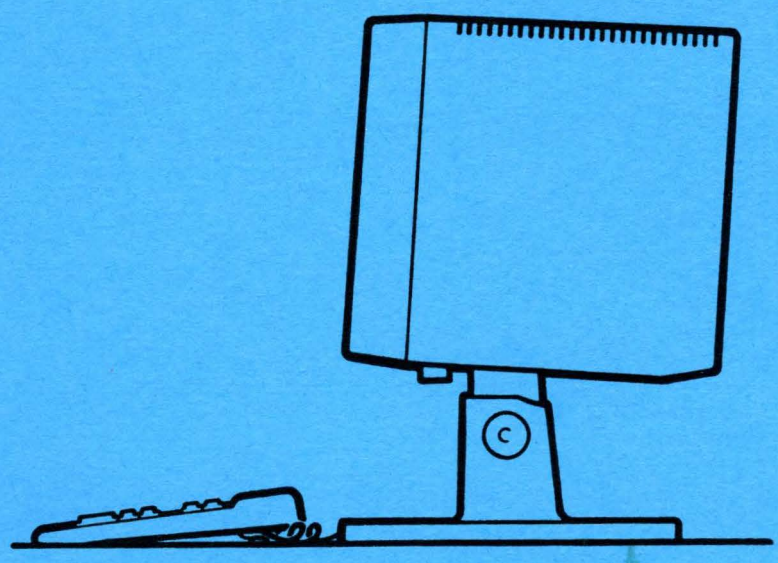
TANDBERG DATA

TDV 2200 SERIES
DISPLAY TERMINALS

TDV 2230
Owner's Manual



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TDV 2230
Owner's Manual

CONTENTS

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Owner's Manual
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TDV 2230
User's Guide

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5214	961326	TDV 2200 Service Manual
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CONTENTS

INTRODUCTION

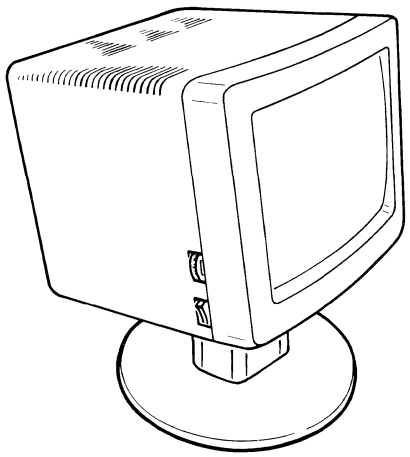
This terminal is used for communication with a host computer. The host computer may be located anywhere; in the same room as the terminal, somewhere else in the building or even in another country. The behaviour of the terminal in any work situation is determined by the program residing in the host computer.

This guide describes the features of the terminal and how these features can be put to best use.
For a detailed description of how to operate your terminal in your work situation, consult your local operating instructions.

CONTROLS AND ADJUSTMENTS

Turning the terminal on

Turn the terminal on with the power on/off switch located on the left-hand side. A blinking cursor appears in the top left hand corner (home) of the screen.



Time-out

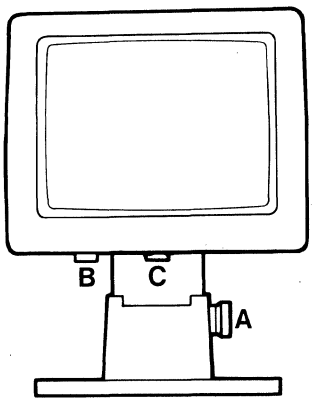
If the terminal is set up with time-out, the screen will go blank after ten minutes if there has been no action on the terminal. This is done to conserve the phosphor of the screen. Press any key (except the Keyboard Function Control Keys) to get back to normal operation.

Adjusting light intensity

The light intensity control is located above the on/off switch on the left hand side of the terminal.

Adjusting height, tilt and swivel

Height: Pull knob Ⓐ on the right hand side of the stand and turn to adjust to desired height. Make certain that the knob is properly locked when the adjustment is complete.



Tilt: The force required to tilt the terminal can be adjusted with knob Ⓑ. Turn knob Ⓑ until the terminal can be tilted easily while remaining stable at any angle. Once a comfortable angle has been found, the tilt can be secured by tightening the knob.

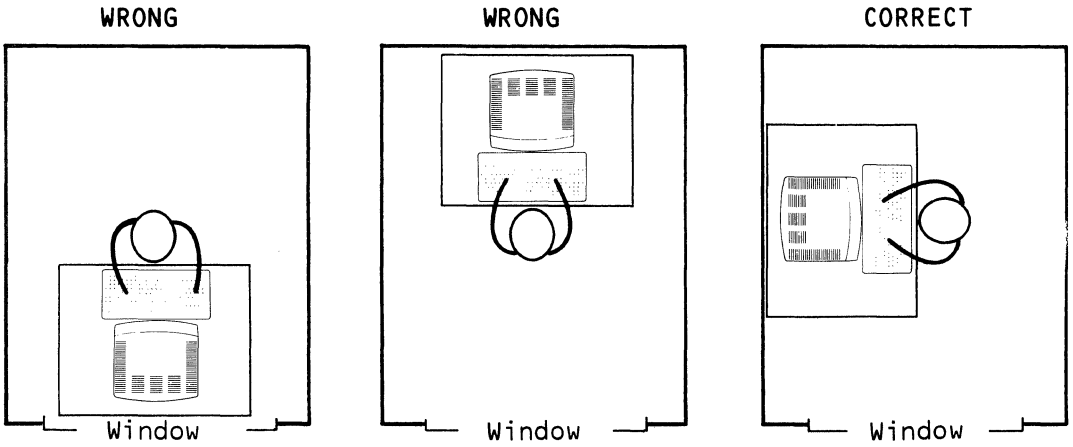
Swivel: The force required to swivel the terminal can be adjusted with knob Ⓒ. Turn knob Ⓒ until the terminal can be swivelled easily. Once a comfortable angle has been found, it can be secured by tightening the knob.

INSTALLATION HINTS

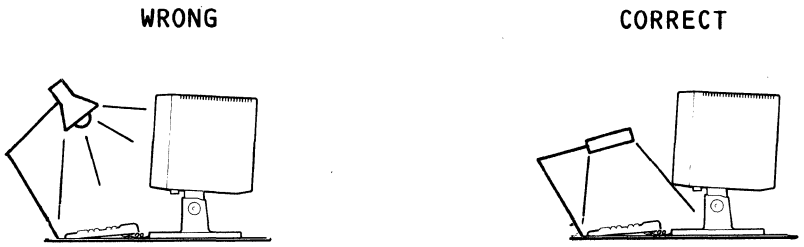
Placing the terminal in order to obtain the best possible working conditions for the operator is subject to two main considerations: Lighting and posture.

Lighting

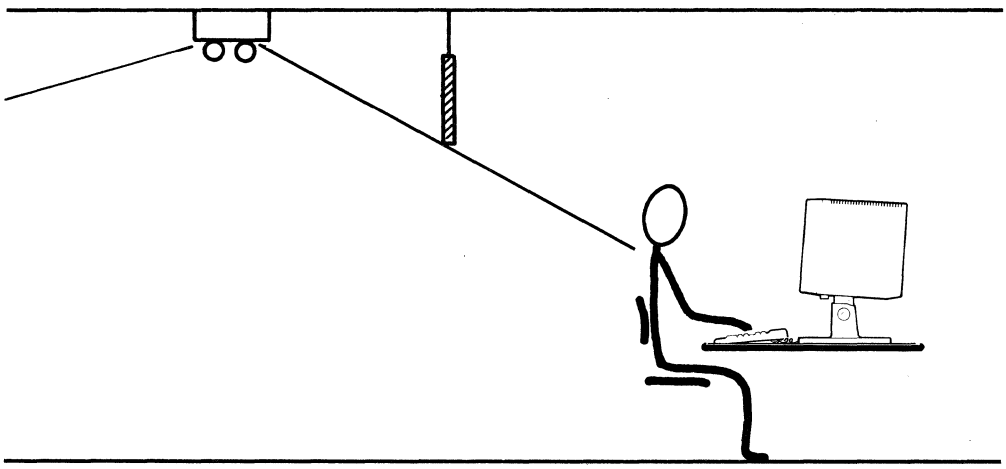
Try to avoid large light contrasts in the operator's viewing area. Do not place the terminal in front of a window.



Try to avoid glare and reflections from other light sources on the screen.

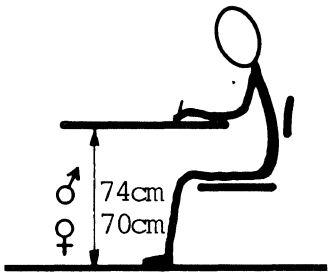


Try to avoid "spot" lamps in the room, use lamps based on the indirect lighting principle. Use screens if necessary.

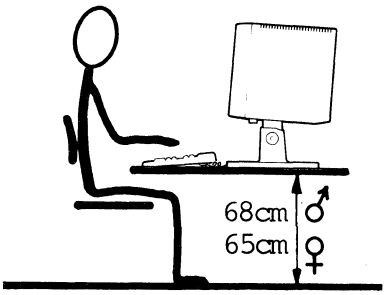


Working posture

The keyboard is connected to the display unit by a flexible twisted cable which allows freedom in finding the best position for both units. The desk plate on which the keyboard is placed, should be high enough to allow room for the knees, and low enough for the forearms to be as horizontal as possible when the hands rest on the keyboard.



Statistical surveys indicate that heights in the range 65 to 68 cm from floor to underside of desk plate fit most operators. Desks with adjustable legs are available. A foot rest and an adjustable chair will often help to provide the best possible working posture.



WARNING!

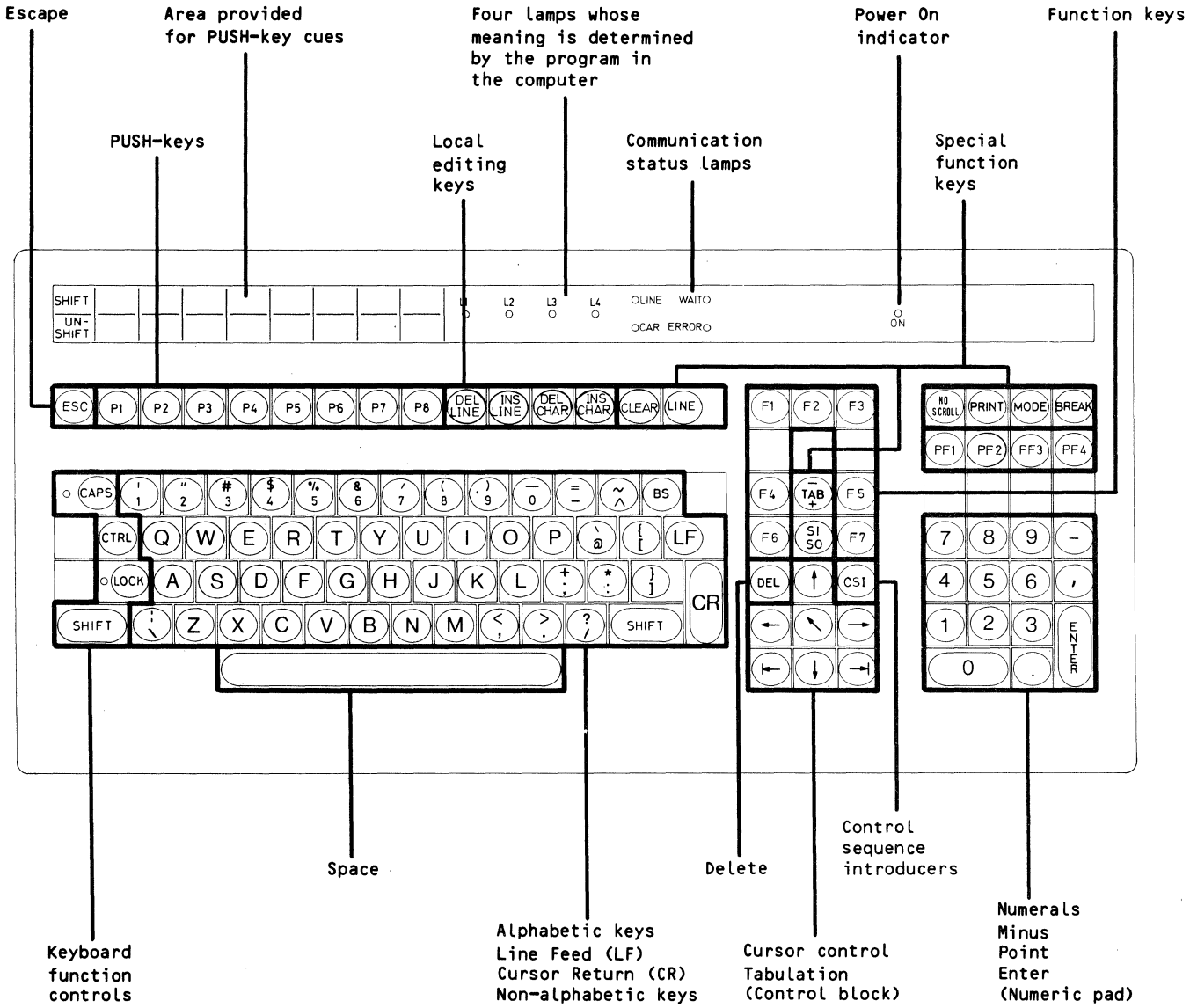
Do not cover the ventilation slots on top of the terminal, blocked slots may cause the terminal to overheat.

Never place paper clips, coins or drinks on top of the terminal. Such objects will, if they enter the terminal, cause serious damage to the electronic components.

KEYBOARD

The keyboard of the terminal is not much different from that of a typewriter. It has more keys and indicators, but it is still easy to use. The illustration below explains the various groups of keys and indicators.

National versions of the keyboard are available. The difference is in the alphabetic keys.

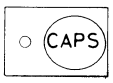


Description of the keys

Each specific key is described on the following pages. Note that a particular application may be programmed so that the reaction to a keystroke is quite different from what is described here.
The switch settings may also affect the keys.
The description in this user's guide refers to the "normal" use of the keys.

SHIFT
Makes it possible to type the upper case symbols and capital letters in the main key group.
Also used in connection with the PUSH-keys (P9 to P16).

LOCK
Locks the keyboard in uppercase. The active state is indicated by a red light in the key.



CAPS
Locks only the alphabetic keys in uppercase. The active state is indicated by a red light in the key.

DEL
Used in certain applications.
Consult your local operating instructions.

Controls

MODE
This key is used (twice in succession) together with SHIFT to enter the Configuration Menu.

CLEAR
This key resets the terminal to the initial state after power up.

Cursor control

CURSOR HOME
Moves the cursor to the first position on the top line.

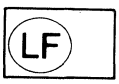
CURSOR RIGHT
Moves the cursor one position to the right.

CURSOR LEFT
Moves the cursor one position to the left.

CURSOR UP
Moves the cursor to the same position on the preceding line. Has no effect if the cursor is on the top line.

CURSOR DOWN
Moves the cursor to the same position on the following line. Has no effect if the cursor is on the bottom line.

CR (CURSOR RETURN)
Moves the cursor to the first position on the current line.



LF (LINE FEED)
Moves the cursor to the same position on the following line.

Sequence introducers

ESC
Starts an escape sequence.
Not normally used by the operator, consult your local operating instructions.

CSI
Starts a control sequence.
Not normally used by the operator, consult your local operating instructions.

Function keys

PF1-PF4 and F1-F7
The function keys send unique ESC sequences to the host.
The host program usually reacts to a function key by sending a frequently used TDV 2230 control sequence to the terminal.

Local editing

DELETE LINE
Deletes the whole edited line. The line can be restored by pressing the INS LINE key.

INSERT LINE
This key is used to enter the LINE EDIT mode.
The last transmitted line will be displayed at the next line position on the screen.

DELETE CHARACTER
Deletes a character in LINE EDIT mode.

INSERT CHARACTER
Inserts a character in LINE EDIT mode.

Tabulation

->|
Causes the cursor to move to the next tabulation stop on the line. If no such tab stop exists, the cursor will move to the last position on the line.

|<-
Causes the cursor to move to the preceding tabulation stop on the line. If no such tab stop exists, the cursor will move to to the first position on the line.

TAB +/-
Unshift : Sets a tabulation stop in the cursor position.
Shift : Removes a tabulation stop from the cursor position.

The tab stops set by the TAB +/- key are only valid temporarily. As soon as the terminal is switched off, these tab stops will be "forgotten". If you want to set them permanently, see description of the tabulation rack on page 17.

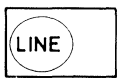
Device control

PRINT
Indicates that the screen contents should be printed out.

Character set control (option)

SI/SO
Controls the character set used on the screen.
Consult your local operating instructions.

DC-keys



LINE
Toggles an internal on-line/off-line switch.

BREAK
Sends the BREAK condition on the line.
Consult your local operating instructions.

Convenience switches

Eight switches that concern the operator's personal preference are included in a menu called "Convenience Switch Menu". The settings of these switches can easily be altered from the keyboard by the operator.

Switch name:	Switch settings:
Cursor Type	LINE and BLOCK
Roll Type	STEP, SMOOTH and CREEP
Key Click	ON and OFF
Key Rollover	ENABLED and DISABLED
Keyboard CAPS	OFF and ON
Auto Repeat	ON and OFF
Margin Bell	ON and OFF
Status Line	ON and OFF

To alter the settings of the convenience switches, proceed as follows:

a) Keep SHIFT depressed and press MODE twice.
   You are now in the "Configuration Menu".

b) Select the "Convenience Switch Menu" by using the CURSOR UP or CURSOR DOWN keys. Then press ENTER.
   The "Convenience Switch Menu" is now displayed. The menu shows the temporary settings. An asterisk (*) to the left of a setting indicates that the temporary and permanent settings are different.

c) Use the CURSOR UP or CURSOR DOWN keys to select the switch you want to alter, and press ENTER.
   The possible settings of this switch are now displayed on the bottom line. The switch setting displayed in inverse video is the permanent one. The cursor is placed on the temporary setting.

d) Use the CURSOR LEFT or CURSOR RIGHT keys to select the switch setting you want, and press ENTER.
   The switch is now temporarily set to this new setting.

e) Press ESC to return to the "Configuration Menu".

f) Press ESC once more to get to the "Configuration Exit".

g) Use the CURSOR UP or CURSOR DOWN keys to select between the possibilities in the "Configuration Exit":

   Make Switches Permanent
   Reset to Initial Switches
   Make Tabulation Rack Permanent
   Reset to Initial Tabulation Rack

   - If you only want the new switch settings to be stored for as long as the terminal is switched on, just press ESC.
     The new settings will be "forgotten" as soon as the terminal is switched off (temporary settings).

   - To store the new switch settings permanently, select the line "Make Switches Permanent" and press ENTER followed by ESC.

   - To make the temporary settings equal with the permanent ones, select the line "Reset to Initial Switches", and press ENTER followed by ESC.

At this point the new switch setting will be operational, and you will be back where you were before you started to alter the convenience switches.

PUSH-keys

The PUSH-keys (Programmable Utility for String Handling) give the user the ability to generate a sequence of characters by pressing one single key. The eight PUSH-keys work in both shift and unshift, thus allowing 16 different often used text strings or code sequences to be programmed and stored.

To program the PUSH-keys (P1 to P16), proceed as follows:

a) Keep SHIFT depressed and press MODE twice.
   You are now in the "Configuration Menu".

b) Select the "PUSH-key Menu" by using the CURSOR UP or CURSOR DOWN keys. Then press ENTER.

   - If the operator is not supposed to alter the PUSH-keys, the message "Prohibited" will start flashing on the screen, and no PUSH-key programming can be done.
     If you really need to alter the PUSH-keys anyway, contact the person responsible for the terminal installation.

   - If the terminal installation is set up to allow the operator to alter the PUSH-keys, the PUSH-key menu will appear on the screen. You can now go ahead and write your own text strings or code sequences.

   The effect of the cursor control keys is as follows:

CURSOR DOWN	Jumps to beginning of next PUSH-key
CURSOR UP	Jumps to beginning of previous PUSH-key
CURSOR HOME	Jumps to beginning of first PUSH-key
CURSOR RIGHT	Forward one position (stops in last)
CURSOR LEFT	Backward one position (stops in first)

   The menu automatically restricts the use of more than the available number of characters per PUSH-key (P1 to P8 = 12, P9 to P12 = 32, and P13 to P16 = 48).

c) When you have finished writing your text strings, press ESC to return to "Configuration Menu".

d) Press ESC once more to get to "Configuration Exit".

e) Press ESC once more to return to normal operation.
   Your text strings are now stored in a memory, and can be fetched by pressing the PUSH-keys P1 to P16.

Note that some of the PUSH-keys may already have been used in your application system. Consult your local operating instructions.

For programming, consult the Owner's Manual part 4, Functional Specifications.

Tabulation rack

The tabulation rack enables the operator to set the tabulation setting in the terminal. It gives the tabulation stops for all 24 lines on the screen.

To alter the tabulation rack, proceed as follows:

a) Keep SHIFT depressed and press MODE twice.
   You are now in the "Configuration Menu".

b) Select "Tabulation Rack" by using the CURSOR UP or CURSOR DOWN keys, and press ENTER.
   The "Tabulation Rack" is now displayed.

c) Move the cursor to the position where a tabulation stop is desired by using the CURSOR LEFT or CURSOR RIGHT keys. (The cursor position is displayed).

d) Press any key except space.
   This will cause a tabulation stop to be set, indicated by a + sign in the relevant position.
   You may set as many tab stops as you like on one line.

e) If you want to clear one or more tabulation stops, press space bar when the cursor is in the relevant position(s).

f) Press ESC to return to the "Configuration Menu".

f) Press ESC once more to get to the "Configuration Exit".

g) Use the CURSOR UP and CURSOR DOWN keys to select between the possibilities in the "Configuration Exit":

   Make Switches Permanent
   Reset to Initial Switches
   Make Tabulation Rack Permanent
   Reset to Initial Tabulation Rack

   - If none of these possibilities are desired, just press ESC.
     In this case, the new tab setting will be stored only as long as the terminal is switched on.
     It will be "forgotten" as soon as the terminal is switched off.
     (The same can be achieved by using the TAB+ and TAB- keys without entering the Tabulation rack).

   - To store the new tab setting permanently, select the line "Make Tabulation Rack Permanent", and press ENTER followed by ESC.
     The new tab setting will be "remembered" even after the terminal has been switched off.

   - If you select "Reset to Initial Tabulation Rack" and press ENTER followed by ESC, the terminal will ignore the new tab setting, and the permanent tabulation rack will be used.

At this point the new tab setting will be operational, and you will be back where you were before you started to alter the tabulation rack.

Keyboard indicators

Host controlled indicators

Consult your local operating instructions for the meaning of the following indicators:

L1, L2, L3 and L4.

Status indicators

WAIT indicates that the terminal tries to go on-line, but the modem does not respond properly.

LINE indicates that the terminal is on-line.

Note: If both WAIT and LINE are off, this implies that the terminal is in the LOCAL mode, i.e. characters from the keyboard are not transmitted but written directly on the screen.
WAIT blinking indicates something wrong with the connection.

CARRIER indicates the present state of the carrier detect signal from the modem.

ON indicates that the power is turned on (and that +5 V is present).

Audio-visual error indication

Blinking ERROR indicator means that a malfunction is detected during power up of the terminal.

The soft switches, PUSH-keys and Tabulation Rack are stored permanently in a memory (EAROM). In case of a malfunction in this memory, the bell will sound continuously and the message
"Error in EAROM! Call System Operator!"
will appear on the screen. The bell can be turned off by pressing any key, but the terminal cannot be used until serviced.

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Specifications & Installation Guide

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CONTENTS

1. ELECTRICAL SPECIFICATIONS

Input power : 70 W max (80 VA)

Inrush current: 25 A max

Line voltage range: 230 V +10% -15%

Loss of 3 half cycles will not bring output voltages outside specs. Time between two losses > 5 sec.

2. ENVIRONMENTAL SPECIFICATIONS

2.1 Definitions

Operating: The unit is unpacked and power is turned on.

Storage : The unit is unpacked and power is turned off.

Transport: The unit is packed and power is turned off.

Equipment: TDV 2200 series terminal in any configuration as defined by TANDBERG DATA including keyboard.

2.2 Temperature, Relative Humidity and Atmospheric Pressure

	Temperature	Relative humidity	Atmospheric pressure
Operating :	0 °C to 40 °C	15% to 80%	860 mbar to 1060 mbar (86 - 106 kPa)
Storage :	0 °C to 50 °C	15% to 90%	450 mbar to 1060 mbar (45 - 106 kPa)
Transport :	-25 °C to 70 °C	Any non-condensing	450 mbar to 1060 mbar (45 - 106 kPa)

2.3 Vibration

	Frequency	Amplitude peak	Accelleration
Operation and storage :	5 to 58 Hz	0.075 mm (0.0029") +/-10%	----
	59 to 150 Hz	----	1 g
Transport :	5 to 12 Hz	3.5 mm (0.137") +/-10%	----
	13 to 150 Hz	----	2 g

2.4 Shock

		Acceleration	Duration
Operating	:	2 g	11 ms
Storage	:	5 g	6+1 ms (6 shocks in Z - axis)
Transport	:	10 g	16+1 ms (6 shocks in Z - axis)

2.5 Impact

Storage : The equipment is lifted 25 mm (1") and allowed to fall freely on the bottom surface (stand not mounted).

Transport : Each face in turn lifted 500 mm (20") and allowed to fall freely.

2.6 Dust

The equipment withstands the dust of a typical office environment.

2.7 Radiated and Conducted Noise

The equipment complies with the Deutsche Bundespost regulations as specified in VDE 871. For conducted emission the N-12 dB limit applies.

2.8 Static Discharge

This specification refers to discharges applied to metal parts accessible with the housing mounted:

> A 330 pF capacitor is charged to 6 kV and discharged through a 480 ohm resistor using common point with equipment safety ground.

The equipment is unaffected by discharges of the specified type.

2.9 Transients in Mains Power

The equipment is unaffected by the following transients:

Between mains phases and ground (assymmetrical injection):

a) Amplitude: 1000 V
Risetime : 10 ns
Duration : 100 ns

b) Amplitude: 1500 V
Risetime : 400 ns
Duration : 50 us

Between mains phases (symmetrical injection):

Amplitude: 750 V
Risetime : 120 ns
Duration : 50 us

2.10 Safety

The equipment conforms to VDE 0804 and IEC 435.

3. MECHANICAL DIMENSIONS

Cabinet :	Width	380 mm (15.0")
	Height	310 mm (12.2")
	Depth	362 mm (14.3")
	Weight	14.8 kg (32.6 lbs.)
Keyboard :	Width	486 mm (19.1")
	Height	30 mm (1.18") at middle row
	Depth	235 mm (9.3")
	Weight	1.9 kg (4.2 lbs.)
	Slope	6 degrees
	Keystroke	4 mm (0.16")
Stand :	Base	340 mm (13.4") diameter
	Height	130 mm (5.1") minimum to cabinet bottom
	Height	220 mm (8.7") maximum to cabinet bottom
	Tilt	10 degrees maximum forward
	Tilt	15 degrees maximum backward
	Swivel	30 degrees maximum both ways
	Weight	3.6 kg (7.9 lbs.)

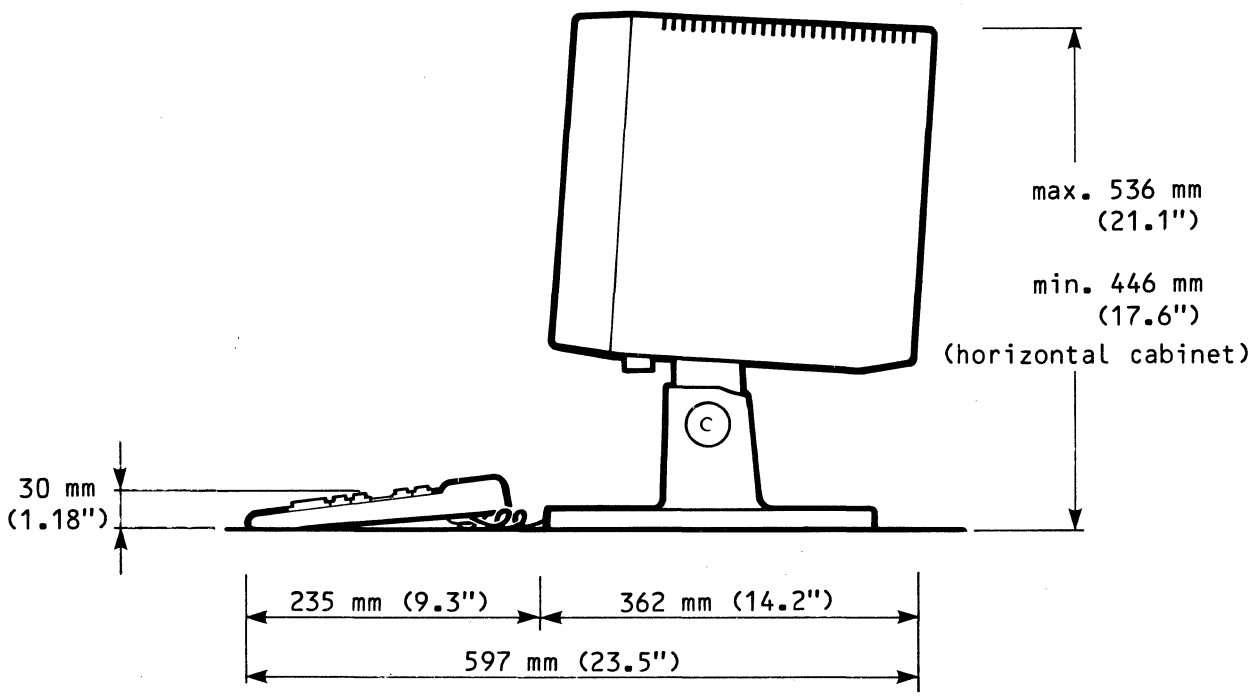


Fig. 3.1 Side view dimensions.

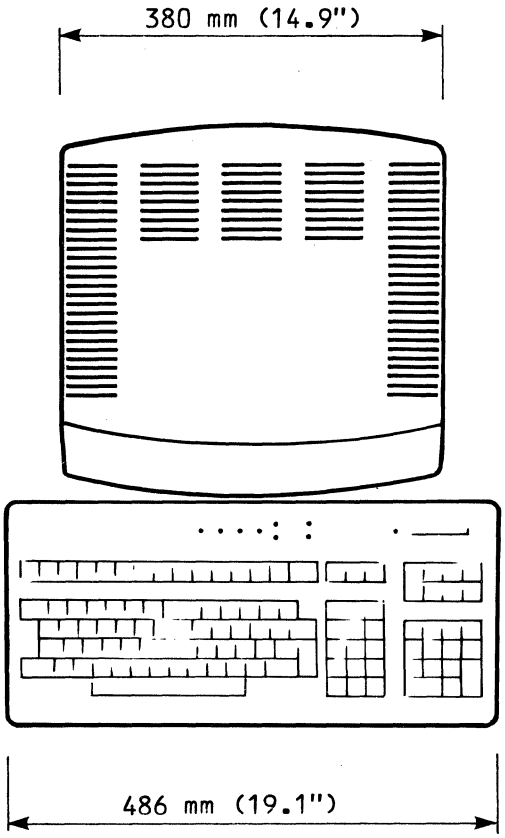
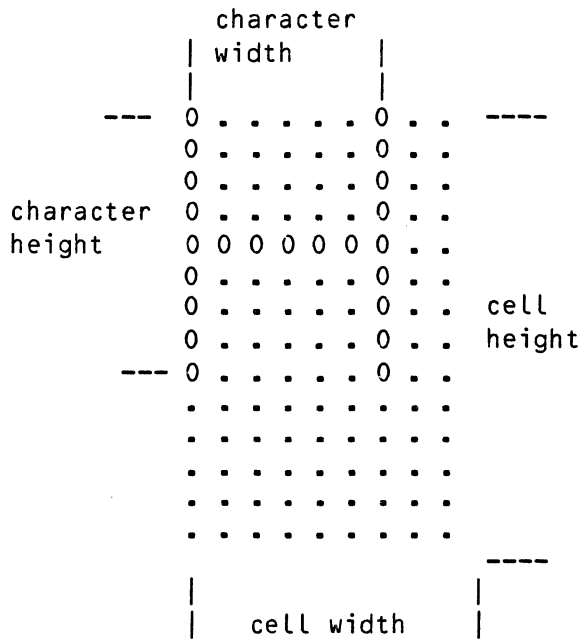


Fig. 3.2 Top view dimensions

4. SCREEN RELATED SPECIFICATIONS

4.1 Physical Dimensions

Tube size	:	15" (381 mm) diagonal
Text area height	:	195 mm (7.68") +/-2%
Text area width	:	260 mm (10.24") +/-2%



Character height	:	4.45 mm (0.175") nominal
Character width	:	2.1 mm (0.083") "
Cell height	:	7.8 mm (0.307") "
Cell width	:	3.25 mm (0.128") "
Line distance	:	3.34 mm (0.131") "
Character distance	:	1.08 mm (0.043") "

All distances are center-to-center according to DIN 66234.

4.2 Geometric Distortion

No picture element is displaced from the right position by more than 2% of text area height (3.9 mm (0.153")).

Difference between characters' size:

any characters : < 15%

adjacent characters : < 7%

Difference being defined as : $\frac{\text{max. size - min. size}}{\text{min.size}}$

4.3 Light Output

When leaving the factory, the light output will be set as follows:

	minimum	maximum
Background	: 4.5 cd/sq. m	20 cd/sq. m
Half intensity	: 20 cd/sq. m	80 cd/sq. m
Full intensity	: 40 cd/sq. m	170 cd/sq. m

All numbers have 20% tolerance and are measured at an ambient vertical light level of 4 lux.
A higher ambient light level would affect the values.

Note that the light level at the maximum setting of the potentiometer is set extra high to allow for the inevitable aging of the tube.

5. INTERFACE SPECIFICATIONS

This section describes the electrical interfaces to the line and the printer.

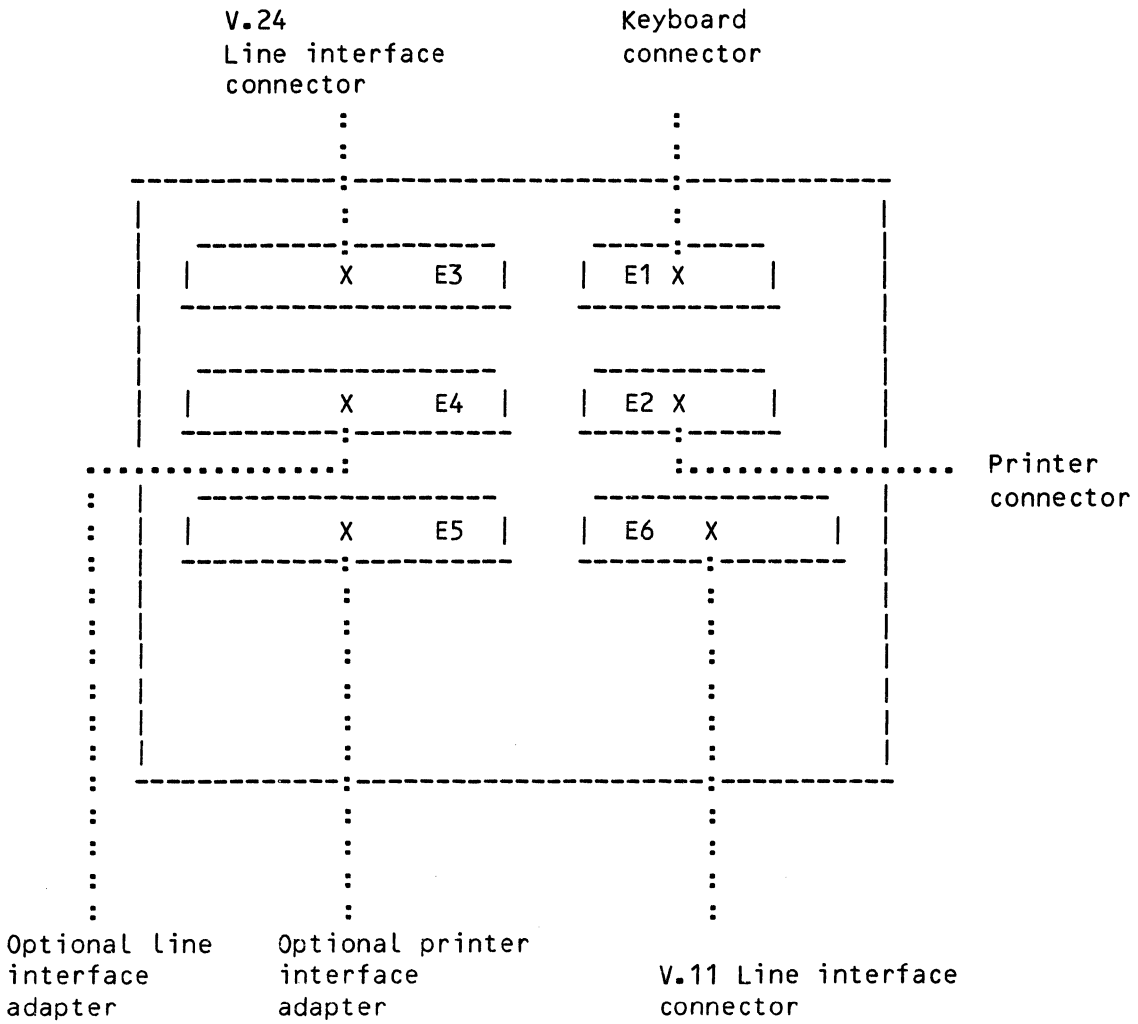


Fig. 5.1 External connections

5.1 Line Interface

Both V.24 (RS-232) and V.11 (RS-422) are provided as standard on the line interface. A current loop adapter is available as option (see section 5.4.3)

The interface logic is shared and only one commmunication line can be handled at a time.

The functional capabilities of the interface are:

	V.24	V.11	Current loop
Asynchronous	x	x	x
Isochronous	x	x	

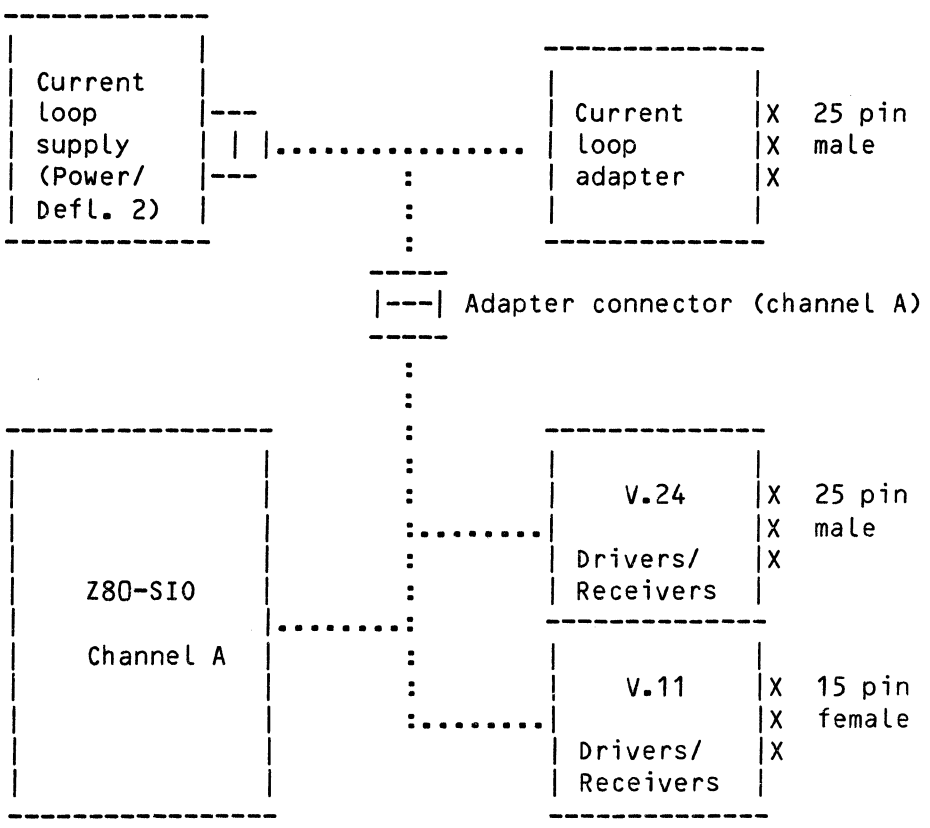


Fig. 5.2 Line interface block diagram.

5.1.1 V.24 Interface

The V.24 signals are available on a 25 pin Delta connector. The male part of the connector is mounted on the terminal.

	V.24	name	pin no.
	CT101	Protective gnd.	1
	CT103	Transmitted data	2
	CT104	Received data	3
	CT105	Request to send	4
	CT106	Clear To Send	5
	CT107	Data Set Ready	6
	CT102	Signal gnd.	7
	CT109	Carrier Detect	8
	CT114	Transmitter clock	15
	CT115	Receiver clock	17
	CT108	Data terminal ready	20
*	CT125	Calling indicator	22
*	CT111	Speed select	23
		V.24 positive level	21
		V.24 negative level	9

* Electrically connected, but not used.

See section 5.4.1 for electrical specifications.

5.1.2 V.11 Interface

The electrical levels are according to V.11 (RS-422)
The connector is according to ISO DIS 4903 and the female part of the connector is mounted on the terminal.

	X 21	name	pin no.
		Protective ground	1
	T(A)	Transmit	2
*	C(A)	Control	3
	R(A)	Receive	4
*	I(A)	Indicator	5
	S(A)	Signal element timing	6
		Not used	7
	G	Ground	8
	T(B)	Transmit	9
*	C(B)	Control	10
	R(B)	Receive	11
*	I(B)	Indicator	12
	S(B)	Signal element timing	13
		Not used	14
		Not used	15

* Electrically connected, but not used.

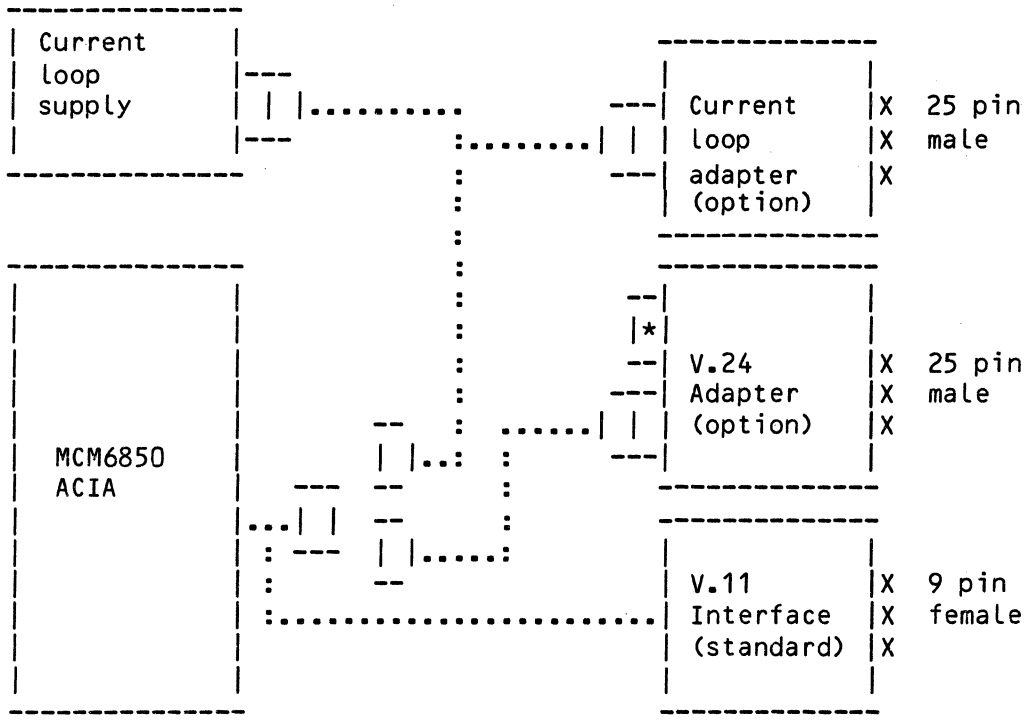
See section 5.4.3 for electrical specifications.

5.2 Printer Interface

The printer interface is an asynchronous interface with V.11 (RS-422) electrical levels as standard.

V.24 and current loop adapters are available as options. The adapters are described in section 5.3.

Control signal handling is neither possible on the V.11 nor the V.24 connections.



* The control signal connector is not used.

Fig. 5.3 Printer interface block diagram

5.2.1 Printer V.11 Interface

The connector is a 9 pin Delta with the female part mounted on the terminal.

	Signal name	pin no
	Protective ground	1
T(A)	Transmitted data (A)	2
R(A)	Received data (A)	4
G	Signal ground	6
T(B)	Transmitted data (B)	7
R(B)	Received data (B)	9

5.3 Interface Adapters

Two optional interface adapters can be present in the unit at the same time.

They occupy external connector positions E4 and/or E5 (See fig. 5.1).

The interconnection diagram below shows how the adapters are connected to Main board.
If one or both of the optional adapters are disconnected, connectors W13 and/or W14 must be strapped. For strapping information, see section 6.

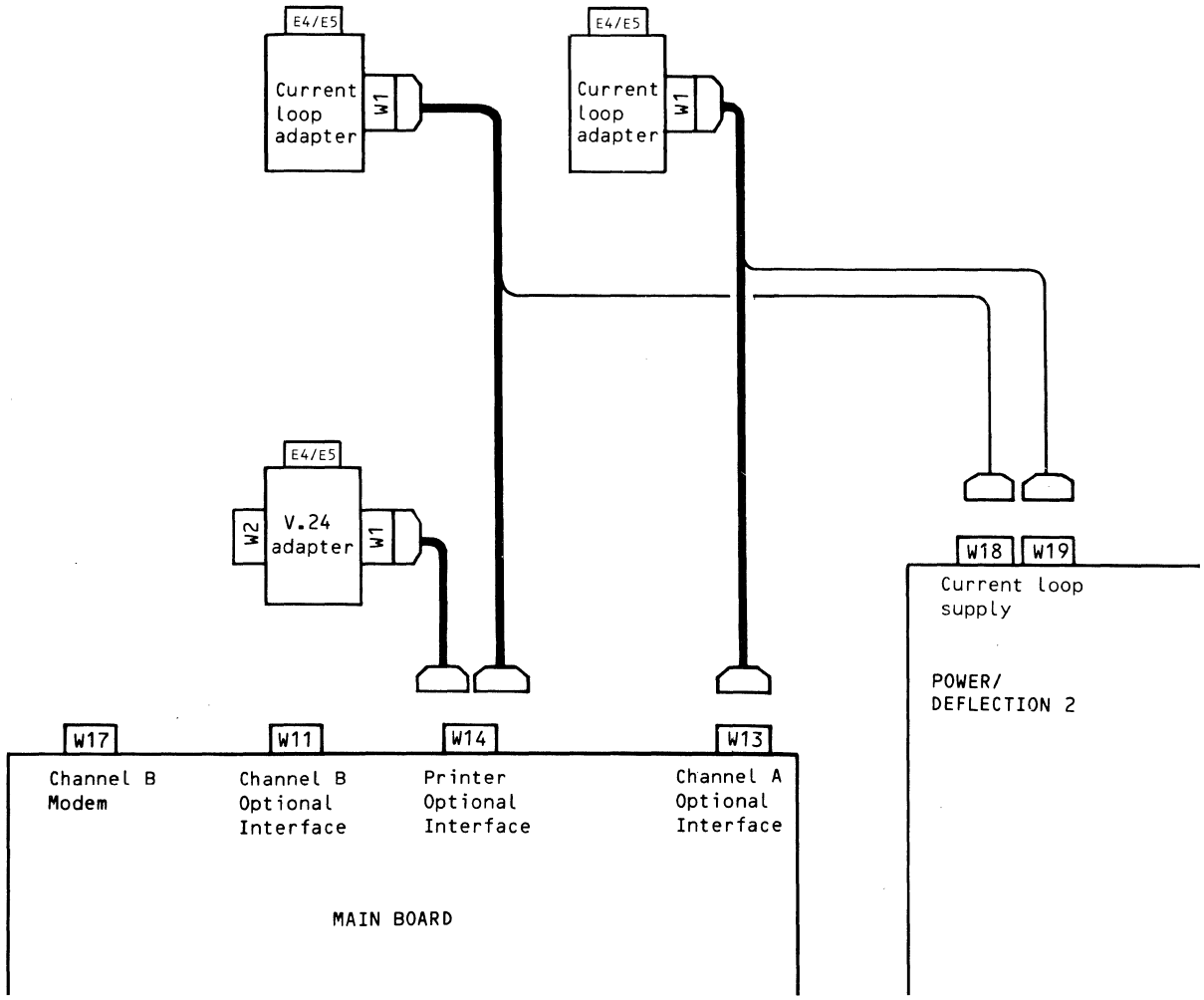


Fig. 5.4 Optional interface adapters, Interconnection Diagram

5.3.1 V.24 Adapter

The V.24 adapter consists of line drivers and receivers for data and control signals. The signals are available on a 25 pin Delta connector. The male part of the connector is mounted on the adapter.

	V.24	name	pin no.
	CT101	Protective gnd.	1
	CT103	Transmitted data	2
	CT104	Received data	3
*	CT105	Request to send	4
*	CT106	Clear To Send	5
*	CT107	Data Set Ready	6
	CT102	Signal gnd.	7
*	CT114	Transmitter clock	15
*	CT115	Receiver clock	17
*	CT108	Data terminal ready	20

* Electrically connected, but not used.

See section 5.4.1 for electrical specifications.

5.3.2 Current Loop Adapter

5.3.2.1 Current Loop Adapter Interface Signals

The current loop signals are available on a 25 pin Delta connector. The male part of the connector is mounted on the adapter.

name	pin no.
Current loop receive +	12
Current loop receive -	13
Current loop transmit +	23 and 18
Current loop transmit -	24
Transmitter current source	10
Receive current source	11
Ground floating (GNDFL)	25

pins 13 and 25 are internally connected.

5.3.2.2 Current Loop Installation Alternatives

By strapping in the plug the current loop interface can be either active (current supplied by terminal) or passive (current supplied by computer).

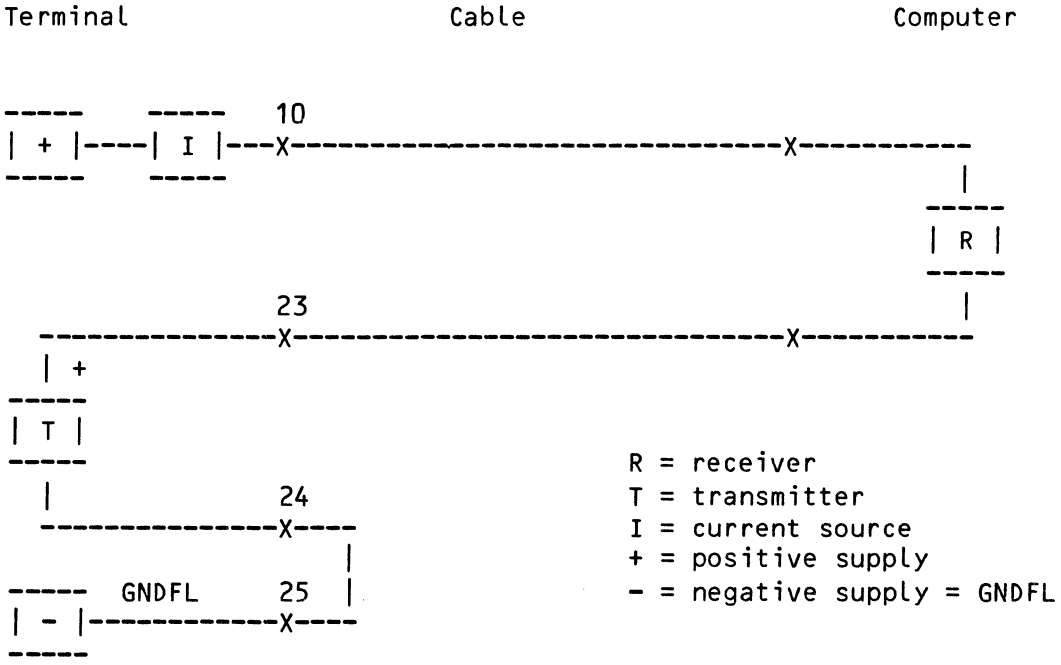


Fig. 5.5 Active transmitter section

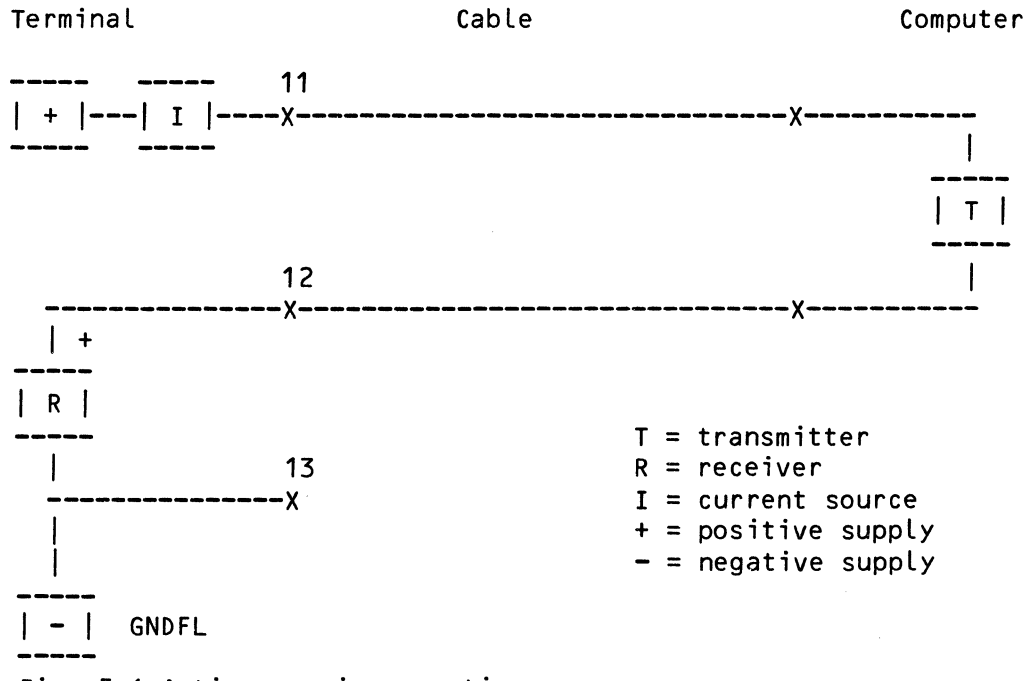


Fig. 5.6 Active receiver section.

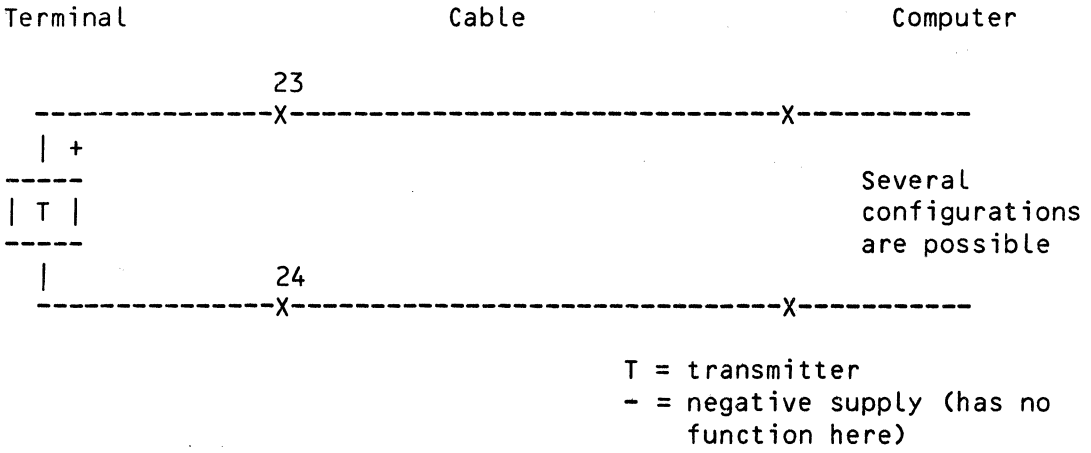


Fig. 5.7 Passive transmitter section

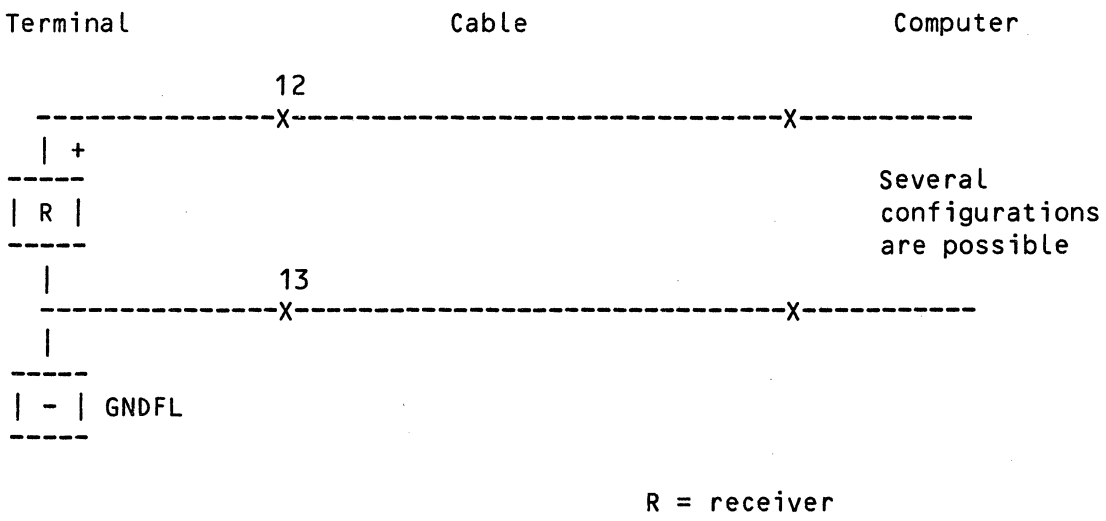


Fig. 5.8 Passive receiver section.

5.4 Electrical Specifications for Interfaces

5.4.1 V.24 Interface Electrical Specifications (V.28)

The electrical characteristics of the interface lines are according to CCITT V.28.

Receiver

Maximum ON voltage	:	25 V
Minimum ON voltage	:	3 V
Maximum OFF voltage	:	-25 V
Minimum OFF voltage	:	-3 V

Transmitter

Nominal ON voltage	:	10 V +/-10%
Nominal OFF voltage	:	-10 V +/-10%
Maximum slew rate	:	30 V/us

5.4.2 Current Loop Electrical Specifications

Internal current loop power-supply

The internal current loop power supply is floating with respect to ground and chassis.

Voltage	:	12 V +/-10%
Maximum voltage to ground and chassis	:	2000 V

Receiver characteristics

Nominal threshold current	:	10 mA
Minimum ON current	:	16 mA
Maximum ON current	:	24 mA
Maximum overshoot	:	100 mA
Minimum OFF current	:	0 mA
Maximum OFF current	:	5 mA
Maximum undershoot	:	-10 mA
Duty cycle	:	50% +/-10% (referred to 10 mA)

Transmitter characteristics

All values refer to a load of 120 ohm in parallel with 60 uF.

Nominal ON current	:	20 mA
Maximum ON current	:	24 mA
Minimum ON current	:	16 mA
Nominal OFF current	:	0.5 mA
Maximum OFF current	:	1 mA

5.4.3 V.11 (RS-422) Electrical Specifications

Receivers

Common mode range:	+/-7 V
Logical 1 on data circuits:	$V_A - V_B$ < -0.3 V
Logical 0 on data circuits:	$V_A - V_B$ > +0.3 V
ON condition on control circuits:	$V_A - V_B$ > +0.3 V
OFF condition on control circuits:	$V_A - V_B$ < -0.3 V
Cable termination:	100 ohm

Transmitters

All data refer to a load of 100 ohm.

Steady state differential voltage:	$V_A - V_B$ = +/-5 V max
DC offset :	3 V max
Logical 1 on data circuits:	$V_A - V_B$ < -2 V
Logical 0 on data circuits:	$V_A - V_B$ > +2 V
ON condition on control circuits:	$V_A - V_B$ > +2 V
OFF condition on control circuits:	$V_A - V_B$ < -2 V

Cable type

The cable should have twisted pairs for each data and control signal pair. Screened cables should be used.

Over the length of the cable the two conductors in a pair should have essentially the same values of:

- capacitance to ground

- longitudinal resistance and inductance

- coupling to adjacent cables and circuits

Cable length

The permissible cable length depends on the cable type employed and the difference in ground potential between the two ends of a communication link.

Normally cable lengths up to 1000 meters can be used at the speeds in question (19200 baud).

6. DISCONNECTED ADAPTERS - STRAPPING INFORMATION

The Main board connectors W13 and/or W14 must be strapped if one or both of the optional interface adapters are disconnected from Main board.

Connectors W13 and W14 are located on the left hand side of Main board. See fig. 6.1 below.

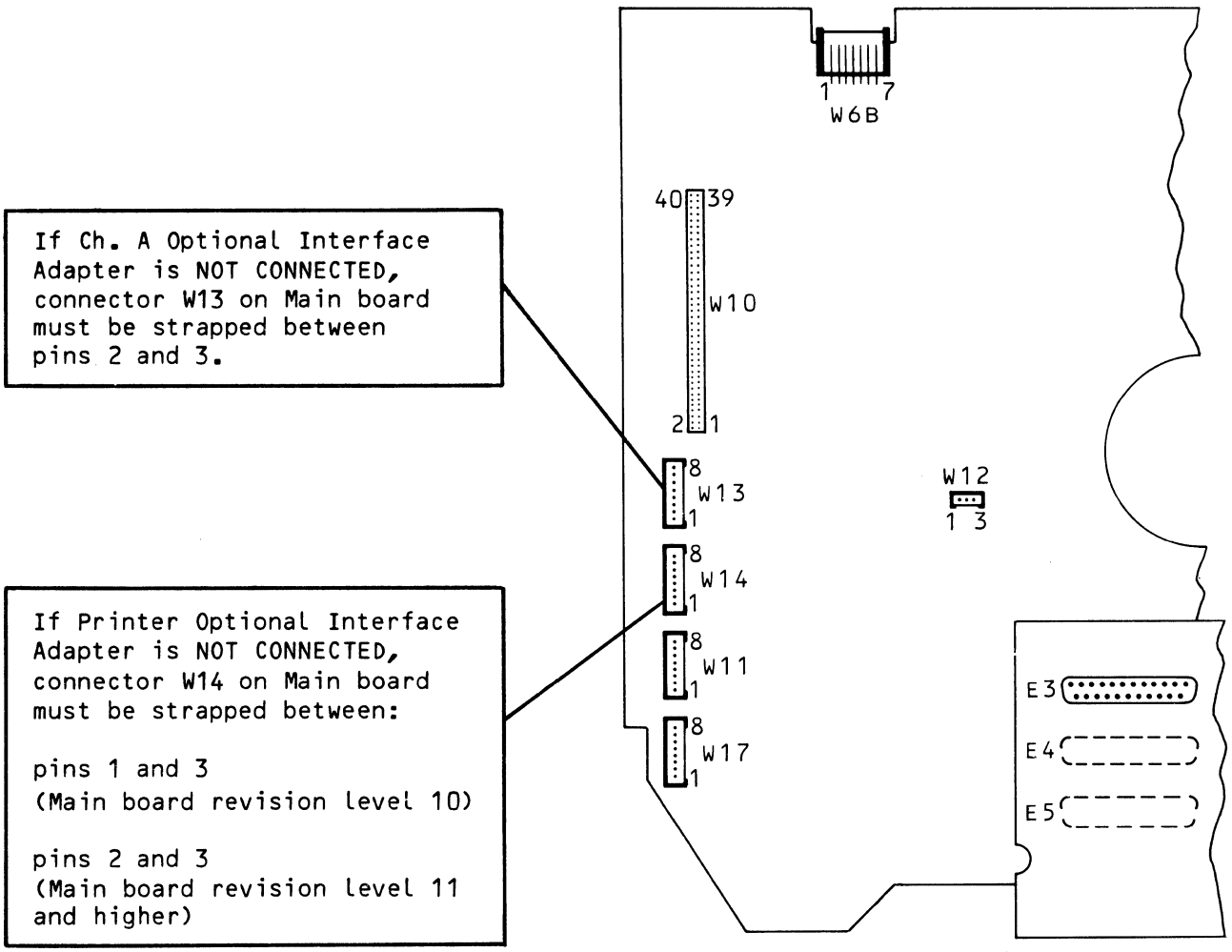


Fig. 6.1 Location and pin numbering of Main board connectors W13 and W14

7. ORDERING INFORMATION

7.1 Versions

The following national versions of the TDV 2230 are available:

Version	Ordering no.
TDV 2230 International	4048
TDV 2230 Norwegian standard	4050
TDV 2230 Swedish	4052
TDV 2230 German	4065

7.2 Options

Options are items that can be installed at the factory or by a competent service engineer in the field.

The following options are available:

Description	Ordering no.	
Print buffer (2K)	961262	(Note 1)
Current loop adapter on the line interface	961145	
Current loop adapter on the printer interface	961145	(Note 2
V.24 adapter on the printer interface	961120	(Note 2)

Note 1: The standard version has a 32 character print buffer.

Note 2: Only one interface adapter can be mounted on the printer interface.

7.3 Accessories

Accessories are items that are not considered to be part of product, but are available separately.

The following accessories are available:

Description	Ordering no.
Modem cable V.24	960586
TDV 2230 V.24/VT100 modem cable	961159
Printer cable open end (current loop)	961304

7.4 Documentation

Description	Ordering no.
TDV 2230 Owner's Manual	961331
TDV 2200 Service Manual	961326

TDV 2230
Quick Reference Guide

TANDBERG DATA A/S
P.O. Box 9 Korsvoll
OSLO 8, NORWAY
Phone (47-2) 23 20 80
Telex 17002 tdata n

Part no. 390509
Publ. no. 5201
August 1982
Revision no. 1

Revision no.	Pages affected
1	All

Related publications available from our Sales and Marketing Department:

Publ. no.	Part no.	Title
5193	961331	TDV 2230 Owner's Manual
5214	961326	TDV 2200 Service Manual

Every effort has been made to avoid errors in text and diagrams. However, Tandberg Data A/S assumes no responsibility for any errors which may appear in this publication.

It is the policy of Tandberg Data A/S to improve products as new techniques and components become available. Tandberg Data A/S therefore reserves the right to change specifications at any time.

We appreciate any comments on this publication.

CONTENTS

1. KEY TO TRANSMITTED CODE (INTERNATIONAL VERSION)

This section presents the codes generated by the keys on the keyboard.

LFT: Local function performed in terminal
 * : Keys are subject to national variations (see individual specs.)
 - : No code generated.

	Legend	Nonshift	Shift	CTRL	Action of control code when echoed
	SPACE	20	20	-	
*	, <	2C	3C	-	
	- =	2D	3D	-	
*	. >	2E	3E	-	
*	/ ?	2F	3F	-	
	0	30	5F	1F	No action
	1 ¡	31	21	-	
	2 "	32	22	-	
	3 #	33	23	-	
	4 $	34	24	-	
	5 %	35	25	-	
	6 &	36	26	-	
	7 '	37	27	-	
	8 (	38	28	-	
	9)	39	29	-	
*	: *	3A	2A	-	
*	; +	3B	2B	-	
*	@ `	40	60	00	No action
	A	61	41	01	No action
	B	62	42	02	No action
	C	63	43	03	No action
	D	64	44	04	No action
	E	65	45	05	Answer Back Message
	F	66	46	06	No action
	G	67	47	07	Bell
	H	68	48	08	Backspace
	I	69	49	09	Horizontal tab
	J	6A	4A	0A	Line feed
	K	6B	4B	0B	Line feed
	L	6C	4C	0C	Line feed
	M	6D	4D	0D	Carriage return
	N	6E	4E	0E	Underline (SO)
	O	6F	4F	0F	Normal (SI)
	P	70	50	10	No action
	Q	71	51	11	Transmission on
	R	72	52	12	No action
	S	73	53	13	Transmission off
	T	74	54	14	No action
	U	75	55	15	No action
	V	76	56	16	No action
	W	77	57	17	No action
	X	78	58	18	Abort control sequence
	Y	79	59	19	No action
	Z	7A	5A	1A	Abort control sequence
*	[{	5B Ö	7B ö	1B	Escape
*	\ |	5C Ä	7C ä	1C	No action
*	] }	5D Ü	7D ü	1D	No action
*	~ ^	5E	7E	1E	No action

Control keys:

	Legend	Nonshift	Shift	CTRL	Action of control code when echoed
	LF	0A	0A	-	Line feed
	CR	0D	0D	-	Carriage return
	|<-	**	**	-	Tab backward
	->|	09	09	-	Tab forward
	DEL	7F	7F	-	Ignored
	SO SI	0E	0F	-	Character set control
*	BS	08	08	-	Cursor back
	NOSCRL	LFT	LFT	-	Scroll/No scroll
	ESC	1B	1B	-	Escape
	LINE	LFT	LFT	-	
	PRINT	-	1B 5B 69	1B 5B 34 69	Start/abort print
	MODE	-	LFT	-	
	BREAK	-	LFT	-	Break condition on line
	CLEAR	LFT	LFT	-	Reset to Initial State (RIS)

The following keys generate no code in VT52 mode. In ANSI mode the following codes are generated:

Legend	Nonshift	Shift	CTRL	Action of control code when echoed
TAB +/-	1B 48	1B 5B 67	-	Tabulation set/reset
CSI	1B 5B	1B 5B	-	Control Sequence

The function keys generate the following codes:

Legend	VT52 mode	ANSI mode	CTRL
PF1	1B 50	1B 4F 50	-
PF2	1B 51	1B 4F 51	-
PF3	1B 52	1B 4F 52	-
PF4	1B 53	1B 4F 53	-
F1	1B 54	1B 4F 54	-
F2	1B 55	1B 4F 55	-
F3	1B 56	1B 4F 56	-
F4	1B 57	1B 4F 57	-
F5	1B 58	1B 4F 58	-
F6	1B 59	1B 4F 59	-
F7	1B 5A	1B 4F 5A	-

These codes are generated in both UNSHIFT and SHIFT modes. No code is sent together with CTRL.

** The effect of the |<- key is a transmission of the number of cursor left commands required to reach the nearest tab stop to the left (if there are any) or the leftmost position on the line.

Codes generated by the cursor movement keys.
The codes depend on the ANSI/VT52 mode and the cursor key mode.

Legend	VT52 mode	ANSI mode Curs. Key mode reset	ANSI mode Curs. Key mode set
CUR DOWN	1B 42	1B 5B 42	1B 4F 42
<-	1B 44	1B 5B 44	1B 4F 44
->	1B 43	1B 5B 43	1B 4F 43
CUR UP	1B 41	1B 5B 41	1B 4F 41
CUR HOME	1B 48	1B 5B 48	1B 5B 48

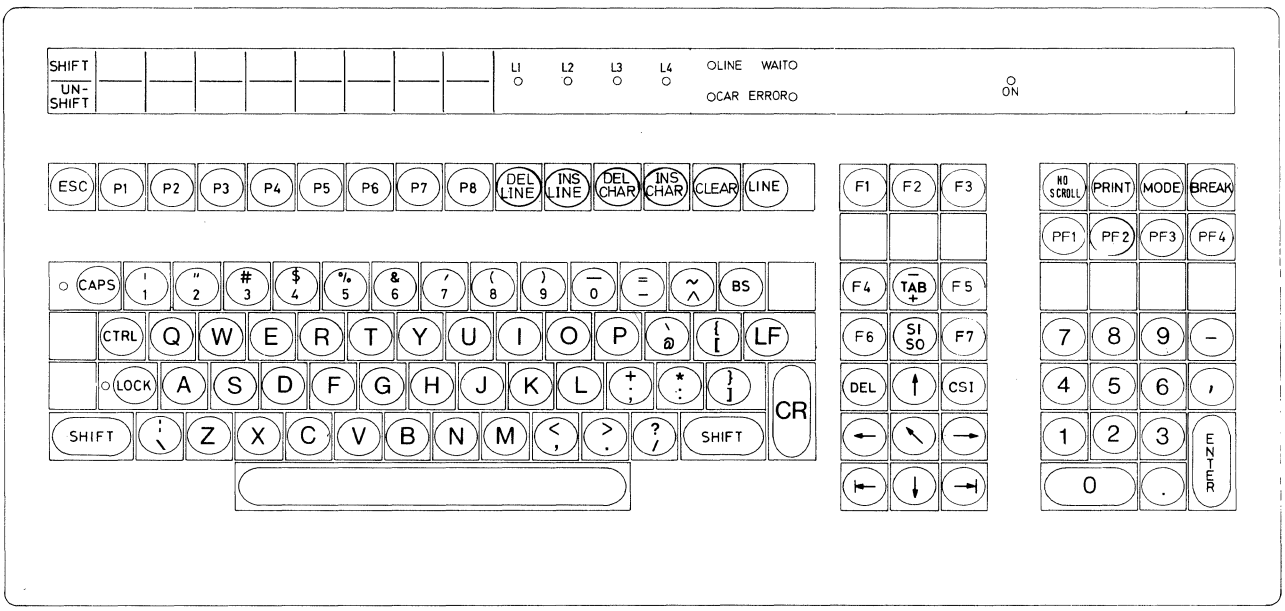
The keys in the numeric pad will generate different codes both in ANSI and VT52 mode, when the terminal is in alternate keypad mode (application). The codes are the same in both shift and nonshift. No action is taken on the codes if echoed.

Legend	Numeric mode	Application mode ANSI	Application mode VT52
0	30	1B 4F 70	1B 3F 70
1	31	1B 4F 71	1B 3F 71
2	32	1B 4F 72	1B 3F 72
3	33	1B 4F 73	1B 3F 73
4	34	1B 4F 74	1B 3F 74
5	35	1B 4F 75	1B 3F 75
6	36	1B 4F 76	1B 3F 76
7	37	1B 4F 77	1B 3F 77
8	38	1B 4F 78	1B 3F 78
9	39	1B 4F 79	1B 3F 79
.	2E	1B 4F 6E	1B 3F 6E
,	2C	1B 4F 6C	1B 3F 6C
-	2D	1B 4F 6D	1B 3F 6D
ENTER	0D	1B 4F 4D	1B 3F 4D

Local (re-)editing keys:

Legend	Nonshift	Shift	CTRL
DEL LINE	LFT	LFT	-
INS LINE	LFT	LFT	-
DEL CHAR	LFT	LFT	-
INS CHAR	LFT	LFT	-

1.1 Keyboard layout



2. TRANSMITTED CODE TO KEY REFERENCE

2.1 Generation of C0 control codes

00	CTRL @, CTRL `
01	CTRL A, CTRL a
02	CTRL B, CTRL b
03	CTRL C, CTRL c
04	CTRL D, CTRL d
05	CTRL E, CTRL e
06	CTRL F, CTRL f
07	CTRL G, CTRL g
08	CTRL H, CTRL h, BACKSPACE
09	CTRL I, CTRL i, TAB
0A	CTRL J, CTRL j, LF
0B	CTRL K, CTRL k,
0C	CTRL L, CTRL l,
0D	CTRL M, CTRL m, CR, ENTER
0E	CTRL N, CTRL n SO
0F	CTRL O, CTRL o SI
10	CTRL P, CTRL p
11	CTRL Q, CTRL q
12	CTRL R, CTRL r
13	CTRL S, CTRL s
14	CTRL T, CTRL t
15	CTRL U, CTRL u
16	CTRL V, CTRL v
17	CTRL W, CTRL w,
18	CTRL X, CTRL x,
19	CTRL Y, CTRL y
1A	CTRL Z, CTRL z
* 1B	CTRL [, CTRL {, ESC
* 1C	CTRL \, CTRL |,
* 1D	CTRL], CTRL },
* 1E	CTRL ^, CTRL ~
* 1F	CTRL _

Codes marked * are subject to national variations.

2.2 Generation of CSI and ESC sequences in ANSI mode ***

```
1B 5B          CSI
1B 48          TAB +
```

All C1 codes can be generated by pushing ESC followed by another key.

```
1B 5B 41       CUR UP
1B 5B 42       CUR DOWN
1B 5B 43       ->  (Cursor forward)
1B 5B 44       <-  (Cursor backward)
1B 5B 48       CUR HOME
1B 5B 4A       ER PAGE
1B 5B 4B       ER LINE
1B 5B 67       TAB -
1B 5B 69       PRINT          (depending on switch)
1B 5B 34 69    PRINT ABORT    (depending on switch)
```

Other CSI sequences can be generated by pushing CSI followed by the appropriate characters.

The following codes are not CSI-sequences but private sequences generated by the function keys and the numeric pad in application mode: ***

```
1B 4F 50       PF1
1B 4F 51       PF2
1B 4F 52       PF3
1B 4F 53       PF4
1B 4F 54       F1
1B 4F 55       F2
1B 4F 56       F3
1B 4F 57       F4
1B 4F 58       F5
1B 4F 59       F6
1B 4F 5A       F7
1B 4F 70       0   (num. pad)
1B 4F 71       1   (num. pad)
1B 4F 72       2   (num. pad)
1B 4F 73       3   (num. pad)
1B 4F 74       4   (num. pad)
1B 4F 75       5   (num. pad)
1B 4F 76       6   (num. pad)
1B 4F 77       7   (num. pad)
1B 4F 78       8   (num. pad)
1B 4F 79       9   (num. pad)
1B 4F 6C       ,   (num. pad)
1B 4F 6D       -   (num. pad)
1B 4F 6E       .   (num. pad)
1B 4F 4D    ENTER  (num. pad)
```

*** Refer to "TDV 2230 Functional Specifications" for details.

The following codes are generated by the cursor movements keys in cursor key mode: ***

1B 4F 41	CUR UP
1B 4F 42	CUR DOWN
1B 4F 43	->
1B 4F 44	<-

2.3 Generation of ESC-sequences in VT52 mode ***

1B 41	CUR UP
1B 42	CUR DOWN
1B 43	->
1B 44	<-
1B 48	CUR HOME
1B 4A	ER PAGE
1B 4B	ER LINE
1B 50	PF1
1B 51	PF2
1B 52	PF3
1B 53	PF4
1B 54	F1
1B 55	F2
1B 56	F3
1B 57	F4
1B 58	F5
1B 59	F6
1B 5A	F7

The following codes are generated when the numeric keypad is in application mode: ***

1B 3F 70	0 (num. pad)
1B 3F 71	1 (num. pad)
1B 3F 72	2 (num. pad)
1B 3F 73	3 (num. pad)
1B 3F 74	4 (num. pad)
1B 3F 75	5 (num. pad)
1B 3F 76	6 (num. pad)
1B 3F 77	7 (num. pad)
1B 3F 78	8 (num. pad)
1B 3F 79	9 (num. pad)
1B 3F 6C	, (num. pad)
1B 3F 6D	- (num. pad)
1B 3F 6E	. (num. pad)
1B 3F 4D	ENTER (num. pad)

*** Refer to "TDV 2230 Functional Specifications" for details.

3. EFFECT OF RECEIVED CONTROL CODES

3.1 Accepted codes in the C0 character set

Code	Mnemonic	Action
00		No action
01		No action
02		No action
03		No action
04		No action
05 *	ENQ	ANSWER BACK MESSAGE
06		No action
07 *	BEL	BELL
08	BS	BACKSPACE
09	HT	HORIZONTAL TAB.
0A	LF	LINE FEED
0B	VT	as LF
0C	FF	as LF
0D	CR	CURSOR RETURN
0E	SO	SHIFT OUT
0F	SI	SHIFT IN
10		No action
11	XON	TRANSMISSION OFF
12		No action
13	XOFF	TRANSMISSION ON
14		No action
15		No action
16		No action
17		No action
18	CAN	ABORT CURRENT CONTROL SEQUENCE
19		No action
1A	SUB	as CAN
1B	ESC	ESCAPE
1C		No action
1D		No action
1E		No action
1F		No action

* Depend on switch

3.2 Accepted ESC sequences in ANSI mode ***

1B 23 33	ESC # 3		Double height, upper part
1B 23 34	ESC # 4		Double height, lower part
1B 23 35	ESC # 5		Single width-line
1B 23 36	ESC # 6		Double width-line
1B 23 38	ESC # 8		Fill screen with uppercase "E"s
1B 28 s	ESC (		Select G0 character set
			A<41> - standard character set
			B<42> - - " -
			0<30> - special graphic character set
			* 1<31> - alternate stand. char. set
			* 2<32> - alternate spec. grap. char. set
1B 29 s	ESC)		Select G1 character set
			A<41> - standard character set
			B<42> - - " -
			0<30> - special graphic character set
			* 1<31> - alternate stand. char. set
			* 2<32> - alternate spec. grap. char. set
1B 37	ESC 7		Save cursor,character set and attribute
1B 38	ESC 8		Restore cursor,character set and attribute
1B 3D	ESC =		Enter alternate keypad mode
1B 3E	ESC >		Exit alternate keypad mode
1B 44	ESC D	IND	Index (Cursor down)
1B 45	ESC E	NEL	New Line
1B 48	ESC H	HTS	Horizontal tabulation set
1B 4D	ESC M	RI	Reverse Index (Cursor up)
1B 50	ESC P	DCS	Device control string (PUSH-key programming)
1B 5A	ESC Z (Note 1)		Identify (not recommended)
1B 5B	ESC [	CSI	Control sequence introducer.
1B 5C	ESC \	ST	String terminator
1B 63	ESC c	RIS	Reset to initial state

Note 1 : Response to ESC Z is CSI ?1;2 c<63>

Other ESC sequences will be ignored.

* option

3.3 Accepted ESC sequences in VT52 mode ***

1B 3C	ESC <		VT52 enter ANSI mode
1B 3D	ESC =		Enter alternate keypad mode
1B 3E	ESC >		Exit alternate keypad mode
1B 41	ESC A		Cursor up
1B 42	ESC B		Cursor down
1B 43	ESC C		Cursor right
1B 44	ESC D		Cursor left
1B 46	ESC F		Enter graphics mode
1B 47	ESC G		Exit graphics mode
1B 48	ESC H		Cursor home
1B 49	ESC I		Reverse line feed
1B 4A	ESC J		Erase to end of screen
1B 4B	ESC K		Erase to end of line
1B 56	ESC V		Print cursor line
1B 57	ESC W		Start relay print
1B 58	ESC X		Stop relay print
1B 59 l c	ESC Y	(Note 2)	Position cursor to line l and column c
1B 5A	ESC Z	(Note 3)	Identify
1B 5D	ESC]		Print screen
1B 5E	ESC ^		Start log mode
1B 5F	ESC _		Stop log mode
1B 63	ESC c		Reset to Initial State

Note 2 : Line and column numbers for direct cursor address are single character codes whose values are the desired number plus 1F hex. Line and column numbers start at 1.

Note 3 : Response to ESC Z is ESC / Z

*** Refer to "TDV 2230 Functional Specifications" for details.

3.4 Accepted CSI sequences

CSI n A<41>	CUU	Cursor up	default 1
CSI n B<42>	CUD	Cursor down	default 1
CSI n C<43>	CUF	Cursor right	default 1
CSI n D<44>	CUB	Cursor left	default 1
CSI l;c H<48>	CUP	Cursor position	default 1,1
CSI s J<4A>	ED	Erase in display	default 0
		0 - cursor to away	
		1 - home to cursor	
		2 - all	
CSI s K<4B>	EL	Erase in line	default 0
		0 - cursor to end	
		1 - beginning to cursor	
		2 - all	
CSI s c<63>	DA	Device attributes	
		0 - what are you	
		The response is: CSI ?1; 2 c<63>	
CSI l;c f<66>	HVP	Horizontal and vertical position. as CUP	
CSI s g<67>	TBC	Tabulation clear	
		0 - clear tab at cursor position	
		3 - clear all tabs	
CSI ms h<68>	SM	Set Mode	
		20 - NEL	53 - KC
		40 - PCL	67 - HAN
		41 - PCP	68 - CT
		42 - PS	69 - PM
		43 - PH	
		Private modes	
		?1 - CURS	?6 - OM
		?2 - VT52	?7 - WRAP
		?4 - RT	?8 - AR
CSI s i<69>	MC	Media copy	
		0 - Hard copy	
		?1 - Print cursor line	
		4 - Stop relay	
		5 - Start relay	
		?4 - Stop log mode	
		?5 - Start log mode	
CSI ms l<6C>	RM	Reset mode (see SM for parameters)	
CSI ms m<6D)	SGR	Select Graphic Rendition	
		0 - normal	
		1 - Depend on the HIR switch	
		3 - Underlined	
		5 - Blinking	
		7 - Inverse video	
CSI ms n<6E>	DSR	Device Status Report	
		0 - (response) Terminal OK	
		3 - (response) Terminal not OK	
		5 - (request) Report terminal status	
		6 - (request) Report cursor position (CPR)	
		Response is CSI n;n R<52>	
		10 - (response) Printer connected and not busy	
		11 - (response) Printer disconnected	
		13 - (response) Printer disconnected	
		15 - (request) Report printer status	

CSI ms q<71>	CL	Load LEDs 0 - Clear L1 through L4 1 - Turn on L1 2 - Turn on L2 3 - Turn on L3 4 - Turn on L4
CSI n;n r<72>	STBM	Set Top and Bottom Margin. Default 1,24
CSI ms x<78>	REQ	Request and Report Terminal Parameters 0 - (request) Unsolicited reports allowed 1 - (request) Only solicited reports 2 - (response) Report *** 3 - (response) Report on request ***
CSI 2;s y<79>	TST	Invoke Confidence Test 0 - Reset to initial state 1 - Power up self-test 2 - Tests the SIO using internal loopback 9 - Repeat self test until failure, or reset button is pressed, or power off 10 - Repeat SIO test until failure, or reset button is pressed, or power off 12 - Repeat SIO test until failure, or reset button is pressed, or power off

n : numeric parameter
ASCII coded 1 - 255

l : numeric parameter
ASCII coded 1 - 24

c : numeric parameter
ASCII coded 1- 80

s : selective parameter
ASCII coded values as specified

ms : multiple selective parameter
ASCII coded parameters separated by ;
maximum number of parameters 10.

All CSI sequences are switch dependent.

*** Refer to "TDV 2230 Functional Specifications" for details.

4. MENUS

4.1 Convenience switches

	Switch name	Default	Alternative settings	No.
1	Cursor Type	LINE	BLOCK	68
2	Roll Type	STEP	SMOOTH, CREEP	?4
3	Key Click	ON	OFF	53
4	Key Rollover	ENABLED	DISABLED	
5	Keyboard CAPS at Power Up	OFF	ON	
6	Auto Repeat	ON	OFF	?8
7	Margin Bell	ON	OFF	54
8	Status Line	ON	OFF	

4.2 Function switches

1	Time-out	ON	OFF	
2	Bell	ON	OFF	
3	High Intens. Representation	***		56
4	Inverse Representation	NORMAL	LOW	
5	Character Set Selection	STANDARD	IMPROVED	
6	New Line	LF	CRLF	20
7	Wrap	STOP	WRAP	?7
8	PUSH-key Programming	ALLOWED	PROHIB.	
9	ANSI/VT52 Mode	VT52	ANSI	?2
10	Printer Mode	LOCAL/REM	REMOTE, LOG	69
11	Printer Extent Mode	SPLIT	SCREEN	19
12	Printer Form Feed	NONE	BEFORE, AFTER, BOTH	18
13	Answer-Back	***		

4.3 Communication switches

1	Send Receive Mode	SIMULTAN.	TRANSPAR.	
2	Online	ONLINE	TOGGLE	
3	Line Interface	V.24	V.11	
4	Modem	LEASED	DIALLED, INHIBIT	
5	Transmission Handshake	OFF	XON/XOFF	67
6	Transmission Code Length	7BIT	8BIT	
7	Transmission Code Parity	NONE	EVEN, ODD	
8	Transmission Code Stopbits	1BIT	2BIT	
9	Transmission Speed	***		
10	Transmission Delay	NONE	20 ms, 40 ms, 60 ms	79
11	Printer Handshake	OFF	XON/XOFF	43
12	Printer Code Format	7 EVEN	7 ODD, 8 NONE, 8 EVEN, 8 ODD	40
13	Printer Speed	***		42

*** Refer to "TDV 2230 Functional Specifications" for details.

4.4 Modes changable from host only

These modes are only changable from the host computer.

Switch name	Default	Alternative settings	No.
Cursor Key Mode	Reset	Set	?1
Origin Mode	Reset	Set	?6
Keypad Numeric/Applic. mode	Numeric	Applic.	

5. CHARACTER SET

5.1 Standard character set

	00	10	20	30	40	50	60	70
0				0	@	P	`	p
1			!	1	A	Q	a	q
2			"	2	B	R	b	r
3			#	3	C	S	c	s
4			$	4	D	T	d	t
5			%	5	E	U	e	u
6			&	6	F	V	f	v
7			'	7	G	W	g	w
8			)	8	H	X	h	x
9			(	9	I	Y	i	y
A			*	:	J	Z	j	z
B			+	;	K	[	k	{
C			,	<	L	\	l	¦
D			-	=	M	]	m	}
E			.	>	N	^	n	~
F			/	?	O	_	o	

5.2 Special graphic character set

	00	10	20	30	40	50	60	70
0				0	@	P	♦	–
1			!	1	A	Q	▒	–
2			"	2	B	R	HT	–
3			#	3	C	S	FF	
4			$	4	D	T	CR	├
5			%	5	E	U	LF	│
6			&	6	F	V	°	└
7			'	7	G	W	±	
8			)	8	H	X	NL	┌
9			(	9	I	Y	VT	≤
A			*	:	J	Z	┘	≥
B			+	;	K	[		π
C			,	<	L	\	┐	≠
D			-	=	M	]		£
E			.	>	N	^	┼	·
F			/	?	O			

TDV 2230
Functional Specifications

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5193	961331	TDV 2230 Owner's Manual

Every effort has been made to avoid errors in text and diagrams. However, Tandberg Data A/S assumes no responsibility for any errors which may appear in this publication.

It is the policy of Tandberg Data A/S to improve products as new techniques and components become available. Tandberg Data A/S therefore reserves the right to change specifications at any time.

We appreciate any comments on this publication.

CONTENTS

0. PREFACE

This document contains the specifications of the TDV 2230 valid for Firmware Revision level 11.
Functional differences between this revision level and its successors are described in the Product Release Documents for the TDV 2230.

TANDBERG DATA is grateful for any comments to this document regarding:

- deviations between specification and product
- consistency of definition
- vague points in the definition
- compatibility with the VT100 terminal

1. TERMINOLOGY

This section gives a summary of some of the terms used in this specification.

Active position

The character position on the visual display that is to display the graphic symbol representing the next graphic character.

ANSI mode

A VT100 mode in which the TDV 2230 recognizes and responds only to escape sequences whose syntax and semantics are in accordance with ANSI (ECMA) specifications.

Away position

The rightmost bottom position of the screen, e.g. the last character on the last line.

Character generator

The part of the terminal which defines how the different characters are going to be displayed on the screen. The TDV 2230 terminal defines the characters within a 9 by 14 framework (a so-called 7 by 9 matrix).

Character position

That portion of a visual display which displays or is capable of displaying a graphic symbol.

C0 - control character set

Control codes from 00 to 1F hex (rows 0 and 1) of the ECMA code standard. These are the same in both 7 and 8 bit representation.

C1 - control character set

Control codes from 80 to 9F hex (rows 8 and 9) of the ECMA 8-bit code standard. These are represented by an ESC followed by a character in the range 40 to 5F hex

Control
- - - -
A control character, an escape sequence or a control sequence that performs a control function.

Control character
- - - - - - - - -
A character whose occurence in a particular context initiates, modifies, or stops a control function.

Control function
- - - - - - - - -
An action that affects the recording, processing, transmission, or interpretation of data.

CSI control sequence
- - - - - - - - - - -
A sequence of characters that is used for control purposes to perform a control function, that begins with the control sequence introducer (CSI), and that may contain a parameter string.

Cursor
- - - -
A visual representation of the active position which is either a steady block (inverse video) or a blinking underline. The cursor indicates on the screen where the next character is to be written.

Cursor control
- - - - - - - -
An editor function that moves the active position.

Default
- - - -
A function-dependent value that is assumed when no explicit value, or a value of 0, is specified.

Display
- - - -
The current active area of the screen, i.e. the area inside the scrolling region, or the entire screen, depending on the origin mode.

Escape character (ESC)
- - - - - - - - - - - -
A control character that provides supplementary characters (code extension) and that is itself a prefix affecting the interpretation of a limited number of contiguous characters.

Escape sequence
- - - - - - - -

A sequence of characters that is used for control purposes to perform a control function and whose first character is the escape (ESC) control character.

Format Effector
- - - - - - - -

A group of ECMA standard control codes and sequences which in some types of terminals may be stored as data or acted upon as control characters dependent on an internal terminal switch setting. In the TDV 2230 terminal this group always acts as control characters, they are never stored.

Graphic character
- - - - - - - - -

A graphic character, other than a control character, that has a visual representation normally handwritten, printed or displayed.

Graphic rendition
- - - - - - - - -

The graphic rendition is the way in which a character is presented on the screen.
Examples of different graphic renditions are inverse video, low intensity, underline and normal.

Hexadecimal values
- - - - - - - - - -

All hexadecimal values are in this book enclosed within angle brackets, e.g. <1F>, <6B> etc.
All other values are decimal values.

Home position
- - - - - - -

The leftmost character of the first line of the screen, e.g. the first character of the screen.

Last data line
- - - - - - - -

The last line on the screen which may contain data.

Lead-in key (code)
- - - - - - - - - -

A key (or code) which must be followed by another key (or code) to achieve a specific effect.

Non-volatile memory
- - - - - - - - - -
An internal memory which contains values of permanent switches, permanent tabulation-rack and PUSH-keys. The memory is firmware alterable, but the contents will be kept even if power is turned off.

Numeric parameter
- - - - - - - - -
A parameter in a CSI sequence which represents a number.

Option
- - - -
A feature which is not a part of the standard TDV 2230 terminal, but which can be ordered from Tandberg, usually at an extra cost. In general, options may not be included through Field Upgrade of the terminal, but must be factory installed when the terminal is produced.

Parameter
- - - - -
(1) A string of one or more characters that represent a single value.
(2) The value so represented.

Permanent switch
- - - - - - - - -
The soft switch value residing in non-volatile memory.

PUSH-key
- - - - -
The TDV 2230 has 8 keys that allow the user to link a string of text or control characters to a single key. This enables the user to transmit frequently used texts or control strings by pushing a single key. The PUSH-keys work in both SHIFTED and UNSHIFTED mode to enable 16 strings to be generated.

Screen
- - - -
The area of the Cathode-Ray-Tube used for displaying characters.

Selective parameter
- - - - - - - - - -
A parameter in a CSI sequence which represents a numbered alternative.

Soft-switch
- - - - - -
A firmware implemented alterable switch within the terminal which controls some aspect of the terminal operation. These may be altered by the operator through use of the configuration menu, some of them may also be altered from the host computer.

There are two sets of switches, temporary and permanent.

Temporary switch
- - - - - - - - - -
When power is turned on, the values of permanent switches contained in the non-volatile memory are copied into internal memory. These copies, referred to as temporary switches, control the terminal operation.

VT52 mode
- - - - -
A VT100 mode in which TDV 2230 recognizes and responds only to escape sequences that the VT52 terminal uses.

2. GENERAL INFORMATION

TDV 2230 is an intelligent terminal that can replace the VT100 terminal in most applications with none or minimal changes in the host software.

The standard communication protocol is asynchronous serial transmission on a character by character basis.

Communication speed, code length, code parity and the number of stop bits are selectable.

The TDV 2230 may display text in several different video modes: low intensity, underline, blinking, inverse video and several combinations of these. Possible combinations are described under the SGR code in section 9.6.2.

The terminal is in the standard version delivered with a character generator of 128 characters, where 32 characters are special graphic symbols. In addition, an alternative character generator may be installed as an option. This gives an additional 128 characters with the same structure as the standard character generator. There are two complete 94 characters character sets in the standard character generator. The two character sets are equal except for the 32 special graphic symbols that replace 32 characters in one of them. With the aid of control codes the two character sets can be designated as first (G0) or second (G1) character set in any combination. Whether the designated first or second character set is used when displaying characters is indicated by control codes. See sections 7.2, 9.3.1 and 9.6.1.

The symbols in the optional 128 character generator may be custom designed.

The keyboard lay-out and the key's functions are described in detail in section 6.

The TDV 2230 terminal has 8 PUSH-keys (Programable Utility for String Handling). These keys enable the operator to transmit text strings by pushing a single key. They work in both shift and unshift, thus allowing 16 different strings or code sequences to be used. The strings are stored in the non-volatile memory, enabling the TDV 2230 terminal to "remember" the strings when it is turned off. See section 5.3 for details.

A printer may optionally be attached. The Print speed, code parity and the number of stop-bits are selectable. See section 7.4 for details.

The terminal mode is factory preset, and normally all the operator has to do is to turn power on by using the POWER ON switch located on the side of the terminal unit housing.

Immediately after power-up, the terminal will perform a self-test to ensure proper operation. If an error should be found, the message ERROR is displayed together with a code indicating the error type. See section 11. for details.

The operation of the TDV 2230 is controlled by soft-switches, see sections 4 and 5.

Hexadecimal values are in this book enclosed within angle brackets, e.g. <1F>, <6B> etc.
All other values are decimal values.

3. BASIC TERMINAL CONCEPT

The switch SRM (Send Receive Mode) determines the main mode of the terminal. It has two settings:
Simultaneous and transparent. See section 4.3.1.

3.1 Operation in Simultaneous Send-Receive mode

In this mode character codes entered from the keyboard are transmitted directly to the host computer without any local action, and data from the host computer are either displayed on the screen or activates local functions in the terminal. Normally data from the keyboard are echoed back by the host computer - it is, however, possible to use an internal echo. (Dotted line on fig. 3.1)

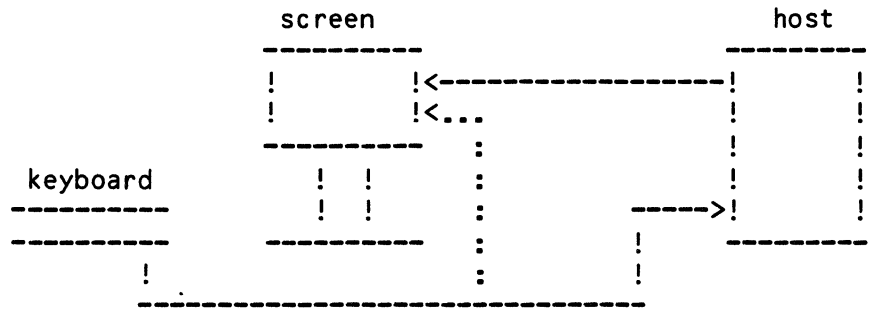


Fig. 3.1 Simultaneous send receive.

The character codes transmitted from the keyboard and the codes accepted from the host computer depends on whether the terminal is in "ANSI" mode or in "VT52" mode. See section 3.3.
The operator may choose between these two modes by changing the ANSI/VT52 mode switch, see section 4.2.9.

Basically the terminal can be online or local. This is controlled by the MODEM switch and the ONLINE switch. See section 4.3.2 and 4.3.4. The status of the modem connection is displayed on the keyboard by the LINE and WAIT lamps.

LINE =	off,	WAIT =	off	The terminal is in the local mode.
LINE =	off,	WAIT =	on	The terminal tries to go online, but the modem does not respond properly.
LINE =	on,	WAIT =	off	The terminal is online.

3.2 Operation in transparent mode

If the terminal is in the transparent mode, data entered from the keyboard or received from the host computer, will be displayed on the screen without any action taken. The purpose of this mode is to allow the operator to check the communication with the host computer by looking at the codes transmitted and received.

The character codes are displayed as follows (Ref. 4.3.1):

Codes received from the host:

<00-1F> will be displayed as shown in fig. 3.2 below.
<20-7F> will be displayed as normal ASCII characters.
<80-FF> will be displayed as for the codes <00-7F> but underlined.

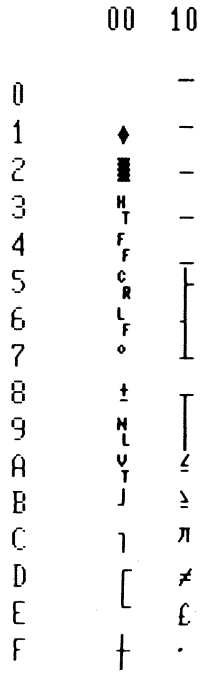


Fig. 3.2 Codes <00-1F>

Codes received from the keyboard will be displayed in the same manner as those received from the host, but in inverse video.

When the mode is entered, the cursor is in the home position. As each line is filled, display continues on the next line. After the last character on the last line is written, an automatic roll-up occurs, and information in the first line will be lost.

Exit from this mode can only be done from the keyboard through a mode selection sequence.

3.3 Operation of the terminal

The TDV 2230 terminal has two different program modes. They may be chosen by a mode setup (4.2.9). The possible modes are ANSI and VT52 mode.

In ANSI mode the terminal will generate and respond to control sequences defined in the ECMA (The European Computer Manufacturer Association) standard.

In VT52 mode, the TDV 2230 terminal can replace the VT52 in most applications. In this mode, the terminal will not respond to or generate CSI-sequences. The terminal will act according to the codes specified in section 9.5.2.

In section 9, the codes which the terminal generates and responds to in the different modes, are described in detail.

3.4 Error indication

Whenever communication or other errors are encountered, the terminal operation is halted and the ERROR lamp is lit. In addition, the bell may be sounded and an appropriate diagnostics shown in the status line. Note however that both the audible alarm as well as the diagnostics may be optionally suppressed via soft switches. (In case that the status line is off when an error occurs pressing the CLEAR key will make the diagnostics appear nevertheless).

To recover from an error and to resume the normal operation the operator must do the following:

- remove the primary cause for the error (e.g. by manipulating communication switches)
- press CLEAR key

4. SOFT-SWITCHES

The operation of the TDV 2230 is controlled by soft-switches.

The switches are divided into three groups and each group has its own menu:

- Convenience switches are switches that are included for operator convenience and they have no bearing on the terminal's basic functions.

- Function switches are switches that define the functional characteristics of the terminal.

- Communication switches are switches that control the operation of the line and printer interfaces.

Optionally, the terminal may be equipped by a security lock which prevents access to the last two menus.

When power is off, the switch values are stored in non-volatile memory (permanent switches). As part of the power-up sequence, the switches are copied into RAM memory (temporary switches). It is important to note that only the temporary switches control the terminal.

The switches can be manipulated by the operator using the configuration menu, see section 5. On the completion of terminal configuration the operator may specify whether

- the temporary switches are to be copied to permanent ones or

- the permanent switches are to be copied to temporary ones.

(if none of the above is chosen the two sets of switches remain different) - note that whatever is chosen, it will affect all switches.

Some switches may be altered by the host computer, see section 7.3.

Upon delivery all switches are set to their default settings.

4.1 Convenience switches

The switches in this menu are included for operator convenience. They are therefore not protected by the optional setup security lock that protects the two other menus from being accessed by unauthorized persons.

4.1.1. Cursor Type switch (CT)

With this switch it is possible to specify what type of cursor the terminal should have.

The switch has two settings: LINE and BLOCK

In the LINE state, an underline blinking cursor will be used.

In the BLOCK state, a steady block cursor will be used.

The default setting is LINE.

4.1.2 Roll Type switch (RT)

This switch controls whether ROLL UP and ROLL DOWN operation should be soft (one TV-scanline at a time) or stepwise (one or two textlines at a time).

The switch has three settings: STEP, SMOOTH and CREEP

The difference between SMOOTH and CREEP is the speed,the SMOOTH mode is twice as fast as the CREEP mode, thus becoming compatible with the smooth scroll speed at VT100.

The default setting is STEP.

4.1.3 Key Click switch (KC)

The key click switch controls whether a clicker in the keyboard should sound on each keystroke.

The switch has two settings: ON and OFF.

The default setting is ON.

4.1.4 Key Rollover switch (KR)

The key rollover switch controls whether the normal rollover function in the keyboard should work.

The switch has two settings: ENABLED and DISABLED.

In the ENABLED position, the rollover function will be enabled, witch means that if two or more keys are depressed simultaneously on the keyboard, all keys will be registered and their codes sent to the terminal.

In the DISABLED position, the rollover function will be disabled, which means that if two or more keys are depressed simultaneously on the keyboard, only the key detected by the keyboard as the first depressed, will be acted upon and others ignored.

The default setting is ENABLED.

4.1.5 Keyboard CAPS At Power Up switch (KCPU)

The keyboard CAPS at power up switch controls the initial setting of the CAPS key after power up.

The switch has two settings: OFF and ON.

In the ON position, the CAPS key will be on after the terminal is switched on (also indicated by the corresponding lamp), thus enabling conversion of all typed characters to upper case without further user action.

In the OFF position the keyboard will not be placed to CAPS mode at power up.

Note that this switch is meaningful only if set permanently i.e. registered in non-volatile memory.

Default setting is OFF.

4.1.6 Auto Repeat switch (AR)

The auto repeat switch controls whether the normal repeat function in the keyboard should work.

The switch has two settings: ON and OFF.

Note that only the typewriter area, the numeric pad and the cursor movement keys (except home) are programmed for repeat when the switch is on.

The default setting is ON.

4.1.7 Margin Bell switch (MB)

The margin bell switch controls whether the bell should sound when the 72nd character position of a line is passed.

The switch has two settings: ON and OFF

If the received character rate exceeds a certain limit, the margin bell will not sound regardless of the setting of the switch.
The margin bell is only activated by writing characters or by backspacing.

The bell code <07> is not affected by this switch (ref. section 4.2.2).

The default setting is ON.

4.1.8 Status Line switch (SL)

The switch has two settings: ON and OFF.

The status line can be suppressed using this switch so that an advanced user need not be distracted by possible messages appearing at the bottom of the screen. The terminal status is then solely reflected by the signal lamps of the keyboard.
Note that possible diagnostics can be made visible by pressing the CLEAR key in the error situations.

The default setting is ON.

4.2 Function switches

4.2.1 Time-out switch (TIM)

This switch controls whether the picture should be turned off after a period with no activity on the terminal.

The switch has two settings: ON and OFF

In the OFF state, the time-out feature is off and the picture will stay on as long as the terminal is turned on.

In the ON state, the picture will be turned off approximately 10 minutes after the last activity was encountered on the terminal. When timed out the picture will immediately turn on when a character is received from the line or from the keyboard. Note that the character will be normally processed.

The default setting is ON.

4.2.2 Bell switch (BEL)

The Bell switch controls whether the terminal should give audible alarm during normal operation.

The switch has two settings: ON and OFF.

In the ON state, a bell-like sound will be activated when the BEL code <07> is received. The margin bell will work as specified in section 4.1.4.

In the OFF state, the BEL code <07> is ignored and the margin bell will be disabled regardless of the margin bell switch.

The default setting is ON.

This switch does not affect audible alarms due to error conditions in the terminal.

4.2.3 High Intensity Representation switch (HIR)

The TDV 2230 does not support high intensity graphic rendition. Instead some alternative renditions may be chosen.

The switch has the following settings:

NORMAL, INVERSE, LOW, INV/LOW, UNDERLINE, INV/UND, UND/LOW, INV/LOW/UN, BLINK, INV/BLINK, LOW/BLINK, LOW/BLINK, INV/LOW/BL UND/BLINK, INV/UND/BL

The default setting is INV/LOW.

4.2.4 Inverse Representation switch (IR)

The switch has two settings: NORMAL and LOW

This switch gives the user the choice of whether the inverse graphic rendition should be used with full intensity (NORMAL) or with low intensity (LOW).

The default setting is NORMAL.

4.2.5 Character Set Selection switch (CSS)

The switch has two settings: STANDARD and IMPROVED.

The switch set to "STANDARD":

> The TDV 2230 will use the special graphics character set and the alternate character generator in the same way as it did in all versions preceding revision level 10 where this switch was first introduced.

The switch set to "IMPROVED":

> The default setting of the G0 and the G1 character sets in ANSI mode are standard and alternate character set respectively.
>
> In the VT52 mode SO and SI will cause the G1 and G0 character sets respectively to be used.
>
> In the VT52 mode ESC F will select the special graphics character set in the standard or alternate character generator depending on whether SO or SI was given last. ESC G similarly gives the normal character set.

Note that the G0 and G1 sets to be used in ANSI mode can be selected by the ESC (x and ESC) x sequences. The selections made for G0 and G1 in ANSI mode will be used in the VT52 mode when this mode is selected after ANSI mode during a session.

In VT52 mode ESC G will always select the special graphics character part of the currently selected character generator. ESC F will similarly always select the ASCII part of the currently selected character generator.

Note also that changing the setting of the character set selection switch will set the G0 and G1 character sets back to their defaults. The defaults are:

"STANDARD"
G0 and G1 both point to the ASCII part of the standard character generator.

"IMPROVED"
G0 points to the ASCII part of the standard character generator. G1 points to the ASCII part of the alternate character generator.

Note finally that on terminals without the alternate character generator the standard character generator will be used as the alternate character generator too.

The default setting is "STANDARD".

4.2.6 New Line switch (NL)

The switch controls the effect of the LF and CR codes.

The switch has two settings: LF and CRLF.

In the LF state, LF is treated as a line feed, i.e. the cursor's horizontal position is not changed. CR is treated as cursor return.

In the CRLF state, the LF code causes a line feed and a cursor return. The CR code causes only a cursor return. However, the CR key (and the ENTER key in the numeric keypad) will in addition to the CR code also generate the LF code.

The default setting is LF.

4.2.7 Wrap switch (WR)

This switch controls the effect of writing at the last character position in the line.

The switch has two settings: STOP and WRAP.

In the STOP position, the last character on the line will be over-written.

In the WRAP position, the next character will be written into the first position of the next line.The cursor will stay in position 80 after the 80th character has been displayed on screen. When the next character is displayed the cursor is placed in position 2 on the next line.

The default setting is STOP.

4.2.8 PUSH-Key Programming switch (PKP)

This switch controls whether the operator should be allowed to alter PUSH-keys.

The switch has two settings: ALLOWED and PROHIBITED

When the switch is set to ALLOWED, PUSH-key programming can be done as specified in section 5.3.

When set to PROHIBITED, PUSH-key programming cannot be done by the operator. PUSH-key programming from the host computer is, however, still possible.

The default setting is ALLOWED.

4.2.9 ANSI/VT52 mode switch (VT52)

The switch controls the operation of the terminal.

The switch has two settings: ANSI and VT52.

In the ANSI mode the terminal is ANSI compatible, i.e. can replace the VT100 terminal in most applications.

In the VT52 mode, the terminal can replace the VT52 terminal in most applications. For accepted codes in VT52 mode see section 9.5.2.

The default setting is VT52.

4.2.10 Printer Mode switch (PM)

This switch defines the way in which the printer is controlled.

The switch has three settings: LOCAL/REM, REMOTE and LOG

When the switch is set to REMOTE, printouts can only be initiated by the host computer (provided that the terminal is on line) using the MC codes (see section 9.6.2). The PRINT key generates the MC code and no action is taken locally.

When the switch is set to LOCAL/REM, the PRINT key on the keyboard initiates a local printout of the screen contents, and the MC code is not sent to the computer. MC codes from the computer will have effect as specified.

In the LOG mode, data will be transferred to the printer on a line by line basis. The transfer is started when the cursor leaves a line, this line is then printed.

See sections 7.4 and 9.6.2 (MC) for additional details.

The default setting is LOCAL/REM.

The switch has no effect on the use of the PRINT key during Soft-switch and PUSH-key setup.

4.2.11 Printer Extent Mode switch (PEM)

The printer extent mode switch decides which part of the screen is printed by the sequences CSI i or ESC <5D>.

The switch has two settings: SPLIT and SCREEN

In SPLIT state only the scrolling region is printed.
In SCREEN state the whole screen is printed.

The default setting is SPLIT.

4.2.12 Printer Form Feed switch (PFF)

The printer form feed switch controls the generation of FF <0C> characters in connection with hard copy printing.

The switch has four settings: NONE, BEFORE, AFTER and BOTH.

In the NONE state no form feed characters are generated.
IN the BEFORE state a form feed character is generated before the screen copy is printed.
In the AFTER state a form feed character is generated after the screen copy is printed.
In the BOTH state one form feed character is generated before and one after the printing.

The default setting is NONE.

4.2.13 Answer-Back switch (AB)

This switch controls the response to the ENQ code. (See section 9.4.1)
The PUSH-keys are used as possible answer-back messages to the host computer, as a response to the ENQ code.

One of the 16 PUSH-key may be used for this purpose.
The switch has the following 17 settings where the P-numbers refer to the corresponding PUSH-key.

NONE or
P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11, P12, P13, P14, P15, P16

The default setting is NONE.

4.3 Communication switches

4.3.1 Send Receive Mode switch (SRM)

The Send-Receive Mode switch controls the logical connection between the TDV 2230 terminal and the host computer.

The switch has two settings: SIMULTANEOUS and TRANSPARENT.

In the SIMULTANEOUS mode, data generated on the keyboard are transmitted to the host computer and data received from the host computer are either displayed on the screen or decoded as control codes or sequences. The operation also depends on the Line/Local status (4.3.4). This is the normal mode of operation for the TDV 2230.

In the TRANSPARENT mode, the data received, whether control codes or graphics, are displayed directly on the screen, see section 3.2.

Note that XON/XOFF from host will not be shown on the screen in the transparent mode. The NOSCROLL, BREAK, CTRL Q and CTRL S keys work as in Simultaneous mode but do not give any symbol on the screen in Transparent mode.
The PRINT key will be ignored if the Printer Mode switch (4.2.10) is set to LOCAL/REM.

The default setting is SIMULTANEOUS.

4.3.2 Online switch (ONL)

This switch controls whether the terminal will react to the LINE key, or whether the LINE key is to be inactive and the unit always on-line, i.e. be prepared to send data to the host and act upon data received from the host.

The switch has two settings: ONLINE and TOGGLE.

In the ONLINE position the unit will always be on-line.

In the TOGGLE position, the unit will initially be on-line. Each subsequent operation of the LINE key will alter the status between being off-line and on-line.

The default setting is ONLINE.

4.3.3 Line Interface switch (LI)

The switch controls the mode of communication.

The switch has two settings: V.24 and V.11

When the V11 setting is selected, the modem switch is automatically forced to the INHIBIT setting on exit from the menu.
If a 20 mA current loop interface ahould be used, an optional current loop adapter must be installed, and the line interface switch must be set to V.24.

The default setting is V.24.

4.3.4 Modem switch (MOD)

The MODEM switch controls the way in which the terminal uses the modem control signals. The operation also depends on the ONLINE switch (4.3.2). Full duplex operation is always assumed.

The switch has three possible settings: LEASED, DIALLED and INHIBIT.

See Appendix A for the principles of modem operation.

The default setting is INHIBIT.

4.3.5 Transmission Handshake switch (TRH)

In certain cases the host computer may be transmitting data at a higher rate than the terminal is able to act upon them. It is therefore useful to have some kind of handshake protocol. This is done by the TRANSMISSION HANDSHAKE switch.

The switch has two possible settings: OFF and XON/XOFF

In the OFF state, the terminal cannot operate safely at high speeds if the computer does not include delays after time consuming codes or code sequences.

In the ON state, the terminal will send an XOFF when the receiver buffer becomes 3/4 full and an XON when it is emptied to 1/4. After an XOFF up to 64 characters can be sent to the terminal without risk of loss. The XON/XOFF feature is coordinated with the effect of the NOSCROLL key and CTRL S/CTRL Q codes. See section 6.3.8 for details.

The default setting is OFF.

4.3.6 Transmission Code Length switch (TCL)

This switch controls the number of data bits of each transmitted character. The switch has two settings: 7BIT and 8BIT with obvious meaning.

The default setting is 7BIT.

This switch may not be altered from the host computer.

4.3.7 Transmission Code Parity switch (TCP)

This switch controls the parity of the transmitted characters.

The switch has three possible settings: EVEN, ODD and NONE.

When the switch setting is NONE, no parity bit will be generated.

The default setting is EVEN.

This switch may not be altered from the host computer.

4.3.8 Transmission Code Stop Bits switch (TCS)

This switch controls the number of stop bits for each transmitted character.

The switch has two settings with obvious meaning: 1BIT and 2BIT.

The default setting is 1BIT.

This switch may not be altered from the host computer.

4.3.9 Transmission Speed switch (TS)

This switch controls the baud-rate in which characters are transmitted to the host.

The switch has 12 settings: 50, 75, 110, 134.5
200, 300, 600, 1200
2400, 4800, 9600 and 19200 baud.

The default setting is 9600 baud.

This switch may not be altered from the host computer.

4.3.10 Transmission Delay switch (TD)

The transmission delay switch controls if the transmission to the host should be in full transmission speed as selected or slowed down.

The switch has four settings: NONE, 20 ms, 40 ms and 60 ms.

In the NONE state, no delay between the transmitted codes is forced.

In the 20, 40 or 60 ms states, the minimum delay between two successively transmitted codes is 20, 40 or 60 milliseconds respectively.

The default setting is NONE.

4.3.11 Printer Handshake switch (PH)

This switch controls whether the printer is controlled by handshaking or not.

The switch has two settings: OFF and XON/XOFF

If the setting is OFF, data are transmitted to the printer at the rate given by the speed setting of the terminal.

When the setting is XON/XOFF, data transmission to the printer will stop after an XOFF has been received from the printer and resume after an XON.

The default setting is OFF.

4.3.12 Printer Code Format switch (PCF)

This switch controls the number of bits and the parity of the codes sent to the printer.

The switch has five settings: 7 EVEN, 7 ODD, 8 NONE, 8 EVEN, 8 ODD.

In the 7 bit state, the printer interface will be set up for two stop bits.

In the 8 bit state, the printer interface will be set up for one stop bit and the 8th bit is always zero.

In the case of 8 NONE, no parity bit will be generated.

The default setting is 7 EVEN.

4.3.13 Printer Speed switch (PS)

This switch controls the baud-rate in which characters are transmitted to the printer.

The switch has 12 settings: 50, 75, 110, 134.5
200, 300, 600, 1200
2400, 4800, 9600 and 19200 baud.

The default setting is 1200 baud.

4.4. Modes changeable from host only

The terminal has three modes which are only changeable from the host computer. These switches are not permanently stored in the non-volatile memory.

4.4.1 Cursor Key mode (CURS) (TDV 2230 private)

This is a private parameter applicable to set mode (SM) and reset mode (RM) control sequences (9.6.2). This mode is only effective when the terminal is in keypad application mode (4.4.3) and the VT52 switch (4.2.9) is set to ANSI.

Under these conditions, if the cursor key mode is reset, the four cursor function keys will send CSI cursor control commands.

If the cursor key mode is set, the four cursor function keys will send application functions.

The default setting of this mode is the reset state. The mode is only changeable from the host computer. The setting is not stored in the non-volatile memory.

4.4.2. Origin mode (OM) (TDV 2230 private)

This is a private parameter applicable to set mode (SM) and reset mode (RM) control sequences (9.6.2).

The reset state causes the origin to be at the upper-left character position on the screen. Line and column numbers are therefore independent of current margin settings (see section 9.6.2). The cursor may be positioned outside the margins with a cursor position (CUP) or horizontal and vertical position (HVP) control sequence (9.6.2).

The set state causes the origin to be at the upper-left character position within the margins. Line and column numbers are therefore relative to the current margin settings. The cursor is not allowed to be positioned outside the margins.

The cursor is moved to the new home position when this mode is set or reset.

Lines and columns are numbered consecutively, with the origin being line 1, column 1.

The default setting of this mode is the reset state. This mode is only changeable from the host computer. The setting of the mode is not stored in the non-volatile memory.

4.4.3 Keypad Numeric/Application mode (PAD) (TDV 2230 private)

This mode is applicable to private escape sequences (ESC = and ESC >).

In the reset state, the keys in the numeric pad will generate the ECMA code or the function engraved on the key.

In the set state, the keys will generate code sequences for application programs. The code sequences generated depend on the setting of the VT52 mode (4.2.9) and the CURS mode (4.4.1). See section 9.2 for codes transmitted.

The setting of this mode is not stored in the non-volatile memory.

The default setting is the reset state.

5. CONFIGURATING THE TERMINAL

Refer to section 4 for a general presentation of the switches and a detailed description of each switch. Note that when a setup session is initiated by the operator, the screen contents is lost.

5.1 Entering the Configuration menu

The setup mode is entered by pressing the MODE key on the keyboard twice while the SHIFT key is depressed. The terminal will respond by clearing the screen and displaying the configuration menu:

```
                    T D V   2 2 3 0

                  Rev. Lev. nn / mmmmmm


            C O N F I G U R A T I O N   M E N U

                  Convenience Switches
                  Function Switches
                  Communication Switches
                  PUSH-keys
                  Tabulation Rack


            Selection:  Cursor up and  down keys
            Enter:  ENTER  key   Exit:  ESC  key
```

The meaning of the parameters nn and mmmmmm are:

nn - Firmware revision level
mmmmmm - Keyboard identification

One of the lines in the menu appears in inverse video, the menu shown on this line can be set up on the screen by pressing ENTER. The inverse video line is in the following text referred to as the marker.

Valid keys in the configuration menu are:

CURSOR UP	Move the marker one line up. If the marker is at the top of the menu it will not move.
CURSOR DOWN	Move the marker one line down. If the marker is at the bottom of the menu it will not move.
CURSOR HOME	Move the marker to the first line in the menu.
ENTER	Enter the menu where the marker is presently located (see 5.2 to 5.4).
ESC	Exit from configuration menu via the configuration exit (see 5.5).
PRINT	A copy of the configuration menu is printed.

A non-valid response from the keyboard will cause the terminal to wait for a correct response and sound the bell, if enabled.

5.2 Soft-switch setup

The three menus with their default settings are shown below as they appear on the screen :

CONVENIENCE SWITCHES

Cursor Type	Line
Roll Type	Step
Key Click	On
Key Rollover	Enabled
Keyboard CAPS At Power Up	Off
Auto Repeat	On
Margin Bell	On
Status Line	On

FUNCTION SWITCHES

Time-out	On
Bell	On
High Intensity Repr.	Inv/Low
Inverse Repr.	Normal
Character Set Selection	Standard
New Line	LF
Wrap	Stop
PUSH-Key Programming	Allowed
ANSI/VT52 Mode	VT52
Printer Mode	Local/Remote
Printer Extent Mode	Split
Printer Form Feed	None
Answer-Back	None

COMMUNICATION SWITCHES

Send Receive Mode	Simultaneous
Online	Online
Line Interface	V.24
Modem	Inhibit
Transmission Handshake	Xon/Xoff
Transmission Code Length	7bit
Transmission Code Parity	None
Transmission Code Stop Bits	1bit
Transmission Speed	9600 Baud
Transmission Delay	None
Printer Handshake	Busy
Printer Code Format	7 Even
Printer Speed	1200 Baud

Fig. 5.1 Soft switch menus

5.2.1 Menu display

During Soft-switch setup one of the three menus is shown on the screen. The switches are shown with their full name and their present setting. One line appears in inverse video, the switch shown on this line can be selected for setup by pushing ENTER. The inverse video line is in the following text referred to as the marker.

An asterix "*" to the left of the present setting indicates that the temporary switch is different from the permanent switch.

5.2.2 Sub-menu display

After having selected a switch for setup, the sub-menu for that switch is shown in the lower part of the screen. The sub-menu shows all possible settings for the switch. The cursor is located at the present setting of the switch and the setting residing in non-volatile memory is displayed in inverse video.

5.2.3 Altering switches

5.2.3.1 Valid keys in the main-menus

The valid keys while in the main-menus are:

CURSOR UP	Move the marker one line up. If the marker is at the the top of the menu it will not move.
CURSOR DOWN	Move the marker one line down. If the marker is at the bottom of the menu it will not move.
CURSOR HOME	Move the marker to the first switch in the menu.
ENTER	Enter the sub-menu for the switch where the marker is presently located.
ESC	Exit from the menu and return to the configuration menu.
SHIFT.PRINT	A copy of the active menu is printed.

All other keys are ignored.

5.2.3.2 Valid keys in the sub-menus

The valid keys while in the sub-menus are:

CURSOR RIGHT — Move the cursor to the next setting to the right. If the cursor is at the rightmost setting, it will not move.

CURSOR LEFT — Move the cursor to the next setting to the left. If the cursor is at the leftmost setting, it will not move.

CURSOR HOME — Move the cursor to the leftmost setting.

ENTER — Return to the main-menu. The setting where the cursor is located will be taken as the new setting for the switch.

All other keys are ignored.

5.3 PUSH-key programming

The PUSH-keys give the user the ability to simulate a sequence of keystrokes by pushing a single key. The PUSH-keys may be used for text strings or control code sequences or both. In most cases it is possible to directly type the required sequence on the keyboard during the setup session.

In some cases the required code cannot be entered directly from the keyboard. To allow all control codes to be generated and stored on PUSH-keys, a facility for programming characters in their hexadecimal values is included, see 5.3.2.

5.3.1 PUSH-key menu display

For each PUSH-key there is a field where the desired sequence can be entered. The length of the field is indicated by underline. In front of each field, the name of the PUSH-key is shown. The maximum number of characters is:

P1 to P8 : 12 characters
P9 to P12 : 32 "
P13 to P16 : 48 "

When PUSH-keys have been programmed, their contents are displayed in the following way:

<00 - 1F> Displayed as full block.
<20 - 7F> Displayed with their normal graphic representation.
<80 - FF> Displayed as full block. See below for details.

In the lower part of the screen there is a window that at all times shows the hex value of the character in the active position.

5.3.2 Valid control keys

The following keys are used for control during PUSH-key programming:

CURSOR UP — Move cursor to the first position in the preceding field. No effect if the cursor is in the first field.

CURSOR DOWN — Move cursor to the first position in the next field. No effect if the cursor is in the last field.

CURSOR HOME — Move the cursor to the first position in the first field.

CURSOR RIGHT — Move the cursor to the right within the present field. No effect if the cursor is in the last position.

CURSOR LEFT — Move the cursor to the left within the present field. No effect if the cursor is in the first position.

SO — This key is used as a lead-in for hex code programming. The hex code for the character must follow. Both the typewriter area and the numeric pad can be used. The hex codes 00, A0-AF and F8-FF cannot be programmed into a PUSH-key string and will be ignored.

SI — When this key is pushed the next key will be included in the PUSH-key string, even if the key is normally used to control PUSH-key programming (e.g. SI). The LINE, PRINT, MODE and BREAK keys cannot be stored on PUSH-keys and will be ignored.

SHIFT.PRINT — A copy of the screen is printed.

ESC — Exit from PUSH-key programming and return to the configuration menu (see 5.1).

5.3.3 Using the typewriter area for PUSH-key programming

The typewiter area is the primary medium for programming PUSH-keys. Characters entered in this area will appear as normal characters on the screen. A PUSH-key string is terminated by the first <00> code, by the first trailing space or by the end of the string. The <00> code or first trailing space is not considered part of the string. Control codes from the C0 - set can be entered by using the typewiter keys with CTRL. Codes are according to the reference list in section 6.2.1. The control code <00> generated by CTRL @ cannot be programmed into a PUSH-key string and will be ignored.

5.3.4. Using the numeric pad for PUSH key programming

Since the PUSH-keys use the internal keyboard code, keystrokes from the numeric pad will appear as full blocks on the screen. The code transmitted will, however, be correct when the PUSH-key is pressed during normal operation. For clarity the number row of the typewriter area is to be used. If the numeric pad is used and the cursor is later set to such a position, the internal code for the key will be displayed in the code window. Be aware that if the keypad numeric mode switch is set, the codes of the numerals are not transmitted but application codes (depending on the setting of the ANSI/VT52 mode switch) will be sent instead, see section 9.2.1.

key	displayed code
0	<E0>
1	<E1>
2	<E2>
3	<E3>
4	<E4>
5	<E5>
6	<E6>
7	<E7>
8	<E8>
9	<E9>
-	<EA>
.	<EB>
,	<EC>

Table 5.1 Numeric pad internal code representation.

5.3.5 Using control keys for PUSH-key programming

The control keys listed below can be used directly during PUSH-key programming. When used, a full block will be displayed on the screen. If the cursor is later set to such a position, the internal code for the key will be displayed in the code window.

key	displayed code
CR	<CD>
LF	<9A>
ENTER	<ED>
CSI	<9B>
ERASE PAGE	<F0>
ERASE LINE	<F2>
TAB RIGHT	<99>
BACKSPACE	<EE>

Table 5.2 Control keys internal code representation (part 1).

The following keys can be used for PUSH-key programming if preceded by an SI. The display of the codes given below is as specified above.

key	displayed code
CURSOR UP	<B1>
CURSOR DOWN	<B2>
CURSOR HOME	<B8>
CURSOR RIGHT	<B3>
CURSOR LEFT	<B4>
SO	<CE>
SI	<CF>
ESC	<DB>

Table 5.3 Control keys internal code representation (part 2).

Be aware that the terminal transmits different codes depending on the ANSI/VT52 (4.2.9) mode switch and the Cursor Key mode (4.4.1). See section 9.2.1 for codes transmitted.

5.4. Tabulation rack setup

The menu for the tabulation rack is different from the other menus. The bottom line is underlined to show the extent of the line and present tab settings are marked with "+".

5.4.1 Valid keys in the tabulation rack setup

While the tabrack menu is displayed, the current cursor position is shown on the screen.

The valid keys while in the tabrack sub-menu are:

->	Move the cursor one position to the right. If the cursor is at the end of the line, it will not move.
<-	Move the cursor one position to the left. If the cursor is at the beginning of the line, it will not move.
->|	Move the cursor to the next tabulation stop to the right. If the cursor is at the end of the line, it will not move.
|<-	Move the cursor to the next tabulation stop to the left. If the cursor is at the beginning of the line, it will not move.
SPACE	If the current position contains a tab it will be cleared. Cursor movement is as for CURSOR RIGHT.
ESC	Exit from tabulation rack setup and return to the configuration menu (see 5.1).

All keys except those listed above will cause a tab to be set at the current cursor position. Cursor movement is as for CURSOR RIGHT.

5.5 Configuration Exit

The configuration exit shown below is entered by pressing the ESC key in the configuration menu :

```
                T D V    2 2 3 0

              Rev. Lev. nn / mmmmmm


        C O N F I G U R A T I O N    E X I T

           Make Switches Permanent
           Reset to Initial Switches
           Make Tabulation Rack Permanent
           Reset to Initial Tabulation Rack


        Selection:  Cursor up and  down  keys
        Enter:  ENTER  key    Exit:  ESC  key
```

The meaning of the parameters nn and mmmmmm are:

nn - Firmware revision level
mmmmmm - Keyboard identification

Valid responses from the keyboard are:

CURSOR UP	Move the marker to the next preceding line, if any
CURSOR DOWN	Move the marker to the next following line, if any
CURSOR HOME	Move the marker to the first line
ENTER	Writes "yes" to the right of the marker line the first time it is depressed and clears it when depressed the next time.
ESC	Exit from the configuration exit and return to normal operation.The questions which are then answered with "yes" are performed. (see below)
SHIFT.PRINT	A copy of the configuration exit is printed

All other keys are ignored.

If the answer of the question "Make Switches Permanent" is yes, the temorary switches will be transferred to non-volatile memory and made permanent.

If the answer of the question "Reset to Initial Switches" is yes, the temorary switch values will be overwritten by the switch values from the non-volatile memory. It makes no sense, and thus it is not possible to answer "yes" at both "Make Switches Permanent" and "Reset to Initial Switches".

Similar handling applies to the other pair of questions.

6. KEYBOARD

The keyboard converts keystrokes into 8 bit codes for transmission to the terminal in a serial form. The terminal will either transfer a keyboard code directly to the line, convert it to another code or code sequence before transmission or use it to activate a local function in the terminal itself.

The keyboard reacts to certain commands from the terminal. The commands turn LEDs on or off, or sound the bell etc. Since the actions taken by the terminal on received codes are described in detail elsewhere in this document, this section will be dedicated to giving information on transmitted codes and to giving cross references to other parts of this document that contain information related to the keys in one way or the other.

6.1 Keyboard layout

The international version of the keyboard layout is shown in fig. 6.1 below. The keyboard is also available in different national versions.

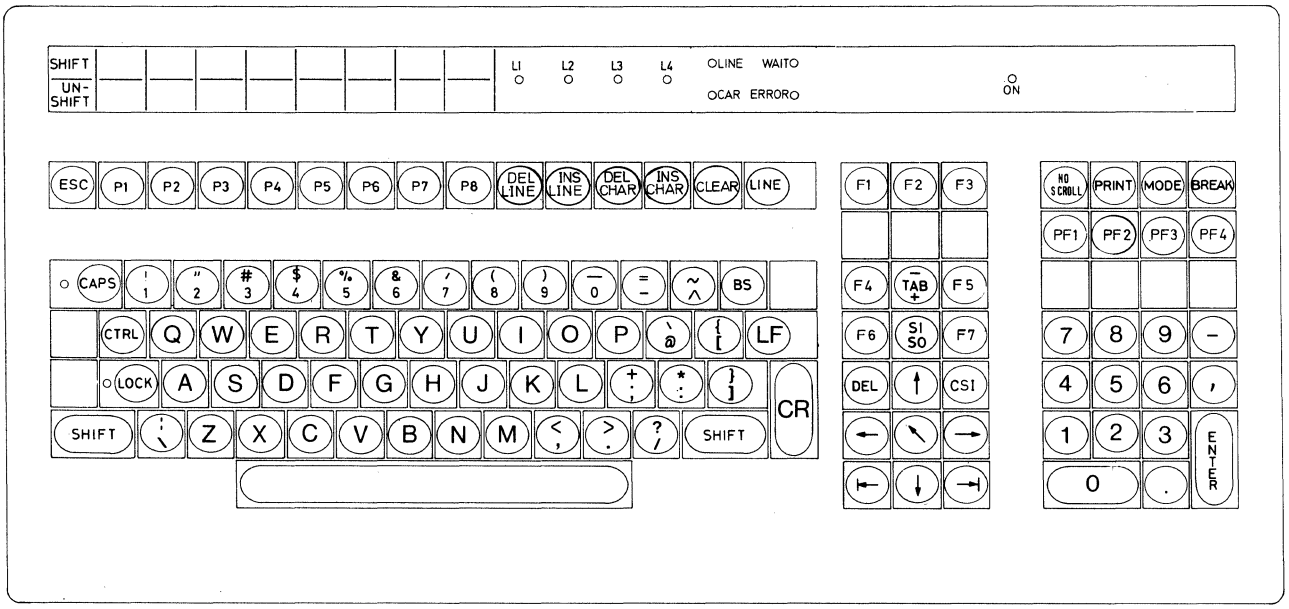


Fig. 6.1 Keyboard layout.

6.2 Typewriter area and numeric pad

The terminal uses standard ASCII coding for these keys.

The typewriter area of the keyboard will generate lower case letters or characters indicated on the lower part of the keytops when SHIFT is not pushed and the LOCK indicator is unlit. With SHIFT pushed or with the LOCK indicator on, upper case letters or characters indicated on the upper part of the keytops are generated.

The CAPS key enables upper case letters to be generated without depending on SHIFT and LOCK while the typewriter number keys and other keys having two symbols work under control of SHIFT. All keys in the typewriter area and the numeric pad have automatic repeat capability. This feature can be disabled by the Auto Repeat switch in the Convenience switch menu (4.1.6).

Table 6.1 is a symbol to transmitted code reference for these keys.

	<20>	@	<40>	`	<60>		
!	<21>	A	<41>	a	<61>		
"	<22>	B	<42>	b	<62>		
#	<23>	C	<43>	c	<63>		
$	<24>	D	<44>	d	<64>		
%	<25>	E	<45>	e	<65>		
&	<26>	F	<46>	f	<66>		
'	<27>	G	<47>	g	<67>		
(	<28>	H	<48>	h	<68>		
)	<29>	I	<49>	i	<69>		
*	<2A>	J	<4A>	j	<6A>		
+	<2B>	K	<4B>	k	<6B>		
,	<2C>	L	<4C>	l	<6C>		
-	<2D>	M	<4D>	m	<6D>		
.	<2E>	N	<4E>	n	<6E>		
/	<2F>	O	<4F>	o	<6F>		
0	<30>	P	<50>	p	<70>		
1	<31>	Q	<51>	q	<71>		
2	<32>	R	<52>	r	<72>		
3	<33>	S	<53>	s	<73>		
4	<34>	T	<54>	t	<74>		
5	<35>	U	<55>	u	<75>		
6	<36>	V	<56>	v	<76>		
7	<37>	W	<57>	w	<77>		
8	<38>	X	<58>	x	<78>		
9	<39>	Y	<59>	y	<79>		
:	<3A>	Z	<5A>	z	<7A>		
;	<3B>	[	<5B>	{	<7B>	ä	
<	<3C>	\	<5C>	|	<7C>		
=	<3D>	]	<5D>	}	<7D>	ü	
>	<3E>	^	<5E>	~	<7E>	ß	
?	<3F>	_	<5F>	DEL	<7F>		

Table 6.1 Symbol to transmitted code reference.

6.2.1 Generating control codes by CTRL key

By pressing keys in the typewriter area simultaneously with the CTRL key, all codes in the range <00 - 1F> can be generated:

<00>	CTRL @,	CTRL `,	CTRL SPACEBAR
<01>	CTRL A,	CTRL a	
<02>	CTRL B,	CTRL b	
<03>	CTRL C,	CTRL c	
<04>	CTRL D,	CTRL d	
<05>	CTRL E,	CTRL e	
<06>	CTRL F,	CTRL f	
<07>	CTRL G,	CTRL g	
<08>	CTRL H,	CTRL h	
<09>	CTRL I,	CTRL i	
<0A>	CTRL J,	CTRL j	
<0B>	CTRL K,	CTRL k	
<0C>	CTRL L,	CTRL l	
<0D>	CTRL M,	CTRL m	
<0E>	CTRL N,	CTRL n	
<0F>	CTRL O,	CTRL o	
<10>	CTRL P,	CTRL p	
<11>	CTRL Q,	CTRL q	
<12>	CTRL R,	CTRL r	
<13>	CTRL S,	CTRL s	
<14>	CTRL T,	CTRL t	
<15>	CTRL U,	CTRL u	
<16>	CTRL V,	CTRL v	
<17>	CTRL W,	CTRL w	
<18>	CTRL X,	CTRL x	
<19>	CTRL Y,	CTRL y	
<1A>	CTRL Z,	CTRL z	
* <1B>	CTRL [,	CTRL {	
* <1C>	CTRL \,	CTRL |	
* <1D>	CTRL],	CTRL }	
* <1E>	CTRL ^,	CTRL ~	
* <1F>	CTRL _		

* subject to national variations

Table 6.2 Generating control codes by CTRL key.

The repeat feature is always disabled by the CTRL key.

6.2.2 Numeric pad

The numeric pad is located at the right side of the keyboard. The codes generated by these keys depend on the numeric pad mode and the ANSI/VT52 mode switch.

Normally these keys will transmit the codes for the numerals, decimal point, minus sign, and comma. In addition, the key labelled ENTER transmits the same code as the CR key. The host cannot tell whether these keys were typed on the numeric keypad or on the corresponding keys on the main keyboard part. Therefore software which requires considerable numeric data entry need not be rewritten to use the numeric pad.

However, if software must distinguish between pressing a key on the numeric keypad and pressing the corresponding key on the main keyboard part, the host can give the terminal a command to place it in keypad application mode. In keypad application mode all keys on the numeric keypad give unique control sequences indicating some special actions to be initiated by the host.

The codes sent by the numeric pad for the various combinations of the ANSI/VT52 mode and the keypad numeric/application mode are shown below.

Key	Numeric mode both ANSI and VT52	Keypad appl.mode VT52 mode	Keypad appl.mode ANSI mode
0	0 <30>	ESC ? p <1B 3F 70>	ESC O p <1B 5F 70>
1	1 <31>	ESC ? q <1B 3F 71>	ESC O q <1B 5F 71>
2	2 <32>	ESC ? r <1B 3F 72>	ESC O r <1B 5F 72>
3	3 <33>	ESC ? s <1B 3F 73>	ESC O s <1B 5F 73>
4	4 <34>	ESC ? t <1B 3F 74>	ESC O t <1B 5F 74>
5	5 <35>	ESC ? u <1B 3F 75>	ESC O u <1B 5F 75>
6	6 <36>	ESC ? v <1B 3F 76>	ESC O v <1B 5F 76>
7	7 <37>	ESC ? w <1B 3F 77>	ESC O w <1B 5F 77>
8	8 <38>	ESC ? x <1B 3F 78>	ESC O x <1B 5F 78>
9	9 <39>	ESC ? y <1B 3F 79>	ESC O y <1B 5F 79>
-(line)	- <2D>	ESC ? m <1B 3F 6D>	ESC O m <1B 5F 6D>
,(comma)	, <2C>	ESC ? l <1B 3F 6C>	ESC O l <1B 5F 6C>
.(period)	. <2E>	ESC ? n <1B 3F 6E>	ESC O n <1B 5F 6E>
ENTER	CR<0D>	ESC ? M <1B 3F 4D>	ESC O M <1B 5F 4D>

These codes will be echoed in keypad numeric mode only. The codes generated in keypad application mode will if echoed, cause the last letter (p-M) to appear on the screen.

6.3 Control Keys

6.3.1 Cursor control keys

These keys are mainly located in the cursor control group on the right hand side of the keyboard. The keys CR and LF are located on the right hand edge of the main part of the keyboard.
The ENTER-key is located on the right hand side of the numeric pad on the right hand edge of the keyboard. The backspace key is located at the right in the upper row of the typewriter area.

These keys will have the same effect regardless of whether the keyboard is in lower case or upper case mode.

The cursor left, cursor right, cursor down and cursor up will generate different codes depending on which modes are currently set in the terminal. The codes depend on the setting of the numeric pad mode, cursor key mode and the ANSI/VT52 mode. The code generated by the cursor home key is not affected by these modes.

Below are shown the codes generated by the keys:

	VT52 mode	ANSI mode curs. key mode reset	ANSI mode curs. key mode set
CURSOR LEFT	ESC D	ESC [D	ESC O D

This key will if echoed in VT52 or ANSI mode with cursor key mode reset, move the cursor one position to the left. If the cursor already is at the left edge of the screen, the key will have no effect. If pressed in ANSI mode while the cursor key mode is set, a D will appear on the screen if the sequence is echoed by the host.

CURSOR UP	ESC A	ESC [A	ESC O A

This key will if echoed in VT52 or ANSI mode with cursor key mode reset, move the cursor to the same horizontal position on the preceding line. If the cursor already is at the top margin, the key will have no effect. In ANSI mode and cursor key mode set, an A will appear on the screen if the sequence is echoed by the host.

CURSOR DOWN	ESC B	ESC [B	ESC O B

This key will if echoed in VT52 or ANSI mode with cursor key mode reset, move the cursor to the same horizontal position in the following line. If the cursor already is at the bottom margin, the key will have no effect. In ANSI mode and cursor key mode set, a B will appear on the screen if the sequence is echoed by the host.

CURSOR RIGHT ESC C ESC [C ESC O C

This key will if echoed in VT52 or ANSI mode with cursor key mode reset, move the cursor one position to the right. If the cursor already is at the right edge of the screen, the key will have no effect. In ANSI mode and cursor key mode set, a C will appear on the screen if the sequence is echoed by the host.

CURSOR HOME ESC H ESC [H ESC [H

This key will if echoed, move the cursor to the home position in all modes. If the cursor already is in the home position, the key will have no effect.

The codes generated by the CR key and the ENTER key in keypad numeric mode depends on the New Line switch.

	New Line reset	New Line set
CR	<0D> (CR code)	<0D 0A> (CR LF codes)

If echoed, the action of this key depends on the setting of the NEL-switch. If the NEL-switch is in the LF position (reset mode), the cursor will move to the first position on the current line. If the NEL-switch is in the CRLF position (set mode), the cursor will be moved to the first position on the next line. See below.

ENTER	<0D> (CR code)	<0D 0A> (CR LF codes)

If echoed, with keypad in numeric mode, the action of this key is equal to the action taken on the CR-key, see above.

If pressed with keypad in application mode the code generated depends on the ANSI/VT52 mode switch. If these codes are echoed, an M will appear on the screen.

Application mode:
ANSI mode: ESC O M
VT52 mode: ESC ? M

LF <0A>

If echoed, the action of this key depends on the New Line switch.
In the LF (reset) state, the cursor is moved to the same character position on the following line. If the cursor is at the bottom line, an automatic roll up will occur, a "new" blank line is added at the last data line, and the cursor is positioned to the same character position on that line.
In the CRLF state, a cursor return is performed in addition i.e., the cursor is moved to the beginning of the line.

BACKSPACE <08> (located in the main pad)

If echoed, this key will move the cursor one position to the left. At the beginning of the line, no action is performed. When moving away from the 72nd position, the bell will sound if the margin bell switch is on.

6.3.2 Sequence introducers

ESC and CSI

The ESC key is located left to the PUSH-keys and the CSI key is located above the cursor control row at the right hand side of the keyboard.

These keys will have the same effect regardless of whether the keyboard is in lower case or upper case.

ESC <1B>

This key is used to start a so-called "Escape-sequence". The key must be followed by a code selected from rows 4 thru 7 (except DEL, 7/15), which determines the actual operation to be performed. Use of rows 4 and 5 are standardized, indicating a character from the C1-set (additional control set of the ECMA 8-bit code). The final characters to be used to form each of the characters in the C1-set are given in section 9.5.

	VT52 mode	ANSI mode
CSI	ignored (no code gen.)	ESC [<1B 5B>

This key is used to start a control sequence. It may be followed by zero, one or up to 10 parameters. These parameters are expressed by codes selected from row 3 of the ECMA 7-bit character set, and have the following meaning:
A digit (0 through 9) will be interpreted as a parameter.
A semicolon (;)(<3B> = 3/11) will be interpreted as a parameter separator.

The operation to be performed is determined by the final code, which must be selected from rows 4 through 7 of the ECMA code. Rows 4 through 6 represent final codes which have been standardized by ECMA, while row 7 is available for private use.

6.3.3 Local Controls

This key is located in the upper right hand part of the control key row.

MODE — No code transmitted

This key is used (if pressed twice in shift) to enter the configuration menu, see section 5.

If the key is depressed only once, i.e. followed by another key, both keys will be ignored.

6.3.4 Tabulation

The tabulation set/clear keys are located in the upper control block to the left of the main keyboard part while the tabulation keys are located in the cursor control block.
Tab set is unshifted, tab clear is shifted and the tabulation keys are the same both shifted and unshifted.

Tab set and tab clear only work on the temporary tabulation rack. Only the tabulation rack setup can make a temporary tabulation rack permanent (Ref. 5.4).

The response to these keys depends on the ANSI/VT52 mode switch.

	VT52 mode	ANSI mode
TAB +	ignored (no code gen.)	ESC H

This key will if echoed, cause a tabulation stop to be set at the current position. The tabulation stop will have effect for all lines.

TAB -	ignored (no code gen.)	ESC [g

This key will if echoed, cause a tabulation stop, if present, to be cleared from the present position. This will have effect for all lines.

TAB ->	<09>	<09>

This key will if echoed, cause the cursor to move to the next tabulation stop on the line. If no such tab stop exists, the cursor will move to the last character on the line.

TAB <-	ignored (no code gen.)	an appropriate number of cursor left commands (CSI D)

This key will if echoed, cause the cursor to move to preceding tabulation stop on the line. If no such tab stop exists, the cursor will move to the first character on the line.

6.3.5 Printer Control

This key is located in the control block in the upper right edge of the keyboard. It operates only in upper case (shifted).

PRINT (shift) ESC [i <1B 5B 69>

If echoed, this key will cause a printout depending on the Printer Mode switch (4.2.10). See section 7.4.

6.3.6 Character set control

These keys are located in the upper control block on the right side of the main keyboard. SI is shifted and SO unshifted. The keys will if echoed, invoke the current selected G0 and G1 character sets. These keys will be ignored in VT52 mode.

A detailed description on how to select character sets is given in section 7.2.

SI <0F>

If echoed, this key indicates that subsequent data entered are from the currently invoked G0 character set, until SO is encountered.

SO <0E>

If echoed, this key indicates that subsequent data entered are from the currently invoked G1 character set until SI is encountered.

6.3.7 Interface Control

These keys control the transmission interface of the terminal. LINE is located in the right hand part of the control row above the typewriter area, while the BREAK key is located in the upper control block at the right hand edge of the keypad.
LINE has the same effect both shifted and unshifted.

LINE not transmitted

This key will toggle the internal on-line/off-line switch. The key will only be active when the ONLINE switch (4.3.2) is in the TOGGLE position.
This key sets the terminal in Line/Local.
In Line mode the Line LED will be on. In Local mode the Line LED will be off. The action taken locally is also dependent on the Modem switch (4.3.4). The key also cancels the effect of the NOSCROLL key. If the display of the text is stopped by the NOSCROLL key, it will start again after pressing the LINE key twice.

BREAK not transmitted

Typing this key causes the transmission line to be forced to its zero state for about 0.2 seconds. If also the shift key is down, the time is increased to 3.5 seconds. Data Terminal Ready (DTR) is also deasserted during this interval. At the end of the 3.5 seconds interval DTR will again be asserted.

These keys are all non-repeating.

6.3.8 Noscroll key

When the Noscroll key is pressed, receiving of characters from the host is immediately stopped. When pressed again, the receiving is resumed. If the transmision continues, XOFF will be sent to the host when the recieve buffer is 3/4 full. In practice, if the host recognizes XOFF, the host will stop transmitting until the noscroll key is pressed again to allow further display. If the handshake switch (4.3.3) is in the OFF position, the Noscroll key has no effect.

The key is coordinated with the CTRL S/CTRL Q feature which enables the operator to start and stop the display of characters respectively.

It is also coordinated with the receive buffer handshake operation.

6.3.9 CTRL BREAK

This key causes the answerback message to be sent.

6.3.10 CLEAR key

This key enables the recovery from erroneous situations. Its depression causes the ESC c (RIS) command to be executed, which resets the terminal to the initial state after power up. The key remains operational in most situations. However, one must note the following: in case that the key is depressed when the status line is switched off and there is a diagnostic available, this will first appear in the status line and only the subsequent depressing of the CLEAR key will invoke its normal action.

6.4 PUSH-keys

The PUSH-keys are marked P1 to P8 and are located on the left hand side above the typewriter area of the keyboard.

These keys enable the operator to transmit text strings or code sequences by pushing a single key. The 8 PUSH-keys work in both shift and unshift, thus allowing 16 different strings or code sequences to be used. See section 5.3 for details.

6.5 Function keys

The terminal has four program function keys located above the numeric pad. These keys generate codes depending on the ANSI/VT52 mode switch. (No action is taken when corresponding codes are received.) In ANSI mode P,Q,R or S respectively will be shown on the screen, if the codes are echoed.

	VT52 mode	ANSI mode
PF1	ESC P <1B 50>	ESC O P <1B 4F 50>
PF2	ESC Q <1B 51>	ESC O Q <1B 4F 51>
PF3	ESC R <1B 52>	ESC O R <1B 4F 52>
PF4	ESC S <1B 52>	ESC O S <1B 4F 53>

In addition, the terminal also features seven function keys (F1-F7) located above the cursor control group. These keys extend the set of program function keys and generate the following codes depending on whether the terminal operates in the VT52 or ANSI mode:

key	VT52 mode	ANSI mode
F1	ESC T <1B 54>	ESC O T <1B 30 54>
F2	ESC U <1B 55>	ESC O U <1B 30 55>
F3	ESC V <1B 56>	ESC O V <1B 30 56>
F4	ESC W <1B 57>	ESC O W <1B 30 57>
F5	ESC X <1B 58>	ESC O X <1B 30 58>
F6	ESC Y <1B 59>	ESC O Y <1B 30 59>
F7	ESC Z <1B 5A>	ESC O Z <1B 30 5A>

6.6 Keyboard indicators

The keyboard has nine indicator LEDs above the typewriter area

6.6.1 Host controlled indicators

Four of the LEDs are programmable from the host. The LEDs are activated by a CSI-sequence from the host. The LEDs may be turned on or off. They are marked L1, L2, L3 and L4.

6.6.2 Modem status indicators

Three LEDs are used to indicate the present status of the modem connection.

The WAIT - indicator is on when the terminal tries to go online, but the modem does not respond properly.

The LINE - indicator is on when the terminal is online.

Note: If both WAIT and LINE are off, this implies that the terminal is in the LOCAL mode, i.e. characters from the keyboard are not transmitted but looped back to the display.

The CARRIER - indicator shows the present state of the carrier detect signal (CT109) from the modem.

6.6.3 Error indicator

This indicator blinks when a terminal malfunction is detected during the self-test in the power up sequence or is continuously lit when an error situation occurs during normal operation.

6.6.4 Power indicator

The power indicator is on whenever the terminal is turned on.

6.7 Audible Indicators

There are three audible alarms associated with the TDV 2230: a short tone (click), a long tone (bell) and series of bells.

CLICK - The short tones are sounded by the terminal whenever a key is presed, with the following exceptions:

- SHIFT and CTRL keys do not generate any keyclick because these keys instead of transmitting codes only modify the codes transmitted by other keys.
- Keyboard Locked statement appears on the status line: in which case the characters typed are lost.
- The key-click feature has been turned off in the menu.

BELL - The long tone is sounded by the terminal to indicate one of the following conditions:

- A bell code is received from the host.
- The cursor is eight characters away from the right margin and the margin bell feature is enabled in the menu.

Series of long tones - The terminal will sound the long tone in rapid succession to indicate that the non-volatile memory had difficulty in reading or writing the switch-settings. The message "EAROM read-write error. Call the system operator" will appear in the status line. Hitting any key will stop the bell sound. The terminal cannot be used until serviced.

6.8 Auto Repeat

The typewriter keys, keys in the numeric pad and the four linear cursor control keys will repeat if they are kept depressed for about 0.8 sec. The repeat can be disabled for the entire keyboard by the auto repeat switch (4.1.6).

6.9 Security Locks

Two security locks, available as options, can be mounted in the keyboard.

Lock 1

Lock 1 will prevent unauthorized personnel from setting up soft-switches and PUSH-keys. The Function switch and the Communication switch menus can only be entered when the lock is opened by the appropriate key. PUSH-key programming is protected by a switch in the Function switch menu.

Entering the Convenience switch menu is independent of the lock.

Lock 2

Lock 2 will prevent unauthorized personnel from using the terminal. When the lock is installed, the terminal will function only if the lock is open. If the terminal is locked during operation, the display will be turned off and no input from keyboard or host will be accepted.
When unlocked, the display will be turned on unchanged, and the terminal will be ready for normal operation.

6.10 Magnetic card reader

The magnetic card reader (MCR) supporting both ABA and SIPASS formats of badgers is implemented (the card reader itself is a keyboard option) - see below for communication syntax.

The magnetic card reader control

Host to terminal sequences:

DCS M 0 ST	= set MCR off
DCS M 1 ST	= set MCR on
DCS M 2 ST	= MCR status requested (see DCS M 2 below for response)

Terminal to host sequences:

DCS M 0 ST	= card has been removed (unsolicited report)
DCS M 2 0 ST	= MCR not installed
DCS M 2 1 ST	= MCR installed
DCS M 3 string ST	= card has been read, string is its contents. Every byte of the card contents is passed as two hexadecimal digits in ASCII form comprising its binary value, e.g. letter A is transmitted as digits 4 and 1, code value 127 comes as 7 and F etc.
DCS M 9 code ST	= error during read operation, code may be one of the following:

1	meaning	timeout
2	meaning	card speed too slow
3	meaning	card speed too fast
4	meaning	format error
5	meaning	overrun error
9	meaning	one minute timeout

Note:

DCS stands for Device Control String (ESC P i.e. <1B><50>)

ST stands for String Terminator (ESC \ i.e. <1B><5C>)

7. NOTES FOR THE SYSTEM PROGRAMMER

7.1 Status report

In certain applications it may be useful that the terminal is able to report back to the computer the current cursor position. This function has the following code sequence:

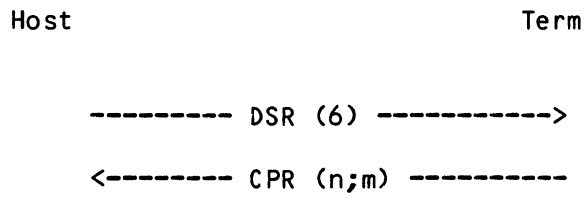


Fig. 7.1 Cursor report protocol.

Where n (1-25) is current line number and m (1-80) is current character position, n and m are ASCII coded decimal numbers. See sections 9.6 and 9.3.2 DSR and CPR explanation.

7.2 Using the special character set

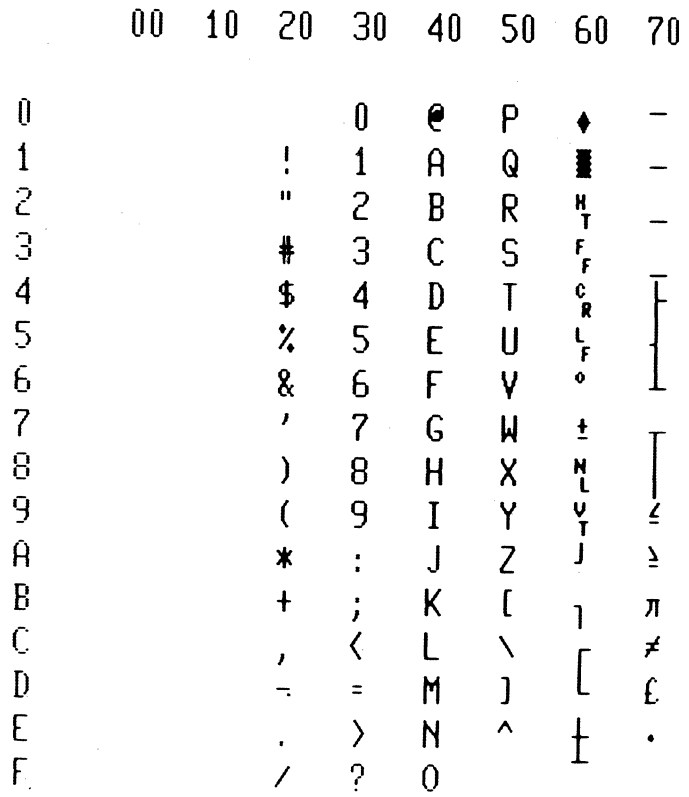
The TDV 2230 terminal is delivered in its basic version with two different character sets.

Standard character set:

	00	10	20	30	40	50	60	70
0				0	@	P	`	p
1			!	1	A	Q	a	q
2			"	2	B	R	b	r
3			#	3	C	S	c	s
4			$	4	D	T	d	t
5			%	5	E	U	e	u
6			&	6	F	V	f	v
7			'	7	G	W	g	w
8			)	8	H	X	h	x
9			(	9	I	Y	i	y
A			*	:	J	Z	j	z
B			+	;	K	[	k	{
C			,	<	L	\	l	¦
D			-	=	M	]	m	}
E			.	>	N	^	n	~
F			/	?	O	_	o	

Special graphic character set:

Note that the 32 special graphics characters have replaced the characters <5F> (underline) to <7E> (~).



Both character sets can be designated as G0 and G1 character sets through the following escape sequences called SCS sequences (9.5.1):

ESC (A or B sets the standard character set as G0

ESC) A or B sets the standard character set as G1

ESC (0 sets the special character set as G0

ESC) 0 sets the special character set as G1

Special graphics means that the characters for the codes <5F-7E> are replaced by the special graphic characters. The specified character set will be used until another SCS is received.

The G0 and G1 sets are invoked by the codes SI and SO (shift in and shift out) respectively.

After power-up the standard character set is designated as both the G0 character set and the G1 character set.

The TDV 2230 may be delivered with an extra character generator which is organized in the same way as the standard character generator, i.e. it has an alternate standard character set and an alternate special graphic character set. All combinations of these four character sets may be designated as the G0 and G1 character sets.

A summary of the SCS sequences is given below:

G0 sets sequences	G1 sets sequences	Meaning
ESC (A or B	ESC) A or B	ECMA set
ESC (0	ESC) 0	Special graphics
ESC (1	ESC) 1	Alternate character ROM standard character set
ESC (2	ESC) 2	Alternate character ROM Special graphics

TDV 2230 will be delivered with the ECMA character set, which is identical to the ASCII character set. However, the £ (pound sign) is available in the standard special graphic character set.

7.3 Switch setting from the host computer

When power is turned on, the switches residing in the non-volatile memory are copied into RAM. The RAM copies are referred to as temporary switches. Most of the temporary switches can be altered by the host computer at any time by using the SM and RM codes (sec. 9.6.2). Note, however, that if the operator enters the setup mode (sec. 5.1), the temporary switches are used as a basis and the non-volatile memory can be specified by the operator to be updated when an exit from the setup mode is done.

This effect can be used to initialize the switch setting for a number of switches with minimum operator intervention.

Application programs may dynamically alter the temporary versions of the switches, but then care should be taken by the operator to avoid unintentional altering of the non-volatile memory.

By host controlled setup, the RM code will set the specified switch to the default setting while SM will increment the setting according to the table given in the description of SM in section 9.6.2. Several (max. 15) switches can be reset by one RM command and several (max. 15) increments can be done by one SM command. The increments in one SM command can affect the same switch or different switches.

Example:

Assume that an application program requires the following switch settings:

New Line switch	CRLF	(no. 20)
Print Mode switch	LOG	(no. 69)

All other switches are known to be set properly by previous setup sessions.

To get a known state for the above switches they are reset by an RM command:

CSI	2	0	;	6	9	l (letter l)
<1B><5B>	<32>	<30>	<3B>	<36>	<39>	<6C>

The CR switch needs one increment and the Printer Mode switch needs two increments each to get to the proper setting. This is done by the following SM command:

CSI	2	0	;	6	9	;	6	9	h
<1B><5B>	<32>	<30>	<3B>	<36>	<39>	<3B>	<36>	<39>	<68>

7.4 Initiating printouts from the host computer

Two types of printouts can be initiated from the host computer when the Printer Mode switch (4.2.10) is set to REMOTE or LOCAL/REMOTE.

- Hard copy where the contents of the screen is transferred to the printer.
- Relay where the terminal serves as a speed convertor between the line and the printer.

The host can also set the terminal to the LOG mode where all transactions on the terminal are transferred to the printer.

7.4.1 Hard copy

Complete printouts of the screen can be initiated from the host computer If the terminal does not have the optional print buffer installed, it is blocked for all input during the entire printing period. If the print buffer is installed, it is only blocked for a few milliseconds while it transfers data to the buffer. In either case, it signals that it is unable to accept input from the host by sending XOFF and that it again becomes ready by sending XON to the host computer. Fig. 7.2 shows the events that take place during a printing session. Note that the XON/XOFF in this case is independent of the Handshake switch (4.3.3).

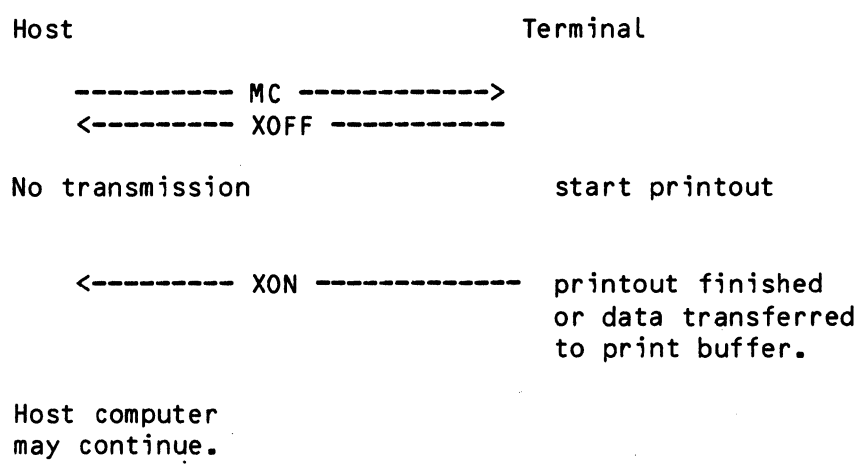


Fig. 7.2 Host-initiated hard copy protocol.

The following characters are sent to the printer in addition:

FF FORM FEED <0C>
This code is sent depending on the function switch Printer Form Feed.

CRLF Cursor Return Line Feed <0D> <0A>
These codes are sent at the end of each line.

Only characters from the range <20 - 7E> are transmitted, semigraphic characters are converted to SPACE.

Double-width characters are printed as normal characters, but at double spacing.

All other graphic renditions are ignored and the characters are printed as normal characters.

Trailing SPACEs are ignored.

7.4.2 Relay printing

When the terminal receives an MC(5), all data received from the line are transferred directly to the printer without affecting the screen contents. The only exception is MC(4) which will set the terminal back to normal operation. Data entered from the keyboard are transmitted to the host computer. To avoid overrun problems if the print speed is lower than the line speed, it is recommended that the Transmission Handshake switch (4.3.5) be set to XON/XOFF.

7.4.3 Parallel printing

When the Printer Mode switch (4.2.10) is set to LOG, lines are transferred to the printer as the cursor leaves them. This feature is useful for logging all transactions taking place on the terminal. To avoid overrun problems if the print speed is lower than the line speed, it is recommended that the Transmission Handshake switch (4.3.5) is set to XON/XOFF.

The PM swith can be set to the LOG state either through function switch menu or by the host computer sending SM codes. See sections 5, 7.3 and 9.6.2 for details.

The characters sent to the printer follow the same rules as for Hard Copy except that FF is never sent and that CRLF is transmitted whenever the cursor leaves a line for other reason than end of line wrap or a rollup or rolldown occurs. In that case the line that the cursor has just left is printed.

7.5 Loading PUSH-keys from the host computer

The PUSH-keys can be loaded from the host computer by Device control strings (DCS), in the following format:

DCS P XX AA BB CC DD EE ST
(spaces are included for clarity only)

where

DCS	ESC P<50>
P	letter P for PUSH <50>
XX	two decimal digits giving numbers in the range 01 to 16 to specify the PUSH-key to be loaded.
AA BB CC DD EE FF	hex value represented by two ASCII digits (<30> to <39> and <41> to <46> or <61 to 66>) for each character to be loaded.
ST	string terminator ESC \<5C>

The number of characters loaded must not exceed the capacity of the specified PUSH-key.

P1 to P8 : 12 characters
P9 to P12 : 32 characters
P13 to P16 : 48 characters

If this rule is violated, the indicated PUSH-key remains unchanged.

Example:

Load the word "Data" to PUSH-key no 5.

ESC	P	P	05	D	a	t	a	ESC	\
<1B>	<50>	<50>	<30><35>	<34><34>	<36><31>	<37><34>	<36><31>	<1B>	<5C>

During the actual storing of a PUSH-key string received from host with the aid of the device control string DCS P, the TDV 2230 will stop transmission from the host with XOFF/XON when the Transmission Handshake switch is set to "XON/XOFF". This is done because the interupt system is disabled for fairly long periods for each character saved in the EAROM. Heavy transmission from the host following a PUSH-key load code sequence from host may cause loss of characters when the Transmission Handshake switch is set to "OFF".

Refer to sections 5.3 and 6.4 for additional details on PUSH-keys programming and use.

7.5.1 Errors in PUSH-key loading

The following error conditions can occur:

- Not 'P' after ESC P
- The PUSH-key number is out of range.
- The PUSH-key string exceeds allowable length.
- ASCII characters outside the ranges 0-9 and A-F (or a-f) are received during PUSH-key contents specification. The hex values A0-AF and F8-FF are illegal in a PUSH-key string and cannot be stored.
- The number of hex coded ASCII characters during PUSH-key contents specification is odd.
- Improper termination.

In either of these cases, no PUSH-key loading takes place. Characters following the detection of the error are considered as ordinary characters and displayed on the screen or decoded as control characters.
The hex codes 00, A0-AF and F8-FF will cause termination of the PUSH-key loading of the string, and the current position and the rest of the PUSH-key are set to 00.

After sending a PUSH-key load code sequence to the TDV 2230 a delay must be generated if no hanshake is used.The delay is calculated by allowing 40 ms per character loaded into the PUSH-key by the sequence.

In case that the TDV 2230 fails to program the non-volatile memory during PUSH-key loading, the bell will sound continuosly to alert the operator attention and the message :

"EAROM read-write error. Call the system operator"

appears at the status line. The bell goes off as soon as any key is depressed but the terminal cannot be used until serviced.

7.6 Using XON/XOFF handshake

Modern terminals are able to perform complex, but time consuming operations. To allow these functions to be executed without risk of receive buffer overflow even at high baud rates, XON/XOFF handshake is used.

XON/XOFF handshake is a simple means of providing the transmitting end of a communication link with information about the receiver's ability to receive information.

When using the XON/XOFF handshake, the TDV 2230 can handle baud rates up to 19200. This mode of operation ensures that the terminals resources are utilized to the maximum during periods of heavy traffic.

If a printer is attached and the printer is used for relay printing, XON/XOFF is normally necessary between terminal and host, otherwise the terminal-host-speed is dictated by the print speed.

Using XON/XOFF both between terminal and host and terminal and printer ensures maximum utilization of communication link, terminal and printer.

7.7 Setting double height line from the host computer

The TDV 2230 cannot display characters in double height. Since this is hardly acceptable in number of applications, a substitute representation is made available which uses two adjacent lines as follows:

the upper line contains the related string in elongated form, while the lower line contains full block padding underneath all nonblank characters of the upper line as well as under the intervening blanks. The full blocks are normally in reverse video. However, they become blank within a reverse video context so that what is to be a double height text will always nicely stick out on the screen.

Due to hardware problems however there are some limitations connected with this feature. One must specifically keep in mind that the lines in question do not retain the double height rendition status. Consequently, the codes for upper and lower lines (ESC # 3 and ESC # 4) must be repeated with each new string to be displayed in this rendition at same lines.
Each of these codes can be issued either before or right after the text which is to be affected. However, note that if the actual text in the lower line follows the ESC # 4 sequence, the full blocks will first appear after the text is terminated by a nongraphic character (e.g. CR or LF). Otherwise it is the user resposibility that the texts associated with the upper and lower lines respectively, are identical.

8. NOTES FOR THE OPERATOR

8.1 Status line

Line 25 at the screen is used as a status line.The following messages may appear in the status line on the TDV 2230:

"LINE EDIT MODE"

appears when operator may re-edit a line of text before sending

"Input inhibited from host"

signifying that XOFF was received from host

"Input inhibited from host, keyboard locked"

signifying that XOFF was received from host, and also indicating that the keyboard buffer is becoming full

"Keyboard Parity Error" or

"Keyboard Code Format Error" or

"Keyboard Overrun" or

"Keyboard Buffer Overflow"

indicating problems in ACIA communication between the terminal and the keyboard

"Printer Parity Error" and

"Printer Code Format"

indicate that the PCF switch is not correctly set

"Printer Off"

informs about the absence of active printer connection

"Printer Overrun"

indicates terminal problem to retrieve correctly the information coming from the printer

"Printer Buffer Overflow"

implies that use of a handshake protocol against printer (see PH switch) is desirable, provided that the printer in question is able to cooperate

"Line Parity Error"

informs about an incorrect setting of the TCP switch (in some cases also a wrongly specified transmission speed is to be blamed)

"Line Code Format Error"

normally calls for another setting of the TCL or TCS switches

"Line Overrun"

indicates terminal's failure to correctly intercept codes from the host, however in most cases this message is a result of some other communication error

"Line Buffer Overflow"

implies that the TRH switch should not be in Off position

Whenever any of these errors occurs, the ERROR lamp on the keyboard comes on and the terminal is halted, because continuing in such situations is usually meaningless.

The status line can be cleared and the ERROR lamp turned off using either the CLEAR key or by typing (with local echo) either ESC c or the selftest code sequence CSI 2;1 y.

The status line can be suppressed using the convenience switch SL so that an advanced user need not be distracted by messages at the bottom of the screen. The terminal status is then solely reflected by the signal lamps of the keyboard. Note that possible messages can be made visible by pressing the CLEAR key in the error situations.

8.2 Local editing

Local (re-) editing of the last transmitted line is enabled so that in case of erroneous entries, the rejected line need not be completely retyped. One can also benefit from this feature when identical or similar lines are to be keyed in one after the other. Finally, one can also reprocess an earlier typed line as long as it is still displayed at the screen, simply by positioning the cursor to it in edit mode.

The edit mode is entered by depressing the INS LINE key, to which the terminal responds by displaying the LINE EDIT MODE in the status line (if this is not suppressed), turning on the WAIT lamp and by displaying the last transmitted line at the next line position on the screen. Note that the last transmitted line is defined as the set of the graphic characters entered between the last two occurences of CR key depressions (however, its length cannot exceed 80 characters). It stands to reason that each character followed by a left cursor or the backspace character in the original sequence are not considered to be a desired part of the transmitted line. Also note that should the edit mode be entered after anything other than the CR character, the line displayed will consist of the graphic characters entered since the last occurence of the CR character.

Once in the edit mode, the active line can be edited using the left and right cursor movements and by overwriting. In addition, INS CHAR and DEL CHAR can be used to insert and delete characters in active position with automatic shifting of the remainder of the line.
The whole line can be erased by DEL LINE key upon which it can be either retyped or reentered by another depression of INS LINE key. Finally, striking of the cursor up key will erase the edited line and move the cursor to the preceding line which can now be edited. (Note that unless disabled by the bell switch, the bell will ring when any key ignored in this mode is depressed.)

Remember however, that it is always what is actually displayed at the active line that is going to be transmitted at exit from the edit mode. In case of an active line generated by INS LINE key, it will normally be only characters entered earlier from the keyboard, while the lines accessed via the cursor up key may also contain characters received from host.

All the time when the terminal resides in the local editing mode, no keyboard action results in the transmitting of any character to the host. On the other hand, the terminal is able to receive from host (unless the line was explicitly blocked by a single operation of the NOSCROLL key).

The whole line (apart from the trailing blanks, if any) which was locally edited is transmitted to the host when the CR key is pressed. At the same time the terminal leaves the local editing mode and resumes the normal character transmission mode in which each character entered at the keyboard is transmitted to the host. (The CR key in fact acts as a SEND key in the sense that it causes the entire line to be transmitted, regardless of the current position of the cursor within the line.)

Note that outside line edit mode the specific editing keys are not operational - with the obvious exception of the INS LINE key. Also note that editing of elongated lines is not supported.

9. TRANSMITTED AND RECEIVED CODES

9.1 Notation

The following notation is used to define characters and character sequences:

<HH>	is used to specify the hex value of a character.
X<HH>	is used to specify the hex value of the character X.
A B	space is sometimes used to separate parts of a sequence. The space is included for clarity, and never as a part of the code sequence. CSI p1;p2 H is equivalent to CSI p1 ; p2 H
;	is a delimiter between parameters in CSI sequences. ;<3B> is included in the data stream.
pn	parameters are represented by one or more ASCII coded decimal digits. <30> to <39>

9.2 Codes generated from the keyboard

The typewriter area generates standard ASCII codes when used alone or with shift.

By using the CTRL key in combination with a key in the typewriter area, all C0 control character can be generated. When CTRL is pressed, the SHIFT key is ignored.

The numeric pad generates codes depending on the numeric pad application mode switch (4.4.3) and the ANSI/VT52 mode switch (4.2.9). The codes generated are shown in section 9.2.1.

9.2.1 Codes generated by the numeric pad

Codes generated by numeric pad:

VT52 mode:

Key	Numeric mode		Application mode	
0	0	<30>	ESC ? p	<1B 3F 70>
1	1	<31>	ESC ? q	<1B 3F 71>
2	2	<32>	ESC ? r	<1B 3F 72>
3	3	<33>	ESC ? s	<1B 3F 73>
4	4	<34>	ESC ? t	<1B 3F 74>
5	5	<35>	ESC ? u	<1B 3F 75>
6	6	<36>	ESC ? v	<1B 3F 76>
7	7	<37>	ESC ? w	<1B 3F 77>
8	8	<38>	ESC ? x	<1B 3F 78>
9	9	<39>	ESC ? y	<1B 3F 79>
,(comma)	,	<2C>	ESC ? l	<1B 3F 6C>
-(line)	-	<2D>	ESC ? m	<1B 3F 6D>
.(period)	.	<2E>	ESC ? n	<1B 3F 6E>
ENTER	CR	<0D>	ESC ? M	<1B 3F 4D>

ANSI mode:

Key	Numeric mode		Application mode	
0	0	<30>	ESC O p	<1B 4F 70>
1	1	<31>	ESC O q	<1B 4F 71>
2	2	<32>	ESC O r	<1B 4F 72>
3	3	<33>	ESC O s	<1B 4F 73>
4	4	<34>	ESC O t	<1B 4F 74>
5	5	<35>	ESC O u	<1B 4F 75>
6	6	<36>	ESC O v	<1B 4F 76>
7	7	<37>	ESC O w	<1B 4F 77>
8	8	<38>	ESC O x	<1B 4F 78>
9	9	<39>	ESC O y	<1B 4F 79>
,(comma)	,	<2C>	ESC O l	<1B 4F 6C>
-(line)	-	<2D>	ESC O m	<1B 4F 6D>
.(period)	.	<2E>	ESC O n	<1B 4F 6E>
ENTER	CR	<0D>	ESC O M	<1B 4F 4D>

9.2.2 Codes generated by the function keys

The codes generated by the function keys depend on the ANSI/VT52 mode switch:

	VT52 mode:	ANSI mode
PF1	ESC P <1B 50>	ESC O P <1B 4F 50>
PF2	ESC Q <1B 51>	ESC O Q <1B 4F 51>
PF3	ESC R <1B 52>	ESC O R <1B 4F 52>
PF4	ESC S <1B 53>	ESC O S <1B 4F 53>
F1	ESC T <1B 54>	ESC O T <1B 4F 54>
F2	ESC U <1B 55>	ESC O U <1B 4F 55>
F3	ESC V <1B 56>	ESC O V <1B 4F 56>
F4	ESC W <1B 57>	ESC O W <1B 4F 57>
F5	ESC X <1B 58>	ESC O X <1B 4F 58>
F6	ESC Y <1B 59>	ESC O Y <1B 4F 59>
F7	ESC Z <1B 5A>	ESC O Z <1B 4F 5A>

9.2.3 Summary of transmitted codes

Character codes from <00> to <7F> will be transmitted as received from the keyboard, except <11> (XON) and <13> (XOFF). These codes are coordinated with the NOSCROLL key and the XON/XOFF receive buffer facility.

If a PUSH-key is depressed, the contents of it will be transmitted as if each character came from the keyboard.

Codes generated by special keys:

	ANSI mode		VT52 mode	
TAB +	ESC H	<1B 48>	none	
TAB -	ESC [g	<1B 5B 67>	none	
CSI	ESC [	<1B 5B>	none	
ESC	ESC	<1B>	ESC	<1B>
SI	SI	<0F>	SI	<0F>
SO	SO	<0E>	SO	<0E>
LF	LF	<0A>	LF	<0A>
* !<-	ESC D	<1B 44>	ESC O D	<1B 4F 44>
->!	HT	<09>	HT	<09>
BACKSPACE	BS	<08>	BS	<08>

* generates one or more CURSOR LEFT sequences

The codes generated by the cursor return key depend on the New Line switch in ANSI mode. In VT52 mode the key will always generate the CR code <0D>.

	New Line reset	New Line set
CR	CR <0D>	CR LF <0D 0A>

Codes generated by cursor keys:

	VT52 mode	ANSI mode and curs.key mode reset	ANSI mode and curs.key mode set
CURSOR UP	ESC A <1B 41>	ESC [A <1B 5B 41>	ESC O A <1B 4F 41>
CURSOR LEFT	ESC D <1B 44>	ESC [D <1B 5B 44>	ESC O D <1B 4F 44>
CURSOR RIGHT	ESC C <1B 43>	ESC [C <1B 5B 43>	ESC O C <1B 4F 43>
CURSOR DOWN	ESC B <1B 42>	ESC [B <1B 5B 42>	ESC O B <1B 4F 42>
CURSOR HOME	ESC H <1B 48>	ESC [H <1B 5B 48>	ESC [H <1B 5B 48>

9.3 Internally generated control codes

This section describes the codes that may be generated from the TDV 2230 without direct keyboard action.

9.3.1 Generated codes in the C0 character set

XON - Transmission on <11>

This code is used by the terminal to notify the host that the terminal is again ready to accept data after an XOFF has been sent.

XON is sent on the following conditions:

1. The receiver buffer is 1/4 full after an XOFF.
2. The terminal is again ready to accept data after a hard copy has been started or a PUSH-key string was recorded in the non-volatile memory.

Conditions depend on the setting of the TH switch.

XOFF - Transmission off <13>

This code is used by the terminal to notify the host that an overrun condition may occur if more data is sent to the terminal.

XOFF is sent on the following conditions:

1. The receiver buffer is 3/4 full.
2. A Hard copy has been started.
3. A PUSH-key string is going to be written to EAROM.

Conditions depend on the setting of the TH switch.

Refer to section 7.6 and 6.3.8 for additional information.

The XON/XOFF feature is synchronized with the use of the Noscroll key and the use of CTRL Q/CTRL S codes. CTRL S (XOFF) and CTRL Q (XON) will be sent to the host immediately when the receive buffer is less than 3/4 full. With the transmission handshake switch set "XON/XOFF", the same holds for the XOFF and XON generated by the NOSCROLL key.

9.3.2 Codes transmitted as responses to requests from the host

The TDV 2230 terminal may as a response to a request from the host send reports on the status of the terminal. The requests and the responses to these are given below.

Cursor Position Report:

Invoked by	ESC [6 n
Response is	ESC [Pl ; Pc R

Pl is the line number and Pc the column number. The values of these depend on the Origin Mode switch.

Status Report:

Invoked by	ESC [5 n	
Response is	ESC [0 n	(terminal ok)
	ESC [3 n	(terminal not ok)

When this request is received, a self-test is performed. The first sequence of the responses is sent when no malfunctions are detected. The second sequence is sent when malfunctions are detected. The terminal will also perform a retry of the self-test.

What Are You: (ANSI mode)

Invoked by	ESC [c
or	ESC [0 c
Response is	ESC [? 1 ; 2 c

2 is the "option present" parameter with the following meaning:

> Base TDV 2230 with the full graphic rendition capability and the capability to have a second character generator ROM/PROM installed.

This response may alternately be invoked by ESC Z (not recommended). The response is the same.

What Are You: (VT52 mode)

Invoked by ESC Z

Response is ESC / Z

Printer status report:

Invoked by ESC ?15 n

Response is ESC ?10 n - Printer connected and not busy.

ESC ?11 n - Printer disconnected or switched off after power up.

ESC ?13 n - Printer disconnected or switched off at power up.

9.4 Accepted control codes from the host

The TDV 2230 has many control commands which cause it to take action other than displaying a character on the screen. In this way, the host can command the terminal to move the cursor, change mode and the graphic rendition, etc. The following paragraphs discuss the terminal control commands.

9.4.1 Accepted from C0-set. <00-1F>

C0 characters have values of <00-1F>, and <7F>. The control codes accepted by the TDV 2230 terminal are shown below. All other control codes cause no action to be taken.

Control characters are specifically excluded from the control sequence syntax, but may be embedded within a control sequence. Embedded control characters are executed as soon as they are encountered by the TDV 2230. The processing of the control sequence then continues with next character received.

The exceptions are:
If the character ESC occurs, the current control sequence is aborted, and a new one commences beginning with the ESC just received. If the character CAN <18> or the character SUB <1A> occurs, the current control sequence is aborted. The ability to embed control characters allows the synchronization characters XON <11> and XOFF <13> to be interpreted properly without affecting the control sequence.

Accepted Control Characters:

ENQ <05> - Request answerback message
The response depends on the current answer back PUSH-key. See section 4.2.13.

BEL <07> - Sounds audible alarm

BS <08> - Move the active position left one character positon. For a specification of the effect of BS in boundary situations, refer to the definition of CUB in section 8.6.1. BS is identical to CUB(1).

HT <09> - Advance the active position to the next defined tab-stop

LF <0A> - The effect of this code depends on the NEL-switch:
NEL=LF: the active position is moved one line down without altering the horizontal position. At the bottom of the page a roll up is performed.
NEL=CRLF: same as for LF, but in addition a cursor return is performed.

VT <0B> - Interpreted as LF

FF <0C> - Interpreted as LF

CR <0D> - Move the cursor to the beginning of the current line.

SO <0E> - Invoke G1 character set, as designated by ESC ')' sequences.

SI <0F> - Invoke G0 character set, as designated by ESC '(' sequences.

XON <11> - Causes the terminal to resume transmission.

XOFF<13> - Causes the terminal to stop transmitting all codes except XOFF and XON.

CAN <18> - If sent during a control sequence, the sequence is immediately terminated and not executed. It also causes the error character to be displayed (checkerboard).

SUB <1A> - Interpreted as CAN

ESC <1B> - Introduces a control sequence

DEL <7F> - Ignored on input (not stored in input buffer).

9.5 Accepted ESC sequences

The accepted ESC-sequences depend on the setting of the ANSI/VT52 mode switch.
The accepted ESC sequences in ANSI mode and VT52 mode are given in sections 9.5.1 and 9.5.2.

9.5.1 Accepted ESC seqences in ANSI mode

The following ESC sequences are accepted by the TDV 2230 terminal in ANSI mode.

ESC # 3<33> - Upper part of a double height line (see 7.7).

ESC # 3<33> - Lower part of a double height line (see 7.7).

ESC # 5<35> - Single-width line (TDV 2230 private)

This sequence causes the line which contains the active position to become single-width. The cursor remains on the same character position. This is the default condition for all the new lines on the screen.

ESC # 6<36> - Double-width line (TDV 2230 private)

This sequence causes the line which contains the active position to become double-width. If the line was single-width, all characters to the right of the 39th character are lost. The cursor remains over the same character position unless it would be to the right of the right margin, in which case, it is moved to the right margin. The attributes of the line are lost.

ESC # 8<38> - Fill the screen with uppercase 'E's

ESC (Ps - Select G0 character set

This sequence designates a G0 character set. The selective parameter Ps decides which. The following values are accepted:

ESC (A<41> or B<42> - Select standard character set as G0 set.

ESC (0<30> - Select special graphic character set as G0 set.

If an alternate character ROM is installed, the following are accepted in addition :

ESC (1<31> - Select alternate standard character set as G0 set.

ESC (2<32> - Select alternate special graphic character set as G0 set.

The organization of the character ROM is described in detail in section 10.

ESC) Ps - Select G1 character set

This sequence designates a G1 character set. The selective parameter Ps decides which. The following values are accepted:

ESC) A<41> or B<42> - Select standard character set as G1 set.

ESC) 0<30> - Select special graphic character set as G1 set.

If an alternate character ROM is installed, the following are accepted in addition :

ESC) 1<31> - Select alternate standard character set as G1 set.

ESC) 2<32> - Select alternate special graphic character set as G1 set.

The standard and special character sets are shown in section 9.

ESC 7<37> - Save cursor (TDV 2230 private)

This sequence causes the cursor position,graphic rendition and character set to be saved. (See restore cursor)

ESC 8<38> - Restore cursor (TDV 2230 private)

This sequence causes the previously saved cursor position, graphic rendition and character set to be restored.

ESC =<3D> - Enter alternate keypad mode (TDV 2230 private)

This sequence causes the numeric keypad keys to send unique escape sequences for use by application programs.

ESC ><3E> - Exit alternate keypad mode (TDV 2230 private)

This sequence causes the numeric keypad keys to send the ECMA codes for the functions and characters engraved on the keys.

ESC D<44> - Index - cursor down - IND

This sequence causes the active position to move downward one line without changing the column position. If the active position is at the bottom margin, a roll up is performed.

ESC E<45> - Next line - NEL

This sequence causes the active position to move to the first position on the next line downward. If the active position is at the bottom margin, a roll up is performed.

ESC H<48> - Horizontal tabulation set - HTS

Set one horizontal tab at the active position.

ESC M<4D> - Reverse index - RI

Move the active position to the same horizontal position on the preceding line. If the active position is at the top margin, a roll down is performed.

ESC P<50> - PUSH-key programming from the line (TDV 2230 private)

See section 7.5 for programming of Push-keys from the line.

ESC Z<5A> - Identify (TDV 2230 private)

This sequence causes the terminal to send the identifier sequence in ANSI mode which is as follows (9.3.2):

ESC [? 1 ; 1 c<63>

The ESC Z sequence should not to be used. Instead the DA sequence should be used (Ref 9.6.2).

ESC [<5B> - Control sequence introducer - CSI

Introduces a control sequence.

ESC '<5C> - String terminator - ST

Terminates the Device Control String sequence (DCS). In all other contexts it will be ignored.

ESC c<63> - Reset to initial state - RIS

Resets the TDV 2230 to its initial state, i.e. the state it was in after power-up. This also causes the execution of the power-up self-test.

9.5.2 Accepted ESC sequences in VT52 mode

The following ESC sequences are accepted by the TDV 2230 terminal in VT52 mode.

ESC < <3C> - VT52 enter ANSI mode (TDV 2230 private)

This sequence causes the terminal to enter ANSI mode.

ESC = <3D> - Enter alternate keypad mode (TDV 2230 private)

The numeric keypad will after this sequence send unique escape sequences for use by application programs.

ESC > <3E> - Exit alternate keypad mode (TDV 2230 private)

The numeric keypad will after this sequence send the ECMA codes for the functions or character engraved on the keys.

ESC A<41> - Cursor up

Move the active position upward one position without altering the horizontal position. If an attempt is made to move the cursor above the top margin, the cursor will stop at the top margin.

ESC B<42> - Cursor down

Move the active position downward one position without altering the horizontal position. If an attempt is made to move the cursor below the bottom margin, the cursor stops at the bottom margin.

ESC C<43> - Cursor right

Move the active position to the right. If an attempt is made to move the cursor to the right of the right margin, the cursor stops at the right margin.

ESC D<44> - Cursor left

Move the active position one position to the left. If an attempt is made to move the cursor to the left of the left margin, the cursor stops at the left margin.

ESC F<46> - Enter graphics mode (TDV 2230 private)

Causes the special character set to be used.

ESC G<47> - Exit graphics mode (TDV 2230 private)

Causes the standard character set to be used.

ESC H<48> - Cursor to home

Move cursor to the home position.

ESC I<49> - Reverse line feed

Move the active position upward one position witout altering the column position. If the active position is at the top margin, a roll down is performed.

ESC J<4A> - Erase to end of screen

Erase all characters from the active position to the end of the screen. The active position is not changed.

ESC K<4B> - Erase to end of line

Erase all characters from the active position to the end of the line. The active position is not changed

ESC V<56> - Print cursor line. With CR LF.

ESC W<57> - Start relay printing
If the printer is disconnected, if any menu is entered and terminated or if a printer error is detected, the relay print is stopped, and the screen is used as the printer instead.

ESC X<58> - Stop relay print

ESC Y<59> line column - Direct cursor address

Move the cursor to the specified line and column. The line and column number are sent as ECMA codes whose values are the number plus <1F>; e.g. <20> refers to the first line or column. <30> refers to the seventeenth line or column.

ESC Z<5A> - Identify

This sequence causes the terminal to send its identifier escape sequence to the host. The sequence is:

ESC /<2F> Z<5A>

ESC [<5D> - Print screen

Depending on the setting of the Printer Extent Mode switch, either the whole screen or only the scrolling region is printed.

ESC ^<5E> - Start log mode

This will set the temporary setting of the Printer Mode switch to the LOG setting

ESC _<5F> - Stop log mode

This will set the temorary setting of the Printer Mode switch to the LOCAL/REMOTE setting.

ESC c<63> - Reset to initial state - RIS

See ESC c in ANSI mode.

9.6 Accepted CSI sequences in ANSI mode

9.6.1 Notation

CSI sequences are only accepted in ANSI compatible mode. The following listing defines the basic elements of the ECMA control sequences.

Control Sequence Introducer - An escape sequence that provides supplementary control and is itself a prefix affecting the interpretation of a limited number of contiguous characters. In the TDV 2230 the CSI is ESC [.

Parameter - (1) A string of zero or more decimal characters which represents a single value. Leading zeroes are ignored. The decimal characters have a range of 0 (<30>) to 9 (<39>).
(2) The value so represented.

Numeric Parameter - A parameter that represents a number, designated by Pn.

Selective Parameter - A parameter that selects a subfunction from a specified list of subfunctions, designated by Ps. In general, a control sequence with more than one selective parameter causes the same effect as several control functions, each with one selective parameter, CSI Psa; Psb; Psc T is identical to CSI Psa T CSI Psb T CSI Psc T.

Parameter String - A string of parameters separated by semicolon <3B>.

Default - A function dependent value that is assumed when no explicit value, or a value of 0, is specified.

Terminator - A character whose bit combination terminates a control sequence.

A CSI sequence with a parameter greater than 255 will cause the entire CSI sequence to be ignored.

9.6.2 Accepted CSI sequences

All of the following control sequences (CSI-sequences) are transmitted from the host to the TDV 2230. Control sequences transmitted from the TDV 2230 to the host are given in sections 9.2 and 9.3.

The control sequences specified are a subset of those specified in the ECMA 48 standard. In addition, some private sequences are included.

CUB - Cursor backward. CSI Pn D<44>
One numeric parameter, default value 1.
The active position is moved to the Pn'th preceding character position. If current cursor position minus Pn goes outside the line, it will stop at the beginning of the line.

CUD - Cursor down. CSI Pn B<42>
One numeric parameter, default value 1.
The active position is moved to the corresponding character position of the Pn'th following line. If the number of the current line plus Pn is greater than 24, the sequence will be ignored.

CUF - Cursor forward. CSI Pn C<43>
One numeric parameter, default value 1.
The active posistion is moved to the Pn'th following character position. If current cursor position plus Pn goes outside the line, it will stop at the end of the line.

CUP - Cursor position. CSI Pl ; Pc H<48>
Two numeric parameters, default values 1.
The active position is moved to the Pl'th line at the Pc'th character position. Pl must be in the range 1 thru 24 and Pc in the range 1 thru 80 (inclusive) or 1 thru 39 (inclusive) if on a double-width line. If Pl does not satisfy these conditions the sequence will be ignored. If Pc is greater than 80, this will cause the cursor to move to coloumn 80.

The numbering of lines depends on the state of the Origin Mode switch, see section 4.4.2.
Default: CURSOR HOME = CUP(1,1)

CUU - Cursor up. CSI Pn A<41>
One numeric parameter, default value 1.
The active position is moved to the corresponding character position of the Pn'th preceding line. If the number of the current line minus Pn is zero or less, the sequence will be ignored.

DA - Device attributes CSI Ps c<63>
Selective parameter, default value 0.
Request from host to TDV 2230 to send the attributes of the terminal. The response is the following sequence:

CSI ? 1 ; 2 c<63>

'? 1' tells the host that this is a private TDV 2230 sequence. 2 is a selective parameter indicating the features in the terminal.

CL - Load LEDs (TDV 2230 private sequence) CSI Ps q<51>
Selective parameter(s), default value 0.
The LEDs will be turned off or on according to the following parameters:

0 - Clear L1 thru L4
1 - Turn on L1
2 - Turn on L2
3 - Turn on L3
4 - Turn on L4

REQ - Request and report terminal parameters CSI Ps x<78>
Receive one selective parameter, default value 0.
Transmits seven selective parameters.
Gives information on the settings of some of the switches in TDV 2230 such as:

Parity, code length, transmimission speed, clock rate installed options, printer parity, printer speed, printer code length and the status of the ANSI/VT52 mode switch.

The terminal can send unsolicited reports depending on the received value of the parameter. The meaning of the parameters are:

0 - This message is a request and the terminal will be allowed to send unsolicited reports (Unsolicited reports are sent when the terminal exits the menu.)
1 - This message is a request: from now on the terminal may only report in response to a request.
2 - This message is a report.
3 - This message is a report, and the terminal only reports on request.

The response to this request is the following sequence:

CSI Ps ; <par> ; <nbits> ; <trspd> ; <trspd> ; 1 ; 0 ;

<swvt52> ; <ppar> ; <pnbits> ; <prspd> ; <prspd> x<78>

The meaning of the parameters is as follow:

Ps	-	See above
<par>	-	1 No parity set
		4 Parity is set and odd
		5 Parity is set and even
<nbits>	-	1 8 bits pr. character
		2 7 bits pr. character
<trspd>	-	transmission speed.
		0 50 baud
		8 75 baud
		16 110 baud
		24 134.5 baud
		40 200 baud
		48 300 baud
		56 600 baud
		64 1200 baud
		88 2400 baud
		104 4800 baud
		112 9600 baud
		120 19200 baud
<swvt52>	-	the status of the ANSI/VT52 Mode soft switch. 0 means VT52 mode and 1 means ANSI mode.
<ppar>	-	parity used in the communication with the local printer. Settings as for the <par> parameter.
<pnbits>	-	number of bits used in the communication with the local printer. Settings as for the <nbits> parameter.
<prspd>	-	speed used in the communication with the local printer. Settings as for the <trspd> parameter.

TBM - Set bottom and top margin (TDV 2230 private) CSI Pt ; Pb r<72>
Two numeric parameters, default values 1 and 24.
Defines which part of the screen which will be affected by roll up and roll down. (i.e. split screen feature)
Pt must be in the range from 1 to 23, and Pb in the range from 2 to 24. Minimum scrolling area is 1 (one) line.
If these conditions are not satisfied the sequence will be ignored.
Pt = top margin, Pb = bottom margin.

TST - Invoke confidence test. (TDV 2230 private) CSI 2 ; Ps y<79>
Two parameters, one constant=2, and one selective parameter. The selective parameter invokes different test routines. The value of the parameter is the sum of the numbers of the test to be done:

0 - Reset to initial state
1 - Power up self-test, tests ROM checksum, optional print buffer RAM if present, keyboard and SIO using internal loopback.
2 - SIO loop back test (modem and data)
9 - Repeat selftest until failure,the TDV 2230 reset button is pressed or power off.
10 - Test the SIO repeatedly until failure, the TDV 2230 reset button is pressed or power up.

DSR - Device status report CSI Ps n<6E>
Selective parameter, default value 0
Requests and reports the general status of the TDV 2230 according to the following parameter(s):

0 - Response from TDV 2230 - Ready, no malfunctions detected (default)
3 - Response from TDV 2230 - Malfunction - retry

5 - Request from host - Please report status (using a DSR control sequence)
6 - Request from host - Please report active position (using a CPR control sequence)

DSR with a parameter value of 0 or 3 is always sent as a response to a requesting DSR with a parameter value of 5.

ED - Erase in display. CSI Ps J<4A>
Selective parameter, default value 0.
Some or all character positions of the page are erased, depending on the parameter value:

0 - the active position and the character positions up to the end of the page are erased

1 - The character positions from the beginning of the page up to and including the active position are erased

2 - all character positions of the page are erased

EL - Erase in line. CSI Ps K<4B>
Selective parameter, default value 0.
Some or all character positions of the active line are erased, depending on the parameter value:

0 - the active position and the character positions up to the end of the line are erased

1 - the character positions from the beginning of the line up to and including the active position are erased

2 - all character positions of the line are erased

HVP - Horizontal and Vertical Position CSI Pl ; Pc f<66>

The action of this sequence is identical with the action taken on the CUP sequence. See above.

MC - Media Copy CSI Ps i<69>
Selective parameter, default value 0.

0 - Initiate a hard copy. The terminal immediately sends an XOFF to the host computer to indicate that it is busy. The terminal signals that it is ready for data by sending XON.

?1 - Print cursor line. With CR LF.

4 - Stop relay to printer. See below.

5 - Start relay to printer. In this mode all data recieved from the line are transferred to the printer without disturbing the screen. The only code the terminal responds to is MC(4) - stop relay to printer. Characters from the keyboard are transmitted to the host computer.

?4 - Stop log mode. This will set the temporary setting of the Printer Mode switch to the LOCAL/REMOTE setting.The parameter 4 must be given without leading zeroes.

?5 - Start log mode. This will set the temporary setting of the Printer Mode switch to the log setting.

The codes 0,4 and 5 depend on the PM (4.2.10) switch. (Ref. sec. 7.4).

RM - Reset mode CSI Ps l<6C>
Selective parameter, no default value.
RM resets one or more modes of the terminal. Each mode is specified by a parameter value, see SM (Set Mode) below.

SGR - Select Graphic Rendition CSI Ps m<6D>
Selective parameter, default value 0.
SGR is a format effector which indicates the beginning of a string of characters in the data stream which are to be rendered in a discernable, uniformly different way. The end of this string is indicated by the following occurence of SGR. The graphic rendition is specified by a parameter value. The following values are accepted by the TDV 2230 terminal:

0 - default rendition (normal)
1 - depending on the High Intensity Repr.(HIR) switch (4.2.3)
4 - underlined
5 - blinking
7 - inverse video

The following combinations are accepted:

1,4	HIR and underlined (Note 1)
(0),1,5	Blinking between normal and HIR (Note 1)
1,4,7	HIR inverse video underlined (Note 1)
1,5,7	Blinking between HIR and inverse video (Note 1) (Has effect only when HIR is set to low, or underline)
1,7	HIR inverse video (Note 1)
(0),4,5	blinking between normal and underline
4,5,7	underlined blinking inverse video
4,7	underlined inverse video
(0),5,7	blinking between normal and inverse video

The HIR is affected by the High Intensity Representation switch. (Ref. 4.2.3)

Note 1:
When the combination of HIR and explicitly specified renditions results in the combination: Inverse, low, underline and blink, the rendition actually used will be inverse, low and blink.

SM - Set Mode CSI Ps h<68>

Selective parameter, no default value.
SM sets one or more switches of the terminal. Each switch is specified by a numeric value. For switches having more than two possible settings, the setting is incremented for each occurence of SM. When the switch reaches its highest value, it remains in this state until reset by RM. The maximum number of parameters is 15.

Parameter values:	RM	1.SM	2.SM	3.SM
18 - Printer Form Feed	NONE	BEFORE	AFTER	BOTH
19 - Printer Extent Mode	SPLIT	SCREEN		
20 - New Line	LF	CRLF		
40 - Printer Code Format	*			
42 - Printer Speed	**			
43 - Printer Handshake	OFF	XON/XOFF		
53 - Key Click	ON	OFF		
54 - Margin Bell	ON	OFF		
56 - High Intensity Rep.	***			
67 - Handshake	OFF	XON/XOFF		
68 - Cursor Type	LINE	BLOCK		
69 - Printer Mode	LOCAL/REM	REMOTE	LOG	
79 - Transmission Delay	NONE	20 MS	40 MS	60 MS
?1 - Cursor Key mode	OFF	ON		
?2 - ANSI/VT52 mode	VT52	ANSI		
?4 - Roll Type	STEP	SOFT	CREEP	
?6 - Origin Mode	OFF	ON		
?7 - Wrap	STOP	WRAP		
?8 - Auto Repeat	OFF	ON		

* (Printer Code Format)

RM	1.SM	2.SM	3.SM	4.SM
7 Even	7 Odd	8 None	8 Even	8 Odd

** (Printer Speed)

RM	1.SM	2.SM	3.SM	4.SM	5.SM	6.SM	7.SM	8.SM	9.SM	10.SM	11.SM
50	75	110	134.5	200	300	600	1200	2400	4800	9600	19200

*** (High Intensity Rep.)

RM	1.SM	2.SM	3.SM	4.SM	5.SM	6.SM
Normal	Inverse	Low	Inv/Low	Underline	Inv/Und	Und/Low
7.SM	8.SM	9.SM	10.SM	11.SM	12.SM	13.SM
Inv/Low/Un	Blink	Inv/Blink	Low/Blink	Inv/Low/Bl	Und/Blink	Inv/Un/Bl

The last six modes are private TDV 2230 modes. The set and reset mode sequences of these must start with '?'. An example of a set mode sequence is:

CSI ? 1 ; 2 ; 6 h<68>

This sequence will set the Cursor Key mode, ANSI/VT52 mode and the Origin mode. See section 7.3 for details.

TBC - Tabulation clear CSI Ps g<47>
Selective parameter, default value 0.
TBC causes one or more tabulation stops to be cleared, depending on the parameter value:

0 - clear the horizontal tabulation stop at the active position
3 - clear all horizontal tabulation stops

9.6.3 Summary of accepted CSI sequences

	4/x		5/x		6/x		7/x (TDV 2230 priv)	
0	I ICH		N	I HPA		p		
	@	(not used)		@	(not used)		(not used)	
1	CUU	CUrsor	T	HPR		CL	Load LEDs	
	A	Up		a	(not used)	q		
2	CUD	CUrsor	S	REP		STBM	Set Top and	
	B	Down	E	b	(not used)	r	Bottom Marg.	
3	CUF	CUrsor		DA	Device			
	C	Forward	T	c	Attributes	s	(not used)	
4	CUB	CUrsor	V	VPA				
	D	Backward		d	(not used)	t	(not used)	
5			2	VPR				
	E	(not used)	3	e	(not used)	u	(not used)	
6				HVP	Hor.and Ver			
	F	(not used)		f	Position	v	(not used)	
7				TBC	Tabulation			
	G	(not used)		g	Clear	w	(not used)	
8	CUP	CUrsor	0	SM	Set		Rep.and Req.	
	H	Position	T	h	Mode	x	Term.Para.	
9			U	MC	Media		Invoke	
	I	(not used)	S	i	Copy	y	Self Tests	
10	ED	Erase in	D		NOT			
	j	Display		j	STD	z	(not used)	
11	EL	Erase	D		NOT			
	K	in Line	V	k	STD	{	(not used)	
12			2	RM	Reset			
	L	(not used)	2	l	Mode	|	(not used)	
13			0	SGR	Select			
	M	(not used)		m	Graph.Rend.	}	(not used)	
14				DSR	Device Stat			
	N	(not used)		n	Report		(not used)	
15								
	O	(not used)		o	(not used)		(not used)	

10. CHARACTERS SETS

10.1 Standard character set, International version

	00	10	20	30	40	50	60	70
0				0	@	P	`	p
1			!	1	A	Q	a	q
2			"	2	B	R	b	r
3			#	3	C	S	c	s
4			$	4	D	T	d	t
5			%	5	E	U	e	u
6			&	6	F	V	f	v
7			'	7	G	W	g	w
8			)	8	H	X	h	x
9			(	9	I	Y	i	y
A			*	:	J	Z	j	z
B			+	;	K	[	k	{
C			,	<	L	\	l	|
D			-	=	M	]	m	}
E			.	>	N	^	n	~
F			/	?	O	_	o	

10.2 Special graphic character set

	00	10	20	30	40	50	60	70
0				0	@	P	♦	—
1			!	1	A	Q	▒	—
2			"	2	B	R	NL	—
3			#	3	C	S	FF	¯
4			$	4	D	T	CR	├
5			%	5	E	U	LF	│
6			&	6	F	V	°	┘
7			'	7	G	W	±	┐
8			)	8	H	X	NL	│
9			(	9	I	Y	VT	≤
A			*	:	J	Z	┘	≥
B			+	;	K	[	┐	π
C			,	<	L	\	┌	≠
D			-	=	M	]	└	£
E			.	>	N	^	┼	·
F			/	?	O			

11. SELF TEST

The TDV 2230 self test consists of a set of routines which are executed before the user gains control of the terminal activities (power up test). In addition, parts of the self test may be initiated by the host with the appropriate control sequences.

If an error is detected, an error message is reported to the operator, and the remaining part of the test sequence is aborted. The test utilizes two channels for error messages; the screen and the keyboard ERROR LED indicator.
When the message is presented, the program execution is halted. If the operator should want to proceed regardless of the error message, the RESET button on the left hand side of the terminal base plate gives the user the possibility to re-initialize the system with a bypass of the self test.

The self test is executed by the terminal itself.
Malfunctions that disturb the self test execution may make it impossible to display the error message or cause a wrong error message to appear.

The following tests are executed during power up:

a) RAM PATTERN TEST of the system RAM area

b) RAM PATTERN TEST of all RAMs except the system RAM

c) CHECK-SUM TEST of the program memory situated in ROM/PROM

d) RAM PATTERN TEST of the Display Memory and Attribute Memory

e) ASYNCHRONOUS COMMUNICATION TEST of the line interface

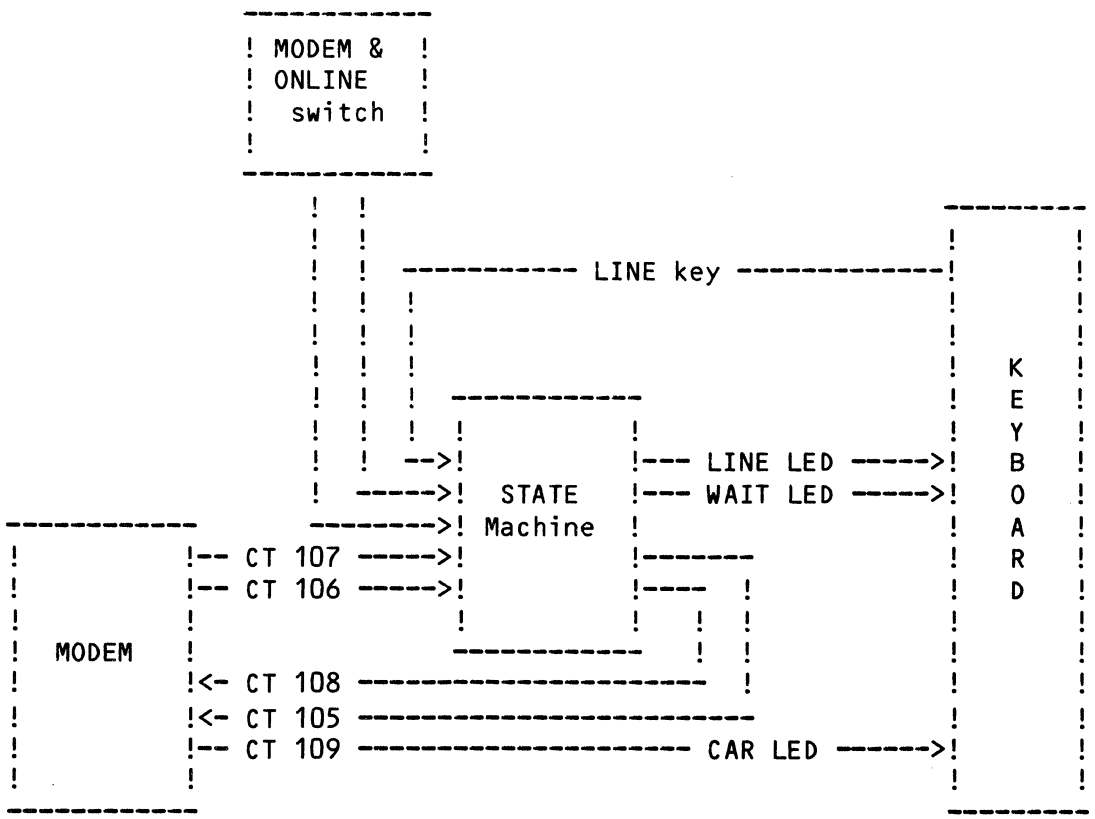
f) KEYBOARD MEMORY TEST and KEYBOARD COMMUNICATION TEST

During the power up initialization all tests are executed in sequence.

11.1 Error messages

Error Message	Malfunction
ERROR no. 01-05	Memory configuration error
ERROR no. 06	The test of the system RAM failed
ERROR no. 07-0D	Memory configuration error
ERROR no. 0E	The test of the print buffer RAM failed
ERROR no. 0F	The test of the display memory failed
ERROR no. 11	The test of the attribute memory failed
ERROR no. 12-14	The line communication test failed
ERROR no. 15-16	The keyboard communication test failed
ERROR no. 17-18	The keyboard memory test failed
ERROR no. 19	The checksum test of ROMs/PROMs failed
ERROR no. 1A	Memory configuration error

APPENDIX A: Principles of Modem Operation



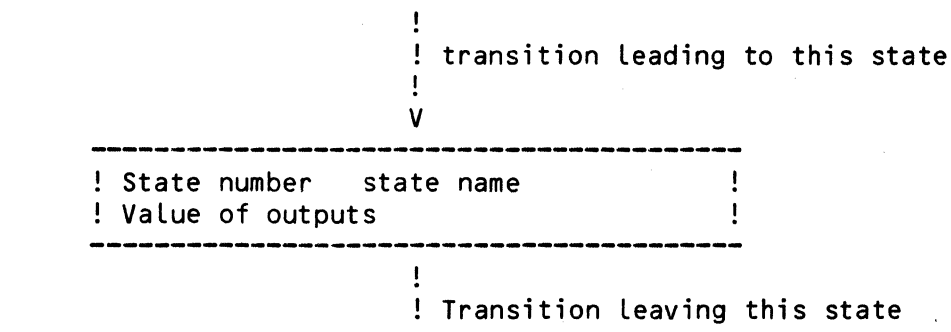
CT 105 - Request To Send
CT 106 - Clear To Send
CT 107 - Data Set Ready
CT 108 - Data Terminal Ready
CT 109 - Carrier Detect

Fig. 1 : Modem control block diagram.

In the following state diagrams the operation of the terminal's modem handler is sketched.

The following syntax is used in the state diagrams.

States and transitions :
- - - - - - - - - - - - -



The condition reqiured for a transition is specified by the value of one or more inputs.

Inputs :
- - - -

CT 106 - Clear to send (from modem)
CT 107 - Data Set Ready (from modem)
LK - LINE key on keyboard has been pushed
OSO - ONLINE switch is set to ONLINE
OST - ONLINE switch is set to TOGGLE

Outputs :
- - - - -

CT 105 - Request To Send (to modem)
CT 108 - Data Terminal Ready
LL - LINE LED on keyboard
WL - WAIT LED on keyboard

Figure 2 below shows the operation in the LEASED state when the ONLINE switch is set to ON-LINE.

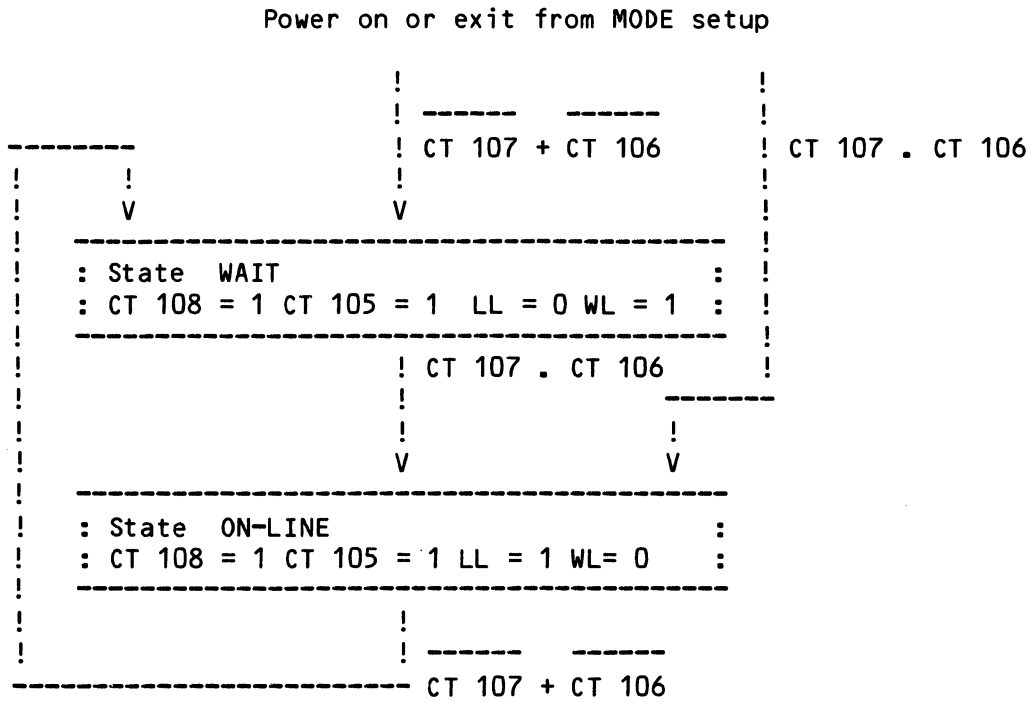


Fig. 2 : State diagram for MODEM switch = LEASED and ONLINE switch = ON-LINE

Figure 3 below shows the operation in the LEASED state when the ONLINE switch is set to TOGGLE.

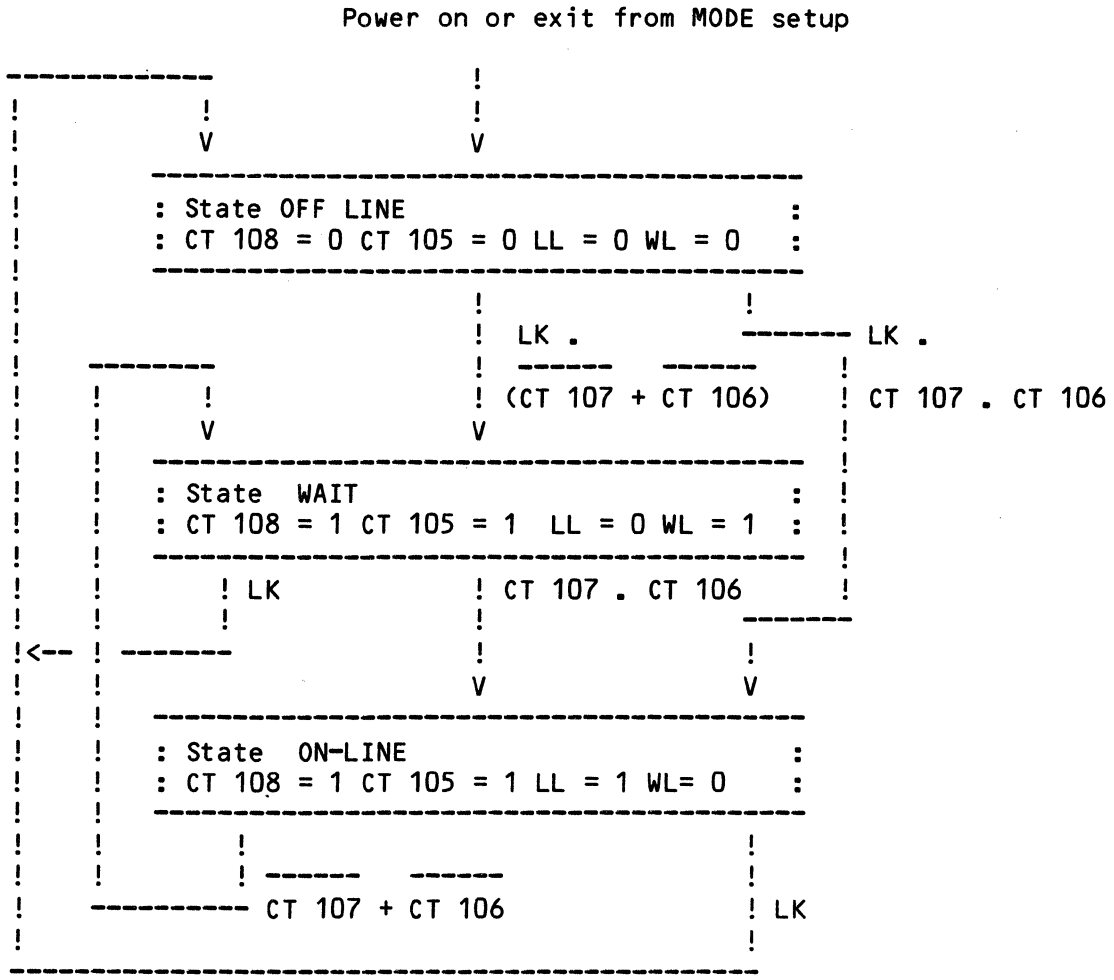


Fig. 3 : State diagram for MODEM switch = LEASED and ONLINE switch = TOGGLE

Figure 4 below shows the operation in the DIALLED state when the ONLINE switch is set to ON-LINE.

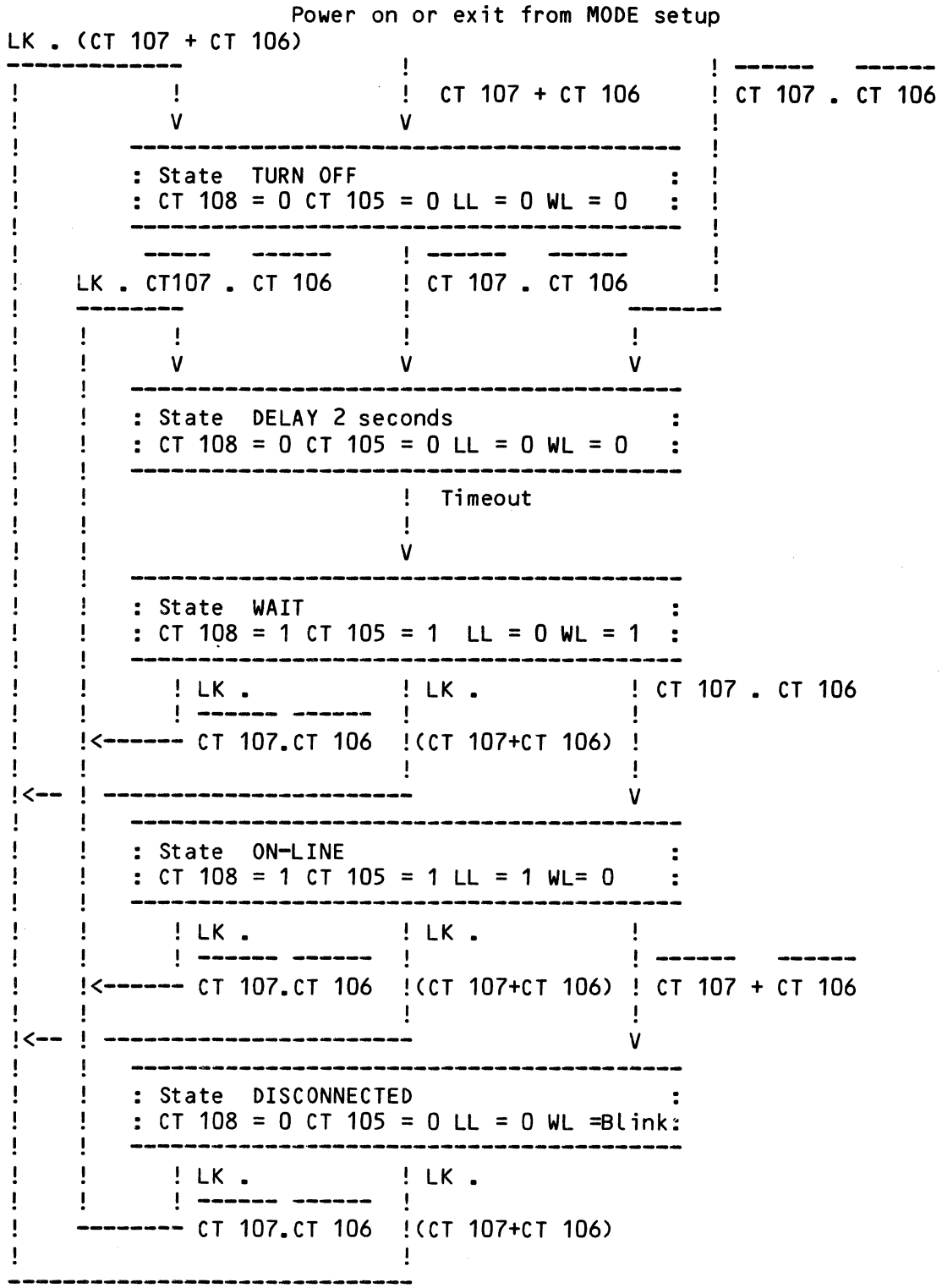


Fig. 4 : State diagram for MODEM switch = DIALLED and ONLINE switch = ON-LINE

Figure 5 below shows the operation in the DIALLED state when the ONLINE switch is set to TOGGLE.

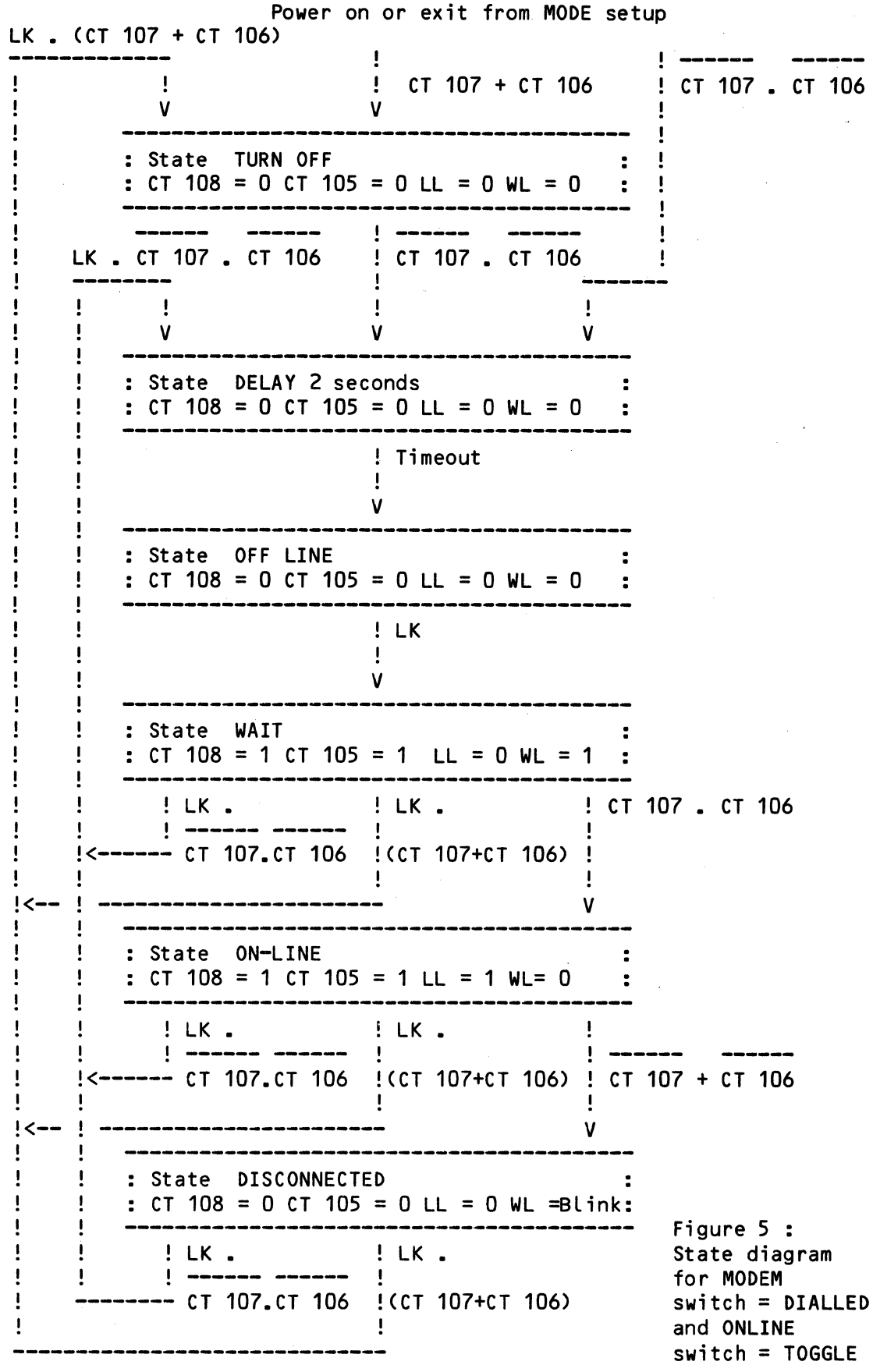


Figure 5 : State diagram for MODEM switch = DIALLED and ONLINE switch = TOGGLE

Figure 6 below shows the operation in the INHIBIT state when the ONLINE switch is set to ON-LINE.

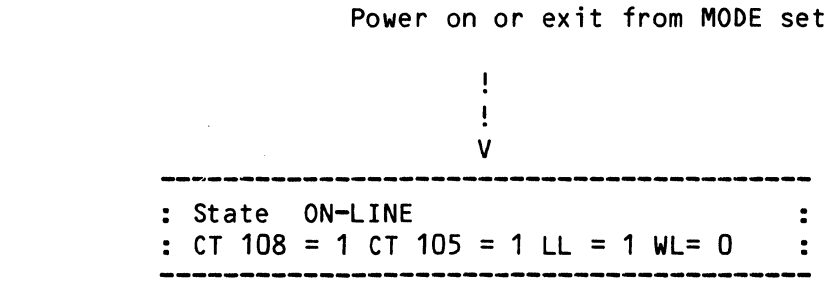


Fig. 6 : State diagram for MODEM switch = INHIBIT and ONLINE switch = ON-LINE

Figure 7 below shows the operation in the INHIBIT state when the ONLINE switch is set to TOGGLE.

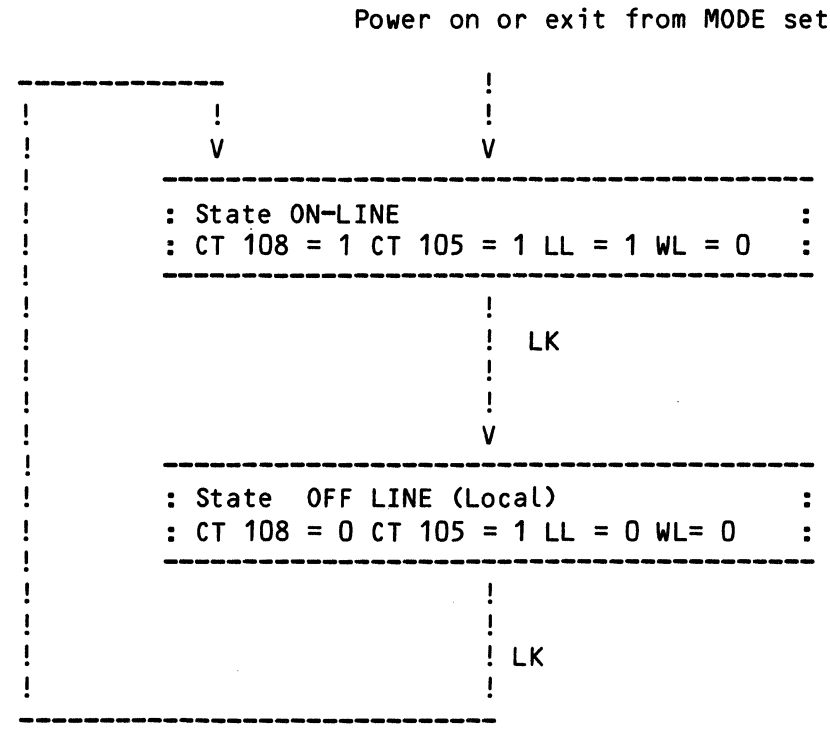


Fig. 7 : State diagram for MODEM switch = INHIBIT and ONLINE switch = TOGGLE

APPENDIX B: Ordering Information

Versions

The following national versions of the TDV 2230 are available:

Version	Ordering no.
TDV 2230 International	4048
TDV 2230 Norwegian standard	4050
TDV 2230 Swedish	4052
TDV 2230 German	4065

Options

Options are items that can be installed at the factory or by a competent service engineer in the field.

The following options are available:

Description	Ordering no.	
Print buffer (2K)	961262	(Note 1)
Current loop adapter on the line interface	961145	
Current loop adapter on the printer interface	961145	(Note 2
V.24 adapter on the printer interface	961120	(Note 2)

Note 1: The standard version has a 32 character print buffer.

Note 2: Only one interface adapter can be mounted on the printer interface.

Accessories

Accessories are items that are not considered to be part of product, but are available separately.

The following accessories are available:

Description	Ordering no.
Modem cable V.24	960586
TDV 2230 V.24/VT100 modem cable	961159
Printer cable open end (current loop)	961304

Documentation

Description	Ordering no.
TDV 2230 Owner's Manual	961331
TDV 2200 Service Manual	961326