUM TYPEWRITER KEYBOARD



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LTR	REVISION



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FIGURE 7-6. FRANCE AND BELGIUM TYPEWRITER KEYBOARD (OPTION)



SHEET 141 174	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY	CHK STD & REC	CHECK FP & F
DATE	DATE	DATE
DSGN	APPROVED	
DATE	DATE	DATE

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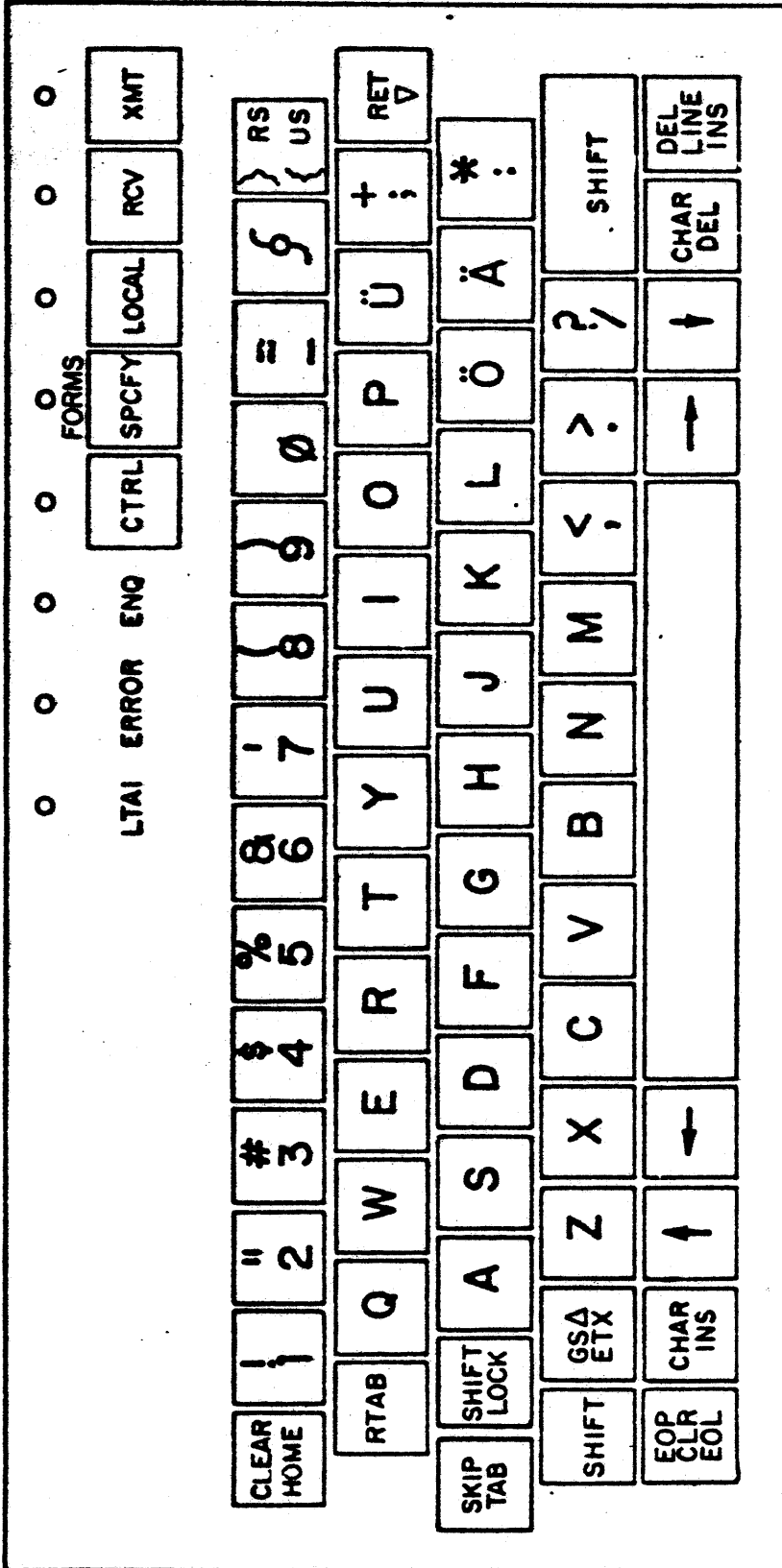


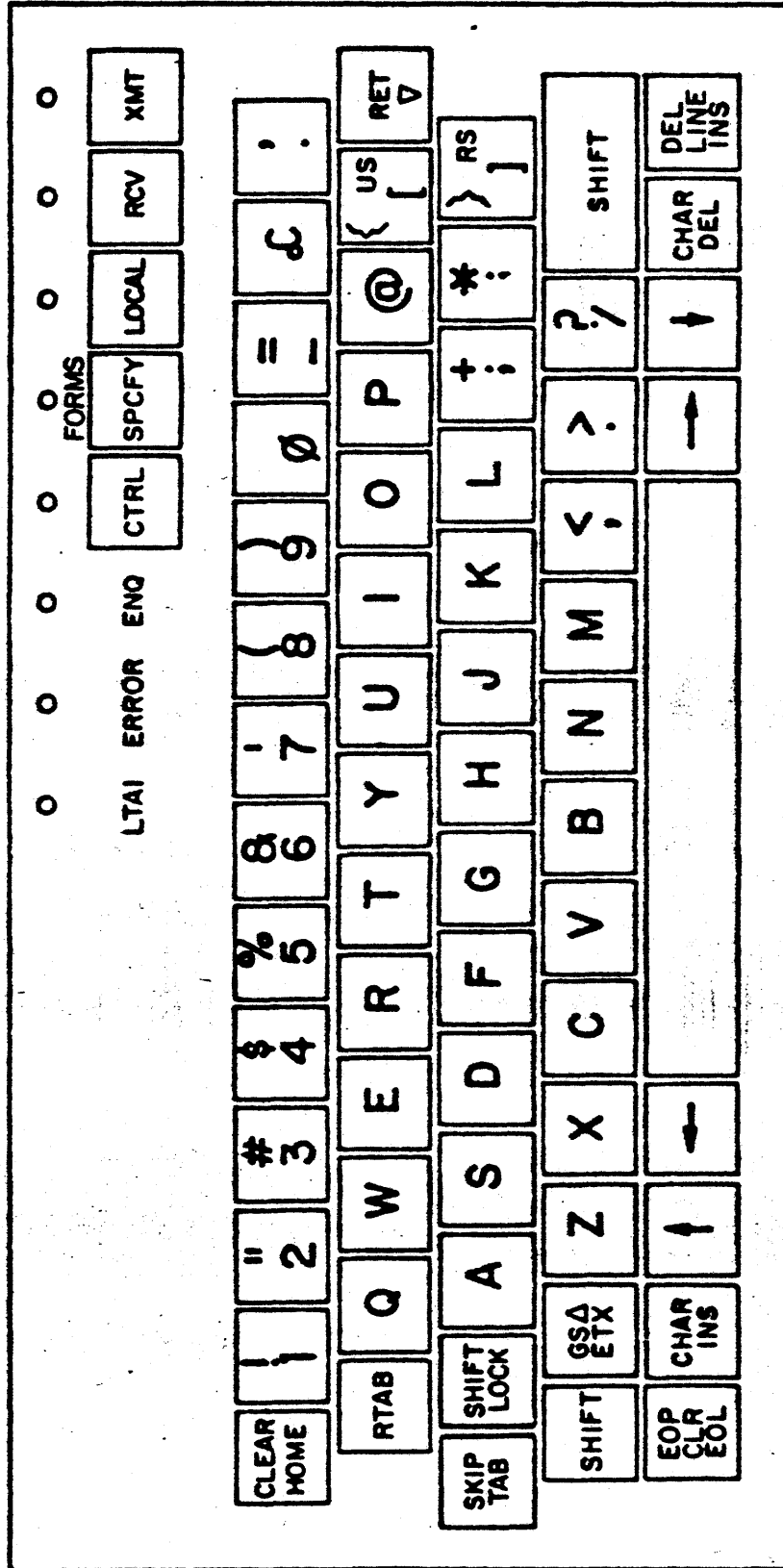
FIGURE 7-7. GERMANY, AUSTRIA, AND SWITZERLAND TYPEWRITER KEYBOARD



SHEET 142 174	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
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FIGURE 7-8. ITALY TYPEWRITER KEYBOARD

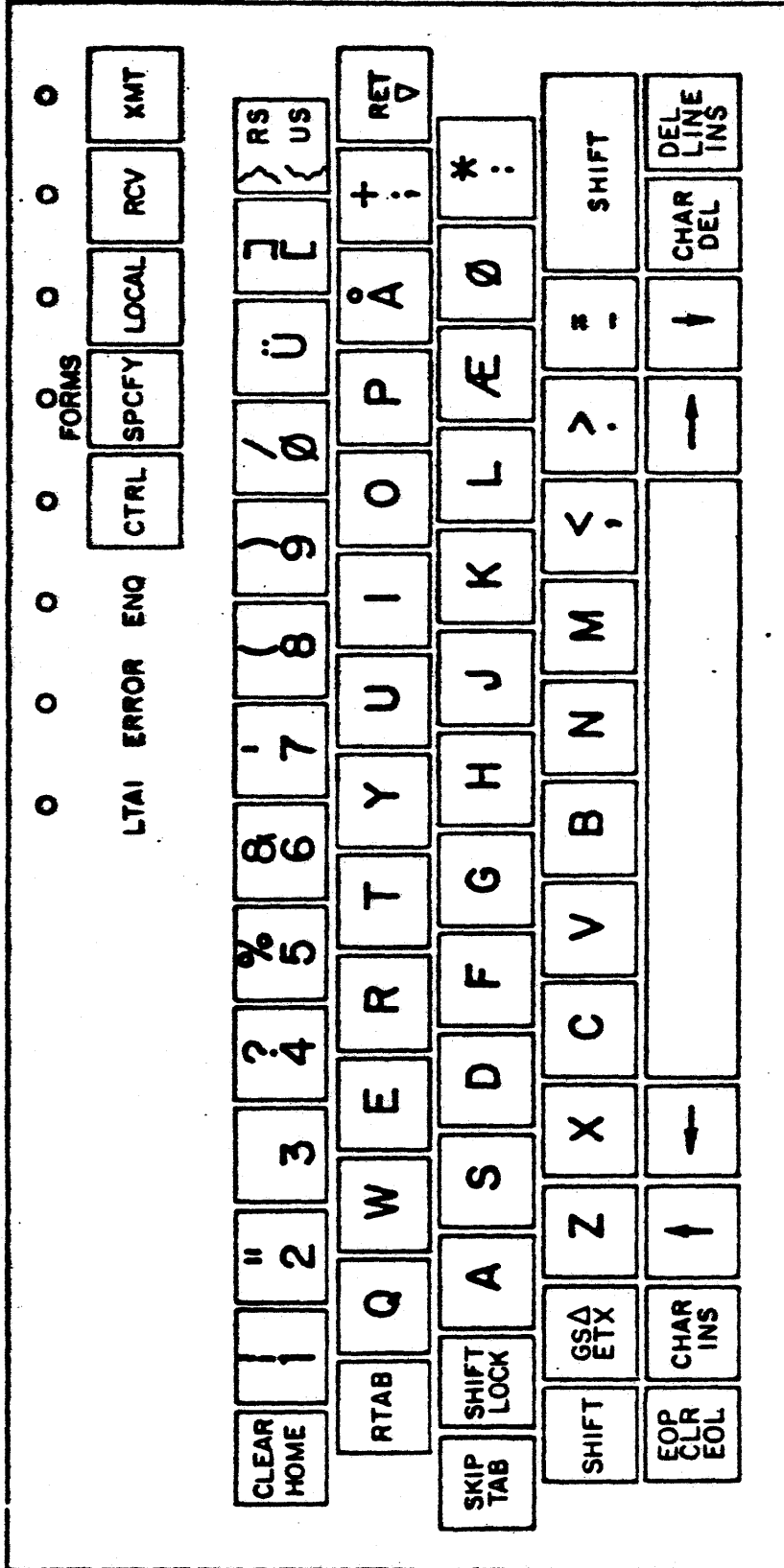




SHEET 143	174	DWG NO. 1691 6256	REV A
CLASS CODE		TITLE	
		ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY	CHK STD & REC	CHECK F P & F	DSEM
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FIGURE 7-9. NORWAY AND DENMARK TYPEWRITER KEYBOARD

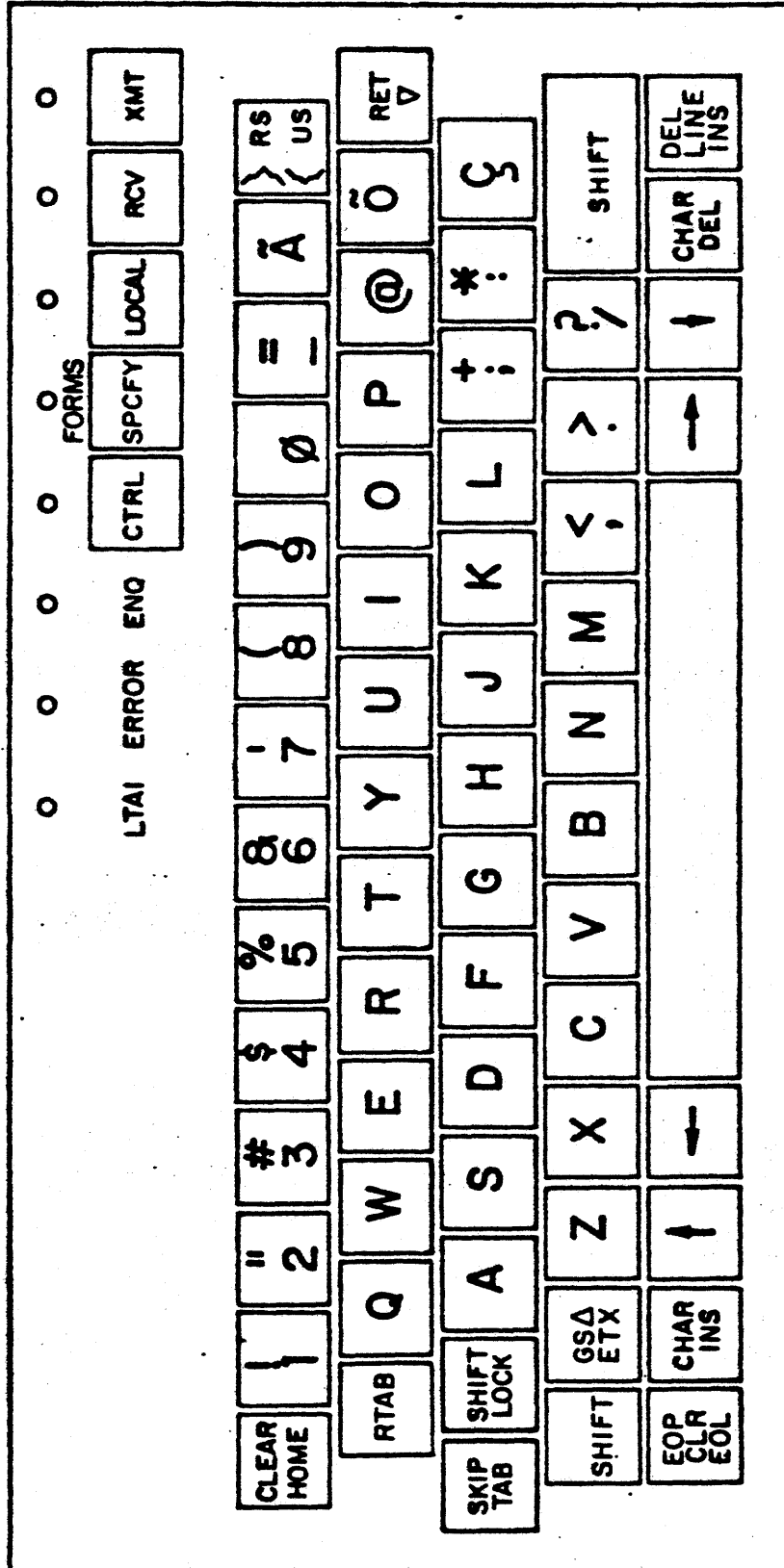




SHEET 144 174	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY	CHK STD & REC	CHECK FF&F
DATE	DATE	DATE
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	DATE	DATE

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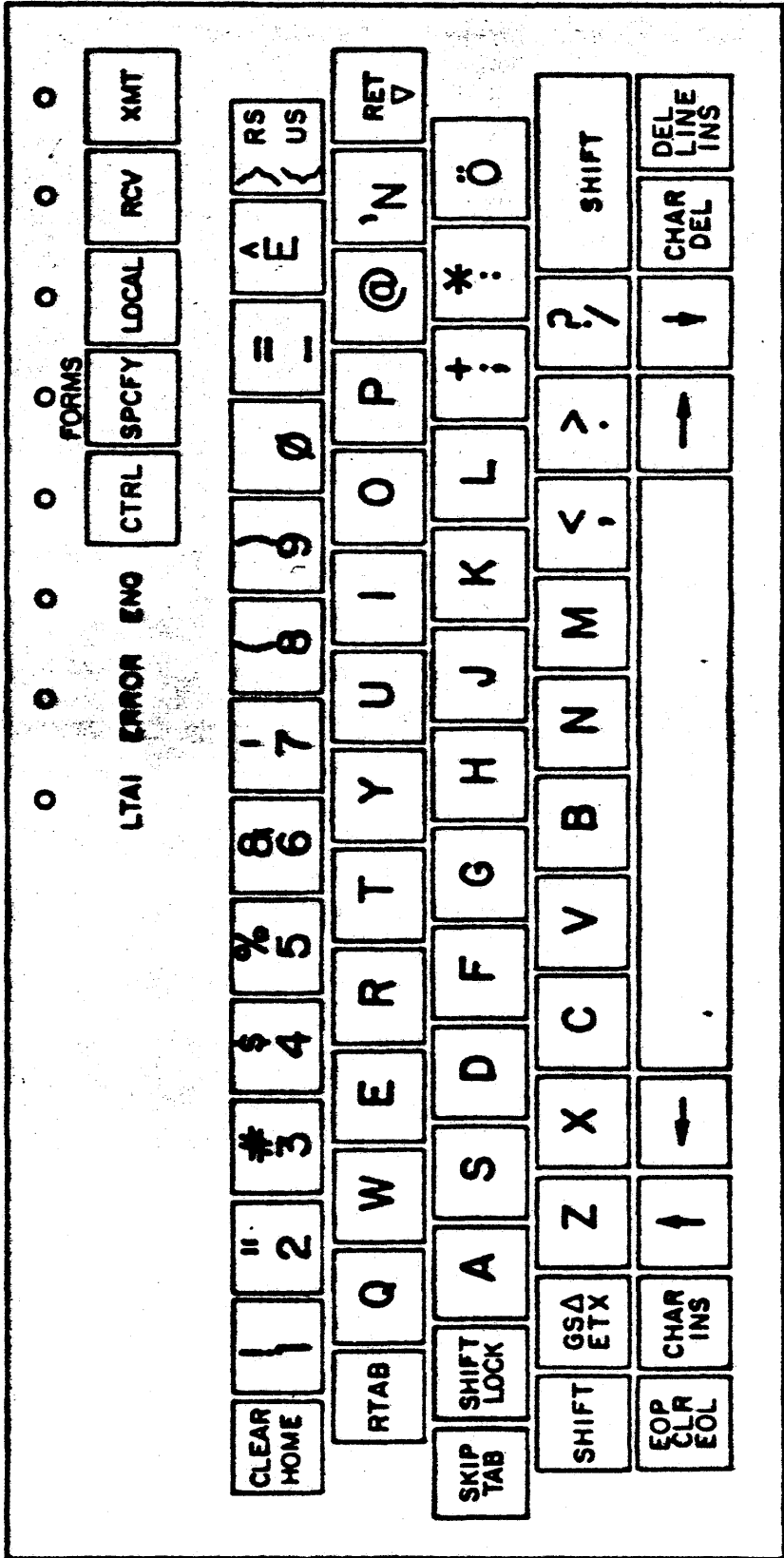


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FIGURE 7-10. PORTUGAL AND BRAZIL TYPEWRITER KEYBOARD

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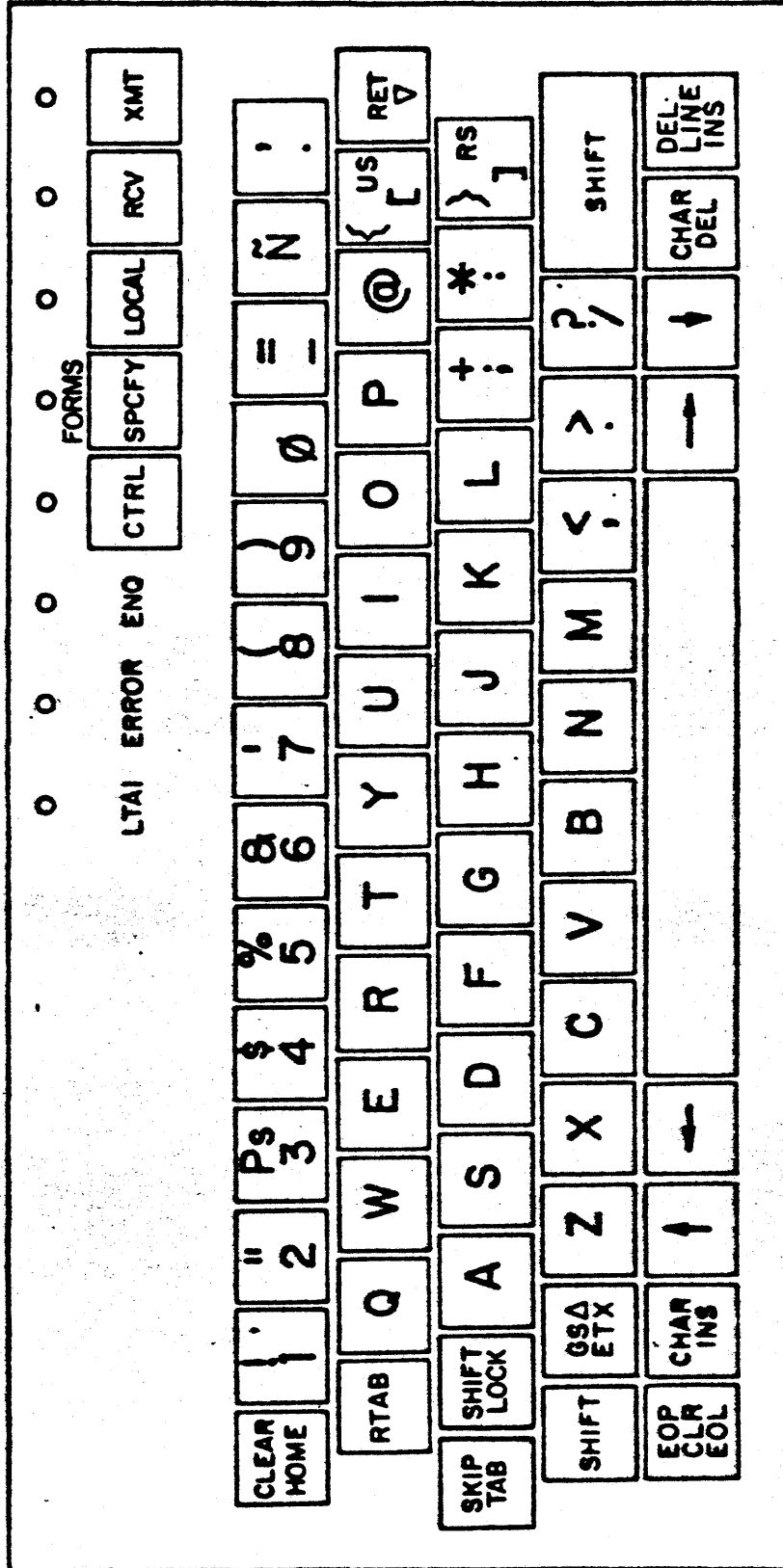
FIGURE 7-11. SOUTH AFRICA TYPEWRITER KEYBOARD



SHEET 146 174	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
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DATE	DATE	DATE
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FIGURE 7-12. SPAIN AND LATIN AMERICA TYPEWRITER KEYBOARD



SHEET 147	174	DWG NO. 1691 6256	REV A
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DRAWN BY	CHK STD & REC	CHECK PFB F	DSGN
DATE	DATE	DATE	DATE
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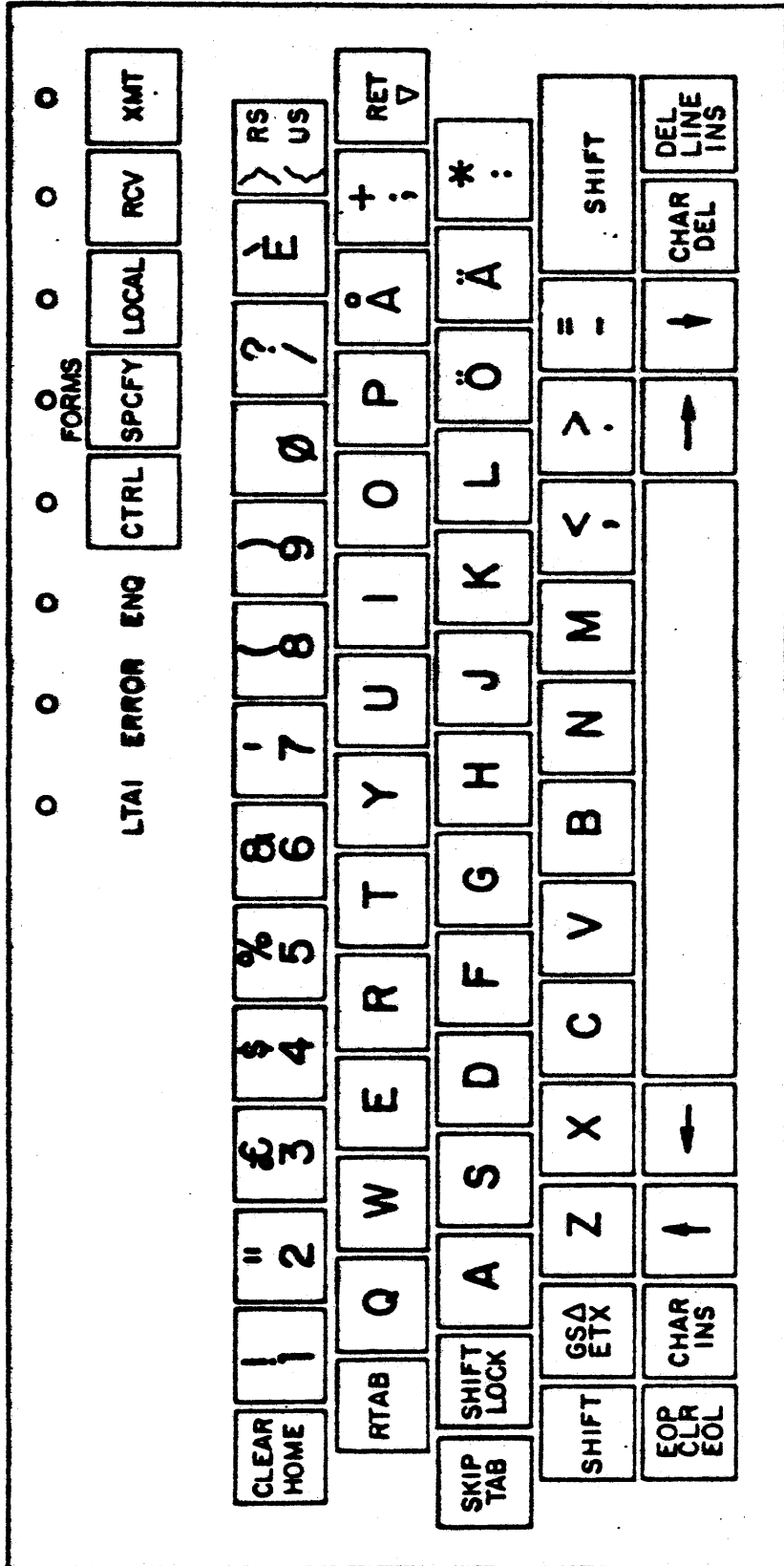


FIGURE 7-13. SWEDEN AND FINLAND TYPEWRITER KEYBOARD

19320Z



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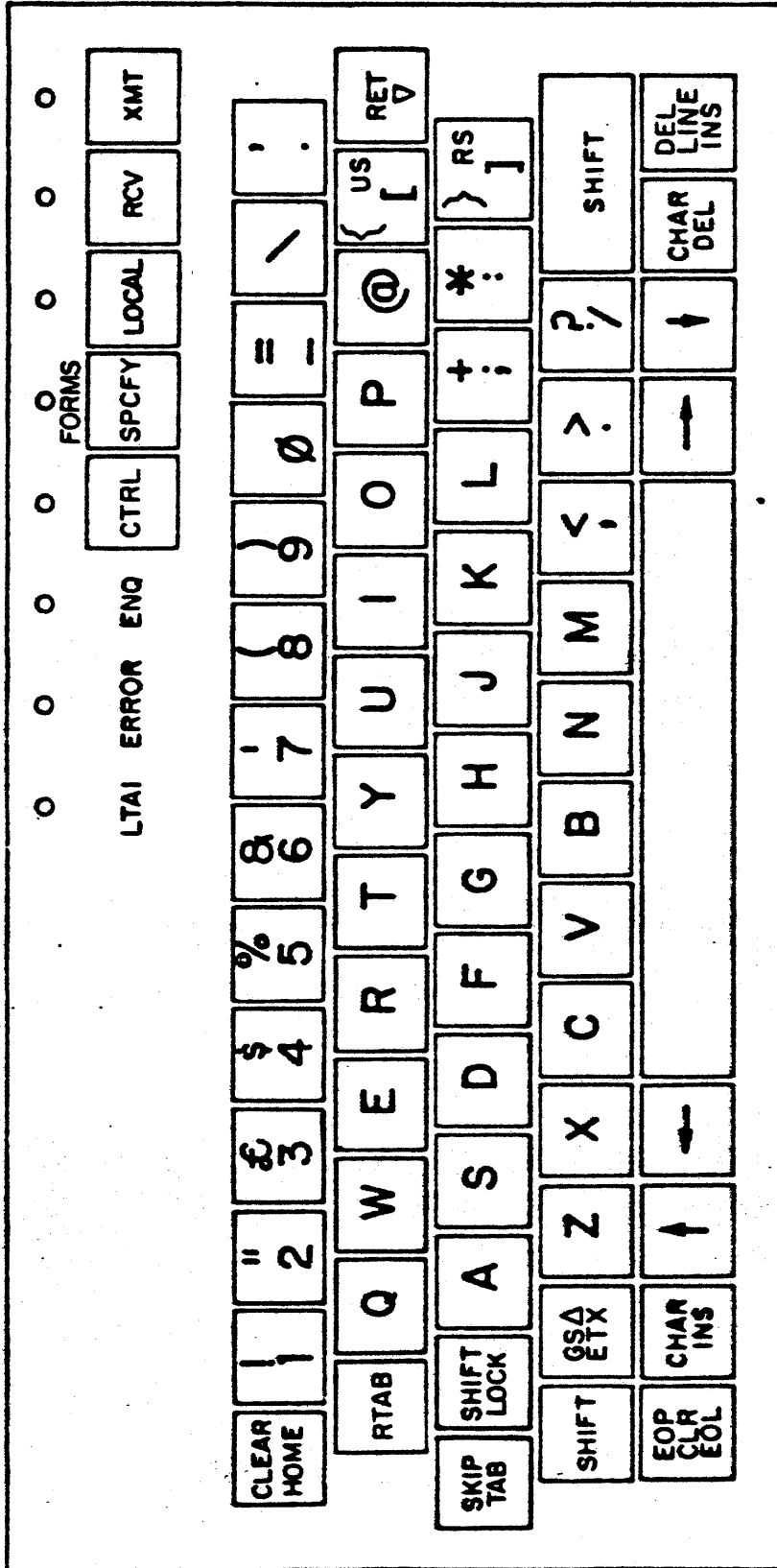


FIGURE 7-14. UNITED KINGDOM TYPEWRITER KEYBOARD



SHEET 149 174	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY	CHK STD & REC	CHECK P P & P
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DESIGN	APPROVED	
DATE	DATE	DATE

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COLUMN →	2	3	4	5	6	7	
ROW ↓	0	Sp	0	ケ	P	ソ	マ
1	*	1	A	Q	タ	ミ	
2	・	2	B	R	チ	ム	
3	#	3	C	S	ツ	メ	
4	o	4	D	T	テ	モ	
5	¥	5	E	U	ト	ヤ	
6	〒	6	F	V	ナ	ユ	
7	イ	7	G	W	ニ	ヨ	
8	ウ	8	H	X	ス	ラ	
9	エ	9	I	Y	ネ	リ	
10	オ	カ	J	Z	ノ	ル	
11	+	キ	K	コ	ハ	レ	
12	・	(	L	サ	ヒ	ロ	
13	-	=	M	シ	フ	ワ	
14	・	)	N	ヌ	ヘ	ン	
15	/	ク	O	セ	ホ	?	

18326

FIGURE 7-15. JAPANESE (KATAKANA) CHARACTER SET



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SHEET 150 174

DWG NO. 1691 6256

REV A

CLASS CODE TITLE  
ENGINEERING SPECIFICATION: TD730/830

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DRAWN BY	CHK STD & REC	CHECK FF & P	DSOM	APPROVED
DATE	DATE	DATE	DATE	DATE

LTR REVISION

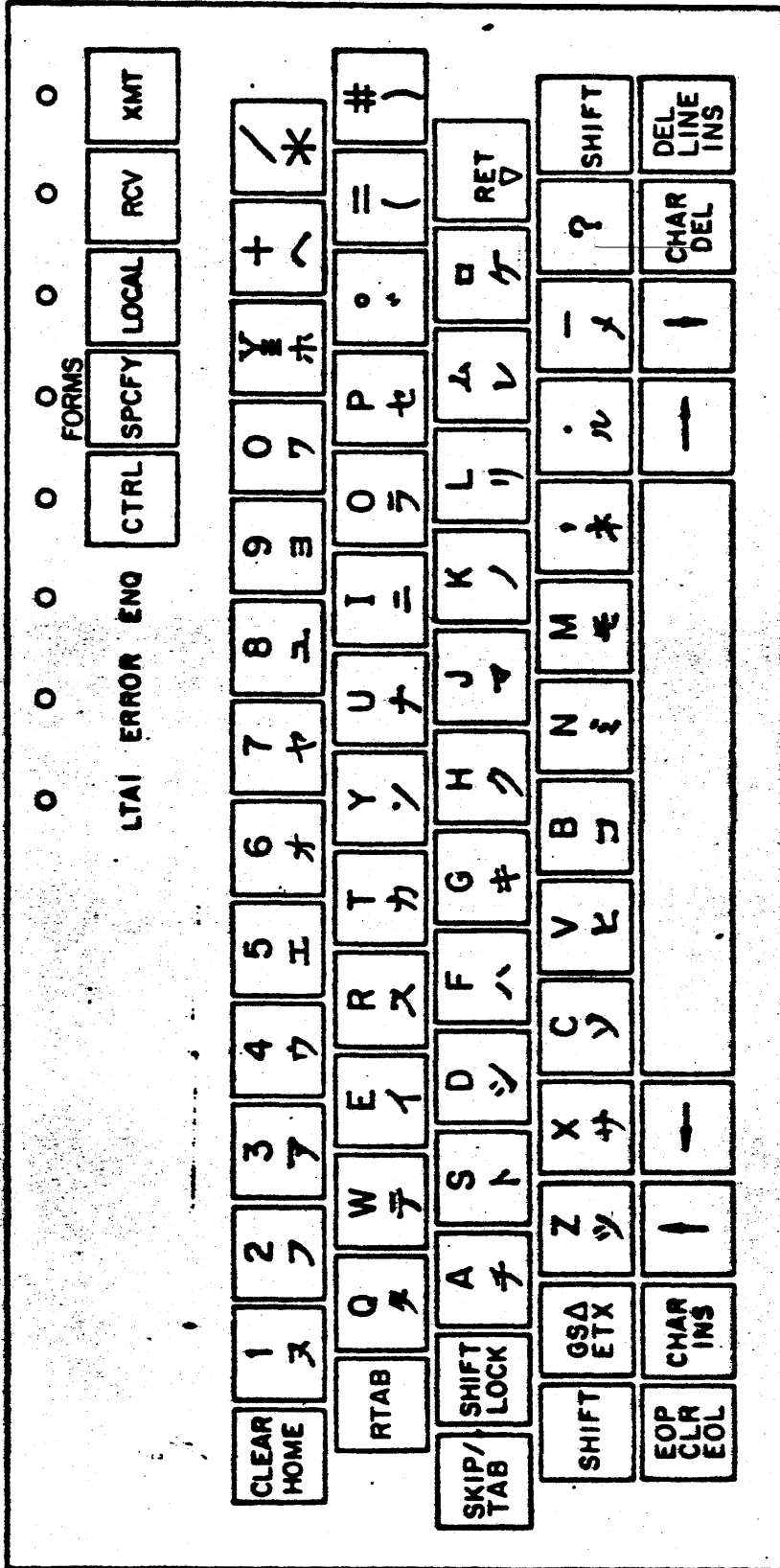


FIGURE 7-16. JAPANESE (KATAKANA) KEYBOARD

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COLUMN Row ↓	2	3	4	5	6	7
0	SP	∅	@	P	Ю	П
1	!	1	A	Q	А	Я
2	"	2	B	R	Б	Р
3	#	3	C	S	Ц	С
4	\$	4	D	T	Д	Т
5	%	5	E	U	Е	У
6	&	6	F	V	Ф	Ж
7	'	7	G	W	Г	В
8	(	8	H	X	Х	Ь
9	)	9	I	Y	И	Ы
10	*	:	J	Z	И	З
11	+	;	K	Г	К	Ш
12	,	<	L	√	Л	Э
13	-	=	M	Г	М	Щ
14	.	>	N	^	Н	Ч
15	/	?	O	-	О	DEL

FIGURE 7-17. LATIN/CYRILLIC (RUSSIAN) CHARACTER SET





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DRAWN BY	CHK STD & REC	CHECK FF&F	DSGM	APPROVED
DATE	DATE	DATE	DATE	DATE

LTR REVISION

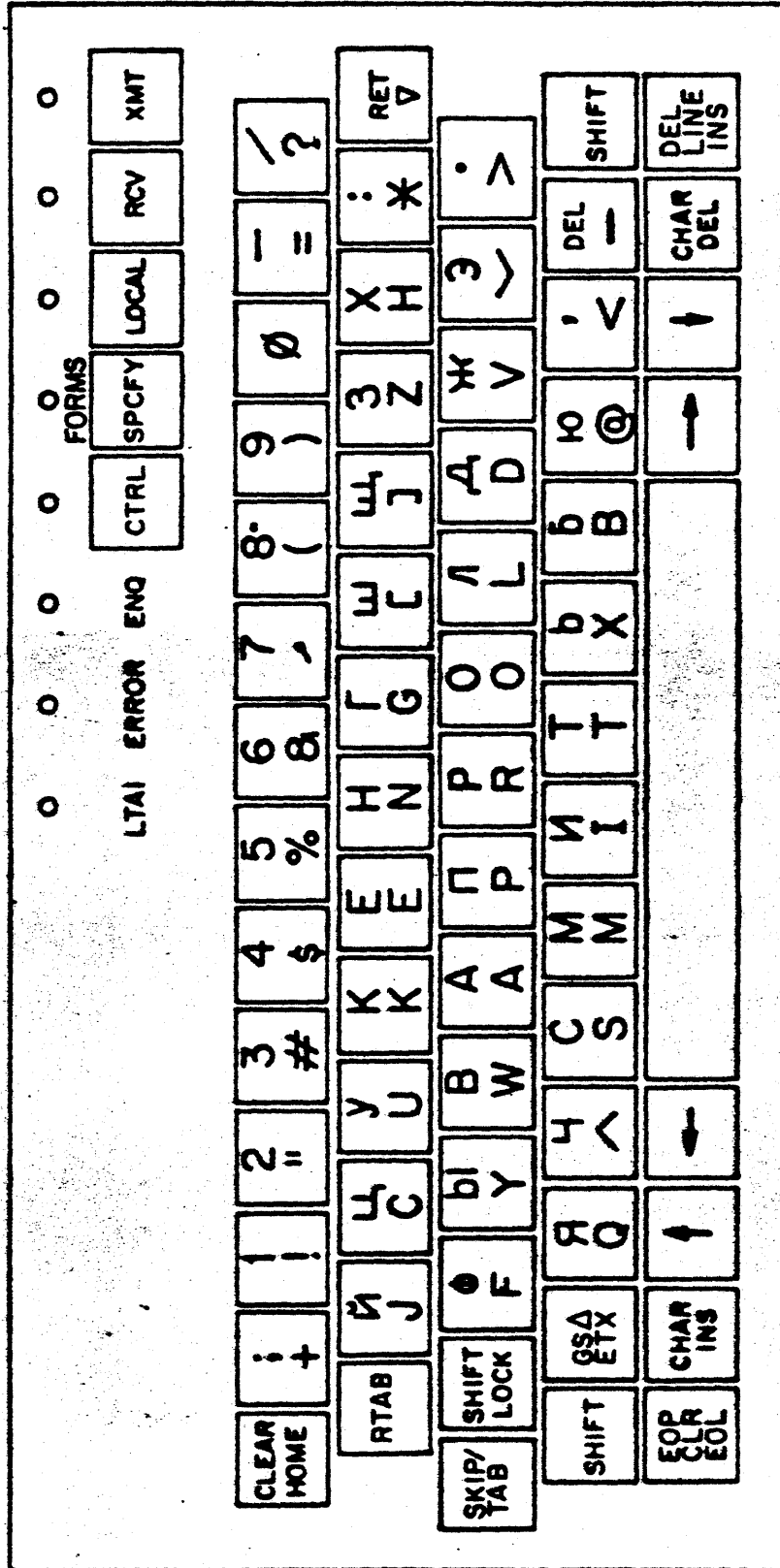


FIGURE 7-18. LATIN/CYRILLIC (RUSSIAN) KEYBOARD

10036Z

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SHEET 153 174	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY CMK STD & REC	CHECK F P & F	DSGN
APPROVED		
DATE	DATE	DATE

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	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
HEX	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0000	0	NUL	DLE		SP	*	-									0
0001	1	SOH	DC1				/		e	j			A	J		1
0010	2	STX	DC2		SYN				b	k	o		B	K	S	2
0011	3	ETX	DC3						c	l	t		C	L	T	3
0100	4		RES*						d	m	u		D	M	U	4
0101	5	HT	NL*		BYP*				e	v	v		E	N	V	5
0110	6		BS	ETB	LF	RS*			f	w	w		F	O	W	6
0111	7	BEL		PRE ESC	EOT				g	p	x		G	P	X	7
1000	8		CAN						h	q	y		H	Q	Y	8
1001	9		EM						i	r	z		I	R	Z	9
1010	A					!	:									
1011	B	VT			.	↓	,	*								
1100	C	FF			<	*	%	©								
1101	D	CR	IGS*	ENQ	NAN	(	)	-*	'			[	]			
1110	E	SB	IRS*	ACK		+	;	>	=							
1111	F	SI	IUS*	BEL*		!	?'	?	"							

\* BEL = COM  
 NL = ~  
 IGS = GS  
 IRS = RS  
 IUS = ITB  
 BYP = ESC  
 RS = DC4  
 ? = }  
 - = {  
 RES = '

38841

FIGURE 7-19. IBM 3270 EBCDIC CHARACTER CODING



SHEET 154 174

DWG NO.

1691 6256

REV A

CLASS CODE

TITLE

ENGINEERING SPECIFICATION: ID730/830

DRAWN BY

CMK STD & REC

CHECK FF & F

DSON

APPROVED

DATE

DATE

DATE

DATE

DATE

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LTR REVISION

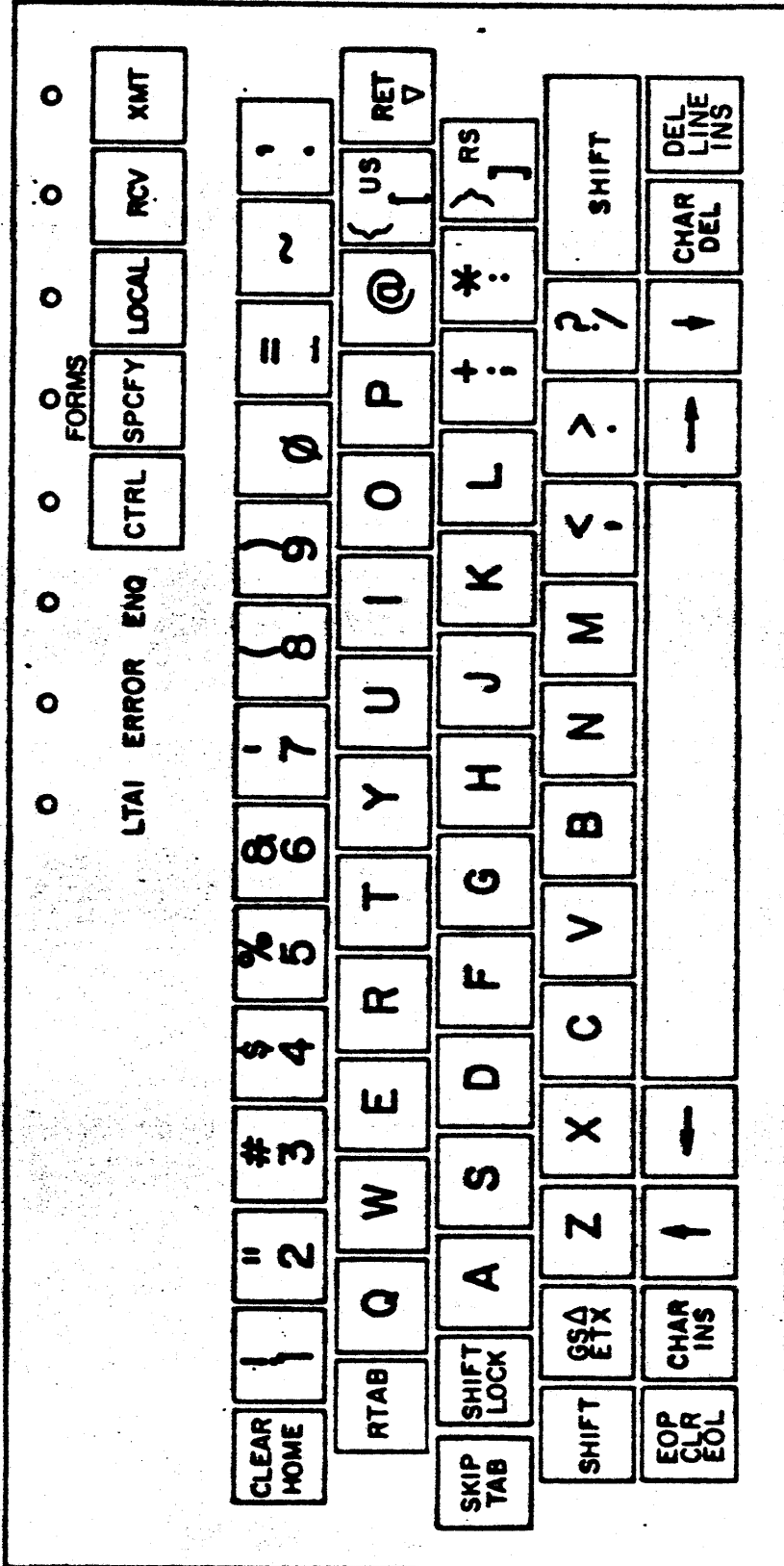


FIGURE 7-20. U.S. TYPEWRITER KEYBOARD

16343Z



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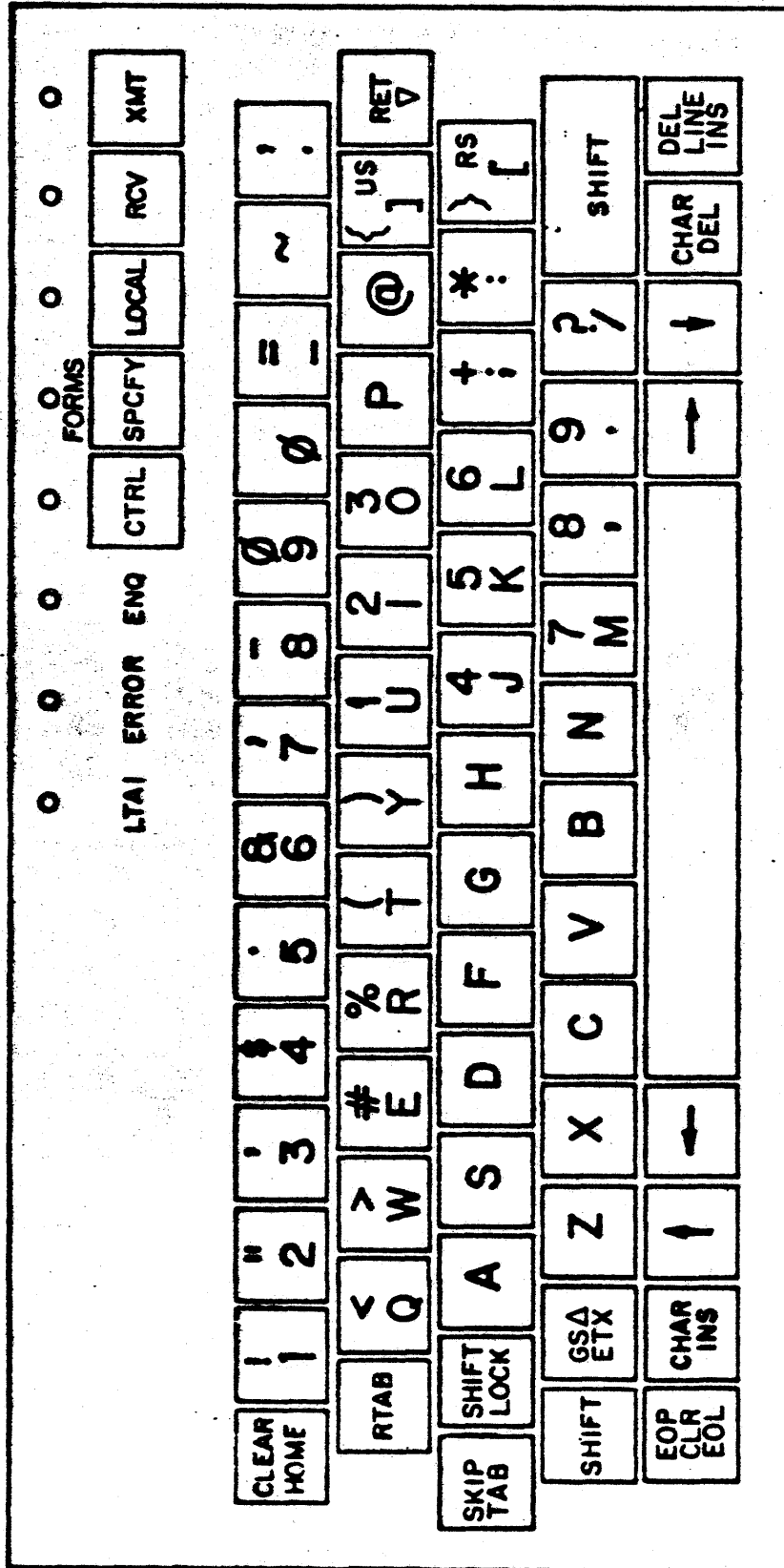


FIGURE 7-21. U.S.A. DATA PREPARATION KEYBOARD



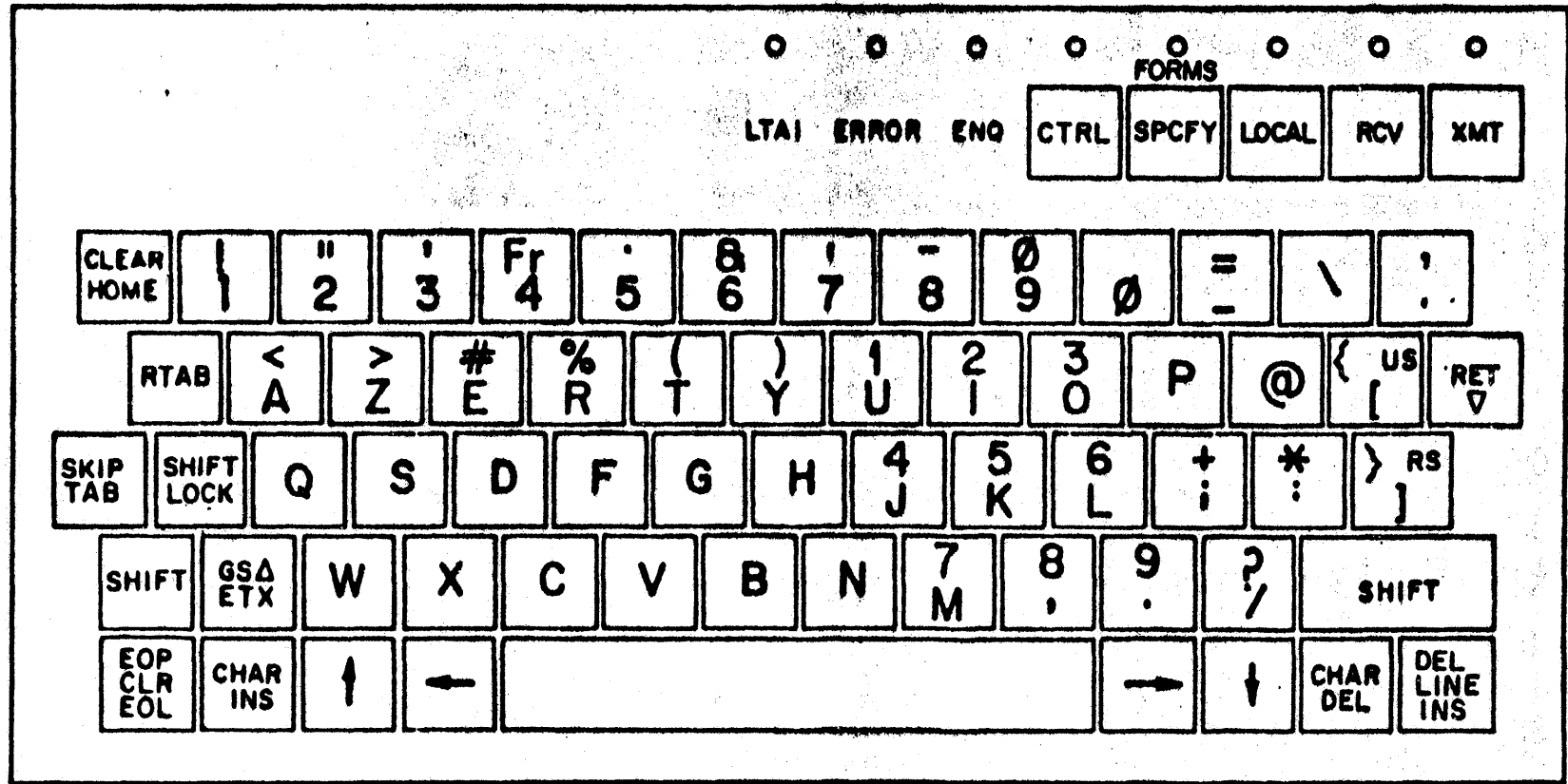
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CLASS CODE	157	174	TITLE	ENGINEERING SPECIFICATION:	TD730/830	APPROVED	
DRAWN BY	CMK	STD 6	REC	CHECK	FR	DF	DSM
DATE			DATE		DATE	DATE	DATE



18347Z

FIGURE 7-23. FRANCE AND BELGIUM DATA PREPARATION KEYBOARD (OPTION)

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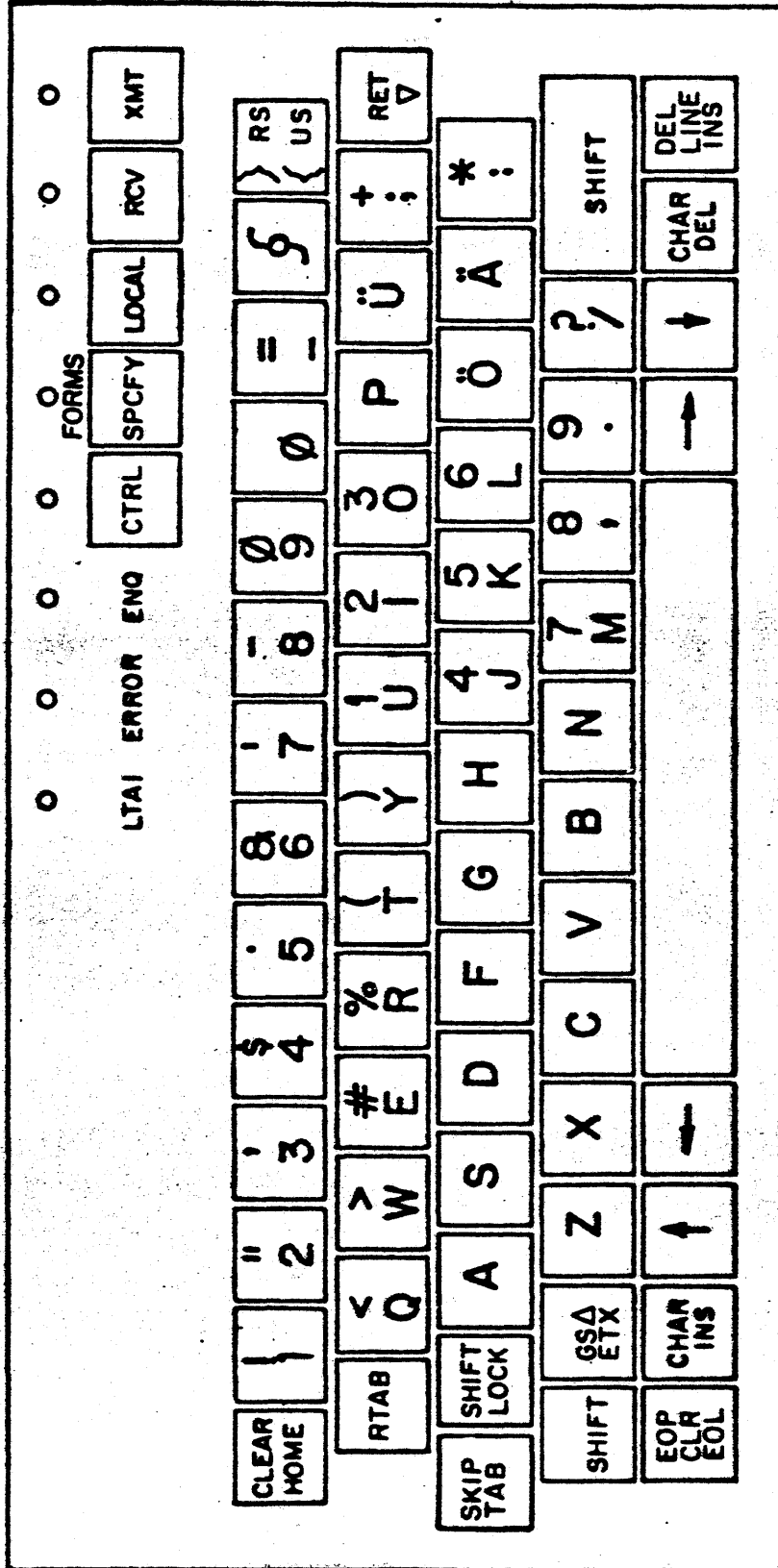
EGD674



SHEET 158 174	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY CMX STD & REC	CHECK FF&F	DSGN
DATE	DATE	DATE
APPROVED		DATE

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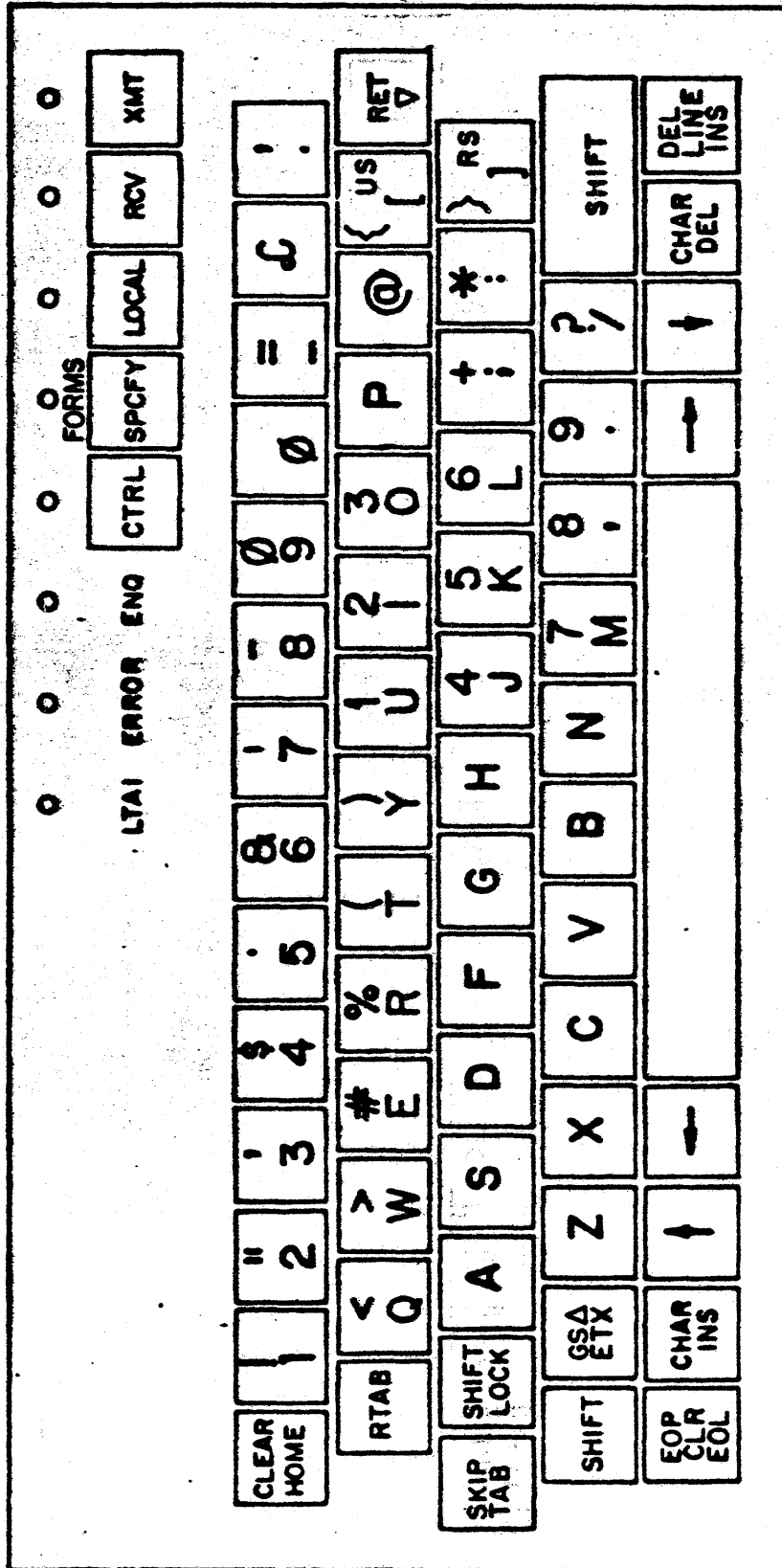
10315Z

FIGURE 7-24. GERMANY, AUSTRIA, AND SWITZERLAND DATA PREPARATION KEYBOARD

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DRAWN BY	CHK STD & REC	CHECK FF & P	DSGN	APPROVED
DATE	DATE	DATE	DATE	DATE

REVISION



10349Z

FIGURE 7-25. ITALY DATA PREPARATION KEYBOARD





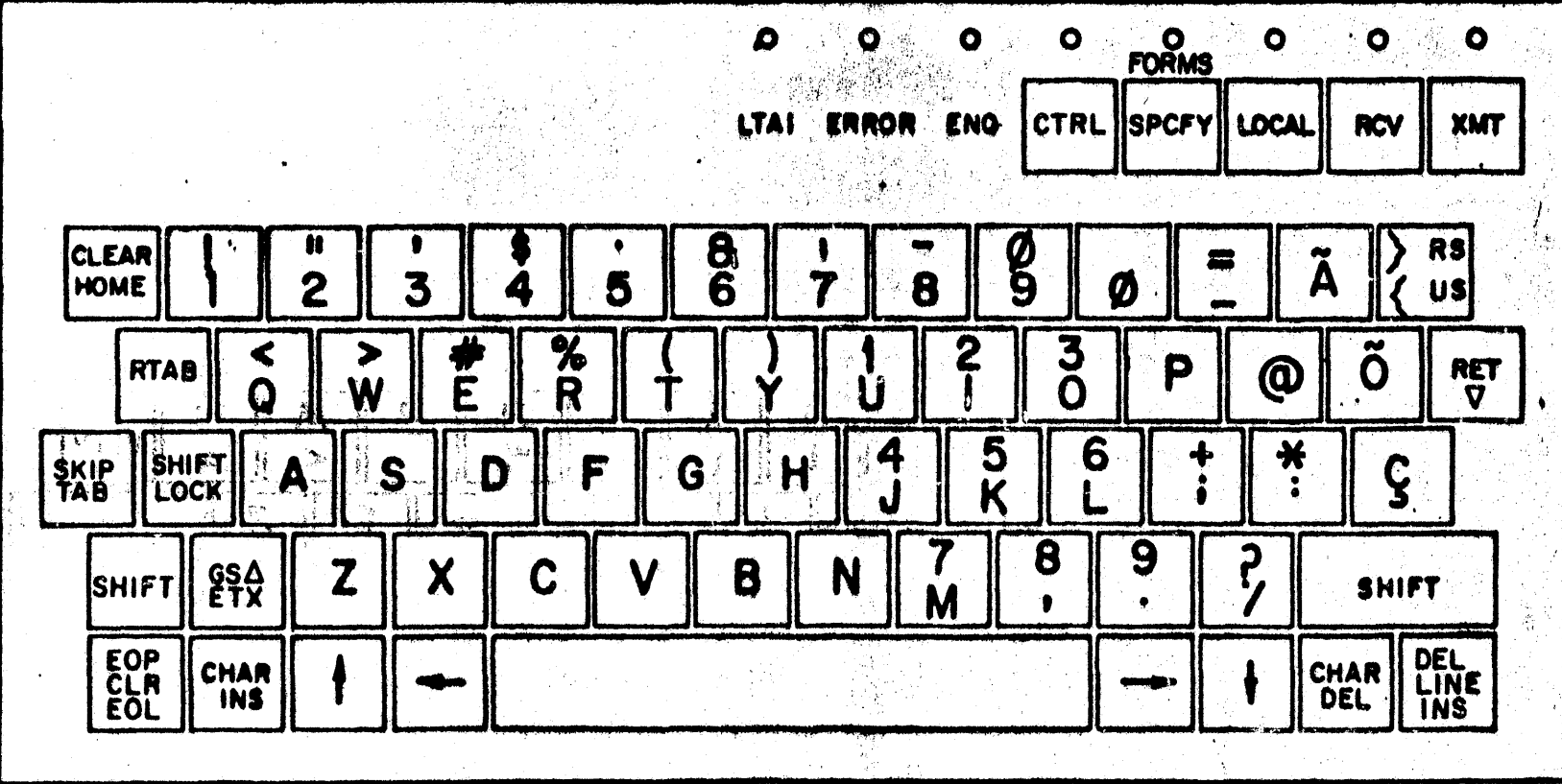
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SHEET	161	174	DWG NO.	1691 6256	REV	A
CLASS CODE	161	174	ENGINEERING SPECIFICATION:	TD730/830	APPROVED	
DRAWN BY	CNR	STD 8	REC CHECK	FRS/P	DATE	DATE
DATE			DATE		DATE	DATE



163172

FIGURE 7-27. PORTUGAL AND BRAZIL DATA PREPARATION KEYBOARD



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DRAWN BY	CHK STD & REC	CHECK PP & P	DSSN	APPROVED
DATE	DATE	DATE	DATE	DATE

LTR REVISION

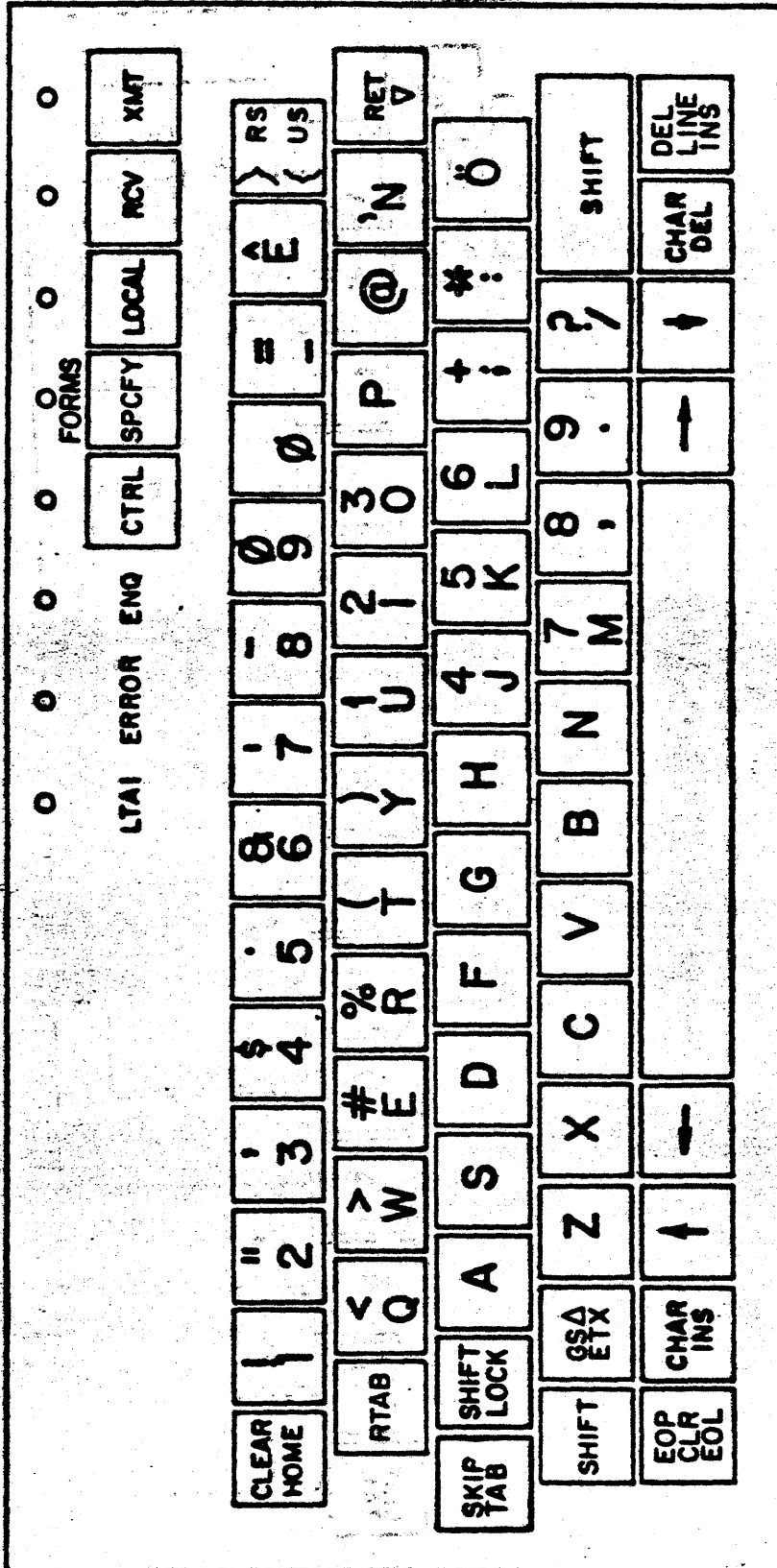


FIGURE 7-28. SOUTH AFRICA DATA PREPARATION KEYBOARD

10319Z







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SHEET 174 OF 174

DWS NO.

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CLASS CODE TITLE  
ENGINEERING SPECIFICATION: TD730/830

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DATE DATE DATE DATE DATE

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## APPENDIX I. COMPATIBILITY

The TD730/830 Terminal has the capability of compatible operation in networks which contain any one type of the following Burroughs data display Terminals: TD700/800 Design Levels 2 through 4, and the TD820 Design Level 1. Compatibility of the TD730/830 Terminal with any one of these Terminal types at one time is defined as the capability to operate in a communications network with the other Terminal without disruption of the network and without requiring physical modifications to the other Terminal. Duplication of all features and characteristics of the other Terminal type by the TD730/830 is not implied. This appendix lists those features and characteristics of other Terminal types which differ from the basic characteristics of the TD730/830 and which the TD730/830 has the capability to emulate through field engineering changes. This appendix also lists those characteristics and features which must remain incompatible between the TD730/830 Terminal and the other Terminal in question.

## COMPATIBILITY BETWEEN TD730/830 AND OTHER BURROUGHS DISPLAY TERMINALS

## 1. TD700 DL2 through DL4 and TD800 DL2 through DL4

DATA TRANSMISSION

Non-Forms - Home to Cursor

Forms - All unprotected data Home to Cursor

1920 character, TD800 Systems may require use of TD730/830 extended memory Terminals

DELIMITERS

{ } , or US, RS - Displayed as &gt; &lt; from CPU; as { } from keyboard.

CONTROL CHARACTERS

VT - Page Advance (TD700)

Fixed Tab 1, 9, etc.

CR same as New Line; Character not Stored

LF following CR is not ignored

DLE used as Prefix in Control Sequence

DLE P Activates Printer (DL3 and DL4)

Transmission Number - @ and A or 0 and 1 or None

Received Data - ETX Character not Stored

CTRL → / CTRL ← - Cause 8 line vertical tabs

## 2. TD820

DATA TRANSMISSION

No IBM2260 Procedure (TD730/830)

Maximum asynchronous data rate - 38.4 k bps (TD730/830)

1920 character, TD820 systems may require use of TD730/830 extended memory Terminals

DELIMITERS

RS used as both Forms and data highlight left delimiter (TD730/830)

Data highlights on a line basis (TD730/830)

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**APPENDIX II. T-SCAN INTERFACE**

**1. GENERAL**

The Terminal has the optional capability of conforming to the requirements of the DC140 21-wire parallel interface as described in this Appendix. This option shall be factory installed.

**2. I/O CONTROL CHARACTERS**

I/O control characters which shall apply to the Terminal are given in Table IIA. They are transmitted to the Terminal via an I/O control command from the DC140.

**3. FORMS MODE OPERATION**

During the Forms mode the following I/O control cursor movements will not recognize Forms delimiters or protected data fields during their use: CSL, CSD, CRLF, CSR, CSU and RCS.

The cursor may be placed in a protected data field by the I/O control character without causing a Forms search. I/O control LDCS will cause a Forms search only if it places the cursor on a delimiter. I/O controls CSH, PAGE, CSHE, and EXM will cause a Forms search after moving the cursor to the home position of the selected page.

I/O control TAB causes a Forms search, during Forms mode, from the cursor position.

**4. LCL/RCV/XMT**

LCL I/O control shall reset the system state to a Local mode similar to power start without affecting memory erase, Forms mode, and cursor blink and position. LCL status shall be transmitted when the Terminal is thereafter addressed.

RCV I/O control shall set the Receive mode, remove status from the data lines and prepare the Terminal to receive data at the next RT pulse, load it into the cursor position and advance the cursor.

XMT I/O control shall set the Transmit mode, remove status from the data lines, place the data of the character under the cursor on the data lines, and prepare to move the cursor to the next character at the RT pulse. The XMT mode can be entered only from the LCL mode.

**5. LDCS**

LDCS I/O control is a two character operation to load the cursor position. The I/O control character indicates the row of the display to be loaded and prepares the Terminal to accept the next RT character as the column of the display to be loaded.

**6. ENQ**

ENQ I/O control shall sound the audible alarm and light the ENQ indicator during the LCL and XMT modes. RCV mode shall inhibit the ENQ I/O control and extinguish the ENQ indicator.





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APPENDIX II. T-SCAN INTERFACE (CONT)

TABLE IIA. I/O CONTROL CHARACTERS

ASCII CODE*	MNEMONIC	FUNCTION
0/0 (NUL)	NOP	No operation (used for time delay)
0/1 (SOH)	STAT	Return to status mode from previous XMT or RCV.
0/2 (STX)	RCV	Force Terminal into RCV ready and remove status
0/3 (ETX)	XMT	Force Terminal into XMT ready and transmit first character
0/4 (EOT)	LCL	Force Terminal into LCL mode and cancel XMT/RCV ready
0/5 (ENQ)	ENQ	Illuminate ENQ indicator and sound audible alarm
0/6 (ACK)	CSH	Move cursor to page 1 home position
0/7 (BEL)	ALRM	Sound audible alarm
0/8 (BS)	CSL	Backspace cursor one position
0/9 (HT)	TAB	Tab cursor
0/10 (LF)	CSD	Line feed cursor, down one line in same column
0/11 (VT)	PAGE	Advance display to next page if enabled
0/12 (FF)	CSHE	Erase memory and home cursor
0/13 (CR)	CRLF	Carriage return/line feed cursor
0/14 (SO)	CSR	Cursor advance
0/15 (SI)	CSU	Reverse line feed cursor, up one line in same column
1/0 (DLE)	NUM	Numeric only keyboard operation, limits to ASCII columns 2 and 3 only. Disabled by CSHE or LCL.
1/1 (DC1)	COF	Cursor off
1/2 (DC2)	CBON	Cursor on, blink on
1/3 (DC3)	CBOF	Cursor on, blink off
1/4 (DC4)	SCS	Save cursor position in storage register
1/5 (NAK)	RCS	Reload cursor position from storage register
1/6 (SYN)	FORM	Forms enable/disable
1/7 (ETB)	EXM	Extended memory enable/disable
1/8 - 1/15	---	Unassigned
2/0 - 3/15	LDCS	Load cursor to position indicated by bits 1 through 5 of LDCS plus the following data character bits 1 through 7 (12 bits total).
4/0 - 7/15	---	Unassigned

Unassigned codes are ignored by Terminal except for parity check

\*See Figure 7-1 column/row

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APPENDIX II. T-SCAN INTERFACE (CONT)

7. TAB

The TAB I/O control shall cause the Terminal to execute a tab function by moving the cursor forward to the next tab stop. Tab stops are located at character positions 1, 9, 17, and 25 of each line of the TD730 Terminal and character positions 1, 9, 17, 25, 33, 41, 49, 57, 65, and 73 of each line of the TD830 Terminal. In the Forms mode the tab character causes the cursor to move forward to the character position following the leading delimiter of the next unprotected data field (Forms search).

8. CSH

The CSH I/O control shall cause the Terminal to execute a cursor home function by moving the cursor to the first character position of the first line (home position) of the first page of memory. In the Forms mode CSH will then initiate a Forms search.

9. CSHE

The CSHE I/O control shall cause the Terminal to execute a combined home and clear function by moving the cursor to the home position and erasing all data (except protected data when in Forms mode) from the display screen and memory of the page displayed.

10. EXM/PAGE

The EXM I/O control shall alternately enable and disable the extended memory.

The PAGE I/O control in the Terminal shall cause the next page to be displayed on the screen leaving the cursor at the home of that page. In the Forms mode both EXM and PAGE cause a Forms search.

11. NOP (NULL FUNCTION)

The NOP I/O control may be used as I/O CTRL time fill when required following characters TAB, EXM, PAGE, CSHE, FORM, and CSH. Also, any cursor movement requiring a Forms delimiter search through protected data may require nulls following the unprotected data.

12. DATA ERROR CHECKING

Upon receipt of a data character which is illegal because of a parity error or invalid block check, the Terminal shall detect the error and illuminate the ERROR indicator. For a parity error in a data character, the Terminal shall, in addition to the above, insert the "question mark" character (Column 3, row 15 of Figure 7-1) into the displayed message at the location of the incorrect character. In either case the Terminal may place an error message in the status line.

13. CONTROL CHARACTER ERROR

A control character may be received incorrectly during any of the control sequences of the communications procedure because of parity error in the character. A parity error shall constitute an illegal character of unknown identification. The Terminal shall be unable to provide a response and will illuminate the ERROR indicator and place an error message in the status line.



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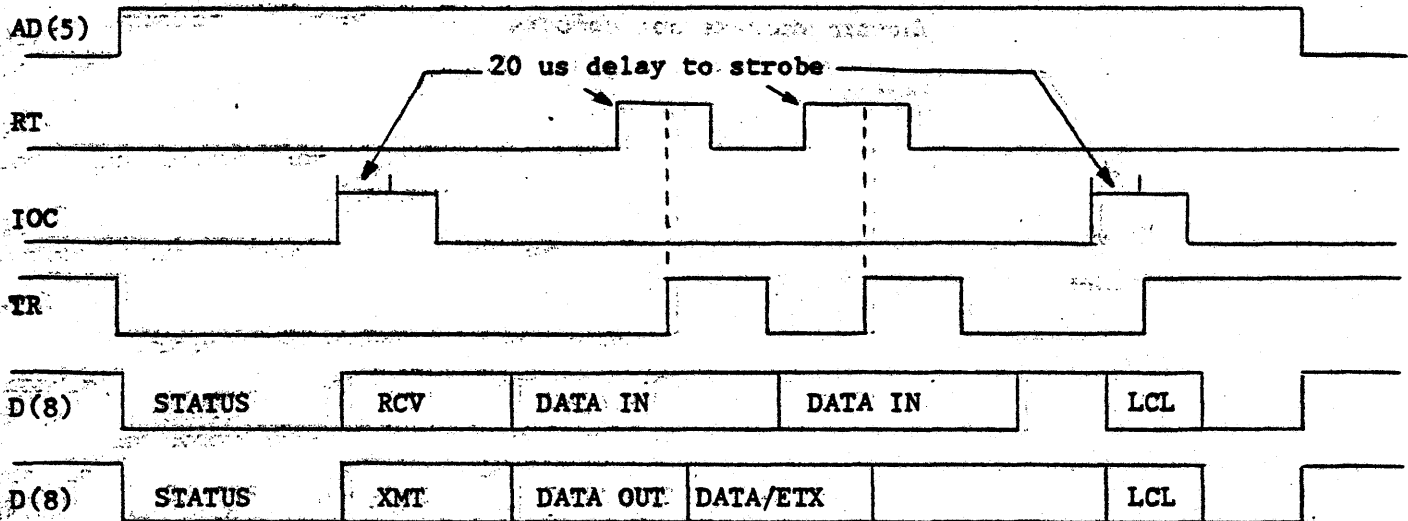
DRAWN BY	CHK STD & REC	CHECK FF & F	DSGN	APPROVED
DATE	DATE	DATE	DATE	DATE

LTR	REVISION
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APPENDIX II. T-SCAN INTERFACE (CONT)

14. PARALLEL ASYNCHRONOUS SCAN INTERFACE

At any time, except power off or XMT/RCV in process, the Terminal shall acknowledge the detection of its unique address on the five address lines by placing its status on the 8 data lines and TR line within 10  $\mu$ s. Individual Terminal address is determined as defined in paragraph 3.2.8. Control is then by the DC140 via the RT or I/O control lines. The inactive state of the data and TR lines is true (1). The Terminal responds to the RT in RCV or XMT mode by raising TR to the true state. I/O control and RT strobes will be delayed 20  $\mu$ s. TR will go false (0) within 10  $\mu$ s of the end of RT if no Forms search was initiated. Forms search will maintain TR true until complete. There is no response to the I/O control pulse (minimum 20  $\mu$ s). A NOP I/O CTRL may be required after RT or I/O CTRL. An I/O CTRL will override any other data transfer operation until acted upon. A RCV or XMT I/O CTRL must be received before data may be transferred and will remove Terminal status. A STAT or LCL I/O CTRL or LCL key activation will return the data lines to Terminal status when addressed.





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APPENDIX II. T-SCAN INTERFACE (CONT)

TABLE IIB. STATUS RESPONSE LINE ASSIGNMENTS

LINE	TR	D1	FUNCTION
			Definition
	0	0	RCV Ready
	0	1	XMT Ready
	1	0	LCL (not ready) or busy
	1	1	Power off
D2			NEW FORM request
D3			Extended memory enabled
D4			Forms mode enabled
D5			Error since last CSHE or LCL I/O CTRL
D6			Busy (TR = 1 and D1 = 0)
D7			Cursor address not compare
D8			Parity

1 = HI = +V = True

0 = LO = -V = False

(V @ ±12 volts)



SHEET 177 of 174	DWG NO. 1691-6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY	CHK STD. & REC	CHECK F.F.S.F.
DATE	DATE	DATE
OSGN	APPROVED	
DATE	DATE	DATE

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LTR	REVISION
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APPENDIX II. T-SCAN INTERFACE (CONT)

15. TERMINAL INTERFACE

The Terminal shall be capable of connection to the 21-wire DC140 asynchronous interface. The circuitry within the Terminal shall be similar in function to that shown in schematic 1534 8758.

TABLE IIC. TERMINAL INTERFACE PIN ASSIGNMENTS

PIN	FUNCTION
A	(do not use)
B	Address bit 2
C	Address bit (LSB)
D	On-line indicator
E	IOCTL
F	Ground
H	Ground
J	Address bit 5 (MSB)
K	Data bit 6
L9	Data bit 2
M	Data bit 1 (LSB)
N	(do not use)
P	TR
R	RT
S	Data bit 4
T	(do not use)
U	Data bit 5
V	Data bit 3
W	Ground
X	(do not use)
Y	Data bit 7
Z	Ground
a	Address bit 4
b	Data bit 8 (MSB)
c	(do not use)
d	Address bit 3

SHEET 173 of 174	DWG NO. 1691 6256	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830	
DRAWN BY	CHEK STORE REC	CHECK P/E & P
DATE	DATE	DATE
DESIGN	DATE	DATE
APPROVED	DATE	DATE

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APPENDIX II. T-SCAN INTERFACE (CONT)

16. INTERFACE CONNECTOR

The Terminal interface connector mounted on the rear of the Terminal shall be a 26-pin male type, connector 1471 9934.

17. CABLING

Cabling from Terminal to Terminal shall be multidrop connection. Cabling is not provided with the Terminal and shall be supplied by Burroughs Plymouth facilities. A maximum of 1000 feet cumulative cable is allowed.

18. MODES OF OPERATION

The Terminal shall operate in three modes: Local, Transmit, and Receive. The operator shall control the mode from the keyboard with the LOCAL, XMT, and RCV keys. Pressing the LOCAL key during either Transmit or Receive immediately transfers the Terminal to Local mode and no further data is transmitted or received.

18.1 LOCAL

In the Local mode, the Terminal shall be off-line and data may be entered manually through the keyboard. If an ENQ I/O CTRL character is received the Terminal shall activate an audible alarm and a visual indicator to alert the operator that the central processor or calling station is transmitting. Power turn-on shall place the Terminal in Local mode regardless of the setting of the mode keys.

18.2 TRANSMIT

Pressing the XMT key on the Terminal keyboard by the operator shall cause the Terminal to indicate XMT READY STATUS when addressed. A XMT I/O CTRL will cause data to be transmitted at the cursor position removing status. Status will be returned via a STAT I/O CTRL. The Transmit ready shall be cancelled only by actuation of the LOCAL key or LCL I/O Control. Every RT pulse will advance the cursor and read the next character from memory and transmit it. Parity transmitted shall be odd.

Transmission begins with the data at the cursor location. At any time during XMT ready the Terminal shall accept I/O CTRL data removing transmit data momentarily. An ETX will be transmitted when the cursor address compares with the save cursor (SCS) position. The Terminal shall not transmit an ETX as the first data character of a transmission, as in a "zero length" message.

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SHEET 174	174	DWG NO. 1691 6236	REV A
CLASS CODE	TITLE ENGINEERING SPECIFICATION: TD730/830		
DRAWN BY CME:STO & REC	CHECK FEB 7	DSGN	APPROVED
DATE	DATE	DATE	DATE

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APPENDIX II. T-SCAN INTERFACE (CONT)

18.3 RECEIVE

Actuation of the RCV key on the Terminal keyboard by the operator shall cause the Terminal to indicate RCV READY status when addressed. The Terminal shall accept a data character from the communication with every RT and load it into memory after first receiving a RCV I/O CTRL removing status. The memory system will transpose ASCII columns 0 and 1 or 6 and 7 into columns 4 and 5 respectively (Figure 7-1).

Receipt of messages by the Terminal shall employ an odd character parity check on both data and I/O CTRL characters, utilizing the eighth bit of each character as the parity bit. The ERROR indicator shall be turned off on receipt of a CSHE or LCL I/O CTRL, or by the operator pressing the LOCAL or CLEAR key on the keyboard. At any time during RCV ready the Terminal shall accept I/O CTRL data.