



TA 2124 X
ISDN TERMINAL ADAPTER

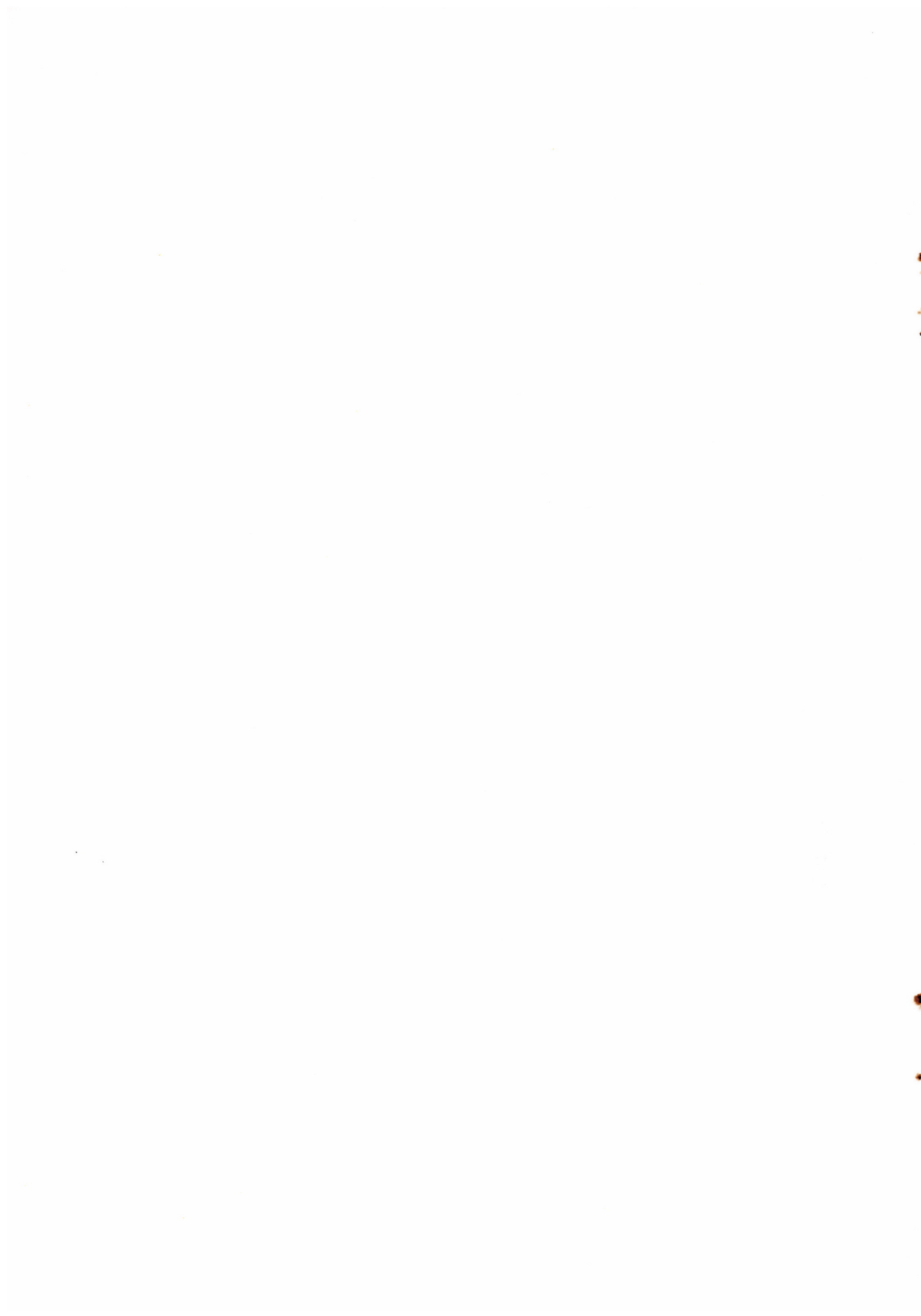
OPERATING INSTRUCTIONS

Hayes is a trademark of Hayes Microcomputer Products Inc.

These operating instructions apply to units with software version:
TA 2124 X VER 1.7, 28.03.96 DATENTECHNIK

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1. GENERAL

1.1. BRIEF DESCRIPTION

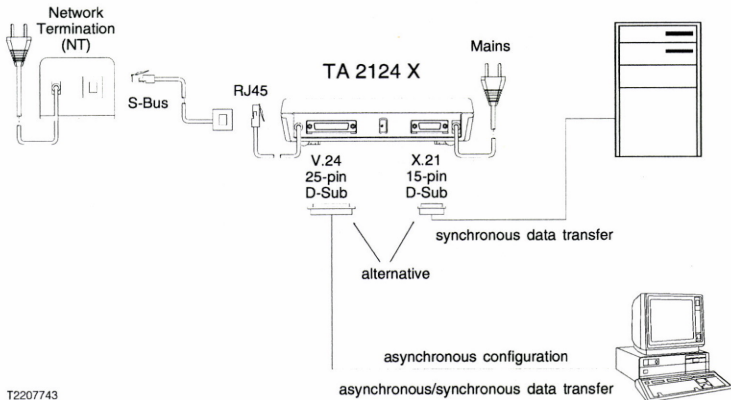
- 1-Port Terminal Adapter
- 1 TR 6 and ETSI protocol on the D-channel
- V.24/V.28 interface or X.21 interface
- V.35 or V.36 interface using passive adapter cables
- Configuration using the Hayes AT command set
- Hayes AT commands, V.25bis dialling procedure, X.21 dialling procedure, direct call, call key
- Memory for 5 subscriber numbers
- Point-to-point fix line
- Local and remote test loops
- Desk-top device with 230 V mains supply

The terminal adapter TA 2124 X facilitates the connection of a terminal equipment with a V.24 or X.21 interface to the S-interface of the ISDN basic rate access. Using a passive adapter cable the X.21 interface can also be connected to a terminal equipment with a V.35 or V.36 interface (see chapters 2.3.1. and 9.2.3.).

The V.24 interface is also used for configuration, i.e. for the setting up of the device parameters and for the storage of the subscriber numbers by means of an asynchronous terminal. A Hayes AT command set, recognized as an industry standard in dial-up line modems, is used for interrogation and modification of the device settings.

The connection can be set up by using Hayes AT dialling commands, the X.21 or the V.25bis dialling procedure, direct call of a stored number (C-dialling or 108.1) or manually using the call key. For a point-to-point fix line there is no connection setup and the TA 2124 X begins automatically with the frame synchronization.

The TA 2124 X is designed as a desk-top with mains supply.

Application example**1.2. SAFETY AND GUARANTEE NOTES**

The manufacturer does not accept responsibility for damage to the terminal adapter resulting from improper use violating the provisions of the national guarantee or disregarding safety instructions. This does not affect your statutory rights.

The device may only be operated within the conditions of temperature, humidity, mains voltage and mains frequency specified in chapter 9.1. "TECHNICAL DATA".

WARNING!!

Some built-in components of the device may operate at hazardous voltage. Therefore, the terminal adapter must be disconnected from the mains before opening the casing.

2. INSTALLATION

2.1. LOCATION

The TA 2124 X is housed in a plastic casing. The “stand-alone” device is suitable for installation as desk-top or wall-mounting unit.

To guarantee long service of the terminal adapter, please ensure that:

- the device is not exposed to direct sunlight and
- neither dirt nor moisture gain access to the interior of the device.

2.2. CONNECTIONS

The connection of a V.24 data terminal equipment is effected using a 25-pin D-Sub socket at the back of the device. An X.21 (or V.35 or V.36) data terminal equipment is connected using the 15-pin D-Sub socket. Only one of the two interfaces can be operated at any one time.

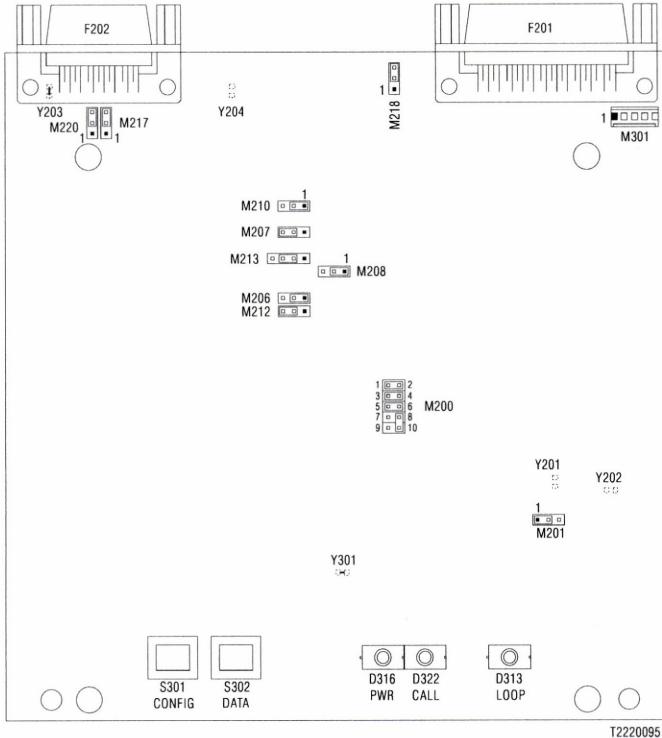
The terminal adapter is supplied with the necessary 230 V by means of a mains cable with Europlugs (UK version for 240 V and with UK mains plug).

Connection to the ISDN access (S-Bus) is effected using a cable with an RJ45 plug.

When connecting the cables and during operation, care should be taken that the cables and plug-in connections are not subjected to tensile loads.

2.3. OVERVIEW OF SETTINGS

Position of jumpers shows factory default.



2.3.1. INTERFACE SETTINGS FOR F202

Jumper pin	X.21	V.35 ¹⁾	V.36/V.11 ¹⁾	V.36/V.11/V.10 ¹⁾
M206	2-1	3-2	2-1	2-1
M207	3-2	2-1	3-2	3-2
M208	2-1 ²⁾	3-2	2-1	2-1
M210	2-1	3-2	2-1	2-1
M212	3-2 ²⁾	2-1	3-2	3-2
M213	3-2	4-3	3-2	3-2
M217	3-2	2-1	2-1	2-1
M218	3-2	2-1	2-1	2-1
M220	3-2	2-1	3-2	2-1

For interface assignment and recommended connections see chapter 9.2.

1) Using an adapter cable (see chapter 9.2.3.)

2) Input impedance 150 Ohm. If a higher input impedance is required, settig as for V.35.

2.3.2. GENERAL SETTINGS

Jumper pin	Setting	Function
M200		Fixed setting
M201	1-2 2-3	Check ETSI service indicator ¹⁾ Ignore ETSI service indicator ²⁾

Solder strap	Setting	Function
Y201	open*) closed	Is parallel to M201/2-3 Evaluation of the ETSI Service Indicators can be selected with mit M201. M201 has no function (according to fix M201/2-3)
Y202		No function
Y203	closed*)	Connects the socket protection with ground
Y204		No function
Y301	closed*)	Watchdog (only for service purposes)

1) For 64 kbps connections the service indicator "Unrestricted Digital Information" is evaluated.

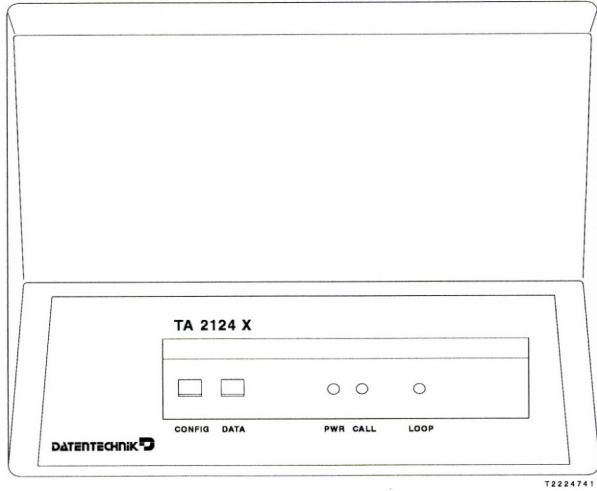
2) For 64 kbps connections other indicators (e.g. Voice, Audio) are also accepted.

*) Factory default setting

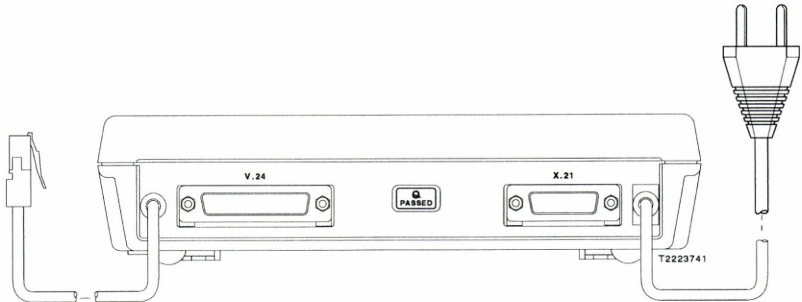
3. OPERATION

3.1. FRONT AND REAR VIEW

Front view



Rear view



3.2. DISPLAY AND CONTROLS

3.2.1. LED DISPLAYS

LED	Function
PWR	Lights up, if the mains cable is plugged in and the correct supply voltage is available.
CALL	<p>Flashes during connection setup.</p> <p>Lights up, if a connection has been established.</p> <p>Where the operating mode has been changed by pressing the CONFIG key: the LED flashes for approximately 2 seconds as an indication that profile 0 has been loaded, or in conjunction with the LOOP LED as an indication that the default profile has been loaded.</p> <p>Where a cold start has been invoked by pressing the CONFIG key: the LED flashes briefly 3 times together with the LOOP LED.</p> <p>In operating mode "point-to-point fix line" (&M11,&M12,&M13): Flashes, if the S₀-Bus frame is not recognized. Lights up, if the S₀-Bus is ready to operate.¹⁾</p>
LOOP	<p>Flashes where there are synchronization errors (only at rates of less than 64 kbps).</p> <p>Lights up, if a local digital test loop is connected.</p> <p>Where the operating mode has been changed by pressing the CONFIG key: the LED flashes for approximately 2 seconds as an indication that profile 1 has been loaded, or in conjunction with the CALL LED as an indication that the default profile has been loaded.</p> <p>Where a cold start has been invoked by pressing the CONFIG key: the LED flashes briefly 3 times together with the CALL LED.</p>

1) In operating mode "point-to-point fix line", the lighting up of the LED CALL cannot inform, if the call was put through to the remote station in the ISDN network.

3.2.2. OPERATING CONTROLS

Key	Function
CONFIG	<p>While off-line: Pressing the key for 0.5 seconds: Switches the operating mode. A new profile is loaded. Various operating modes corresponding to the contents of profile 0, profile 1 and the default profile can be set up in sequence (see also 3.6.2.).</p> <p>Pressing the key for 3 seconds: Results in a cold start, equivalent to power ON reset (see AT%Z). Kept pressed down while switching on the power supply (standard setup function): The default profile will be loaded.</p> <p>While on-line: Brief pressing where there is an established ISDN connection causes the terminal adapter to switch to the on-line command state (see chapter 3.3.).</p>
DATA	<p>While off-line: Brief pressing causes a direct call to be sent. The first of the 5 stored subscriber numbers is dialled.</p> <p>While on-line: Disconnection of the call.</p> <p>Attention: The key has no effect in operating modes &M2, &M3, &M7, &M10, &M11, &M12 and &M13.</p>

3.3. OPERATING STATES

The current status can be displayed using the command AT10. The following states should be differentiated (see diagram on page 10):

Off-line

The terminal adapter is operational (Idle State). There is no ISDN connection established nor is one being set up. In the case of a Hayes operating mode (&M0, &M1) the terminal adapter is ready for configuration (dialogue mode using AT commands).

Incoming Call

The terminal adapter is dialled from the remote station. The establishing of an ISDN connection is dependent on the Auto-Answer setting. The incoming call can further be accepted depending on the result of the MSN checking (see AT#N) and whitelist checking (see AT#W).

Call Accepted

An incoming call has already been accepted, however the connection is not yet ready for data transfer. The synchronization with the ISDN network still has to be completed.

Outgoing Call

The terminal adapter dials the remote station.

On-line (data transmission)

The ISDN connection is set up and ready for transparent data exchange.

Config

The configuration, i.e. the setting of parameters, takes place in this state using Hayes AT commands via the V.24 interface (see chapter 4.).

On-line Command

Only possible for asynchronous operating modes &M0 and &M3, where register setting S2 is not "000" (see chapter 4.2.2.)

If the escape sequence "+++" is input or the CONFIG key pressed where an ISDN connection is established, the local terminal adapter switches to on-line command state. The ISDN connection remains, but data exchange with the remote station cannot take place. A return to data transmission state can be effected using ATO. The connection can be cleared using ATH.

Remote Command

Only possible for asynchronous operating modes &M0 and &M3 where the register setting S40 is not "000" (see chapter 4.2.2.).

If the remote escape sequence "—" is input where an ISDN connection is established, the remote terminal adapter switches to remote command state. The remote escape sequence "—" must be input with the parity matching settings of the remote station. After input of the remote escape sequence "—" the local terminal adapter will work according to the settings of the remote terminal adapter, in particular the ATE, ATQ, etc. settings. Key functions are locked in this state to eliminate the possibility of incorrect operation. The ISDN connection remains, but data will not reach the remote station. The settings of the remote terminal adapter can be interrogated. A return to data transmission state can be effected using ATO. The connection can be cleared using ATH.

Note: An escape sequence requires neither the prefix "AT" nor delimitation with "CR". Prior to and following the input of the escape sequence there must be a pause of at least 1 second and between the individual characters (e.g. "+++") not more than 1 second should elapse. Since the recognition of an escape sequence does not take place until after the final character, the input will take place without being echoed (blind input). The device responds to a correct input with an "OK" message. Further input will be interpreted as commands and not forwarded to the remote station. The character definition for an escape sequence takes place in the S2 register. Any character can be defined there, with the exception of characters already allocated. The input takes place using ASCII code. The input "000" switches off the escape recognition.

3.4. SETTING UP A DATA LINK

Dependent on the operating mode, the terminal adapter has various options for setting up ISDN switched line links:

- Hayes AT dialling commands (&M0, &M1)
- Direct call of a stored subscriber number by control of line "C" or 108.1 (&M2, &M3) or using the DATA key (&M0, &M1 and &M4 to &M9)
- V.25bis dialling procedure (&M4, &M5, &M6, &M8, &M9)
- X.21 dialling procedure (&M7)
- Point-to-point fix line (&M11, &M12, &M13)

If the X.21 interface is used with a passive adapter cable for the connection of a terminal equipment having a V.35 or V.36 interface, line "C" corresponds to line DTR (108) and line "I" to line DCD (109).

3.5. CLEARING A DATA LINK

In addition to the passive connection clearance, i.e. where the connection is cleared by the remote station or by the network, there are the following possibilities:

- Control of the interface line DTR
- Pressing the DATA key
- ATH command
- Activity monitoring

In the operating mode "point-to-point fix line" it is not possible to clear the data link.

3.5.1. CONTROL OF THE INTERFACE LINE DTR

Disconnection of the interface line "C" for the X.21 interface or DTR (108) for V.24, V.35 or V.36 by the data terminal, effects an immediate clearing of the connection (not for setting &D0 in operating modes &M0, &M1, &M4, &M5, &M6, &M8, &M9, &M11, &M12 and &M13).

3.5.2. DATA KEY

Pressing the DATA key while on-line clears the connection. The key has no effect in operating modes &M2, &M3, &M7, &M10, &M11, &M12 and &M13.

3.5.3. ATH COMMAND

This type of connection clearing is only possible in the Hayes operating mode and depends on the state of the terminal adapter (see chapter 3.3.).

If an established ISDN connection is to be cleared, the escape sequence “+++” must first be used to switch to on-line command state. The connection can then be cleared by input of ATH. The same is possible in remote command state, which can be implemented by input of “—” (remote escape sequence).

Local:

```
"+++ " (not displayed)
"OK "
"ATH"
"NO CARRIER"
```

Remote:

```
"-- " (not displayed)
"OK " (from the remote station)
"ATH"
"OK " (from the remote station)
"NO CARRIER"
```

During an incoming call the input of ATH effects the immediate rejection of the call of the remote station.

```
"RING"
"ATH"
"NO CARRIER"
```

The input of ATH during an outgoing call effects an immediate termination of the connection setup.

```
"ATD0123456789 "
"DIALING: 0123456789 "
"ATH"
"NO CARRIER"
```

3.5.4. ACTIVITY MONITORING (only for asynchronous operation)

If no data is received for a period of 3 minutes (timeout), the connection will be cleared automatically to save charges for unwanted connections. Every character received restarts the activity monitoring.

If for a long period of time data will be only sent, the activity monitoring should be switched off using AT\T0.

Note: The activity monitoring will be disabled locally during on-line state (“+++”). Since in this state no data is sent to the remote terminal adapter, its activity monitoring may cause an unintentional clearing of the connection.

3.6. SETTING THE OPERATING MODE

First of all the terminal adapter must be in off-line state and in a Hayes operating mode (&M0 or &M1) (asynchronous dialogue mode with AT commands). If the terminal adapter is set to a different operating mode (V.25bis or direct call), the CONFIG key has to be pressed (see chapter 3.6.2.).

In addition it may be useful to reset the parameters to their default values so that the DTE and the terminal adapter can communicate (see chapter 4.1.).

The parameter settings of the terminal adapter (operating modes, parameters) are accomplished and stored using AT commands via the V.24 interface. A parameter set is called a profile. There are three independent profiles available with different properties:

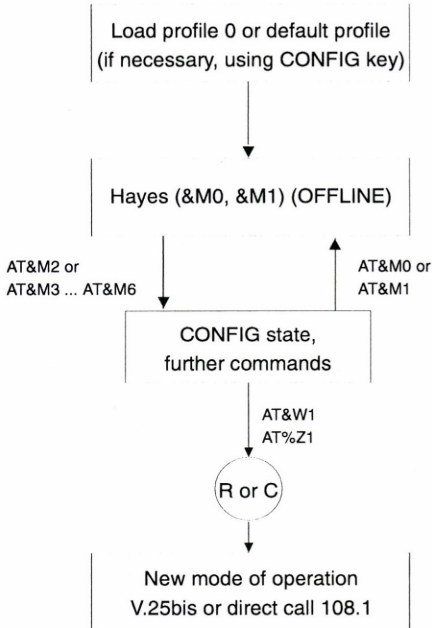
- Profile 0: Adjustable, storable for Hayes operating modes (&M0, &M1, device works using AT commands)
- Profile 1: Adjustable, storable for all operating modes (i.e. also X.21, V.25bis and direct call)
- Default profile: Stored permanently.
Used to create a defined initial state.
Corresponds to the factory default setting (&M0).

Switching between the different profiles can also take place using the CONFIG key.

Overview of possible settings:

	Interface	Dialogue mode	Data transfer
&M0	V.24	Hayes AT asynchronous	asynchronous
&M1	V.24	Hayes AT asynchronous	synchronous
&M2	V.24	Direct call using DTR 108.1	synchronous
&M3	V.24	Direct call using DTR 108.1	asynchronous
&M4	V.24	V.25bis BSC	synchronous
&M5	V.24	V.25bis HDLC	synchronous
&M6	V.24	V.25bis asynchronous	asynchronous
&M7	X.21	X.21 protocol	synchronous
&M8	X.21	V.25bis BSC	synchronous
&M9	X.21	V.25bis HDLC	synchronous
&M10	X.21	Direct call C-dialling	synchronous
&M11	X.21	Point-to-point fix line	synchronous
&M12	V.24	Point-to-point fix line	synchronous
&M13	V.24	Point-to-point fix line	asynchronous

3.6.1. USING THE COMMAND AT&M(n)



C Press the CONFIG key for 0.5 seconds

R Reset using ATZ command, Power ON or pressing the CONFIG key for 3 seconds

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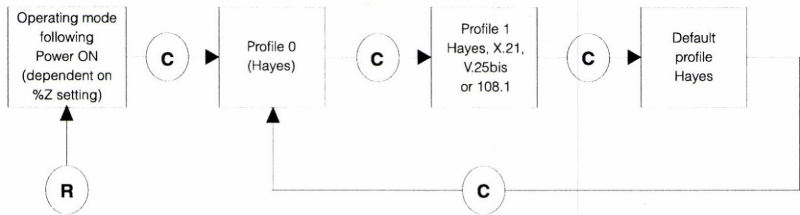
When connecting the power supply, the device automatically loads a profile dependent on the AT%Z setting. If the CONFIG key is held down at the same time, the default profile is loaded.

The setting of parameters is made exclusively using Hayes commands (load profile 0 or default profile as specified in chapter 3.6.2.).

If AT&M0 or AT&M1 is entered, the device will immediately be ready to set up a connection.

The selection of X.21, V.25bis or direct call operating modes (AT&M2 to AT&M10) puts the TA 2124 X in a configuration state (CONFIG state). Settings can be undertaken (operating mode, parameters), but it is not possible to set up a connection. Saving the settings in profile 1 (AT&W1), selection of profile 1 (AT%Z1) and subsequent reset activates the new operating mode.

3.6.2. MANUAL SWITCHING USING THE CONFIG KEY



- C** Press the CONFIG key for 0.5 seconds
- R** Reset using the ATZ command, Power ON or pressing the CONFIG key for 3 seconds

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This option for profile switching ensures simple manual operation.

Starting from the current operating mode, the operating mode can be changed by pressing the CONFIG key for 0.5 seconds.

The first time the key is pressed after switching on the power supply causes the contents of profile 0 to be loaded to the active profile.

As confirmation the CALL LED flashes for approximately 2 seconds.

Pressing again causes the contents of profile 1 to be loaded to the active profile. As confirmation the LOOP LED flashes for approximately 2 seconds.

Pressing again causes the loading of the contents of the default profile. As confirmation both LEDs flash for approximately 2 seconds. The cycle then begins anew with profile 0.

3.7. OPERATING MODES

3.7.1. HAYES OPERATING MODE (&M0, &M1)

In order to be able to connect terminal equipment which have Hayes compatible communications software to the terminal adapter, an extended Hayes AT command set has been implemented.

Possible Hayes operating modes are:

- asynchronous operation (&M0)
- asynchronous command mode with synchronous data transfer (&M1)

The call setup is controlled using the dialling command ATD.

The acceptance of a call depends on the Auto-Answer setting:

- If Auto-Answer is switched on and the interface signal DTR (108) from the terminal equipment is ON, the terminal adapter accepts every incoming call.
- If Auto-Answer is switched off and the interface signal DTR is ON, the call can be accepted using ATA or rejected by using ATH. If no command is input, the call will be rejected after expiry of a timeout of 30 seconds.

In case of an incoming call, if Calling Line Identification Presentation (CLIP, see ATX9) is enabled, the number of the calling party will be displayed after the RING message. This function allows either the operator (manually) or the DTE (automatically) to accept or reject the call after verification of the number.

If whitelisting is enabled (AT#W1) and an incoming call with a mismatching number detected, the call will be rejected. If CLIP is enabled, the message CALL REJECTED XXXXX will be displayed, where XXXXX is the calling party number. No RING message will be displayed.

For further details see chapter 5.

3.7.2. DIRECT CALL OF A STORED SUBSCRIBER NUMBER

Direct call 108.1 (&M2, &M3)

For settings &M2 or &M3 the terminal adapter automatically dials the subscriber number stored in subscriber number store location 1 as soon as the interface line DTR (108) from the data terminal changes from the OFF state to the ON state. If no subscriber number has been stored, a direct call cannot take place.

See S10 register setting in chapter 4.2.2 for the possible types of redialling for direct call 108.1. For storing the subscriber numbers see chapter 4.2.3.

Data formats: Synchronous (&M2)
 Asynchronous (&M3)

For direct call operating modes the control of the call acceptance takes place using the interface line DTR (108) in conjunction with the interface line Ring Indicator (125) and the Auto-Answer setting. While S0=0 incoming calls will be rejected.

By controlling the interface line "C" (&M10)

Direct call by control of the interface line "C" on the X.21 interface or DTR (108) on a V.35 or V.36 data terminal equipment. The subscriber number stored in subscriber number store 1 will be dialled automatically. If no number has been stored, a direct call cannot take place.

For the possible types of redialling for direct call C-dialling see S10 register setting in chapter 4.2.2. For storing of subscriber numbers see chapter 4.2.3.

Call acceptance, i.e. connection setup by the remote station, takes place by switching the line "C" or DTR (108) to the ON state during an incoming call (timeout of 20 seconds).

Manual with call key (DATA key)

The data key can be used for a connection setup (not for operating modes &M2, &M3, &M7 and &M10, &M11, &M12 and &M13). Pressing while off-line initiates the dialling of the number in subscriber number store location 1. Pressing while there is an established connection (on-line) has the effect of clearing the connection (not for operating modes &M2 and &M3).

3.7.3. V.25bis DIALLING PROCEDURE (&M4, &M5, &M6, &M8, &M9)

For data terminal equipment having software designed for automatic connection setup conforming to V.25bis, the connection setup takes place using V.25bis dialling commands.

Principles of call acceptance:

In V.25bis operating mode the message INC is displayed for an incoming call. The call is accepted using CIC and rejected using DIC.

For further details see chapter 6.

Data formats: BSC Byte synchronous (&M4, &M8)
 HDLC/SDLC Bit synchronous (&M5, &M9)
 Asynchronous (&M6)

3.7.4. X.21 DIALLING PROCEDURE (&M7)

The dialling procedure for the automatic setup of a data connection defined in accordance with CCITT X.21 is supported. The subscriber number is transferred from the data terminal equipment.

Call acceptance, i.e. connection setup by the remote station, also takes place using the procedure described in X.21.

3.7.5. POINT-TO-POINT FIX LINE (&M11, &M12, &M13)

The data transmission is transparent on a fix assigned ISDN B-channel. In some countries this service substitutes the standard leased lines. As there is no connection setup or clearing, all the corresponding parameters and whitelisting as well as the DATA key have no function.

NOTE: The application for a point-to-point fix line should be made to the local network providers.

3.7.6. CALL ACCEPTANCE

In addition to the Auto-Answer setting S0=0 or S0=1, the TA 2124 X offers two internal mechanisms to control call acceptance. This applies for all operating modes:

- Where an MSN is programmed, the terminal adapter only accepts incoming calls if the Called Party Number matches the MSN (see AT#N).
- When whitelisting is enabled, the terminal adapter only accepts incoming calls if the Calling Line Identification matches a number in the whitelist (see AT&Z and AT#W).

4. CONFIGURATION

4.1. INTRODUCTION

The setting of the terminal adapter parameters is performed the using Hayes AT commands via the V.24 interface. If settings are to remain in place following "Reset" or "Power Down", they should be stored using the AT&W(n) command.

Command lines must always begin with the ASCII characters "AT" or "at". Exception: "A" or "a" leads directly to the repetition of the last command entered.

"AT" entered on its own results only in the confirmation of dialogue readiness (message: "OK"). If, despite the configuration status no OK message results, the default settings (9600 bps, 8 bit, no parity) can be set up as described in chapter 3.6.2.

After initiating the command using "AT", one or more commands (command characters) can usually follow in the command line with their appropriate parameters which are stored in the command buffer (max. 25 characters). The AT string must not be repeated between the commands in the command line, but spaces can be inserted for improved legibility. The message *"ERROR: TOO MANY CHARACTERS IN LINE"* will be displayed and the buffer deleted if more than 25 characters are input.

AT command lines must be delimited with a "CR" or "CR/LF" before the command buffer is processed.

A command structure recognized as incorrect will be acknowledged with "ERROR". Characters other than "A" or "a" at the start of the command line are ignored.

"Backspace" leads to the deletion of the character most recently entered in the command buffer. After entry of a command line the system waits for the appropriate message or response from the terminal adapter. Further commands cannot be entered until this message has been received.

"OK" acknowledges receipt of a correct command.

Most commands can be associated with parameters "(n)", which must be entered directly after the command character. Where no parameter is entered, the value 0 is assumed. If the parameter entered exceeds the permissible value range, the maximum permissible value is assumed. A parameter entry for commands not taking a parameter results in an ERROR message.

The state of the interface line DTR (108) can be either ON or OFF during the dialogue between the terminal adapter and the data terminal equipment.

4.2. PARAMETER SETUP

4.2.1. PARAMETER DISPLAY

I(n) Display of the current hardware and firmware version
 0 Status of the terminal adapter

	Adapter status	Display possible
0	Off-line	yes
1	Incoming Call	yes
2	Call Accepted	no
3	Outgoing Call	no
4	On-line Command	yes
5	Remote Command	yes (at remote station)
6	On-line	no
7	Config	yes

1 Display of the hardware and firmware version

&VO

Output of the full configuration, i.e. of all active and stored profiles (=parameter set-ups) and the stored subscriber numbers

```

ACTIVE PROFILE:
E1 Q0 V1 X1 &B4 &C0 &D1 &K1
&M00 &N0 &R0 S0 \T1 %Z0
#D0 #F0 #G0 #L0 #N #P0 #S0 #T255 #U0 #W0

S00:001 S02:043 S03:013 S04:010 S05:008
S10:000 S20:000 S40:000 S41:001

STORED PROFILE 0:
E1 Q0 V1 X9 &B4 &C0 &D1 &K1
&M00 &N0 &R0 &S0 \T1 #F0 #L0 #N #W0

S00:001 S02:043 S03:013 S04:010 S05:008
S10:000 S20:000 S40:000 S41:001

STORED PROFILE 1:
E1 Q0 V1 X9 &B4 &C1 &D1 &K1
&M05 &N0 &R0 &S1 \T1 #F0 #L0 #N #W0

S00:001 S02:043 S03:013 S04:010 S05:008
S10:000 S20:000 S40:000 S41:001

STORED NUMBERS:
0: 0123456789
1: 0123456789
2: NO NUMBER STORED
3: NO NUMBER STORED
4: NO NUMBER STORED

WHITE LISTING:
10: NO NUMBER STORED
11: NO NUMBER STORED
12: NO NUMBER STORED
13: NO NUMBER STORED
14: NO NUMBER STORED
15: NO NUMBER STORED
16: NO NUMBER STORED
17: NO NUMBER STORED
18: NO NUMBER STORED
19: NO NUMBER STORED
20: NO NUMBER STORED
21: NO NUMBER STORED
22: NO NUMBER STORED
23: NO NUMBER STORED
24: NO NUMBER STORED
25: NO NUMBER STORED
26: NO NUMBER STORED
27: NO NUMBER STORED
28: NO NUMBER STORED
29: NO NUMBER STORED
OK

```

&V1 Output of the active profile and the stored subscriber numbers

```

ACTIVE PROFILE:
E1 Q0 V1 X1 &B4 &C0 &D1 &K1
&M00 &N0 &R0 &S0 \T1 %Z0
#D0 #F0 #G0 #L0 #N #P0 #S0 #T255 #U0 #W0

S00:001 S02:043 S03:013 S04:010 S05:008
S10:000 S20:000 S40:000 S41:001

STORED NUMBERS:
0: 0123456789
1: 0123456789
2: NO NUMBER STORED
3: NO NUMBER STORED
4: NO NUMBER STORED
OK
    
```

&V2 Ausgabe der gespeicherten Rufnummern

```

STORED NUMBERS
0: 0123456789
1: 0123456789
2: NO NUMBER STORED
3: NO NUMBER STORED
4: NO NUMBER STORED

-- HIT ANY KEY TO CONTINUE --
WHITE LISTING:
10: NO NUMBER STORED
11: NO NUMBER STORED
12: NO NUMBER STORED
13: NO NUMBER STORED
14: NO NUMBER STORED
15: NO NUMBER STORED
16: NO NUMBER STORED
17: NO NUMBER STORED
18: NO NUMBER STORED
19: NO NUMBER STORED
20: NO NUMBER STORED
21: NO NUMBER STORED
22: NO NUMBER STORED
23: NO NUMBER STORED
24: NO NUMBER STORED
25: NO NUMBER STORED
26: NO NUMBER STORED
27: NO NUMBER STORED
28: NO NUMBER STORED
29: NO NUMBER STORED
OK
    
```

&V3Output of the active profile in menu format¹⁾

```

ACTIVE PROFILE:
BAUD RATE (&B)      : 9600Bd
DATA BITS (&K)     : 8
PARITY (&N)        : NONE
ECHO (E)           : ON
ACTIVITY CHECK (\T) : ON
AUTO ANSWER (S0)   : ON
MESSAGES (X, Q)    : ON / EXTENDED CODES
MESSAGE FORM (V)   : TEXT FORM
ISDN PROTOCOL (#P) : ETSI
LEASED LINE        : OFF
MODE (&M)          : ASYNCHRONOUS OPERATING MODE
DUPLEX MODE (S20)  : FULLDUPLEX
DCD (&C)           : ALWAYS ON
DSR (&S)           : ALWAYS ON
CTS (&R)           : FOLLOWS RTS

-- HIT ANY KEY TO CONTINUE --

POWER ON TEI (#D)  : ON
L2 IDLE-STATE (#S) : 4
IGN. LOW LAYER COMP. : OFF
MSN (#N)           :
GLOBAL ADDRESS (#G) : 0
TEI (#T)           : AUTO
REDIAL 108.1 (S10) : OFF
STARTPROFILE (%Z)  : Profile 0
WHITE LIST CHECK (#W) : OFF
OK

```

1) The AT commands to set up the parameter are not displayed in the menu. They are inserted here between brackets only as reference.

4.2.2. SETTING, MODIFICATION AND STORAGE OF PARAMETERS

Procedure: Set the parameters in main memory (active profile), then subsequently store as profile 0 or profile 1 (see AT&W).

E(n) Echo during asynchronous command mode
 0 Input is not echoed to the data terminal equipment
 1*) Input is echoed to the data terminal equipment

Q(n) Output of messages (for all operating modes but &M2)
 0*) Messages are output to the data terminal equipment
 1 No output of messages to the data terminal equipment

Note: ATQ1 is fixed for operating mode AT&M2.

S(n)=(x) Definition of the S-register

Setting of the Auto-Answer function (for all operating modes) and definition of ASCII characters for the escape sequences and control characters (for operating modes M0, &M1 and &M6)
 (decimal value 0 - 127)

S00	0*)	Auto-Answer	OFF
		(manual or disabled)	
	1	Auto-Answer	ON
S02	043*)	ESC	("+")
	000	On-line command disabled	
S03	013*)	CR	
S04	010*)	LF	
S05	008*)	BS	
S40	000*)	Remote command disabled	
	045	Rem ESC	Standard ("-")

*) Factory default setting

- S10** Direct call redialling (108.1 and C-dialling)
(&M2, &M3 and &M10)
- 0*) No redialling
- 1 Redialling after approximately 20 seconds using the same number in the event of an unsuccessful connection attempt.
- 2 The next number from the subscriber number store will be dialled, in the event of an unsuccessful connection attempt (redialling will be terminated after storage location 4).
- 3 Redialling will take place, in the event of an unsuccessful connection setup and where the connection is cleared, as long as interface signal DTR (108) is ON (pseudo-leased line operation).
- S20** Full-/Half-duplex mode
(HDX only in &M1, &M2, &M4, &M5 mode)
- 0*) FDX (full-duplex)
- 1 HDX (half-duplex, 8 ms delay)
- 2 HDX (half-duplex, 80 ms delay)
- 3 HDX (half-duplex, 180 ms delay)
- S41** Definition of the control field for V.25bis and HDLC operation
- 0 Control field C8_{HEX}
- 1*) Control field 13_{HEX}

S(n)?

Display of the current S-register setting

*) Factory default setting

V(n) Format of the messages in the Hayes operating mode
 0 Output of the message in digits
 1*) Output of the message in words

Digit	Text
00	OK
01	CONNECT
02	RING XXXXX
03	NO CARRIER
04	ERROR
05	CONNECT 1200
07	CALL REJECTED XXXXX
10	CONNECT 2400
11	CONNECT 4800
12	CONNECT 9600
13	CONNECT 19200
14	CONNECT 38400
20	ERROR: NO NUMBER STORED
21	ERROR: TOO MANY CHARACTERS IN LINE
22	EEPROM ERROR
30	TA 2124 X
40	DIALLING: XXXXX
99	RESET

X(n) Messages to the data terminal equipment
Hayes messages
 0 OK, ERROR, RING, NO CARRIER, CONNECT
 1 OK, ERROR, RING, NO CARRIER, CONNECT+speed
 9*) All messages, including display of calling party number (whitelist number) and Cause Information from Layer 3
 RING XXXXX and CALL REJECTED XXXXX

V.25bis messages
 0 VAL, INV, INC, CFINT
 1 VAL, INV, INC, CFINT, CNX+speed
 9*) VAL, INV, INC, CFINT, CNX+speed, CFINS

Z Resetting and loading of the profile defined by AT%Z(n) setting

*) Factory default setting

&B(n)

Set baud rate in bps (for all operating modes)
 It must match the speed of the terminal equipment.
 The new baud rate becomes effective only after the entry of this command.
 The message is hence output at the previously set speed.
 An unintentional modification of the baud rate leads to an interruption in the dialogue between the terminal adapter and the data terminal equipment.

asynchronous/synchronous (&M0, &M1, &M3, &M6, &M13)	synchronous (&M2, &M4, &M5, &M11, &M12)
0 1200	0 1200
1 2400	1 2400
2 4800	2 4800
3*) 9600	3*) 9600
4 19200	4 19200
5 38400	5 38400
	6 48000
	7 56000
	8 64000

&C(n)

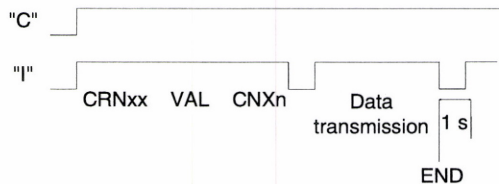
Behaviour of the interface line DCD (109) of the V.24 interface

- 0*) DCD always ON
- 1 DCD conforms to CCITT V.24, i.e. ON if the connection is established and synchronized

Function for &M8, &M9 (V.25bis across X.21 interface)

Behaviour of the "I" line:

- 0 "I" = ON, only during data transfer (Behaviour conforms to 107, DSR or DCD), "I" = OFF during dialogue and connection setup
- 1 "I" echoes "C"; i.e. if "C" = ON, "I" = ON
 "I" = OFF briefly prior to switching through the data connection, i.e. data transfer readiness exists after a new flank. After connection clearing "I" is OFF for 1 second and subsequently follows "C" again (behaviour conforms to 106, CTS)
 Successful connection setup:



*) Factory default setting

&D(n)¹⁾	Response to the interface line DTR (108) 0 Ignore DTR (internally set to ON) (only for &M0, &M1, &M4, &M5 or &M6) 1*) According to CCITT V.24																																													
&F(n)	Load a stored profile into the active profile 0 Default profile 1 Profile 0 2 Profile 1																																													
&K(n)¹⁾	Character length for asynchronous data transfer It must match that of the terminal equipment 0 7 Data bits 1*) 8 Data bits																																													
&M(n)	<table border="0" style="width: 100%;"> <tr> <td></td> <td style="text-align: center;">operating mode</td> <td style="text-align: center;">data transmission</td> </tr> <tr> <td>0*)</td> <td>V.24 Hayes AT</td> <td>asynchronous</td> </tr> <tr> <td>1</td> <td>V.24 Hayes AT</td> <td>synchronous</td> </tr> <tr> <td>2</td> <td>V.24 Direct call 108.1</td> <td>synchronous</td> </tr> <tr> <td>3</td> <td>V.24 Direct call 108.1</td> <td>asynchronous</td> </tr> <tr> <td>4</td> <td>V.24 V.25bis BSC</td> <td>synchronous</td> </tr> <tr> <td>5</td> <td>V.24 V.25bis HDLC</td> <td>synchronous</td> </tr> <tr> <td>6</td> <td>V.24 V.25bis async.</td> <td>asynchronous</td> </tr> <tr> <td>7</td> <td>X.21 X.21 dialling procedure</td> <td>synchronous</td> </tr> <tr> <td>8</td> <td>X.21 V.25bis BSC</td> <td>synchronous</td> </tr> <tr> <td>9</td> <td>X.21 V.25bis HDLC</td> <td>synchronous</td> </tr> <tr> <td>10</td> <td>X.21 Direct call (C-dialling)</td> <td>synchronous</td> </tr> <tr> <td>11</td> <td>X.21 Point-to-point fix line²⁾</td> <td>synchronous</td> </tr> <tr> <td>12</td> <td>V.24 Point-to-point fix line²⁾</td> <td>synchronous</td> </tr> <tr> <td>13</td> <td>V.24 Point-to-point fix line²⁾</td> <td>asynchronous</td> </tr> </table>		operating mode	data transmission	0*)	V.24 Hayes AT	asynchronous	1	V.24 Hayes AT	synchronous	2	V.24 Direct call 108.1	synchronous	3	V.24 Direct call 108.1	asynchronous	4	V.24 V.25bis BSC	synchronous	5	V.24 V.25bis HDLC	synchronous	6	V.24 V.25bis async.	asynchronous	7	X.21 X.21 dialling procedure	synchronous	8	X.21 V.25bis BSC	synchronous	9	X.21 V.25bis HDLC	synchronous	10	X.21 Direct call (C-dialling)	synchronous	11	X.21 Point-to-point fix line ²⁾	synchronous	12	V.24 Point-to-point fix line ²⁾	synchronous	13	V.24 Point-to-point fix line ²⁾	asynchronous
	operating mode	data transmission																																												
0*)	V.24 Hayes AT	asynchronous																																												
1	V.24 Hayes AT	synchronous																																												
2	V.24 Direct call 108.1	synchronous																																												
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5	V.24 V.25bis HDLC	synchronous																																												
6	V.24 V.25bis async.	asynchronous																																												
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11	X.21 Point-to-point fix line ²⁾	synchronous																																												
12	V.24 Point-to-point fix line ²⁾	synchronous																																												
13	V.24 Point-to-point fix line ²⁾	asynchronous																																												
&N(n)¹⁾	Parity bit for asynchronous data transfer. It must match that of the terminal equipment 0*) NONE 1 ODD 2 EVEN 3 MARK																																													
&Q(n)	Same function as &M(n)																																													
&R(n)¹⁾	Behaviour of the interface line CTS (106) while on-line: 0*) CTS follows RTS (105) in the data phase 1 CTS follows DCD (109) in the data phase i.e. ON state While off-line CTS follows DTR (108.2)																																													

*) Factory default settings.

1) Function is not applicable for operating modes &M7, &M8, &M9 and &M10 (ERROR message).

2) Point-to-point fix line implemented from software version 1.5 on.

&S(n)¹⁾	Behaviour of the interface line DSR (107) 0*) DSR always ON 1 DSR conforms to CCITT X.21, i.e. OFF while off-line, ON while on-line
&W(n)	Store the active configuration 0 Store in profile 0 (for Hayes operating modes) 1 Store in profile 1 (for all operating modes)
%Z(n)	Set which profile should be loaded automatically following a power ON or reset 0*) Profile 0 1 Profile 1 2 Default profile
\T(n)	Activity monitoring The receive data RD (104) is monitored for activity during asynchronous data transfer. Should permanent states occur for more than 3 minutes, the connection will be cleared. 0 Activity monitoring OFF 1*) Activity monitoring ON

*) Factory default setting

1) Function is not applicable for operating modes &M7, &M8, &M9 and &M10 (ERROR message).

4.2.3. COMMANDS FOR STORING CALL NUMBERS

- &Z(n)=x...x** Store a subscriber number

 - 0 - 4 Storage location for a subscriber number
 - x...x Subscriber number to be stored
 (maximum 20 digits)

If more digits are input, the message: "ERROR: TOO MANY CHARACTERS IN LINE" is displayed.

- &Z(n)=(*)x...x** Store a whitelist number (calling party number, used for whitelisting incoming calls)

 - 10 - 29 Storage location for a whitelist number
 - * Optional wildcard *
 - If input, the TA 2124 X will only check the digits following the "*" to match with the last digits of the calling party number.
 - "*" can be used to ignore country or area codes.
 - x...x Subscriber number of party authorized to establish a call to the TA 2124 X (1 to 19 digits).

- &Z(n)=** Delete a stored subscriber number or whitelist number

 - 0 - 4 Storage location for one of up to 5 subscriber numbers
 - 10 - 29 Storage locations of the whitelist numbers

4.2.4. COMMANDS FOR SETTING THE ISDN INTERFACE PARAMETERS

Warning: The following commands affect the behaviour of the device at the ISDN interface. They are intended for use only during installation and must be operated by qualified technical staff.

#D(n)	<p>Activation of layer 1 and layer 2</p> <p>0 No automatic activation of layer 1 and 2 after reset. Activation does not take place until there is an outgoing or incoming call</p> <p>1*) Automatic activation of layer 1 and 2 following reset or power ON</p>
#F(n)	<p>Point-to-point fix line¹⁾</p> <p>0*) on channel B1</p> <p>1 on channel B2</p>
#G(n)	<p>Set Global Call Digit (valid only in 1 TR 6 mode) (country specific setting for the recognition of a call not given an EAZ)</p> <p>0*) - 9</p> <p>Incoming Global Calls are in general indicated by a "0" transmitted as the last digit of the subscriber number. For use in some countries (Sweden) it is also necessary to recognize other digits as indicating Global Calls. Incoming Global Calls with called party number ending with the Global Call Digit will be accepted by the terminal adapter</p> <p>Note: Unintentional alteration leads to the call not being accepted and/or to incorrect access!</p>
#L(n)	<p>Ignore Low Layer Compatibility</p> <p>0*) OFF</p> <p>1 ON</p>

*) Factory default setting for standard version.

1) The command AT#F is implemented from software version 1.5 on.

#N(n)

Multiple Subscriber Number (MSN in ETSI mode,
EAZ in 1 TR 6 mode)
None or 0*) - 99999

The MSN serves for the selection of a specific terminal device (port) where several equivalent terminal devices are linked through a single ISDN access.

Note: If #N is entered without a parameter, a stored MSN will be deleted. All calls will be accepted.

In *ETSI-ISDN networks* one or more MSNs are allocated by the local network operator (postal authority) upon request. The MSN programmed will be compared with the last digits of the Called Party Number. Up to 5 digits may be programmed, if required for distinction among several MSNs on the same basic rate access. Only calls with matching MSN will be accepted.

In *1 TR 6-ISDN networks* only the last digit is usually used as MSN (terminal select digit EAZ). Therefore, it may be sufficient to program one digit only.

If no MSN is stored (AT#N), MSN check is disabled.

Note: It should be noted that an MSN must be requested from the local network operator (postal authority)!

#P(n)

Protocol on the D-channel
0*) ETSI
1 1 TR 6

Note: This command affects the behaviour of the device at the ISDN access. An incorrect setting leads to the non-functioning of the device. This special command also triggers a reset and loads the profile defined with AT%Z(n). The modified parameter values not saved with AT&W will be lost.

#S(n)

Stable / not stable in state 7
0 Layer 2 active after connection (stable)
1*) Layer 2 deactivated after connection (not stable)

*) Factory default settings.

#T(n)	<p>Setting the TEI value (Terminal Endpoint Identification) The treatment of the TEI is a component of the ISDN interface protocol. 0 - 63 Fixed setting of the TEI value</p> <p>Note: An application for a fixed TEI value should be made to the local network operator (postal authority)!</p>
	<p>255*) Auto-TEI operation The TEI value is negotiated automatically between the network and terminal adapter.</p>
#U(n)	<p>Rate indication for 38.4 kbps¹⁾</p> <p>0*) "Reserved codes" used for rate coding Generally used in EURO-ISDNs. Setting valid for countries as Germany, Netherlands, Austria, Switzerland. Not suitable in UK for current BTs ISDN2.</p> <p>1 "I-bits" used for rate coding This setting must be used in the UK. Can be used in other countries as well, but make sure remote terminal adapter is set up similarly.</p>
#W(n)	<p>Whitelisting OFF/ON</p> <p>0*) No verification of the calling line identification</p> <p>1 Call acceptance, only if the calling line identification matches a whitelist number (see AT&Z(n) for storage of whitelist numbers)</p>
<p>Note: The values set for #D, #G, #P, #S, #T and #U are stored automatically. They are not affected by AT&W or AT&F.</p>	

*) Factory default setting for standard version

1) The command AT#U is implemented from software version 1.5 on.

5. HAYES OPERATING MODE

5.1. AT COMMANDS AND MESSAGES

5.1.1. COMMANDS

All permissible AT commands are listed below in alphabetical order. Input of "AT&?" displays all commands on the terminal. Input of "AT11" displays the hardware and firmware versions of the equipment. For details see chapter 4.2.

A/ or a/	Repeat the last command executed (without initial AT)
&?¹)	Display all permissible AT commands
A¹)²)	Access to receive an incoming call
D(x...x)²)	Dial a subscriber number (only possible when off-line) x...x Subscriber number (max. 20 digits)
DS(0,1,2,3,4)²)	Dial command for a stored subscriber number A maximum of 5 subscriber numbers can be stored 0 - 4 Indicates the storage location of the subscriber number
E(0,1)¹)	Echo in command mode
H¹)²)	Clear the ISDN connection after input of the escape sequences "+++" or "- - -"
I(0,1)¹)²)	Display of the state of the terminal adapter or the firmware version
O¹)²)	Switch from on-line command state or remote command state to on-line data transmission state
Q(0,1)¹)	Switch on/off message
S0=(0,1)¹)	Set the Auto-Answer function ON/OFF
S2=(nnn)¹)	Selection of the ASCII character for the on-line command escape sequence
S3=(nnn)¹)	Selection of the ASCII character for CR (Carriage Return)
S4=(nnn)¹)	Selection of the ASCII character for LF (Line Feed)

1) Command is also possible in on-line command state and in remote command state.

2) Command for connection setup and connection clearing.

S5=(nnn)¹⁾	Selection of the ASCII character for BS (Back Space)
S10=(0,1,2,3)¹⁾	Direct call redialling (108.1 and C-Dialling)
S20=(0,1,2,3)	Full-/Half-duplex operation
S40=(nnn)¹⁾	Selection of the ASCII character for the remote command escape sequence
S41=(0,1)¹⁾	Selection of the control field (C8 _{HEX} , 13 _{HEX}) in V.25bis synchronous operation HDLC
S(0,2,3,4,5,10,20,40,41)?¹⁾	Display of the S(n) register
V(0,1)¹⁾	Definition of the format of the messages issued
X(0,1,9)¹⁾	Definition of which messages are output
Z	Resetting and loading of the configuration setup using AT%Z
&B(0,1,2,3,4,5)	Set up baud rate (asynchronous, synchronous)
&B(6,7,8)	Set up baud rate (only synchronous)
&C(0,1)¹⁾	Behaviour of the interface line DCD
&D(0,1)¹⁾	Response to the interface line DTR
&F(0,1,2)	Load the default profile, profile 0 or profile 1 into the active profile.
&K(0,1)	Character length for asynchronous data transfer (data bits)
&M(0,1)	Set up Hayes operating modes for the V.24 port
&M(2,3)	Set up direct call operating modes for the V.24 port
&M(4,5,6)	Set up V.25bis operating modes for the V.24 port
&M(7,8,9,10,11)	Set up operating modes for the X.21 port
&M(12,13)	Set up point-to-point fix line connection for the V.24 port
&N(0,1,2,3)	Parity bit for asynchronous data transfer

1) Command is also possible in on-line command state and in remote command state.

&Q(0,1,2,3,4,5,6)	Set up operating mode (same function as &M)
&R(0,1)¹⁾	Behaviour of the interface line CTS
&S(0,1)¹⁾	Behaviour of the interface line DSR
&V¹⁾	Display of the current configuration, the configurations in profiles 0 and 1 and the stored subscriber numbers
&V1¹⁾	Display of the current configuration and the stored subscriber numbers
&V2¹⁾	Display the stored subscriber numbers
&V3¹⁾	Display the current configuration in menu format
&W(0,1)	Store the current configuration in profile 0 or profile 1
&Z(0,1,2,3,4)=x...x¹⁾	Store a subscriber number (5 storage locations)
&Z(0,1,2,3,4)=¹⁾	Delete a subscriber number from a storage location
&Z(10,...,29)=(*)x...x¹⁾	Store a whitelist number (20 storage locations)
&Z(10,...,29)=	Delete a whitelist number from a storage location
%Z(0,1,2)¹⁾	Set up the profile to be loaded automatically following power ON or reset.
\T(0,1)¹⁾	Activity monitoring
#D(0,1)	Activation of layers 1 and 2 with mains ON
#F(0,1)	Point-to-point fix line on channel B1, B2
#G(0-9)¹⁾	Definition of the Global Address
#L(0,1)	Ignore Low Layer Compatibility
#N(xxxxx)¹⁾	Store a Multiple Subscriber Number (up to 5 digits)
#P(0,1)	Protocol on the D-channel
#S(0,1)	Stable / not stable in State 7
#T(xxx)	Set up the TEI value

1) Command is also possible in on-line command state and in remote command state.

#U(0,1)	Rate indication for 38.4 kbps
#W(0,1)	Whitelist check
+++ ¹⁾	The escape sequence causes the switch from on-line data transmission state to on-line command state for an established ISDN connection.
-- ¹⁾	If received from the remote terminal adapter, the remote escape sequence causes the switch from on-line data transmission state to remote command state for an established ISDN connection. If input locally, the remote escape sequence causes the remote terminal adapter to switch to remote command state (if it is in operating mode &M0 or &M6 and the setting of S40 matches).

5.1.2. MESSAGES

The issue of the message is dependent on ATV(n), ATX(n) and ATQ(n):

Display	Meaning
OK	Valid input
ERROR	Error or inadmissible input
CONNECT	Connection
RING XXXXX	Display for an incoming call, with calling party number XXXXX
CALL REJECTED XXXXX	Incoming call from calling party number XXXXX has been rejected because of whitelist number mismatch (no RING message displayed)
NO CARRIER	No data connection
No user respond.	Additional Cause Information when enabled
Normal, unspecif.	
.	
.	
.	
.	

1) Command for connection setup and connection clearing.

CONNECT 1200	Data connection at 1200 bps
CONNECT 2400	Data connection at 2400 bps
CONNECT 4800	Data connection at 4800 bps
CONNECT 9600	Data connection at 9600 bps
CONNECT 19200	Data connection at 19200 bps
CONNECT 38400	Data connection at 38400 bps
ERROR: NO NUMBER STORED	Error, no number stored
ERROR: TOO MANY CHARACTERS IN LINE	Command line too long
EEPROM ERROR	EEPROM error
TA 2124 X	Display of the terminal adapter type
DIALLING: XXXXX	Subscriber number XXXXX is being dialled
RESET	Reset

5.2. DATA FORMAT

Character set	ASCII
	1 Start bit
	7 Data bits
	Even, odd, mark and space parity
	1 Stop bit
or	
	1 Start bit
	8 Data bits
	Even, odd and no parity
	1 Stop bit

6. CCITT V.25bis OPERATING MODE

The V.25bis operating mode (V.25bis commands and messages) was implemented to connect data terminal equipment with software designed for dialogue for automatic connection setup according to V.25bis dial procedure.

The configuration for V.25bis including parameter setup takes place using AT commands (see chapter 4.2.2.).

V.25 operation is possible using the V.24 interface (&M4, &M5 and &M6) and also the X.21 interface (&M8 and &M9).

6.1. COMMANDS AND MESSAGES

6.1.1. DIALLING COMMANDS

CRNnnn	Call Request Number provided Proceed to dial using subscriber number nnn = subscriber number with maximum 20 digits
	Note: If the terminal adapter is in direct call mode (108.1) and if a connection has been cleared, this command can be input as long as the interface signal DTR from the terminal has been applied.
CRSx	Call Request Stored number Dialling command for one of up to 5 stored numbers x = 0, 1, 2, 3, 4 (For storing a subscriber number see chapter 4.2.3.)
CRNPnnn	Same function as CRNnnn
CRNTnnn	Same function as CRNnnn
CRInnn;yyy	Same function as CRNnnn
CRIPnnn;yyy	Same function as CRNnnn
CRITnnn;yyy	Same function as CRNnnn
DIC	Disregard Incoming Call Do not answer incoming calls (Auto-Answer OFF, equals S0=0). If entered up to 10 seconds after INC for Auto-Answer OFF, this command applies to the current incoming call, i.e. rejects the incoming call in order to free the port for the outgoing call.

CIC Connect Incoming Call
Answer incoming calls (Auto-Answer ON) ("global")
If Auto-Answer is OFF, when it is input directly as an answer to INC, the call will be accepted and the command applies only to the current incoming call.

6.1.2. MESSAGES

VAL Valid
Confirmation of a command recognized as being valid

INV Invalid
Rejection of a command with an incorrect format

INC Incoming Call
Indication of an incoming call (precedence over outgoing connection setup)

CNXxxxx Call Connected
Successful connection setup with appropriate data rate.
Message occurs following dialling command and INC.

CNX1200 Data link at 1200 bps

CNX2400 Data link at 2400 bps

CNX4800 Data link at 4800 bps

CNX9600 Data link at 9600 bps

CNX19200 Data link at 19200 bps

CNX38400 Data link at 38400 bps

CNX48000 Data link at 48000 bps

CNX56000 Data link at 56000 bps

CNX64000 Data link at 64000 bps

CFINS Call Failure Indication, no number stored
After CRS: Unsuccessful connection setup, since no subscriber number has been stored.

CFINT Call Failure Indication, no tone
Unsuccessful connection setup

6.2. DATA FORMATS**6.2.1. ASYNCHRONOUS OPERATING MODE (&M6)**

Character set: ASCII
 Start bit: 1
 Data bits: 7
 Parity: Even, odd, mark, space

or

Character set: ASCII
 Start bit: 1
 Data bits: 8
 Parity: Even, odd, none

6.2.2. SYNCHRONOUS OPERATING MODE HDLC (BIT SYNCHRONOUS) (&M5, &M9)

Character set: ASCII
 Data bits: 7
 Parity: Odd
 Synchronous character: Flag (7E_{HEX})

The command structure comprises the following characters:

Flag 7E_{HEX}
 A Address field FF_{HEX}
 C Control field C8_{HEX} or 13_{HEX}
 Character string See chapter 6.1.
 FCS Check character 16 bit
 Flag 7E_{HEX}

	Flag	A	C	Character string	FCS	Flag
(hex	7E	FF	C8	xxxxxxxxxxxx	(16 bit)	7E)

6.2.3. SYNCHRONOUS OPERATING MODE BSC (BYTE SYNCHRONOUS) (&M4, &M8)

Character set: ASCII
 Data bits: 7
 Parity: Odd
 Synchronous character: SYN (16_{HEX}) Bisync 2 sync

The command structure comprises the following characters:

SYN 16_{HEX}
 SYN 16_{HEX}
 STX 02_{HEX}
 Character string See chapter 6.1.
 ETX 03_{HEX}

	SYN	SYN	STX	Character string	ETX
(hex	16	16	02	xxxxxxxxxxxx	03)

7. CCITT X.21 OPERATING MODE

7.1. DIALLING PROCEDURES AND CALL ACCEPTANCE

7.1.1. X.21 DIALLING PROCEDURE (&M7)

The dialling procedure as defined in CCITT X.21 permits a data terminal equipment with an X.21 interface to set up a data connection. The subscriber number is transferred from the data terminal.

Call acceptance, i.e. the connection setup by the remote station, also takes place following the procedure described in X.21.

7.1.2. V.25bis DIALLING PROCEDURE (&M8, &M9)

For data terminals equipment having software designed for an automatic connection setup conforming to V.25bis. The connection setup takes place using V.25bis dialling commands.

Data formats: Synchronous BSC (byte synchronous) (&M8)
 Synchronous HDLC/SDLC (bit synchronous) (&M9)

Call acceptance, i.e. connection setup by the remote station, takes place using the procedure described in V.25bis. The stored subscriber numbers can be dialled in V.25bis using CRS0 to CRS4.

7.1.3. DIRECT CALL OF A STORED SUBSCRIBER NUMBER

By controlling the interface line "C" (&M10)

Direct call by control of the interface line "C" of the X.21 interface or DTR (108) of a V.35 or V.36 data terminal. The line state is controlled. If the state changes from OFF to ON, the direct call is activated, i.e. the first stored subscriber number is dialled.

Redial in the event of unsuccessful calls or connection interruption can be set using ATS10 (S10 register) (see chapter 4.2.2.).

Call acceptance, i.e. connection setup by the remote station, takes place when the line "C" or DTR (108) is switched to the ON state during an incoming call (timeout of 20 seconds).

Manual using the call key (DATA key)

Pressing the DATA key effects a connection setup with the first of the stored subscriber numbers in operating modes &M8 and &M9 (equates to the input of "CRS0"). The message output can be suppressed by ATQ1. The interface line "C" or DTR (108) must be ON for this. The call will only be sent once and not repeated again.

Call acceptance, i.e. the connection setup by the remote station, takes place if the interface line "C" or DTR (108) is in an ON state.

7.1.4. CALL ACCEPTANCE

Is equivalent to a connection setup by the remote station. The call acceptance can be affected by the Auto-Answer function (S0=0 or S0=1) (see "Incoming Call" in the table in chapter 7.2.).

7.2. FUNCTIONAL OVERVIEW X.21 INTERFACE

The following table provides an overview of the action of the individual settings with regard to incoming and outgoing calls.

Settings			Function	
AT&M(n)	ATS0	ATS10	Outgoing Call	Incoming Call
&M7 X.21 dialling procedure	0	0	X.21 dialling procedure	In accordance with X.21 dialling procedure Timeout 2 seconds
		1		
&M8, &M9 V.25bis dialling procedure	0	0	"C" ON and dialling command in accordance with V.25bis "I" behaves as "CTS"	"INC" 30 seconds, wait for "CIC" or "DIC", for timeout reject call "Disconnect"
		1		
&M10 Direct call (C-dialling)	0	0	No redialling	Call rejection "Disconnect"
		1	Redial with same number after approx. 20 seconds when connection attempt unsuccessful	
		2	Dial next number from subscriber number store when connection attempt unsuccessful, abort after store 4	
	3	Redial when connection attempt unsuccessful and where the connection is cleared, as long as "C" ON		
	1	0	No redialling	"I" ON, wait for "C" ON, then accept call
		1	Redial with same number after approx. 20 seconds when connection attempt unsuccessful	
		2	Dial next number from subscriber number store when connection attempt unsuccessful, abort after store 4	
3		Redial when connection attempt unsuccessful and where connection is cleared, as long as "C" ON		

8. TEST LOOPS

A local test loop conforming to CCITT V.54 loop 3 can be formed via the V.24 interface. If the interface line LL (pin 18 of the V.24 interface) is switched to ON, the test loop is activated. The LOOP LED lights up as confirmation.

Bit patterns sent from the terminal equipment must be received correctly (Echo). The functioning of internal circuits is checked using this test. Hayes AT commands have no effect.

Test loops conforming to CCITT V.54 loop 2 (remote loop) and loop 3 (local loop) can be formed via the X.21 interface. The activation takes place from the terminal equipment with special bit patterns according to CCITT X.21. The LOOP LED lights up as confirmation.

Remote loop (loop 2)



Local loop (loop 3)



9. APPENDIX

9.1. TECHNICAL DATA

9.1.1. S-INTERFACE

Techn. Recommendations: ETS 300.012 and 1 TR 230 (layer 1)

D-Channel protocol: ETS 300.125 and 1 TR 6 (layer 2)
ETS 300.102 and 1 TR 6 (layer 3)

Connection: RJ45 plug on a flexible cable, approx. 2 m long

9.1.2. R-INTERFACE

V.24 (Data transmission and configuration)

Interface

functional: CCITT V.24
electrical: CCITT V.28

Bit rates

asynchronous: 1200, 2400, 4800, 9600, 19200, 38400 bps
synchronous: 1200, 2400, 4800, 9600, 19200, 38400,
48000, 56000, 64000 bps

Bit rate adaptation

asynchronous: CCITT V.110
synchronous: CCITT X.30

Configuration: Hayes AT command set

Connection: 25-pin D-Sub socket (ISO 2110)

X.21 (Data transmission)

Interface

functional: CCITT X.21
electrical: CCITT V.11

Bit rates

synchronous: 1200, 2400, 4800, 9600, 19200, 38400,
4800, 56000, 64000 bps

Bit rate adaptation

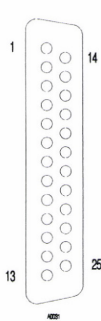
synchronous: CCITT X.30

Connection: 15-pin D-Sub socket (ISO 4903)

9.2. INTERFACE ASSIGNMENT

9.2.1. V.24 INTERFACE

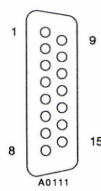
Pin assignment of the 25-pin D-Sub socket (ISO 2110). The logical and functional values conform to CCITT V.24, the electrical values conform to CCITT V.28.



	Line			Function
	CCITT	Signal	Pin	
102	GND		7	Signal Ground
103	TD		2	Transmit Data
104	RD		3	Receive Data
105	RTS		4	Request To Send
106	CTS		5	Clear To Send
107	DSR		6	Data Set Ready
108.1	DTR		20	Connect Data Terminal to Line
108.2				Data Terminal Ready
109	DCD		8	Data Carrier Detect
114	TC		15	Transmit Clock
115	RC		17	Receive Clock
125	CI		22	Call Indicator
141	LL		18	Local Loopback
142	TI		25	Test Indicator

9.2.2. X.21 INTERFACE

Pin assignment of the 15-pin D-sub socket (ISO 4903), if the jumpers are set to X.21 as described in the table in chapter 2.3.1. The logical and functional values conform to CCITT X.21, the electrical values conform to CCITT V.11.



Pin (X.21 Port)	Signal conforming to X.21
1	Signal Ground
2	TD a
3	C a
4	RD a
5	I a
6	S a
7	—
8	Signal Ground
9	TD b
10	C b
11	RD b
12	I b
13	S b
14	—
15	—

9.2.3. OPERATION TOGETHER WITH DTEs WITH V.35 OR V.36 INTERFACE

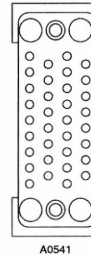
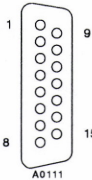
Data terminal equipment with V.35 or V.36 interface can be connected to the X.21 interface by means of passive adapter cables. For the jumper settings required for operation see chapter 2.3.1.

The following pin assignment is a recommendation. You should ask your distributor for information about the relevant settings for your specific data terminal equipment.

9.2.3.1. V.35 mode

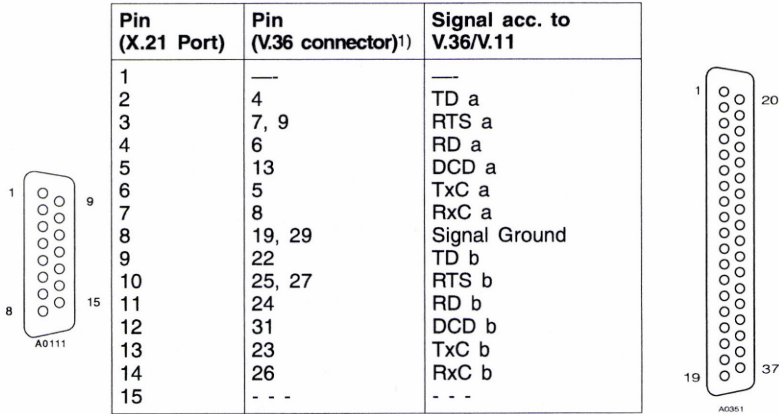
If the jumpers are set to V.35, the interface lines TD, RD, TxC and RxC are available symmetrically according to V.11. RTS, DTR, DCD and DSR are available unsymmetrically according to V.28.

Pin (X.21 Port)	Pin (V.35 connector)	Signal acc. to V.35
1	—	—
2	P	TD a
3	C	RTS
4	R	RD a
5	F	DCD
6	Y	TxC a
7	V	RxC a
8	B	Signal Ground
9	S	TD b
10	H	DTR
11	T	RD b
12	—	—
13	AA	TxC b
14	X	RxC b
15	not defined	RI



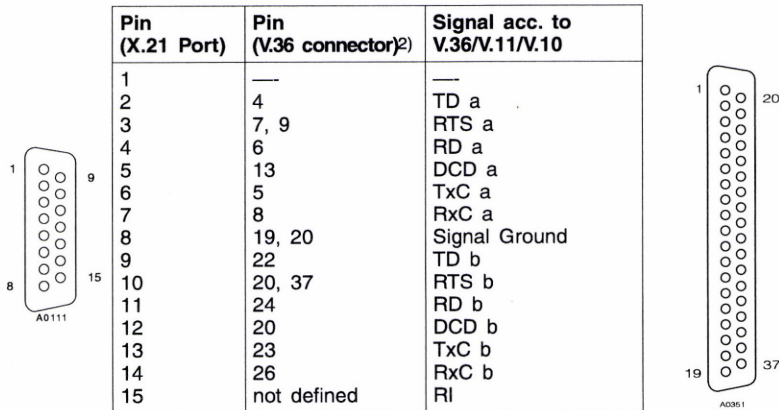
9.2.3.2. V.36/V.11 mode

If the jumpers are set to V.36/V.11, the interface lines TD, RD, TxC, RxC, RTS and DCD are available symmetrically according to V.11.



9.2.3.3. V.36/V.11/V.10 mode

If the jumpers are set to V.36/V.11/V.10, the interface lines TD, RD, TxC and RxC are available symmetrically according to V.11. RTS is available unsymmetrically according to V.10, DCD and DSR are arranged unsymmetrically according to V.28 (compatible with V.10 input).



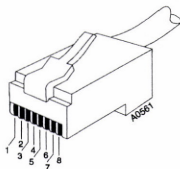
1) By means of adapter cable. The cables should be also connected like follows:

- CTS a (9) connected to RTS a (7)
- CTS b (27) connected to RTS b (25)

2) CTS a (9) connected to RTS a (7)

9.2.4. S-INTERFACE

Pin assignment of the RJ45 plug.



Pin	Function
3	Send +
4	Receive +
5	Receive -
6	Send -

9.3. FACTORY DEFAULT SETTINGS

```

Default Profile:
E1 Q0 V1 X9 &B3 &C0 &D1 &K1
&M00 &N0 &R0 &S0 \T1 %Z0
#D1 #F0 #G0 #L0 #N #P0 #S1 #T255 #U0 #W0

S00:001 S02:043 S03:013 S04:010 S05:008
S10:000 S20:000 S40:000 S41:001

STORED NUMBERS:
0: NO NUMBER STORED
1: NO NUMBER STORED
2: NO NUMBER STORED
3: NO NUMBER STORED
4: NO NUMBER STORED
OK

```

Profile 0 is equivalent to the default profile
 Profile 1 is equivalent to the default profile

VERSION FOR ENGLAND (UK)

```

Default Profile:
E1 Q0 V1 X9 &B3 &C0 &D1 &K1
&M00 &N0 &R0 &S0 \T1 %Z0
#D0 #F0 #G0 #L0 #N #P0 #S1 #T255 #U1 #W0

S00:001 S02:043 S03:013 S04:010 S05:008
S10:000 S20:000 S40:000 S41:001

STORED NUMBERS:
0: NO NUMBER STORED
1: NO NUMBER STORED
2: NO NUMBER STORED
3: NO NUMBER STORED
4: NO NUMBER STORED
OK

```

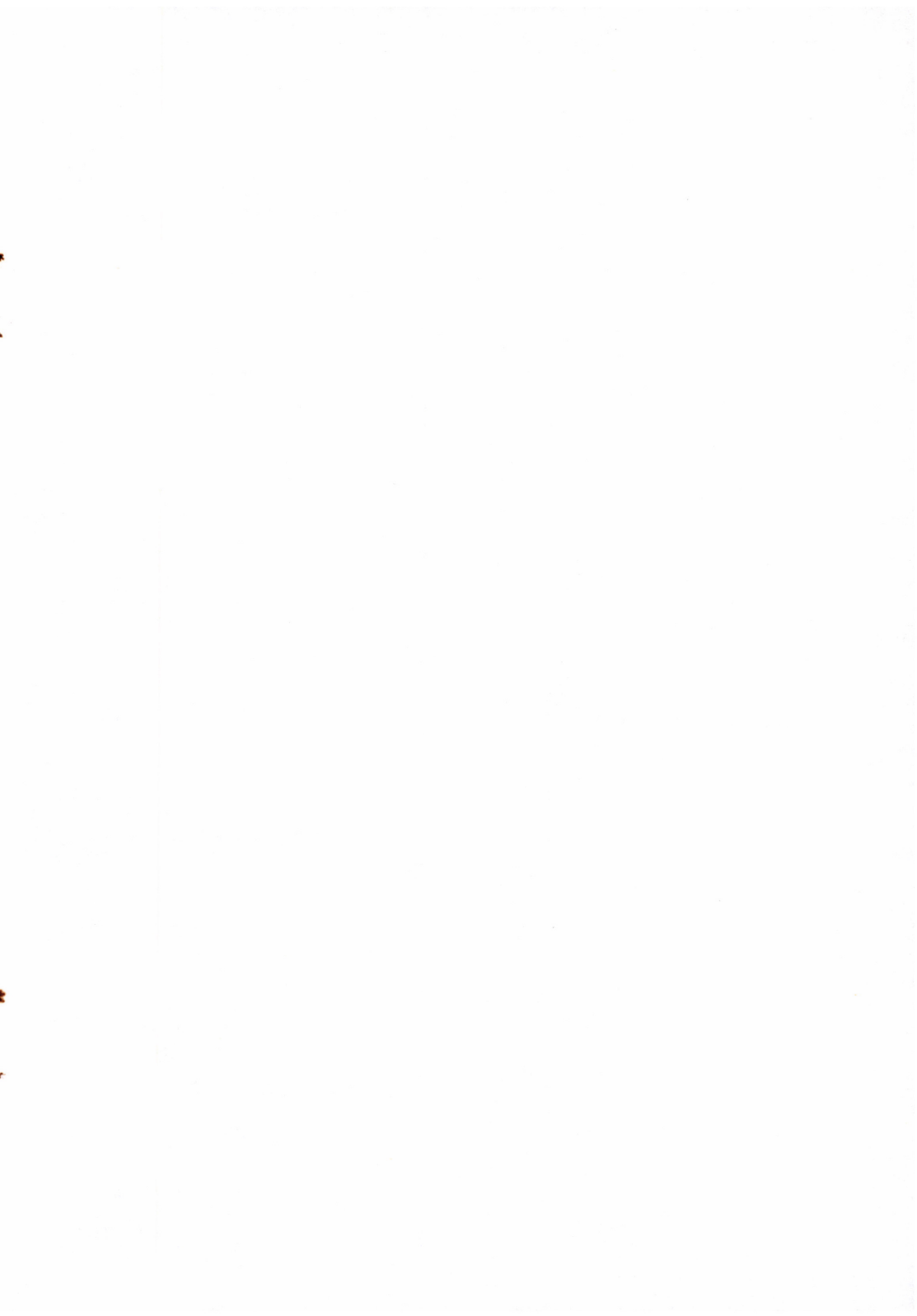
9.4. CONVERSION TABLE, BINARY-HEXADECIMAL-DECIMAL

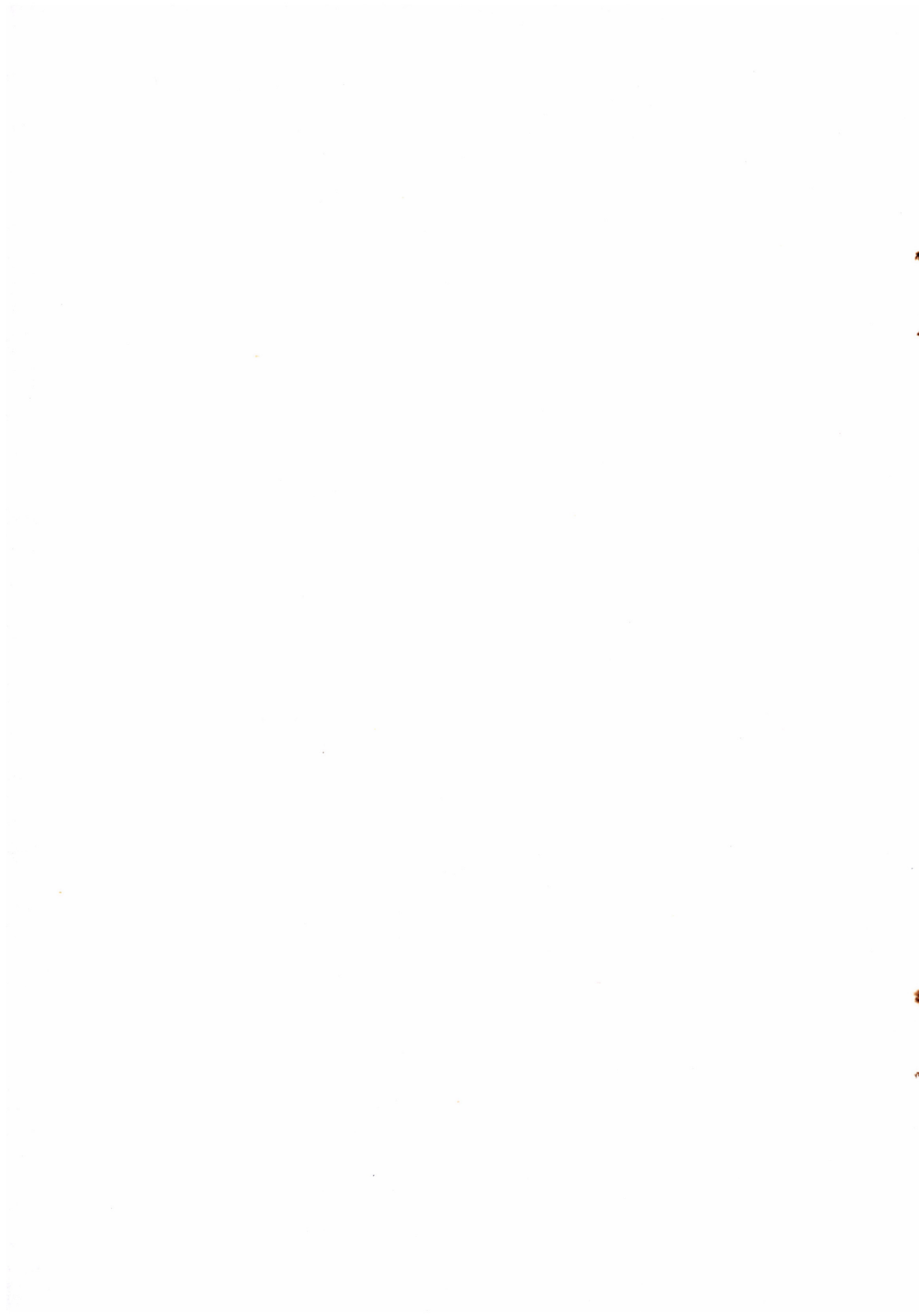
																b3 b2 b1 b0	
																b7 b6 b5 b4	
																bin	
0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111	1111	hex
0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F ←	H/L ↓	
0	16	32	48	64	80	96	112	128	144	160	176	192	208	224	240	0	0000
1	17	33	49	65	81	97	113	129	145	161	177	193	209	225	241	1	0001
2	18	34	50	66	82	98	114	130	146	162	178	194	210	226	242	2	0010
3	19	35	51	67	83	99	115	131	147	163	179	195	211	227	243	3	0011
4	20	36	52	68	84	100	116	132	148	164	180	196	212	228	244	4	0100
5	21	37	53	69	85	101	117	133	149	165	181	197	213	229	245	5	0101
6	22	38	54	70	86	102	118	134	150	166	182	198	214	230	246	6	0110
7	23	39	55	71	87	103	119	135	151	167	183	199	215	231	247	7	0111
8	24	40	56	72	88	104	120	136	152	168	184	200	216	232	248	8	1000
9	25	41	57	73	89	105	121	137	153	169	185	201	217	233	249	9	1001
10	26	42	58	74	90	106	122	138	154	170	186	202	218	234	250	A	1010
11	27	43	59	75	91	107	123	139	155	171	187	203	219	235	251	B	1011
12	28	44	60	76	92	108	124	140	156	172	188	204	220	236	252	C	1100
13	29	45	61	77	93	109	125	141	157	173	189	205	221	237	253	D	1101
14	30	46	62	78	94	110	126	142	158	174	190	206	222	238	254	E	1110
15	31	47	63	79	95	111	127	143	159	175	191	207	223	239	255	F	1111

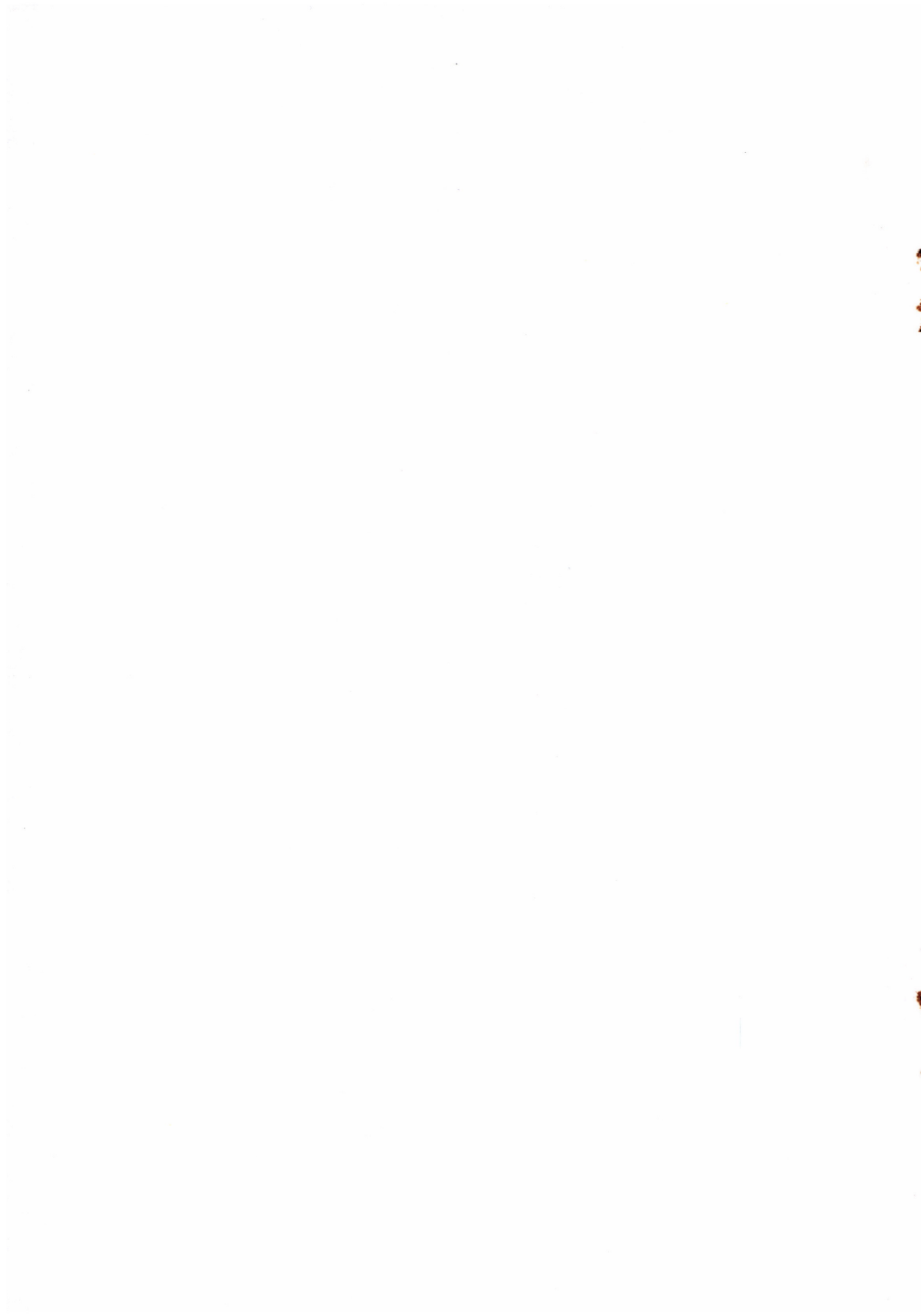
9.5. CONVERSION TABLE, HEXADECIMAL-DECIMAL-ASCII

HEX b8-0	DEC	HEX b8-1	DEC	ASCII
0	0	80	128	NUL
1	1	81	129	SOH
2	2	82	130	STX
3	3	83	131	ETX
4	4	84	132	EOT
5	5	85	133	ENQ
6	6	86	134	ACK
7	7	87	135	BEL
8	8	88	136	BS
9	9	89	137	HT
A	10	8A	138	LF
B	11	8B	139	VT
C	12	8C	140	FF
D	13	8D	141	CR
E	14	8E	142	SO
F	15	8F	143	SI
10	16	90	144	DLE
11	17	91	145	X-ON
12	18	92	146	TAPE ON
13	19	93	147	X-OFF
14	20	94	148	TAPE OFF
15	21	95	149	NAK
16	22	96	150	SYN
17	23	97	151	ETB
18	24	98	152	CAN
19	25	99	153	EM
1AR	26	9A	154	SUB
1B	27	9B	155	ESC
1C	28	9C	156	FS
1D	29	9D	157	GS
1E	30	9E	158	RS
1F	31	9F	159	US
20	32	A0	160	SP
21	33	A1	161	!
22	34	A2	162	.
23	35	A3	163	#
24	36	A4	164	\$
25	37	A5	165	%
26	38	A6	166	&
27	39	A7	167	'
28	40	A8	168	(
29	41	A9	169)
2A	42	AA	170	
2B	43	AB	171	+
2C	44	AC	172	,
2D	45	AD	173	-
2E	46	AE	174	=
2F	47	AF	175	/
30	48	B0	176	0
31	49	B1	177	1
32	50	B2	178	2
33	51	B3	179	3
34	52	B4	180	4
35	53	B5	181	5
36	54	B6	182	6
37	55	B7	183	7
38	56	B8	184	8
39	57	B9	185	9
3A	58	BA	186	:
3B	59	BB	187	:
3C	60	BC	188	<
3D	61	BD	189	=
3E	62	BE	190	>
3F	63	BF	191	?

HEX b8-0	DEC	HEX b8-1	DEC	ASCII
40	64	C0	192	@
41	65	C1	193	A
42	66	C2	194	B
43	67	C3	195	C
44	68	C4	196	D
45	69	CV5	197	E
46	70	C6	198	F
47	71	C7	199	G
48	72	C8	200	H
49	73	C9	201	I
4A	74	CA	202	J
4B	75	CB	203	K
4C	76	CC	204	L
4D	77	CD	205	M
4E	78	CE	206	N
4F	79	CF	207	O
50	80	D0	208	P
51	81	D1	209	Q
52	82	D2	210	R
53	83	D3	211	S
54	84	D4	212	T
55	85	D5	213	U
56	86	D6	214	V
57	87	D7	215	W
58	88	D8	216	X
59	89	D9	217	Y
5A	90	DA	218	Z
5B	91	D B	219	[
5C	92	DC	220	
5D	93	DD	221]
5E	94	DE	222	
5F	95	DF	223	-
60	96	E0	224	GRAVE ACC
61	97	E1	225	a
62	98	E2	226	b
63	99	E3	227	c
64	100	E4	228	d
65	101	E5	229	e
66	102	E6R	230	f
67	103	E7	231	g
68	104	E8	232	h
69	105	E9	233	i
6A	106	EA	234	j
6B	107	EB	235	k
6C	108	EC	236	l
6D	109	ED	237	m
6E	110	EE	238	n
6F	111	EF	239	o
70	112	F0	240	p
71	113	F1	241	q
72	114	F2	242	r
73	115	F3	243	s
74	116	F4	244	t
75	117	F5	245	u
76	118	F6	246	v
77	119	F7	247	w
78	120	F8	248	x
79	121	F9	249	y
7A	122	FA	250	z
7B	123	FB	251	{
7C	124	FC	252	
7D	125	FD	253	}
7E	126	FE	254	-
7F	127	FF	255	DEL









Technical data subject to change without prior notice.