

3B945

CRYPTOMATIC[®] HC-530 / HC-535



INSTALLATION AND OPERATING INSTRUCTIONS

WARNING

VOLTAGES INSIDE THE HC-530/535 CIPHERING TERMINALS CAN CAUSE DEATH OR INJURY. UNDER NO CIRCUMSTANCES SHOULD THESE UNITS BE OPENED WITHOUT FIRST DISCONNECTING THE POWER CORD FROM THE MAINS SUPPLY. NEVER APPLY POWER TO A UNIT IF IT IS OPEN.

WARNING

NEVER ALLOW A SHORT CIRCUIT TO OCCUR ACROSS THE TERMINALS OF THE REMOVABLE NICKEL-CADMIUM (NI-CD) ACCUMULATOR OF THE HC-530/535. THE LOW INTERNAL IMPEDANCE OF THE ACCUMULATOR WILL ALLOW HIGH CURRENTS TO BE THEN PRODUCED, WHICH CAN HEAT AND MELT CONDUCTORS, PRODUCING BURNS, FIRE HAZARDS AND EQUIPMENT DAMAGE. FURTHER, SINCE NI-CD ACCUMULATORS CONTAIN HIGHLY-POISONOUS CADMIUM, NEVER DISPOSE OF WORN-OUT ACCUMULATORS IN THE GARBAGE, NEVER OPEN THEM AND NEVER BURN THEM. RATHER ALWAYS RETURN THEM TO CRYPTO AG FOR RECYCLING.

CAUTION

BEFORE CONNECTING THE LINE CORD TO YOUR AC MAINS SUPPLY, ENSURE THAT THE VOLTAGE SELECTOR SWITCH (FIGURE 3.1) IS SET TO YOUR LOCAL SUPPLY VOLTAGE VALUE (110 OR 220 VAC) NOTE: THIS CAUTION DOES NOT APPLY IF A DC CHARGER MODULE PSB-530 IS BEING USED; IT HAS NO VOLTAGE SELECTOR SWITCH.

EMERGENCY CLEAR OF BASIC KEYS

TO DESTROY THE SECRET BASIC KEYS, ENTER

CTRL R CTRL B CTRL X Y
└─ * ─┘ └─ * ─┘ └─ * ─┘

* PRESS THESE KEYS SIMULTANEOUSLY.

TYPE DESIGNATION

THE HARDWARE VERSION (HWV) IS SPECIFIED BY THE THREE DIGITS FOLLOWING HC-530- (OR HC-535-) ON THE METAL NAMEPLATE OF YOUR HC-530/535. REFER TO SECTION 6.4.1 TO OBTAIN THE SOFTWARE VERSION (SWV). THIS DOCUMENT IS VALID FOR HWV = 2XX AND SWV = 02XX WHERE X CAN BE 0 TO 9.

C O N T E N T S

	Page
1. GENERAL	1-1
1.1 DESCRIPTION	1-1
1.2 APPLICATIONS	1-2
1.3 CONSTRUCTION	1-2
1.3.1 KEYBOARD	1-2
1.3.2 DISPLAY	1-3
1.3.3 PRINTER	1-4
1.3.4 SERIAL INTERFACE	1-4
1.3.5 COUPLERS	1-5
1.3.5.1 ACOUSTIC COUPLER	1-5
1.3.5.2 GALVANIC COUPLER	1-5
1.3.6 POWER SUPPLY	1-6
1.3.7 ACCESSORIES	1-7
1.3.8 OPTIONS	1-9
2. SPECIFICATIONS	2-1
2.1 TECHNICAL DATA HC-530/535	2-1
2.2 SYSTEM SPECIFIC PARAMETERS	2-5
2.3 CRYPTOLOGY	2-5
2.4 ENVIRONMENTAL CONDITIONS HC-530 ONLY	2-6
2.5 ENVIRONMENTAL CONDITIONS HC-535 ONLY	2-7
2.6 MECHANICAL DATA HC-530/535	2-8

	<u>Page</u>
3. INSTALLATION	3-1
3.1 UNPACKING	3-1
3.2 PACKING	3-1
3.3 COMMISSIONING	3-2
4. OPERATION	4-1
4.1 GENERAL OPERATING INFORMATION	4-1
4.1.1 REMOTE CONTROL VIA SERIAL INTERFACE	4-4
4.2 MONITOR MODE (COMMAND MODE)	4-4
4.3 VARIABLE PARAMETER (VP) PROGRAMMING	4-5
4.3.1 INITIAL PROGRAMMING OF VARIABLE PARAMETERS (VP)	4-7
4.3.2 MODIFICATION OF A VALID VP COMBINATION	4-7
4.3.3 CLEARING THE VP DATA	4-9
4.3.4 TWO VARIABLE PARAMETER COMBINATIONS	4-10
4.3.5 STATION IDENTIFICATION (ID) FOR SELECTIVE CALL	4-11
4.4 BASIC KEY (BK) MODE	4-11
4.4.1 BASIC KEYS	4-12
4.4.1.1 FEATURES FOR THE BASIC KEYS	4-12
4.4.1.1.1 "D" FOR BIGRAM DISPLAY	4-13
4.4.1.1.2 "E" FOR BASIC KEY ENTRY	4-14
4.4.1.1.3 "M" FOR MASTER KEY SELECTION	4-15
4.4.1.1.4 "C" FOR CANCELLING BASIC KEYS	4-16
4.4.2 BASIC KEY EMERGENCY CLEAR	4-17

	Page
4.5 TEXT INPUT MODE	4-18
4.5.1 CLEARING THE ENTIRE TEXT FROM MEMORY	4-18
4.5.2 SELECTION OF INPUT MODE WITH KEYBOARD OPERATION	4-19
4.5.3 TEXT INPUT MODE WITH SERIAL INTERFACE	4-19
4.5.4 COUPLER RECEPTION	4-20
4.5.4.1 INTRODUCTION	4-20
4.5.4.2 AUTOMATIC OUTPUT PROCESS	4-20
4.5.4.3 MANUAL INTERRUPTION OF THE COUPLER AUTO- MATIC OUTPUT PROCESS	4-22
4.5.4.4 CLEARING THE RECEIVING MEMORY	4-23
4.5.4.5 RECEIVING WITH ACOUSTIC COUPLER	4-23
4.5.4.6 RECEIVING WITH GALVANIC COUPLER	4-25
4.5.4.6.1 GALVANIC COUPLER AND RADIO OPERATION	4-28
4.5.4.6.1.1 CONNECTIONS FOR RADIO	4-28
4.5.4.6.1.2 OPERATION AT RADIO RECEIVER	4-31
4.5.4.6.1.3 OPERATION AT RADIO TRANSMITTER	4-32
4.5.4.6.1.4 RADIO CALIBRATION	4-32
4.6 PRINTER MODE	4-33
4.7 SERIAL OUTPUT (OUTPUT OF MEMORY CONTENTS)	4-34
4.7.1 SELECTION OF SERIAL OUTPUT MODE	4-35
4.8 CIPHERING	4-35
4.8.1 CIPHERING BY PRINTER	4-37
4.8.2 CIPHERING BY DISPLAY	4-38
4.8.3 CIPHERING VIA THE SERIAL INTERFACE	4-38
4.8.3.1 MESSAGE-SWITCH NETWORKS	4-39

Page

4.8.4	CIPHERING VIA THE COUPLER (ACOUSTIC AND GALVANIC)	4-39
4.8.5	SELECTIVE CALL	4-41
4.8.5.1	VP SELECTION FOR SELECTIVE CALL	4-42
4.8.5.2	GROUP CALL UPS AND CALLS-TO-ALL	4-42
4.9	DECIPHERING MODE	4-44
4.9.1	DECIPHERING WITH PRINTER	4-46
4.9.2	DECIPHERING WITH DISPLAY	4-46
4.9.3	DECIPHERING VIA THE SERIAL INTERFACE	4-47
4.9.4	DECIPHERING CONTINUATION	4-47
4.10	EDITOR MODE	4-49
4.10.1	READING OF TEXT	4-52
4.10.2	TEXT SEARCH	4-52
4.10.3	TEXT DELETION	4-53
4.10.4	TEXT INSERTION	4-53
4.10.5	CHANGING TEXT	4-54
4.11	MEMORY EMERGENCY CLEAR	4-54
4.12	PLAIN TEXT OUTPUTS	4-55
5.	CHECKS	5-1
5.1	GARBLED TEXT AFTER DECIPHERING	5-1
5.2	POOR PRINTING QUALITY	5-1
5.3	OTHER CHECKS	5-2

	<u>Page</u>
6. MAINTENANCE PROCEDURES	6-1
6.1 REPLACING PRINTING PAPER	6-1
6.2 HANDLING OF THE THERMO PAPER	6-3
6.3 ACCUMULATOR MAINTENANCE	6-4
6.4 DIAGNOSTIC SOFTWARE (OPTION)	6-5
6.4.1 DIAGNOSTIC TEST PROGRAM	6-7
6.4.1.1 GENERAL TEST DETAILS	6-9
6.4.1.2 FAULT SIGNALIZATION	6-14
6.4.2 FUNCTIONS DIAGNOSED BY DIAGNOSTIC TEST PROGRAM	6-15
6.4.3 FUNCTIONS NOT DIAGNOSED BY DIAGNOSTIC TEST PROGRAM	6-16
APPENDIX A1 CASES	
APPENDIX A2 MODULE BLOCK DIAGRAM	
APPENDIX A3 SERIAL INTERFACE PIN ASSIGNMENTS	
APPENDIX A4 GALVANIC COUPLER PIN ASSIGNMENTS	
APPENDIX A5 GALVANIC COUPLER CABLE AND PLUG (RADIO APPLICATIONS)	

1. GENERAL

1.1 DESCRIPTION

The CRYPTOMATIC[®] HC-530/535 is a universal ciphering terminal for mobile or stationary use. It serves primarily for the ciphering and deciphering of text in the off-line mode, yet can also be used for ciphered transmission directly over the line via serial or coupler outputs.

The unit is available in a civilian version (HC-530), which comes in a compact elegant Samsonite attaché case or in a military version (HC-535), which comes in a ruggedized military-type case (Appendix 1). Both units can be operated without being removed from their cases.

The various text input and output possibilities as well as a powerful microprocessor system give the units an exceptional flexibility. Operation of the units is simple and logical.

The units will operate, due to their rechargeable, gas-tight nickel-cadmium accumulator (batteries), for up to 5 hours independently of the mains supply. A removable AC (or DC) charger module allows mains buffer or charging operations at all times. The integral printer can also be continuously operated from the accumulator if ever necessary for a duration of approximately 0.8 hours.

The robust metal housing of the HC-530/535 gives excellent EMC protection. The standard text memory is 2000 characters and an optional version with 6000 characters is available. An independent 6000 character receiving memory is available for coupler reception.

1.2 APPLICATIONS

The HC-530/HC-535 allows ciphering and deciphering of secret messages. Messages may be transferred via the acoustic coupler, galvanic coupler or serial interface. The serial interface permits output/input via various types of peripheral equipment such as a tape punch/reader or a telegraph interface for a teleprinter.

1.3 CONSTRUCTION

The HC-530/535 consists of the following plug-in assemblies (modules), Appendix A2:

- Alpha-numeric keyboard and display
- Thermo-printer
- Serial interface
- 5 printed circuit (PC) boards in EURO-format
- Couplers (acoustic and galvanic) with common modem
- Power converter PC board for internal voltages
- AC charger module
- Accumulator (i.e., rechargeable battery) pack.

The connections between modules are provided mainly by ribbon cables.

1.3.1 KEYBOARD

The keyboard of the HC-530/535 has four rows. An n-key rollover function permits fast and error-free inputting. Each key is equipped with a mechanical contact which locks the key during operation. The contact is gold plated and is located in a dust-proof housing. The key caps are removable. The code correlation is pre-set in a matrix. All control and operating commands are entered via the keyboard (by pressing the control key CTRL and another key simultaneously).

1.3.2 DISPLAY

The 40 position liquid crystal display (LCD) serves as a check during text input, provides text output and shows operating instructions and information. A window at the far left of the display indicates the current mode of the HC-530/535. These modes are as follows:

<u>Mode Indicator</u> <u>(Status)</u>	<u>Operating Mode</u>
V	Variable parameter programming mode
M	Monitor (command) mode
B	Basic key mode
I	Text input mode
P	Printing mode (text from memory)
S	Serial output mode (text from memory)
C	Ciphering mode
D	Deciphering mode
T	Test mode
E	Editor mode
EI	Editor insert mode
EC	Editor change mode
EL	Editor locate mode
F	Fault mode
N	Identification number (for inputs)

The following warning signals are also shown (flashing display):

- an asterisk (*) alternating with text (indicates memory nearly full)
- Blank display alternates with text (indicates that the Ni-Cd accumulator is nearly discharged).

1.3.3 PRINTER

A robust thermo-printer is located in the HC-530/535. Printing is in transverse format, i.e., along the long dimension of the thermo-paper strip, providing clear easily-readable text. The printer consists of a transport roller, a thermo-head with 100 printing points and a stepping motor with gearing. A pushbutton for paper feed is located under the lid covering the printer. When this pushbutton is operated the printer head is lifted and mechanical pressure released. Paper feed can only be carried out when the unit is in monitor mode (status M).

1.3.4 SERIAL INTERFACE

The serial interface serves for serial data input and output as well as for test purposes. The asynchronous data input and output signals are available in V28/V24 levels. These signals as well as other signals are available on the interface plug in TTL level (CMOS 5 volt). In addition, the supply voltages are fed to the interface plug for test purposes. Serial data transmission speeds can be selected from 50 to 1200 baud. It is also possible to employ external clocks, whereby 16-fold bit rate can be applied.

The bit rates for input and output can be independently preselected by means of an operator-controlled variable parameter programming mode. It is possible to work in either 5 bit Baudot code or in 8 bit ASCII. In 8 bit code there are various format possibilities: with and without parity, 1 or 2 stop-bits as well as 7 or 8 data bits.

The serial interface pin assignments are given in Appendix A3.

1.3.5 COUPLERS

Various types of coupler operation are programmable

- Normal or
one time: 240 baud (48 characters per second)
- FEC (or
redundant): Multiple transmission with multiple decision
during reception. In this way interference inter-
ruptions of up to approximately 0.5 seconds can be
bridged.
- Selective
Call: Individual addressing or group calling

1.3.5.1 ACOUSTIC COUPLER

The acoustic telephone coupler allows transmission of ciphered messages over telephone lines. The design of the telephone coupler allows coupling to practically all current types of telephone hand sets. Transmission takes place synchronously.

1.3.5.2 GALVANIC COUPLER

The galvanic coupler is an electronic interface which allows telephone and radio communications with the HC-530/535 to take place electrically, i.e., without conversion to an acoustic signal. The galvanic coupler is supplied as part of the acoustic coupler option and uses the same modem.

Switchover from acoustic to galvanic operation occurs automatically as soon as the galvanic coupler is connected to a telephone interface (such as, e.g., the TFG-530 Telephone/Galvanic Switch-over Interface) or to a radio transmitter (both covered in Chapter 4).

The galvanic coupler allows data to be transferred completely electrically thus avoiding background noise sources which can negatively influence acoustic coupler reception.

The galvanic coupler pin assignments are given in Appendix A4.

1.3,6 POWER SUPPLY

The mains supply feeds the charger module of the HC-530/535. (By "mains supply" is meant the 110/220 VAC source for the standard AC charger module or the 10 to 30 VDC source for the optional PSB-530 DC charger module.) The HC-530/535 charger module works with a 24 volt nickel-cadmium (Ni-Cd) accumulator in buffer operation as follows: The accumulator will charge regardless of whether the HC-530/535 is turned on or off, but only when the HC-530/535 is connected to the mains supply. When the printer is operating, however, the accumulator helps the charger module supply power to the printer; the accumulator will thus be discharging somewhat when the printer is in use. (The accumulator can, of course, supply power if both operation and printing when the mains supply is not connected.)

Complete discharging of the accumulator during operation (unit switched on) is not possible since a monitor control switches out the accumulator as soon as the terminal voltage drops below approximately 21V. For mains independent operation the unit should be charged for 12 to 15 hours before use. This gives up to 5 hours of normal operation or 0.8 hours of continual printing operation. With a used accumulator these operating times are, of course, reduced. The accumulator voltage is stepped-down by a power converter to provide the internal voltages (see also Section 4.6).

This power converter is equipped with over-current and over-voltage cut-out devices. The over-current protection is provided by a fuse. The charger module is also protected by a fuse on the secondary side. The charger is fitted with a thermal fuse on the mains side.

A separate 4.8V Ni-Cd accumulator protects the basic key and variable parameter memories. (This accumulator is mounted on the keyboard and display PC board - Appendix A2.)

1.3.7 ACCESSORIES

The HC-530/535 is delivered with the following standard accessories:

- 2 mechanical security keys
- 2 rolls of thermo paper for printing
- 1 cleaning band for the printer
- 1 set of operating instructions (this document)
- 1 plasticized Reference Card
- 1 plasticized Short Form Instructions Booklet

In addition the following accessories are available (Figure 1.1):

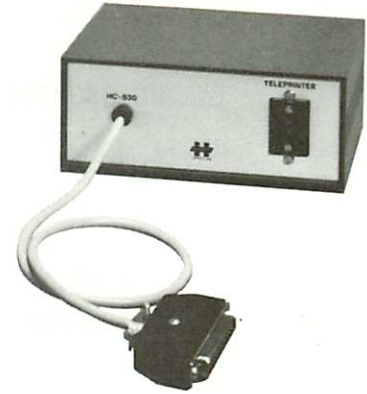
- TPR-530 Tape Punch/Reader for producing and reading paper tapes in the 5-bit Baudot code (CCITT No. 2) at 200 baud
- PSB-530 DC Charger Module for a supply voltage of from 10 to 30 VDC
- ATX-530 Teleprinter Interface with built-in power supply and providing data conversion from the 5V CMOS of the HC-530/535 to a high level 60V, 40ma single-current teleprinter signal.
- PTS-530 Thermo paper (in packs of 25)
- Specially-wired back-back connector cable for test purposes (i.e., for connecting together two HC-530/535 terminals) and for connecting the V24 interface of the HC-530/535 to peripherals of other manufacturers having an RS-232C interface, e.g., visual display units (VDU's), standard high-speed ASCII printers, etc.
- TEA-530 Diagnostic Test Unit for troubleshooting the HC-530/535 to a module level



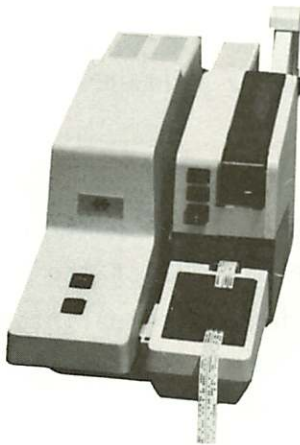
PTS-530
Thermo-paper
Rolls
542.101



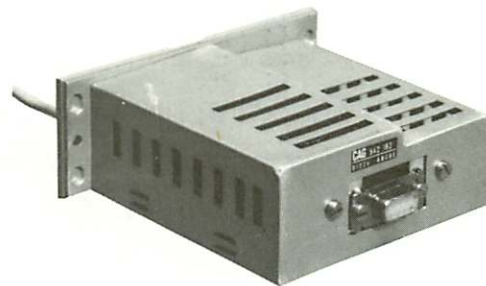
ADA-530
HF Link Frequency
Adjustment Indicator



ATX-530
Teleprinter
Interface



TPR-530
Tape Punch/Reader Station



PSB-530
DC Charger Module

Figure 1.1 HC-530/535 Accessories



Coupler Cable
and Plug

546.944A : Free End

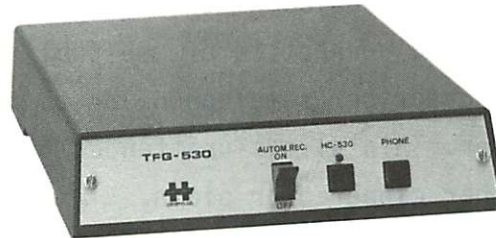
Also for radio:

546.674 : SE-20

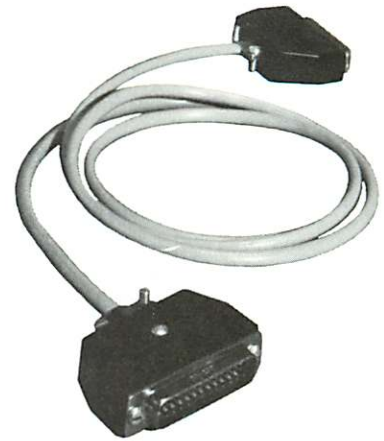
547.899 : PRC-77 Handset

547.925 : PRC-77 Wideband

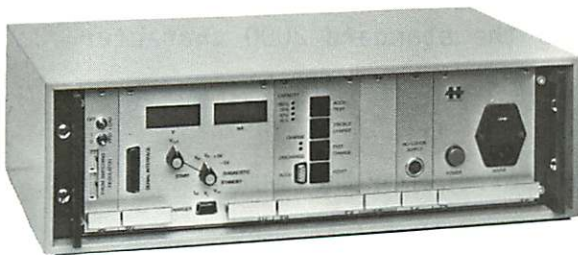
546.816 : SYNCAL, Harris, etc.)



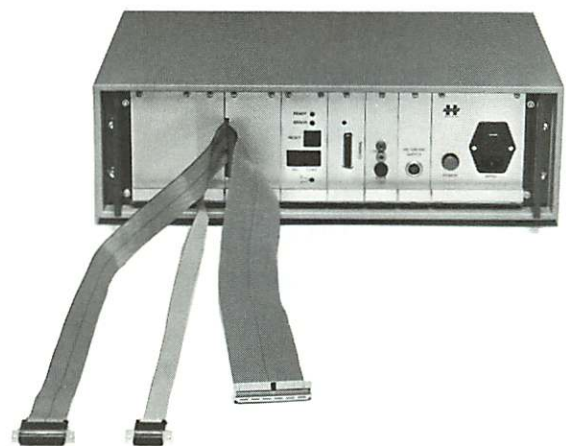
TFG-530
Telephone/Galvanic
Switchover Interface



Back-Back
Connector
546.945A



TEA-530
Diagnostic
Test Unit



TED-530
Diagnostic
Test Unit

- TED-530 Diagnostic Test Unit for troubleshooting the HC-530/535 to a component level
- TFG-530 Telephone/Galvanic Switchover Interface allowing manual or automatic connection of the public telephone line to either the subscriber's telephone or to the HC-530/535 galvanic coupler. This allows unattended receiving station operation, either ciphered or plain.
- Galvanic Coupler Cable and Plug for radio applications (Appendix A5)
- ADA-530 HF Link Frequency Adjustment Indicator for radio calibration purposes (Section 4.5.4.6.1.4).

1.3.8 OPTIONS

- Acoustic/Galvanic Coupler (for telephone and radio operation)
- 6000-Character Memory (replaces the standard 2000 character memory)
- Text Editor (for modifying and correcting the memory contents)
- Diagnostic Test Software (for unit check and fault isolation)

2. SPECIFICATIONS

2.1 TECHNICAL DATA HC-530/535

Technology:	Predominantly Complementary Metal Oxide Semiconductor (CMOS)
Microprocessor:	Type 6802
Mode-of-Operation:	Off-line, digital
Internal Processing Code:	International telegraphic alphabet CCITT No. 2 (5-bit-code)
Data Input:	Keyboard, serial IN, acoustic or galvanic coupler
Data Output:	Display, printer, serial OUT, acoustic or galvanic coupler
Data Memory:	Capacity: 2000 characters (2K) Expandable to: 6000 characters (6K)
Coupler receiving memory:	6K
Keyboard:	Four-row full size keyboard 55 alpha-numerical keys 1 control key N-key rollover function allowing fast entries Automatic figure-shift/letter-shift changeover Key-lift, approx. 4 mm Actuating force, approx. 0.7 N Coding: matrix (changeable)

- Printer:** Principle: Thermo-paper printer
Transverse format
Automatic formatting
69 characters per line (max.)
20 lines per "page"
20 characters per second printing speed (approx.)
Printout pattern, matrix 5 x 5
Paper transport via stepping motor
100 point thermohead
Thermohead overload protection
Paper: Type JUJO F 9
Paper width: 72 mm (in 25 m rolls)
- Display:** Principle: Liquid Crystal Display (LCD) matrix
38 characters + status indicator
Character resolution: 5 x 7 + cursor underline
Character dimensions: 4,5 x 3 mm (approx.)
- Serial Interface:** 25 pole Cannon female-connector DB 244 or M24308/2-3. (Test signals included). Remote control possibility via computer.
- Series Input: CCITT code No. 2 or CCITT code No. 5 (8 bit) asynchronous
Level: CMOS 5V (TTL) and V28/V24
Speed: Ext. timing pulse (16-fold) or 50-1200 Bd
 - Series Output: CCITT code No. 2 or CCITT code No. 5 (8 bit) asynchronous
 - Additional Signals at the Interface: Coupler: Input and output data 240 Bd
Input ready
Output busy (serial OUT + coupler OUT)
16-fold bit timing pulse (for external UART)
Supply voltages (for test)
Test signals

Couplers: Principle: Acoustic (for virtually all types of telephone handsets) and galvanic (electrical) for telephone or radio.

Half-duplex synchronous, 5 bit
(without start-stop)

Speed: 240 Bd (48 characters per second)

Redundant transmission: Selectable (16 characters per second)

Simplex transmission: Selectable (without return channel)

Sensitivity: Better than -45 dB

Modem frequency: CCITT V21 channel 2
(1850 Hz/1650 Hz)

Automatic connection control during operation start-up (not in simplex mode)

Automatic start program evaluation at coupler receiver

Selective call/unattended operation possible (optional) in conjunction with additional receiving memory for permanent standby receiving state.

Power Supply: Removable Ni-Cd accumulator 24V, 450mAh.

Removable AC charger module

Average mains-free operation time: approx. 5 hours without printing, approx. 0.8 hours with continuous printing.

Automatic switch-off during discharge (no complete discharge of the accumulator is possible)

Charging time of the accumulator, approximately 12 to 15 hours (empty/full).

Fusing: 1A standard fuse on power converter PC board.

Separate 4.8V Ni-Cd accumulator on keyboard/display PC board for basic key and variable parameter protection.

AC Charger Module: Input voltage 220 V/110 V $\pm 15\%$ (selectable)

Frequency range 40 - 60 Hz.

Power consumption 4 - 9 VA.

Primary thermal overload protection.

Electronic control for continuous buffer operation with current and voltage limitation

Fusing: PTC thermistor (thermal fuse) on primary side; 250mA slow-blow on secondary side.



DC Charger Module (Optional):	For supply from vehicle battery (10V - 30VDC). Fusing: 2.5A standard fuse.
Internal Supply	+ 5V, - 5V, + 16V, + 24V, with over-voltage and over-current protection
End-of-Operation Indication:	With accumulator operation, optical warning (the display flashes) approximately 0.5 hours before automatic switch-off. (The accumulator must then be recharged.)

2.2 SYSTEM SPECIFIC PARAMETERS

MTBF	$15 \times 10^3 \text{ h} / B = 0.9$
Test/Diagnostic:	Self test upon switch-on. Troubleshooting in conjunction with optional diagnostic test software and with TEA-530 and TED-530 Diagnostic Test Unit accessories.

2.3 CRYPTOLOGICAL DATA

Ciphering Principle:	Text-dependent pseudo-random method (μ P software).
Basic Keys:	Input and deletion via keyboard or serial interface.
	Multiple basic keys, each with a two-digit bigram.
	Variety: approx. 2×10^{28} .
	Storage capacity when switched off: 3 months.



Message Key: Automatically generated with internal random generator or manually input.
 Variety: approx. 1.4×10^{14} .

Period: Approx. 10^{65} steps.

Access Protection: Operation possible only with mechanical security key. Automatic emergency clear in case of unauthorized access.

2.4 ENVIRONMENTAL CONDITIONS HC-530 ONLY

Test according to MIL-STD-810-C

<u>Low Temperature:</u>	Method 502.1-I	
	Operating temperature	0°C
	Storage temperature	-20°C
<u>High Temperature:</u>	Method 501.1-I	
	Operating temperature	+55°C
	Storage temperature	+60°C
<u>Humidity:</u>	Method 507.1-II	+55°C/95%
		Relative Humidity
<u>Vibration:</u>	Method 514.2-X	7-200Hz/2.5g
	(Unit in Case)	
<u>Shock:</u>	Method 516.2-I	30g/11ms
	(Unit in Case)	
<u>Drop:</u>	Method 516.2-II	0.6m with Case
		1.2m with Packing
<u>Radiation:</u>	In accordance with MIL-STD-461/462	

2.5 ENVIRONMENTAL CONDITIONS HC-535 ONLY

Test according to MIL-STD-810-C

<u>Low Temperature:</u>	Method 502.1-I	
	Operating temperature	- 5°C
	Storage temperature	-20°C
<u>High Temperature:</u>	Method 501.1-I	
	Operating temperature	+55°C
	Storage temperature	+70°C
<u>Humidity:</u>	Method 507.1-II	+55°C/95%
		Relative Humidity
<u>Rain:</u>	Method 506.1-II	2 hours
	(Unit in Case)	
<u>Vibration:</u>	Method 514.2-X	7-200 Hz/2.5g
	(Unit in Case)	
<u>Shock:</u>	Method 516.2-I	30g/11ms
	(Unit in Case)	
<u>Drop:</u>	Method 516.2-II	0.6m with Case
		1.2m with Packing
<u>Radiation:</u>	In accordance with MIL-STD 461/462	
<u>Tempest:</u>	In accordance with CAG standard Spec 3G901	

2.6 MECHANICAL DATA HC-530/535

Dimensions:

(without case): 402 L x 100 H x 294 D

(with case): 465 L x 125 H x 365 D

Weight:

(without case): 6.5 kg

(with case): 9.4 kg

ALL SPECIFICATIONS SUBJECT TO CHANGE

3. INSTALLATION

3.1 UNPACKING

Since all packing cases should be saved for possible further use, they should have been opened with care and the packing material saved.

The units and accessories should be visually inspected for any signs of transport damage. If there are signs of damage, the relevant parties should be notified as specified in the contract.

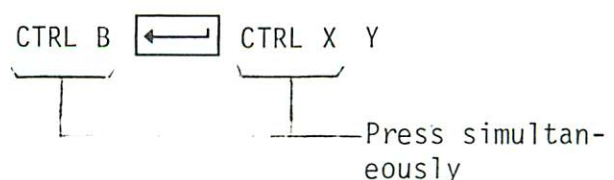
In no event should power be applied to any unit if it shows signs of damage, has loose parts, etc.

The combination lock of the HC-530 Samsonite case is set to "000" and the case may be opened by resetting to this combination. The combination may then be changed as desired (see Samsonite instructions).

3.2 PACKING AND STORAGE

The original packing material should be used if any unit is to be shipped or stored. Turn the unit off and safeguard the mechanical security key before packing. If the unit is to be stored, care should be taken to ensure that the environmental conditions for storage are not exceeded (Section 2).

CAUTIONS: THE PC BOARD-MOUNTED 4.8V NI-CD ACCUMULATOR, IF FULLY CHARGED, WILL HOLD THE (SECRET) BASIC KEYS IN MEMORY FOR ABOUT ONE MONTH WHEN THE MAINS SUPPLY IS DISCONNECTED. THUS BE SURE TO ERASE THE BASIC KEYS FROM MEMORY BEFORE PACKING BY PRESSING:



FURTHER, IF THE UNIT IS WITHOUT A MAINS SUPPLY FOR MORE THAN A MONTH, THEN CONNECT THE UNIT TO A MAINS SUPPLY FOR AT LEAST 24 HOURS TO ENSURE THAT THE 4.8V ACCUMULATOR CAN AGAIN PROTECT THE BASIC KEYS AND VARIABLE PARAMETERS IN THE EVENT OF A POWER OUTAGE.

3.3 COMMISSIONING

CAUTION:

BEFORE CONNECTING THE HC-530/535 TO THE MAINS SUPPLY, ENSURE THAT IT IS SWITCHED TO THE CORRECT AC MAINS VOLTAGE, FIGURE 3.1. Note: The DC charger module has no voltage selector switch.

The voltage selector switch is located at the right side of the unit. You must remove the unit from its carrying case in order to access this switch.

The HC-530/535 terminal can then be connected to the mains supply and switched on by means of the mechanical security key. Immediately after switch-on, some characters appear on the display. This indicates that an internal startup test of the memory is taking place.

If the results of this test are positive, "ENTER VP" will appear on the display if the variable parameters are not stored in the terminal (Section 4.3). After entering the variable parameters, the terminal will be in the "monitor" mode (Section 4.2). The basic keys may then have to be entered (Section 4.4), etc.

Once in monitor mode, the paper feed mechanism should be tested by pressing the paper feed pushbutton, arrow, Figure 3.2.

If, on the other hand, the results of the internal startup test are negative, "RAM FAILURE" will appear on the display and the terminal cannot be put into operation. It should then be serviced.

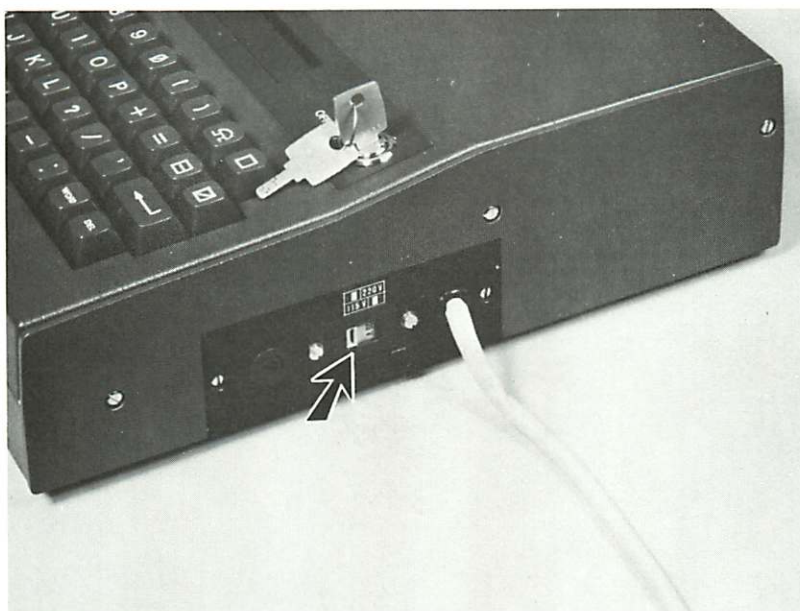


Figure 3.1 Arrow Shows Location of Voltage Selector Switch



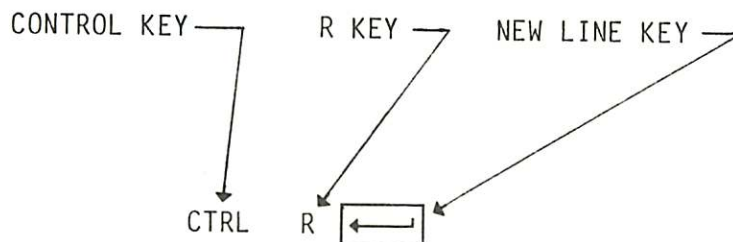
Figure 3.2 Arrow shows Location of Paper Feed Pushbutton Under Printer Lid



4. OPERATION

(For sequential operational sequences including display reaction, please see Short Form Instructions, document 3K960.)

4.1 GENERAL OPERATING INFORMATION

The command inputs take place at control level via the keyboard. For control operations the control key (CTRL) must be pressed and held while the appropriate key, for the desired command, is simultaneously pressed. For example, if CTRL R is to be entered, press the CTRL key and hold it down while you are pressing R. In these operating instructions the command processes are abbreviated as follows:



Command inputs must be terminated by pressing new line key, i.e., . The commands CTRL A, CTRL R and CTRL X are exceptions and do not require terminating with .

During input of data and commands via the keyboard, immediate correction of word and characters (WORD and DEL keys) is possible. In the editor mode (Section 4.10) these correction keys are not operational. In the case of false operation or other disturbances, operating information will often be displayed, e.g. "MEMORY EMPTY", "MEMORY USED", "BK MISSING", "BATTERY LOW", "LINE NOT READY", etc. In these situations the unit will return to monitor mode as soon as any key is operated.

A summary for your reference of operations and commands follows on Tables 4.1 and 4.2. These are all explained later.

INPUT VARIABLE PARAMETERS	CTRL V <input type="button" value="←"/> Y INPUT IN ACCORDANCE WITH TABLE 4.3
INPUT OF BASIC KEY	CTRL B <input type="button" value="←"/> E INPUT NEW KEY INFORMATION <input type="button" value="←"/>
DELETE ALL BASIC KEYS	CTRL B <input type="button" value="←"/> CTRL X Y
RETURN TO MONITOR MODE	CTRL R
PRINT TEXT IN MEMORY	CTRL P <input type="button" value="←"/>
CIPHERING	CTRL I <input type="button" value="←"/> INPUT TEXT FOR CIPHERING CTRL R CTRL C <input type="button" value="←"/> OR, CTRL CD <input type="button" value="←"/> (Display) CTRL CP <input type="button" value="←"/> (Printer) CTRL CS <input type="button" value="←"/> (Serial) CTRL CT <input type="button" value="←"/> (Coupler)
ERASE TEXT	CTRL X Y STATUS INDICATOR MUST NOT BE V OR B
DECIPHERING	CTRL I <input type="button" value="←"/> INPUT TEXT FOR DECIPHERING CTRL R CTRL D <input type="button" value="←"/> OR, CTRL DD <input type="button" value="←"/> (Display) CTRL DP <input type="button" value="←"/> (Printer) CTRL DS <input type="button" value="←"/> (Serial) CTRL DC <input type="button" value="←"/> (Continuation)

Note: Deciphering via coupler is always automatic and according to the VP value.

Table 4.1 Summary of Important Operations

HC-530/535 COMMANDS

CTRL		= CONTROL KEY (COMBINED WITH ANOTHER KEY)
←		= NEW LINE KEY
CTRL I	←	= INPUT MODE (TEXT INPUT FROM KEYBOARD OR SERIAL INTERFACE)
CTRL P	←	= PRINTOUT (MEMORY TEXT UNCHANGED)
CTRL S	← Y	= SERIAL INTERFACE OUTPUT (MEMORY TEXT UNCHANGED)
CTRL C	←	= CIPHERING MODE (OUTPUT DEVICE ACCORDING TO VP VALUE)
CTRL CD	←	= CIPHERING OUTPUT DEVICE = DISPLAY
CTRL CP	←	= " " " = PRINTER
CTRL CT	←	= " " " = COUPLER
CTRL CS	←	= " " " = SERIAL INTERFACE
CTRL D	←	= DECIPHERING MODE (OUTPUT DEVICE ACCORDING TO VP VALUE)
CTRL DD	←	= DECIPHERING OUTPUT DEVICE = DISPLAY
CTRL DP	←	= " " " = PRINTER
CTRL DS	← Y	= " " " = SERIAL INTERFACE
CTRL DC	←	= DECIPHERING MODE CONTINUATION
CTRL A		= ADVANCE
CTRL B	←	= SELECTION OF BASIC KEY (BASIC KEY MODE)
CTRL V	← Y	= SELECTION OF PARAMETERS (VP MODE)
CTRL R		= RETURN (EXIT) TO MONITOR (COMMAND MODE)
CTRL X	Y	= RESET (MEMORY CLEAR)
CTRL E	←	= EDITOR MODE (OPTIONAL)
CTRL T	← Y	= TEST (OPTIONAL) / SPACE BAR / P / U / Y /
CTRL M	←	= COUPLER SENDS 1850 HZ TONE (MARK POLARITY)
CTRL N	←	= STATION IDENTIFICATION (FOR SELECTIVE CALL)
DEL		= LAST CHARACTER DELETE (OR CTRL K)
WORD		= LAST WORD DELETE (OR CTRL W)

Table 4.2 HC-530/535 Commands

4.1.1 REMOTE CONTROL VIA SERIAL INTERFACE

Remote control of the HC-530/535 is possible by means of the serial interface. The signalization must be in ASCII code; the control symbols generated by a remote ASCII keyboard are then evaluated by the HC-530/535 as though they were entered from the HC-530/535 keyboard.

In order to set the HC-530/535 for remote operation, variable parameter 6 (VP6) must be assigned a VP value from 5 to 9, Section 4.3.

4.2 MONITOR MODE (COMMAND MODE)

The monitor mode (left window of display shows "M") is the starting point for all operating modes. A new operating mode can only be selected when the unit is in this mode. When the HC-530/535 is switched on, the unit goes automatically to monitor mode unless variable parameter (VP) data is missing, whereupon the unit goes automatically to the VP mode (Display will show "ENTER VP" - see Section 4.3).

Initialization will be required in monitor mode if:

- the basic keys (BK) are missing. (Display will show "BK MISSING" - see Section 4.4).
- the station identification (ID) is missing. (Display will show "ENTER OWN STATION ID" - see Section 4.3.5)

Once the above information has been entered, the monitor mode display possibilities are:

<u>DISPLAY</u>	<u>MEANING</u>
ENTER CMD:	Enter command from Table 4.2
NO MASTER / ENTER CMD:	Same as above but see Section 4.4
MEMORY USED / NO MASTER / ENTER CMD:	Same as above but see Sections 4.4 and 4.5

With the exception of the VP start-up mode described immediately above where the VP data must first be entered, you may return from all modes to monitor mode at anytime by pressing CTRL R.

The commands of Table 4.2 are explained in later sections of this chapter.

Thermal-printer paper feed (Figure 3.2) can only be done in monitor mode.

4.3 VARIABLE PARAMETER (VP) PROGRAMMING

With VP-mode selected the machine functions are programmed via the keyboard by selecting a VP value from Table 4.3 for each of the following variable parameters (VP):

- | | | |
|------|---|-------------------------|
| VP1 | Coupler transmission procedure = ? | |
| VP2 | Preferred output device = ? | |
| VP3 | Speed of serial input = ? | |
| VP4 | Speed of serial output = ? | FOR SERIAL
INTERFACE |
| VP5 | Serial I/O polarity = ? | |
| VP6 | Serial I/O code + format = ? | |
| VP7 | Message key (MK) to be automatically generated
or manually input via keyboard? | |
| VP8 | Basic key (BK) bigram to be output with clear text? | |
| VP9 | Cipher text format = ? | |
| VP10 | Automatic process after receiving with coupler = ? | |
| VP11 | Selective call via coupler desired = ? | |

HC-530/535 VARIABLE PARAMETER (VP) PROGRAMMING

(ENTER 11 VALID VP VALUES AND TERMINATE WITH 0)

VP VALUE:	0	1	2	3	4	5	6	7	8	9	
VP 1: COUPLER OUTPUT *	N	FEC									N = NORMAL FEC = FORWARD ERROR CORRECTION (REDUNDANT)
VP 2: PREFERRED OUTPUT DEVICE	D	P	S								DISPLAY/PRINTER/SERIAL
VP 3: SERIAL INPUT SPEED	EXT	50	75	110	150	200	300	600	1200		BAUD RATE (bps)
VP 4: SERIAL OUTPUT SPEED	EXT	50	75	110	150	200	300	600	1200		
VP 5: SERIAL I/O POLARITY	I/O	I/O	I/O	I/O							NORMAL / INVERSE
VP 6: SERIAL I/O CODE + FORMAT	BD	A2	A3	A4	A5	A6	A7	A8	A9		BD = BAUDOT / A = ASCII
VP 7: MK TO BE AUTOMATICALLY GENERATED?	Y	N									YES/NO
VP 8: OUTPUT BK BIGRAM WITH CLEAR TEXT?	Y	N									YES/NO
VP 9: CIPHER TEXT FORMATTING	5	10	60								5, 10 OR 60 LETTER GROUPS
VP 10: AUTOMATIC OUTPUT PROCESS AFTER RECEIVING WITH COUPLER	MEM CTRL S	MEM CTRL DS	MEM CTRL DP	CTRL S	CTRL DS	CTRL DP	INTR CTRL S	INTR CTRL DS	INTR CTRL DP		MEM = RECEIVED MESSAGE TRANSFERRED INTO TEXT MEMORY IF EMPTY INTR = LOCAL PROCESS INTERRUPTED
VP 11: SELECTIVE CALL (VIA COUPLER)	N	Y	Y/ID								N = NO, Y = YES, Y/ID = CALLER TERMINAL IDENTIFICATION ADDED TO MESSAGE

↑ --- CAN BE USED WHEN CHANGING ALREADY ENTERED VP VALUES.


ASCII FORMAT
A2 = 7 BIT
A3 = 8 BIT
A4 = 8 BIT / PAR. ODD } REMOTE OFF
A5 = 8 BIT / EVEN } WITH FORM FEED
A6 = 8 BIT / 2 STOP } FOR FX80
A7 = 8 BIT / 2 STOP } PRINTER
A8 = 8 BIT / 2 STOP / X-ON, X-OFF
A9 = 8 BIT / 2 STOP / INPUT WITH ECHO


* SIMPLEX TRANSMISSION ONLY IF SELECTIVE CALL MODE WITH GROUP OR GENERAL CALL. AUTOMATICALLY CHANGED AT TRANSMITTER AND RECEIVER.

Table 4.3 HC-530/535 Variable Parameters




4.3.1 INITIAL PROGRAMMING OF VARIABLE PARAMETERS (VP)

If no valid VP programming combination of VP values is stored in the unit, the unit will display "ENTER VP" and the status indicator will be V. In this operating situation the machine is ready for VP programming. The variable parameters can be programmed by entering eleven appropriate VP values via the keyboard as selected from Table 4.3. Complete the entry with . The VP value "0" cannot be used during this initial programming procedure, but can be used during VP value modifications (next section below). One possible example of VP programming is shown in Table 4.4.


Note: Keying in a VP value not filled in on Table 4.3 will result in rejection of the entire VP with return of "ENTER VP" when  is pressed.

4.3.2 MODIFICATION OF A VALID VP COMBINATION

VP modification is carried out as follows:

1. Enter CTRL R.
2. Enter CTRL V . The unit will display the existing combination and "SURE?"
3. Enter Y (i.e., YES) via the keyboard. The display then specifies "Enter VP", i.e., enter the eleven VP values desired.

Note: You may enter "0" (i.e., No Change) for any VP value you do not wish to change. (See Table 4.3 for the VP value list.)

4. After entering the eleven VP values, complete the entry with . The unit will accept the change and return to monitor mode.

EXAMPLE: PROGRAMMING VP VALUES:

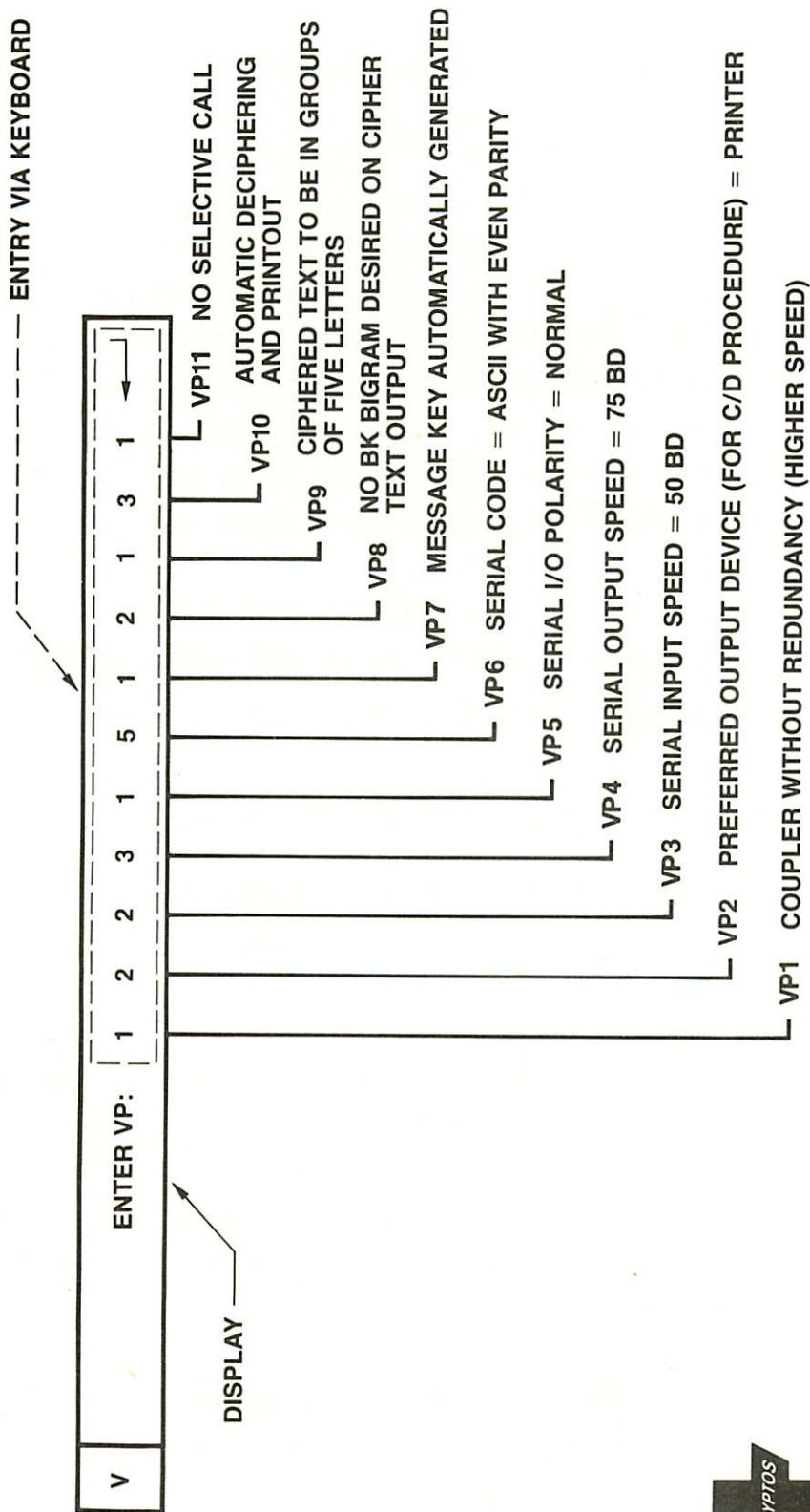


Table 4.4 Example of Variable Parameter Programming

4.3.3 CLEARING THE VP DATA

This operating mode is, in principal, not required since the VP values can be altered as detailed in the previous section. However, it is possible to clear the VP memory as follows:

1. Enter CTRL R.
2. Set the machine to VP mode by entering CTRL V .
3. Enter CTRL X whereupon the question "EXEC?" (EXEC = execute) is displayed.
4. By entering Y (yes), all VP values are cleared and "ENTER VP" appears. Now see Section 4.3.1 above.

The following are specific examples for use in various types of operation: (X can be any VP value which is valid according to Table 4.3).

VP: X X 6 6 1 1 X X X 2 X

For use with TPR-530 Tape Punch/Reader (200 Baud, 5 Bit)

VP: 1 X 9 9 1 9 X X X 3 X

For use with video (1200 Baud) and coupler data via telephone link, ASCII format 8 bit/2 stop (legend, Table 4.3). The received message is automatically deciphered and printed out on the built-in thermo printer.

VP: X X 2 2 1 1 2 X 2 2 X

For use with ATX-530 Teleprinter Interface (Section 1.3.7) and teleprinter (50 Baud), message key input via keyboard, cipher text format in 10 letter groups.

VP: 2 1 9 9 1 6 1 1 1 2 2

For use with FX 80 ASCII printer and coupler data via radio link (selective call).

4.3.4 TWO VARIABLE PARAMETER COMBINATIONS


Two variable parameter combinations (called A and B), each of 11 VP values, may be programmed. This allows, e.g., connecting two peripherals having different baud rates and controlling them by means of an external switchover unit. Control and activation of one or the other of these combinations is by means of an external signal applied to pin 20 of the serial interface (Appendix A3).

If pin 20 sees a high impedance (e.g., no connection), then the first (normally-used) variable parameter combination "A" is active. Put 0V on pin 20, however, and the second VP combination "B" is active.


4.3.5 STATION IDENTIFICATION (ID) FOR SELECTIVE CALL

Upon initial turn-on or following reassembly after opening the housing with the main switch set to OFF, the HC-530/535 terminal will request its own station identification. The display will be:

ENTER OWN STATION ID

The input requires five numbers in the range 0 to 9. The five numbers are given in on the keyboard and then programmed into the HC-530/535 with the  key. The ID is then stored in non-volatile (Ni-Cd protected) RAM memory.

An already-stored station ID may be changed as follows:

- Enter CTRL N  . The display will be, e.g., STATION ID. 00042 / CHANGE?
- Enter Y (for Yes)
- Continue as described in the paragraph immediately above.

4.4 BASIC KEY (BK) MODE

The BK mode serves for the input and clearing of basic key information that is in the non-volatile (i.e., Ni-Cd accumulated-protected) memory. A master BK may also be selected and the key bigrams (key identifications) brought to the display. This is covered below.

4.4.1 BASIC KEYS

Each basic key has a two-letter identifier associated with it called a bigram. One key can be defined to be a master key.

The key used for ciphering is always the one currently defined to be the master. If no master is defined, the HC-530/535 will automatically request the bigram of the key to be used for ciphering.


The key used for deciphering is that assigned to the bigram given in the ciphered text header. If no bigram is given, the master key will be used by default assuming one has been defined.

Upon initial turn-on or following reassembly after opening the housing with the main switch to OFF, the HC-530/535 terminal will display

BK MISSING / ENTER CMD

This requires entry of basic keys. (See following sections.)

4.4.1.1 FEATURES FOR THE BASIC KEYS


The basic key information can be manipulated after unit switch-on or at any other later time. First go to monitor mode if not already there by entering CTRL R. Then enter CTRL B  to get to basic key mode. The display will be:

"DISPLAY, ENTER, SELECT MASTER, CANCEL BK"

Which of the above is selected depends on which of the underlined letters is entered on the keyboard. The description of each possibility follows.

NOTE: Pressing any key other than an underlined one (or pressing CTRL R anytime) causes a return to monitor mode.

4.4.1.1.1 "D" FOR BIGRAM DISPLAY

Do entry of Section 4.4.1.1 above, i.e., enter CTRL R CTRL B  .
If you then press D (or CTRL D) one of three displays is possible as follows:

Display Possibility 1: (No Basic Keys)

If no basic keys (BKs) are in memory, the display will be

BK MISSING / ENTER CMD:

One or more basic keys must then be entered before going further (see next section).

Display Possibility 2: (No Master Key Defined)

If one or more basic keys have already been entered and no key has been defined to be the master key, the display format will be, e.g.,

BI: GV MV LO KI

The signifies that no master key has been assigned. To assign one, see Section 4.4.1.1.3 below.

Display Possibility 3: (Master Key Defined)


If a master key has been assigned, the display format will be, e.g.,

BI: MV GV MV LO KI

where here the basic key having bigram MV is the master key.


NOTE: The display can only show 9 or 12 bigrams at one time. If you have more than 9 bigrams, press any key repeatedly to view the rest.

4.4.1.1.2 "E" FOR BASIC KEY ENTRY

Do entry of Section 4.4.1.1 above, i.e., enter CTRL R CTRL B  .
If you then press E (or CTRL E) the display will be either


ENTER BK:

if no basic keys are in memory, or the bigrams of any already-entered keys will be displayed. If the bigrams appear, then press any key as often as necessary to obtain the "ENTER BK" display.

You may now enter basic keys as you wish. First enter a two-letter bigram (the 26 letters of the alphabet may be used here as desired). Then press the space bar. Now enter the 20 letters of the basic key in groups of five letters. Press the space bar between groups. Make corrections as necessary using the keys DEL and / or WORD . Press  to enter the key into memory. As long as "ENTER BK" appears, you can repeat the procedure.


If you try to enter a basic key having a bigram already in use,

BK ALREADY USED

will appear on the display upon pressing  . That basic key will not be accepted. Press any key to continue.

If you try to enter more basic keys than the memory can hold,


BK MEMORY FULL

will appear on the display upon pressing  . That basic key will not be accepted.

NOTE: When "ENTER BK" is in the display, basic keys can also be input by means of:

- a remote teleprinter via the ATX-530 Teleprinter Interface or,
- a local TPR-530 Tape Punch/Reader via the serial interface.

4.4.1.1.3 "M" FOR MASTER KEY SELECTION

Do entry of Section 4.4.1.1 above, i.e., enter CTRL R CTRL B  .
If you then press M (or CTRL M) the display will be

BK MISSING / ENTER CMD:

or

NEW MASTER BI: AA EXEC?

If BK MISSING/ENTER CMD: is displayed then no basic keys have been entered. In this case see the previous section.

If the basic keys have been entered, the display will be in the form NEW MASTER BI: AA EXEC? You may then assign whichever basic key you like to be the master. Simply press Y if you wish the basic key associated with the bigram in the display to be the master. Press any other key to step through the bigrams one by one. When the master has been assigned or all the bigrams have been displayed but not selected, the HC-530/535 will return to monitor mode.

It can happen that a user of an HC-530/535 may use a different key for each of the different stations with which he is communicating. In this case it would be desirable not to have a master key, because a new master would have to be defined prior to a transmission with each different station. To eliminate the assignment of a master key without destroying any already-entered keys, do the following:


- Enter CTRL R CTRL B
- Press M
- Press the space bar until

NEW MASTER BI: EXEC?

appears on the display ("EXEC?"
means "Execute?")

- Press Y (for "Yes")

4.4.1.1.4 "C" FOR CANCELLING BASIC KEYS

Do entry of Section 4.4.1.1 above, i.e., enter CTRL R CTRL B  .
If you then press C (or CTRL C), the display will be either:

ALL BK'S CANCELLED

if no basic keys are currently in memory or, e.g.,

CANCEL BK WITH BI: AA EXEC?

If "ALL BK'S CANCELLED" is in the display, press any key to return to monitor mode. Then see Section 4.4.1.1.2 to enter basic keys.

If, e.g. "CANCEL BK WITH BI: AA EXEC?" is in the display, then you can either:

- cancel the basic key having the bigram indicated by pressing Y whereupon the next bigram will appear, or
- you can skip to the next bigram by pressing any key.

The unit will return to monitor mode when all bigrams have been displayed.


4.4.2 BASIC KEY EMERGENCY CLEAR

You can cancel all basic keys at one time (Emergency Clear) by entering:


CTRL R CTRL B  CTRL XY

(Upon pressing CTRL X, "CANCEL ALL BK'S? SURE?" will appear in the display. Press Y as indicated above to cancel, or press any other key not to cancel; the unit will then return to monitor mode).


4.5 TEXT INPUT MODE

The text input mode CTRL I  serves for the input of text into the memory, i.e., the

- input of plain text which can then be ciphered, or the
- input of ciphered text which can then be deciphered.

Header text which is not to be ciphered is entered first. It is then followed by what is called the "advance sequence". The advance sequence can be entered as either CTRL A or as ///// .


A flashing warning, text alternating with asterisks, indicates that the text memory is nearly full and that only a further 38 characters can be entered. After completion of text input, monitor mode must be re-selected by entering CTRL R.

When the input mode is exited, the text is compressed. Non-essential characters such as letter shift and figure shift are eliminated and CR, CR and LF transformed internally to  (new line) code. This transformation takes a variable time, depending on the length of text. Due to this, it is quite possible that a full memory will subsequently, in editor mode, have space for additional characters. (When the input mode is exited (via input of CTRL R), it will not be possible to re-enter input mode until the memory has been cleared.)

4.5.1 CLEARING THE ENTIRE TEXT FROM MEMORY

To erase the text memory, enter CTRL R CTRL XY.

4.5.2 SELECTION OF TEXT INPUT MODE WITH KEYBOARD OPERATION

Starting point is monitor mode CTRL R. To select the text input mode enter CTRL I . In this case where the text memory is already occupied, "MEMORY USED" is displayed, and the input mode cannot be selected. In this situation the memory must be first cleared by pressing CTRL R (return to monitor mode) and then entering CTRL XY.

When the text input mode is accepted, "I" is displayed and the text can be entered via the keyboard.

The text on the display can be checked and, where necessary, corrected. The last character (letter or number) on the display can be deleted by pressing DEL ; the last word can be deleted by pressing WORD . (The combinations CTRL K and CTRL W can be used instead of the DEL and WORD keys respectively.)

4.5.3 TEXT INPUT MODE WITH SERIAL INTERFACE

This mode is, in principal, identical to the keyboard input mode described in the previous section. Selection of the text input mode is carried out in the identical manner as for the keyboard. It is possible to enter data alternately from the serial input and the keyboard.

A full duplex ASCII-code video monitor may be connected to the serial interface. The variable parameters may then be selected so that what appears on the video display of the transmitting side is not what is transmitted, rather what is received as an echo from the receiving station. In other words, the ciphered information is transmitted, received and then sent back. What is sent back then appears on the transmitting-side video monitor as a verification that the receiving side has correctly received the message. Set variable parameter 6 to a VP value of 9 to obtain this operation.

Should the input via the serial interface be faulty, a check should be carried out to ensure that the VP memory is correctly programmed with respect to the peripheral device that is connected (Section 4.3). Ensure that VP3, VP5 and VP6 (input speed, polarity and format) are correctly programmed.

The serial interface pin assignments are given in Appendix A3.

4.5.4 COUPLER RECEPTION

4.5.4.1 INTRODUCTION

A separate memory called the receiving memory is used for coupler reception. Following a reception, via coupler, the information received will be automatically output in ciphered or deciphered form (depends on the programming of the variable parameter VP10). Coupler reception is signalled on the display. The end of the transmission is also signalled, but only if the HC-530/535 is not in monitor mode.

4.5.4.2 AUTOMATIC OUTPUT PROCESS

An automatic output process follows coupler reception. The process is programmable and normally begins only when the HC-530/535 is in monitor mode, i.e., when local processing is not in progress. When the automatic output process starts,

AUTO RUN

will appear on the display.

Variable parameter 10 is used to program the output of the automatic process. The VP values selectable for VP10 are:

VP VALUES
FOR VP10

1	4	7	Output ciphered text to the serial interface
2	5	8	Output deciphered text to the serial interface
3	6	9	Output deciphered text to the built-in thermo printer
			<div> <div></div> <div>Receive with high priority. Local processes will be interrupted. No backup storage of text into text memory.</div> </div>
			<div> <div></div> <div>Local processes not interrupted. No backup storage of text in text memory.</div> </div>
			<div> <div></div> <div>Backup storage of information in text memory if space available there. Local processes not interrupted.</div> </div>

NOTE: If, for some reason the message cannot be deciphered (message key not transmitted, incorrect bigram, etc.), the message will be output in ciphered form to the chosen output device. This output will, however, only occur if the received information is not stored in the text memory.

If information in the receiving memory has not been processed (e.g., output) and another coupler call up occurs, any ongoing local process will be interrupted. The display will then show:

LOCAL PROCESS INTERRUPTED

for a short period of time. If an input mode local process was interrupted by this display, you will be able to continue on with the input once the "LOCAL PROCESS INTERRUPTED" words disappear. Other processes must be restarted.

4.5.4.3 MANUAL INTERRUPTION OF THE COUPLER AUTOMATIC OUTPUT PROCESS

Manual interruption of the automatic output process is rarely necessary but can be done as follows if ever required: Enter

CTRL H

where H means "Halt". The display will be

AUTOMATIC PROCESS HALTED / ENTER CMD

A new VP or BK may, e.g., be now entered. Once such changes have been completed, the automatic output process will restart from the beginning.

NOTE: Entering CTRL R will cause an in-progress to restart from the beginning if the message is not also stored in the text memory. If the message is stored in the text memory, CTRL R will interrupt the automatic process completely.

4.5.4.4 CLEARING THE RECEIVING MEMORY

The receiving memory is automatically erased following each automatic output process. The receiving memory can also be erased by keyboard command during the automatic output process if desired as follows: Enter CTRL X. The display will then be:

CLEAR RECEIVING MEMORY ? EXEC ?

Entering Y will then clear the entire receiving memory.

NOTE: (The text memory will not be affected by this procedure if it is done during the automatic process.)

4.5.4.5 RECEIVING WITH ACOUSTIC COUPLER

To receive (or transmit) using a telephone, perform the steps of section 4.8.4 with reference to Figure 4.1.



Figure 4.1 Receiving Ciphred (or Plain*) Text Via Telephone

* Transmission in plain is possible by using an extended header-section 4.5



TFG-530 (or Radio)

Figure 4.2 Receiving Ciphred Text via the Galvanic Coupler

4.5.4.6 RECEIVING WITH GALVANIC COUPLER

The galvanic coupler is an electronic interface which allows telephone and radio communications with the HC-530/535 to take place electrically, i.e., without conversion to an acoustic signal. The galvanic coupler is supplied as part of the acoustic coupler option and has its own modem.

Switchover from acoustic to galvanic operation occurs automatically as soon as the galvanic coupler is connected to an audio interface (such as, e.g., the TFG-530 Telephone/Galvanic Switchover Interface) or to a radio transmitter.

Data can be input to the HC-530/535 from another HC-530/535 by means of a radio or telephone connection to the galvanic coupler, Figures 4.3 and 4.4, also Section 1.3.5.2 and Appendices A4 and A5. Unattended operation is then possible if a TFG-530 Telephone/Galvanic Switchover Interface is used, Section 4.8.4.

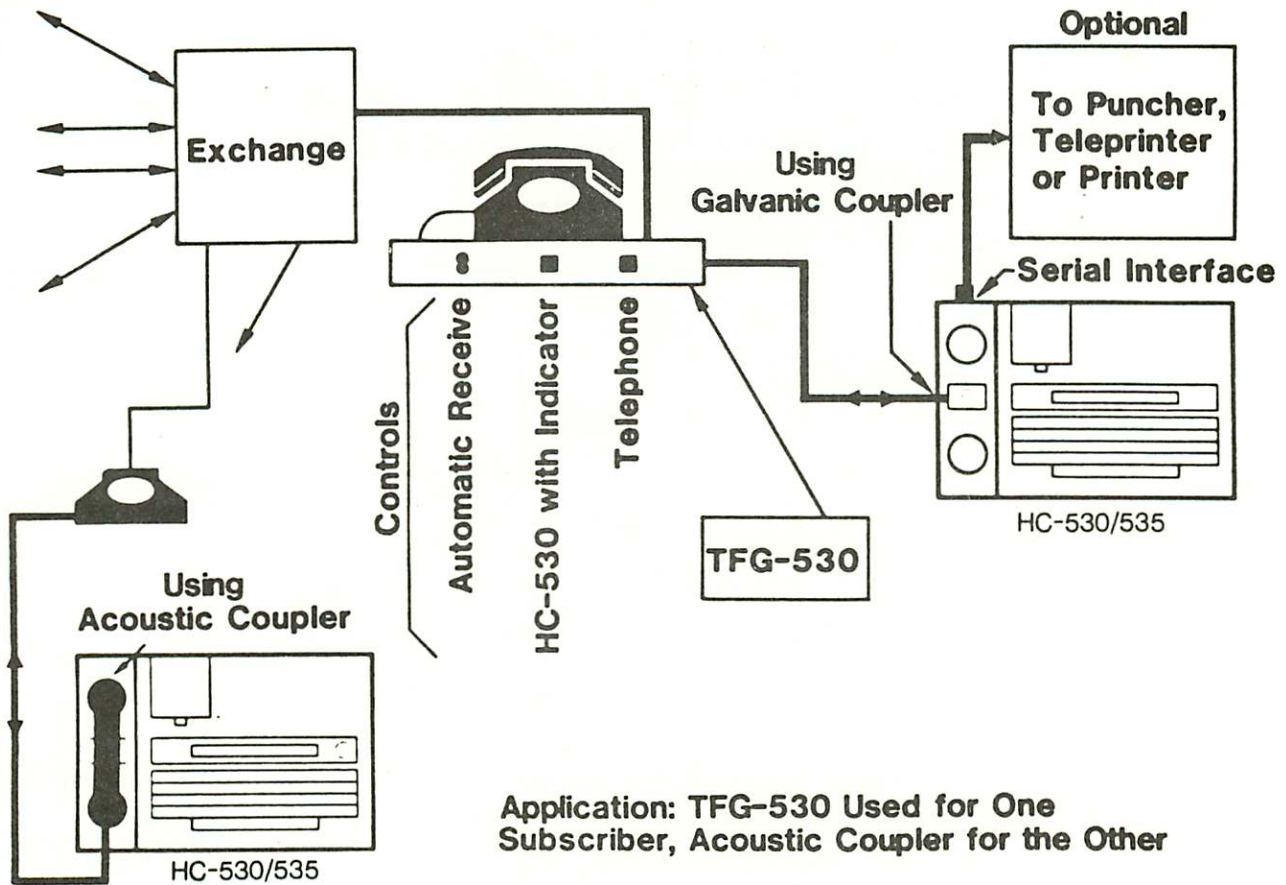
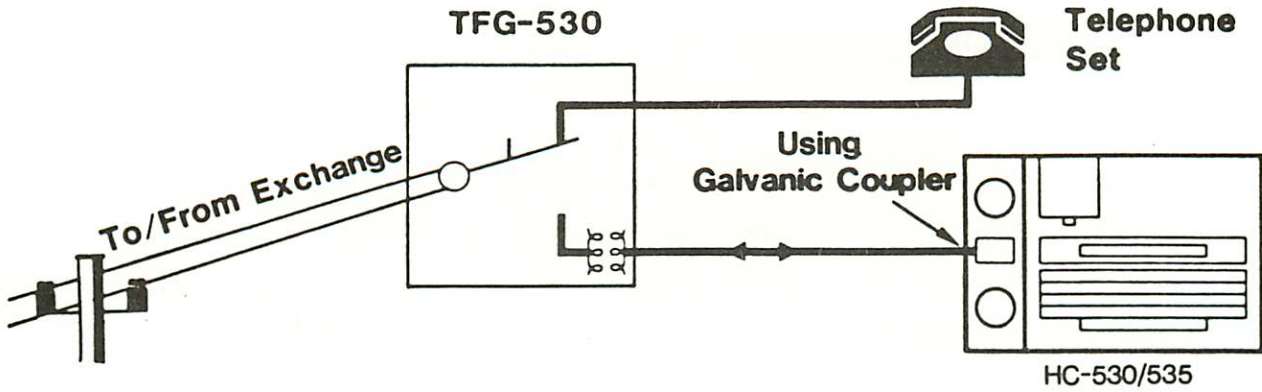
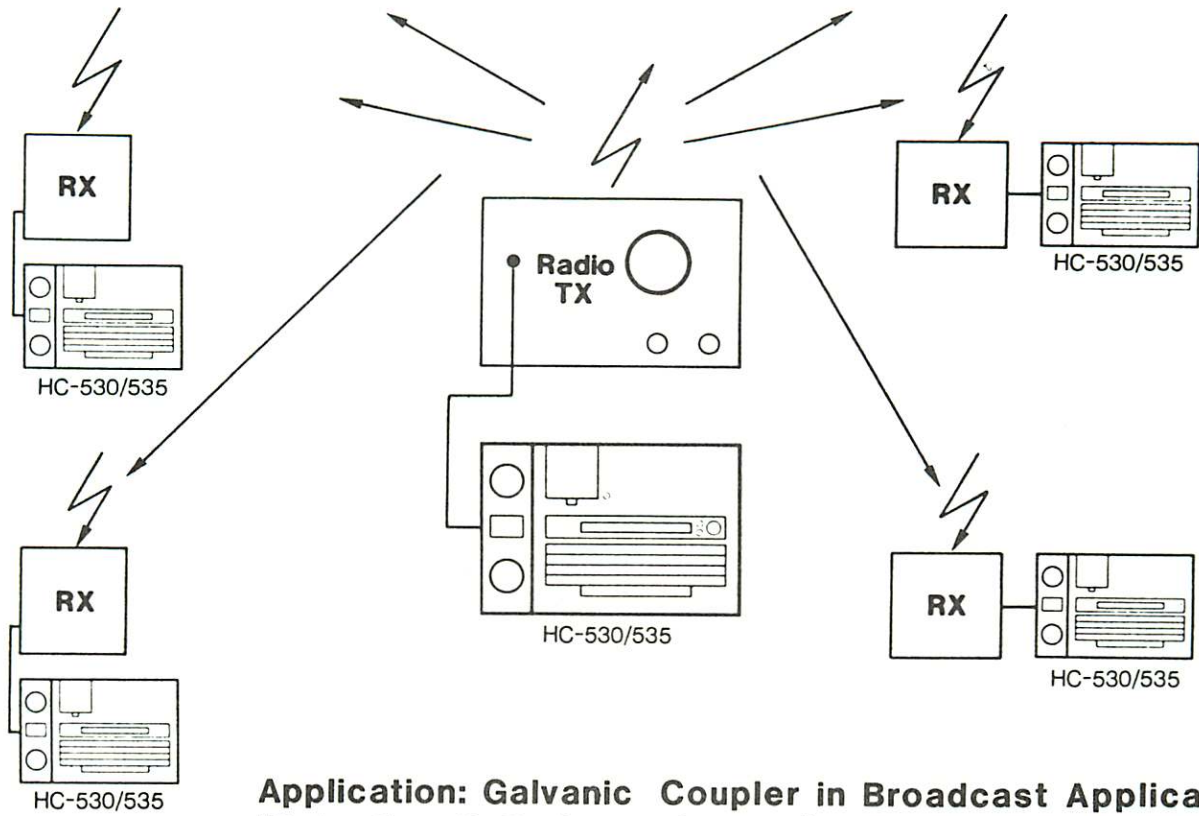
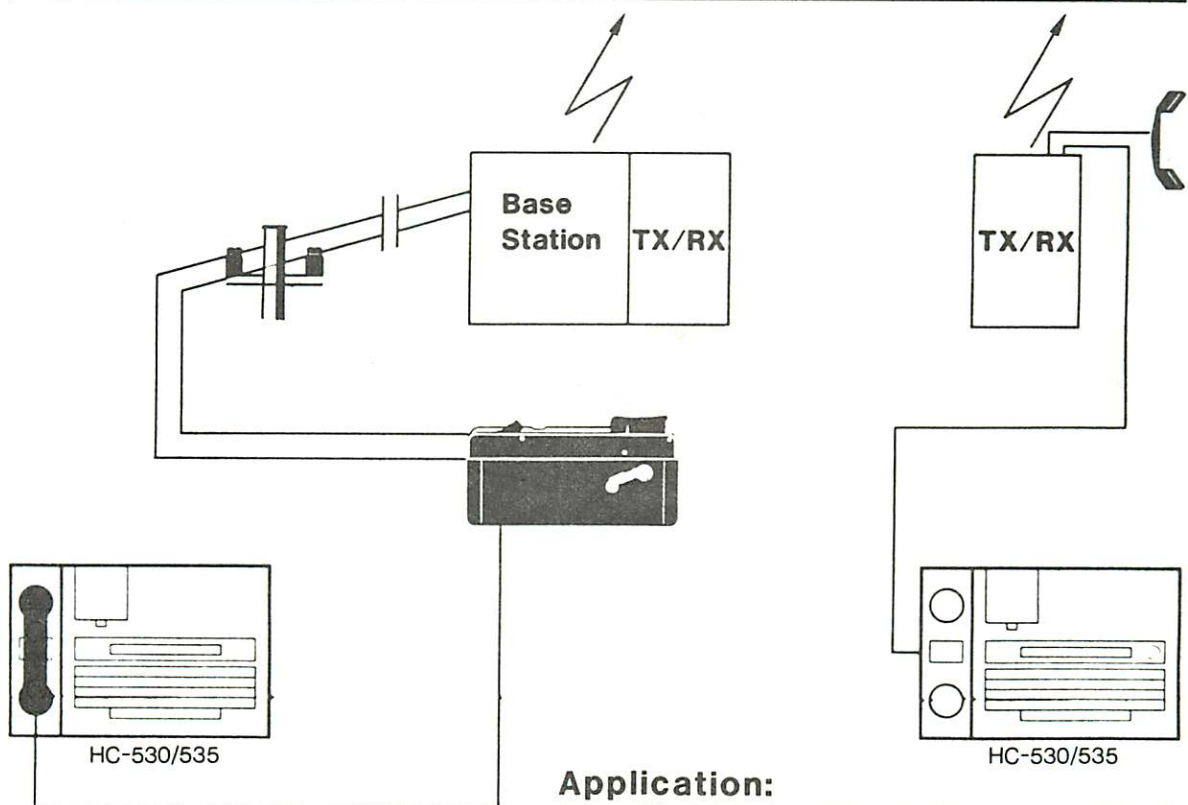


Figure 4.3 Various Connecting Possibilities for the Acoustic and Galvanic Couplers for Telephone Applications.



**Application: Galvanic Coupler in Broadcast Application
(Selective Call, Group Call-Up)**



**Application:
in a Mobile Radio-Telephone System**

Figure 4.4 HC-530/535 Radio Applications

4.5.4.6.1 GALVANIC COUPLER AND RADIO OPERATION

Radio transmitters can be connected to the galvanic coupler of the 530/535, Figure 4.3. The connection is isolated from the HC-530/535 circuitry. For best results the frequency deviation of such radio transmitters should be below a maximum of ± 75 Hz. The transmitted signals are the CCITT standard V 21 frequencies of 1650 Hz and 1850 Hz for logic bits "1" and "0" respectively. The advantage of this narrowband is that it allows using the galvanic coupler in both radio and telephone networks as well as in mixed networks. (See Appendices A4 and A5.)

Modern amplitude-modulated (AM) or single-side band (SSB) radios having stable phase locked loop (PLL) circuitry can also be used with the galvanic coupler.

4.5.4.6.1.1 CONNECTIONS FOR RADIO

An "X"-mode plug can be used to advantage at the radio side of the galvanic coupler/radio connection. (An audio plug, e.g., Microtel, may also be used.) The advantages of using the X-mode plug are as follows:

- The volume control setting does not influence the signal received by the HC-530/535. The result is fewer operational faults.
- The radio can be used as desired for voice or data transmission without having to change cables.

The audio transmission level to the radio can be set to one of three coarse ranges by means of jumpers. Fine setting for optimum modulation is by means of trimmer "TX". Trimmer "RX" serves to set the receive level to the optimum between -35 to -40 dBm (50mV peak to peak).

IMPORTANT: The correct level setting is a necessity for optimum results under poor transmission conditions.

Trimmers RX and TX are found within the telephone coupler housing. The receive level can be measured on printed circuit board (PCB) 545.631A (test points TP2 and TP3). This PCB is part of the coupler module. (The technician should refer to Figure 4.5 following and the HC-530/535 Technical Handbook for details.)

Activation of the transmitter takes place by means of an (isolated) "push-to-talk" signal from the HC-530/535. The signal starts approximately 0.4 seconds before start of the data transmission and remains on during the data transmission.

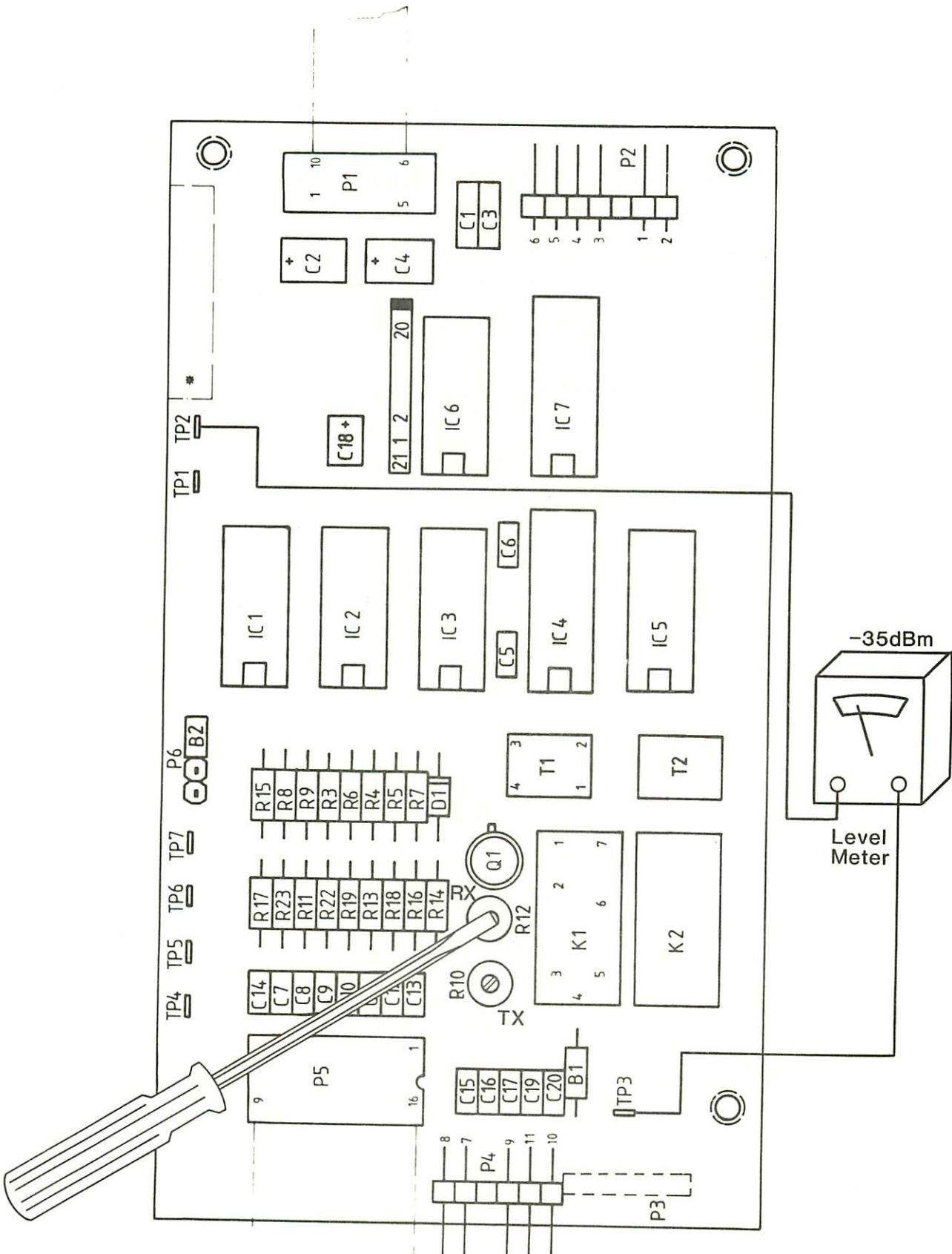




Figure 4.5 Galvanic Coupler (Audio Switch) PC Board

4.5.4.6.1.2 OPERATION AT THE RADIO RECEIVER

- Connect cable between HC-530/535 galvanic coupler and radio receiver. (See section on RADIO CALIBRATION following if calibration is necessary.)
- Turn on radio and HC-530/535 (the HC-530/535 must be switched on.)
- The message will be automatically received (display shows "RECEIVING") and temporarily stored in the receiving memory.
- At the end of the transmission, the message will be output (automatic output process of Section 4.5.4.2) as programmed by the variable parameters. The receiving memory is then automatically erased.
- (Possibly acknowledge receipt of message by voice communication.)

4.5.4.6.1.3 OPERATION AT THE RADIO TRANSMITTER


- Connect cable between HC-530/535 galvanic coupler and radio transmitter. (See next section if calibration is necessary.)
- Turn on HC-530/535 only
- Place message into HC-530/535 memory, enter CTRL I  and, at message end, enter CTRL R.
- Turn on radio transmitter
- Enter CTRL CT  into HC-530/535. (During transmission of the message, "TRANSMITTING" will appear in the display.)

4.5.4.6.1.4 RADIO CALIBRATION

When using the galvanic coupler for radio communications, the receiver must be adjusted for minimum deviation from the transmitting signal.

For this reason, a 1850 Hz tone can be generated at each HC-530/535 which, in conjunction with the ADA-530 HF-Link Frequency Adjustment Indicator, can reduce this deviation to a minimum. The procedure is as follows:

Install the ADA-530 HF-Link Frequency Adjustment Indicator between any HC-530/535 which is to receive messages and its associated radio: plug the cable from the ADA-530 into the galvanic coupler socket of the HC-530/535. Plug the cable from the radio into the ADA-530.

The transmitting-side operator should then key in CTRL M  in order to produce the 1850 Hz calibration tone.

The receiving-side operator should then adjust his radio receiver until the lamp (LED) on his ADA-530 lights.

The transmitting-side operator then presses a key (e.g., space bar) in order to stop the 1850 Hz tone.


NOTE: If an exchange of messages is expected, the above sequence should be repeated to calibrate the receiver at the other side. The ADA-530 units may be left in place.

Message transmission can now take place.

4.6

PRINTER MODE

This mode provides the operator with a control document before processing (ciphering/deciphering). The printed text can also be used, e.g., as a copy for edit-mode reference.

To select printer mode the unit must be in monitor mode and CTRL P  must be entered. In the case where no data is stored in the text memory, "MEMORY EMPTY" is displayed. (If the paper runs out during printing, a new roll can be inserted, Section 6.1, and the printing repeated.)

To avoid using a separate copy machine, the printer output can be repeated as often as desired.

During printing, more power is required than the charger module can deliver. The additional current is provided by the accumulator. The accumulator is, therefore, used from time to time even if the unit is connected to an external power source; this, however, is favourable for the accumulator life span, Section 1.3.6.

If the printer is in heavy use or if the HC-530/535 is used for a long period independently of an external supply, the accumulator voltage may drop below approx. 21V. If this happens, the printer will be automatically shut off and "BATTERY LOW" will appear on the display. The unit may then be further used without the printer, e.g., use editor mode to output text via the display. (If the accumulator voltage drops to less than approx. 19V, the unit will shut itself down completely to avoid false operation or accumulator damage). Charging is then necessary: connect the HC-530/535 to an external power source.


Should the printing quality be unsatisfactory (poor contrast, variable intensity, etc.), then see Section 5.2.

NOTE: Paper feed (Figure 6.2) can only take place if the unit is in monitor mode, CTRL R.

4.7 SERIAL OUTPUT (OUTPUT OF MEMORY CONTENTS)

This mode of operation serves a purpose similar to that of the printing mode if an external page printer is connected to the serial interface. In this mode it is also possible, provided that the relevant peripheral equipment is available, to copy the memory contents to other units such as magnetic cassette recorders or paper-tape puncher units.

4.7.1 SELECTION OF SERIAL OUTPUT MODE

The unit must be in monitor mode and CTRL S  Y entered. The check "SURE?" is provided since the memory contents will be transmitted unaltered to the serial interface.

Should the output be defective, check that the VP parameters are correctly programmed for the peripheral device which is connected to the serial interface: VP 4, VP 5 and VP 6 must be correct (output speed, polarity and format).

If no data is stored in the text memory, "MEMORY EMPTY" is displayed.

The serial interface pin assignments are given in Appendix A3 at the end of this manual.


4.8

CIPHERING


The cipher mode serves for the actual ciphering of messages stored in the memory. The memory is not overwritten during the ciphering process; the memory contents can thus be sent out to several output devices one after the other. (It is only possible to use one device per cipher output process.)

The selection of the cipher output can be by "default", such that if no specific output device is specified when the cipher mode is selected, the output will be via the "preferred" output device programmed in the VP-mode (VP2). In the VP mode the following parameters for ciphering mode can be programmed (Section 4.3):

- VP7: Message key, automatic or manual
- VP8: BK bigram output (or not output) upon clear text output
- VP9: Ciphred text format, in groups of 5, 10 or 60 letters per line


Plain header text and text to be ciphered must be entered in the input mode, CTRL I . Plain header text, i.e., text which is to remain plain, should be separated from the main text by entering CTRL A after the header text, Section 4.5.


The basic key must have already been entered or if not, it must now be entered via BK mode, Section 4.3. In this latter case the message in memory is not affected.

For selection of the cipher mode the unit must be in the monitor mode, CTRL R. CTRL C  can then be entered whereupon the output device is selected by "default", i.e., the output device is that programmed as VP2. (The output device can also be selected from the keyboard - see next sections.)

If a master BK has been defined, that BK will always be the one used during ciphering. If no master BK has been defined, then the HC-530/535 will request that a key be selected. The display will be:

NO MASTER / ENTER BI:

where BI is the bigram identifier of the key desired. The desired BI should now be entered followed by  .


If the HC-530/535 has been programmed for manual i.e., local message key (MK) entry (VP7 = 2), "ENTER MK" will be displayed. The correct MK must then be entered, (5 letters, space, 5 letters) via the keyboard. This should be checked and, where necessary, corrected using DEL and WORD (or CTRL K and CTRL W) as necessary before completing the entry with  .


The ciphered text will then be output to the pre-selected or defaulted output device.

When the cipher process is finished the unit returns to monitor mode and the memory can, if no longer required, be cleared by pressing CTRL XY.


4.8.1

CIPHERING BY PRINTER

Preparation is as described previously in Section 4.8. To select ciphering by printer, CTRL CP  must be entered (or CTRL C if the printer is the preferred output device).

If the HC-530/535 has been programmed for manual, i.e., local message key (MK) entry (VP7 = 2), "ENTER MK" will be displayed. The correct MK must then be entered via the keyboard (5 letters, space, 5 letters) and terminated with . "IN PROCESS" will be displayed as confirmation of correct operation while the unit calculates the cipher text. The calculation time is dependent on the length of text entered and can last up to 10 seconds. Should the ciphered text be longer than one page, the first page will be printed and then the second page calculated and printed.



The HC-530/535 returns automatically to monitor mode at the end of the process.


Should the printing paper run out, the process can be stopped with CTRL R  and the process repeated after new thermal paper has been installed, Section 6.1.

NOTE: To improve legibility, the spacing between printed ciphered letters is somewhat larger than between plain-text letters.

4.8.2

CIPHERING BY DISPLAY



Preparation is as described previously in Section 4.8. To select ciphering by display, CTRL CD  must be entered (or CTRL C  if the display is the preferred output device).


If the HC-530/535 has been programmed for manual, i.e., local message key (MK) input, "ENTER MK" will be displayed. The correct MK must then be entered via the keyboard (5 letters, space, 5 letters) and terminated with  .

The space bar must then be pressed whereupon the processed text (ciphered) will be displayed and can be written down as required. With each further operation of the space bar the next processed-text section is displayed until the end of the message. The unit then returns to monitor mode. Ciphered text in the display is always in the 5-letter group format.

4.8.3 CIPHERING VIA THE SERIAL INTERFACE

Preparation is as described in Section 4.8, in addition to which the variable parameters for output speed, polarity and code (VP4, VP5, VP6) must be correctly programmed for the peripheral device which is connected (Section 4.3).

Ciphering via the serial interface is selected by entering CTRL CS  (or CTRL C  if the serial output is the preferred output).

If the HC-530/535 has been programmed for manual, i.e., local message key (MK) input, "ENTER MK" will be displayed. The correct MK must then be entered via the keyboard (5 letters, space, 5 letters) and terminated with .

The cipher text is then transmitted to the connected device. When the process is completed the unit returns to monitor mode.

4.8.3.1 MESSAGE-SWITCH NETWORK



When the HC-530/535 terminal is being used in networks having message switch facilities, the plain header must be prefaced with the message-switch character sequence "ZCZC". The HC-530/-535 will then automatically generate the message-switch end character sequence of "NNNN", but only if the message is ciphered to the serial interface.

4.8.4 CIPHERING VIA THE COUPLER (ACOUSTIC AND GALVANIC)

Preparation is as described in Section 4.8. For transmission via a telephone connection, the selective call feature should be turned off (VP11 = 1). For poor connections it will be necessary to use FEC (redundant) transmission (VP1 = 2). To program the variable parameters, see Section 4.3.

Ciphered text transmitted via the coupler is transmitted without spaces, carriage return, letter shift etc., i.e., with only the 26 letter combinations: no 5, 10 or 60 letter groupings occur.

When the operators have agreed to communicate using the acoustic coupler, they must both place their telephone handsets on the rubber pads of their units (Figure 4.1). The earpieces should be on the rear pads and the handsets centered. Each handset should then be secured with its rubber strap. The transmitting side should be in monitor mode, CTRL R.

The transmitting side operator should then enter CTRL CT . If the HC-530/535 has been programmed for manual, i.e., local message key (MK) input, "ENTER MK" will be displayed. The correct MK must then be entered via the keyboard (5 letters, space, 5 letters) and terminated with .

Transmission will then take place.

If 10 consecutive attempts to start are unsuccessful, "LINE NOT READY" is displayed. In this case the telephone handset should be removed from the coupler and the operators of the transmitting and receiving stations should get in telephone contact to discuss the problem. When the receiver is ready the process may be repeated.

Transmission is normally always half duplex, with handshake. The HC-530/535 will, however, automatically switchover to simplex operation if selective call has been selected and a radio-transmitted group call-up or general call-up is broadcast. Note that in the simplex case there can be no handshake; the transmitting-side operation must ensure that the receiving side is ready.

During transmission the display of the transmitting HC-530/535 indicates "TRANSMITTING". At the end of the ciphered transmission, the HC-530/535 returns automatically to monitor mode except when the message is too large for the receiving station. In this case the display will show "END OF PART, PRESS C KEY WHEN READY". In this situation the telephone handset should be removed from the HC-530/535 for the purpose of communicating with the operator of the receiving station. When the receiving operator has deciphered the text, he gives the "go ahead" to continue. The handsets at both stations should then be replaced onto the HC-530/535 units and the transmitting-station operator can continue by pressing the C key.

The sequence is the same when using the galvanic coupler (Section 4.5.4.2) except that the TFG-530 Telephone/Galvanic Switchover Interface is then used. If the receiving terminal uses a TFG-530 Telephone/Galvanic Switchover Interface, a one-second tone will be heard in the handset of the transmitting station as a signal to start transmission. The transmitting operator then places his handset onto his HC-530/535 and transmission can take place using the above steps.

It is also possible for both sides to speak over the telephone, agree to transmit ciphered data, switch their TFG-530 units over to galvanic operation and then one transmits and the other receives. If both sides then replace their handsets on their telephones, the transmission will go to completion, followed by automatic disconnection of the telephones.

If neither side replaces his handset, the two parties may again converse if they both switch back their TFG-530 units following transmission completion.

4.8.5

SELECTIVE CALL

Selective call is a technique for radio applications whereby the transmitting terminal can specify which of several individual or groups of terminals is to receive a message. For the HC-530/535, selective call functions with the galvanic or acoustic coupler.

The selective call itself is a frequency shift keying (FSK) signal having a five place number, each number being made up of five bits. Each HC-530/535 in a selective call network is assigned one of these numbers and that is then the address of that HC-530/535.

Selective call can be programmed in an HC-530/535 using VP11. The HC-530/535 will then request the address of the station to receive the message as soon as ciphered transmission via coupler is selected. Further transmissions can be made to the same station without re-entering the station's address each time. A different station's address can be entered at any time, however.

4.8.5.1 VP SELECTION FOR SELECTIVE CALL

Variable parameter (VP) 11 is the selective call parameter. The VP values for VP11 are:

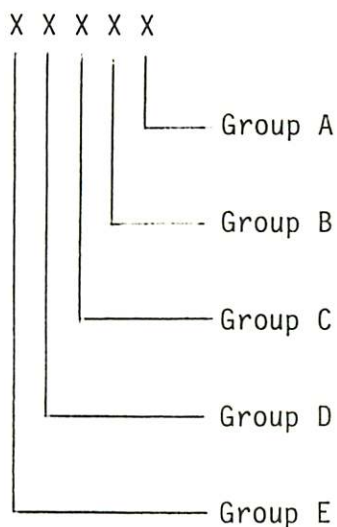
VP11	
<u>VP value:</u>	<u>Meaning</u>
1	Selective call turned off
2	Selective call turned on
3	Selective call turned on with labeling of the transmitter terminal given in the deciphered text at the receiving terminal.

NOTE: The transmitting terminal of a coupler message will always be indicated on the display of the receiving station even if the receiving station has its selective call turned off.

4.8.5.2 GROUP CALL-UPS AND CALLS-TO-ALL

The address of each HC-530/535 terminal in a selective call network has five digits. If desired, the position of each digit can be used to define the group to which that terminal belongs:

Address of
HC-530/535



X can have any
value from 0 to 9.

For example, station number 00005 belongs to group A, station number 00070 belongs to group B, station number 00200 belongs to group C, station number 05000 belongs to group D, etc. Station number 02073 would belong to groups A, B and D.

If the number of an address selected at a transmitting terminal is replaced with the letter A (for "ALL"), then the message will be sent to all the terminals of that group.

For example, if all the stations in group C are to receive the message, then the address to be entered at the transmitting terminal is 00A00. Similarly, to send a message to all the stations in groups B and E, the address to use is A00A0 and so on.

To send a message to all stations of a selective call networks (call-to-all), the address is AAAAA.

4.9

DECIPHERING MODE

For deciphering to be possible, the ciphering and deciphering machines must use exactly the same basic key and the same message key.


During deciphering the resulting plain text can be passed to any of several output devices but only one device can be used per deciphering process. The deciphering of the memory may be repeated as many times as required, however, except in the special case described in Section 4.9.4., Deciphering Continuation.

Selection of the deciphering output device can be by "default" in the same manner as described in Section 4.8 for the ciphering mode.

The text to be deciphered must be entered via the keyboard (input mode) or be received via the coupler into the receiving memory.


NOTE: Text entered into a HC-530/535 memory can be entered from another device (TPR-530 Punch/Reader, galvanic or acoustic coupler etc.) or from the keyboard:

For text entered via devices other than the keyboard:

All advance sequences CTRL A or /////  used by these devices (e.g., after the plain header, after the message key, before and after a character count, etc.) must be existent on the entry medium (e.g., on the paper tape) or else improper deciphering can occur.


For text entered via the keyboard:


Only the ciphered text part should be entered without any advance sequences. (It is also possible to enter all items of a message via the keyboard, but then all advance sequences normally entered by the devices as explained above must be entered -- not a recommended procedure).

To decipher to the defaulted output device of the variable parameter number 2, place the HC-530/535 into monitor mode CTRL R and enter CTRL D  .

Each basic key (BK) is identified by a two-letter code called a bigram. If no bigram was submitted with the text to be deciphered and more than one BK is stored, then

ENTER BI:

will appear on the display. The desired two-letter bigram should then be entered via the keyboard and terminated with  .




If the message key (MK) was not keyed-in, "ENTER MK" will now appear on the display. The correct message key must then be entered via the keyboard (5 letters, space, 5 letters) and checked. Corrections can be made using CTRL K (or DEL) and CTRL W (or WORD) as necessary. Terminate with  .

The deciphered text is then immediately issued to the default device because CTRL D was entered above. To decipher to another device, see the following sections.



When the decipher process is complete the machine returns to monitor mode. If the memory contents are no longer required, they may be erased by entering CTRL XY.

4.9.1 DECIPHERING WITH PRINTER

Preparation of the unit is as detailed in Section 4.9. In addition, the printing paper should be checked to ensure that sufficient paper is on the roll. If not, see Section 6.1.


With the unit in monitor mode the printing decipher mode may be selected by entering CTRL DP  or CTRL D  (if the printer is the preferred output device). If the message key is missing, "ENTER MK" will appear on the display. The correct message key must then be entered (5 letters, space, 5 letters), checked and terminated with . As confirmation that the input is completed, "IN PROCESS" is displayed. Dependent on the length of text, 15 seconds may pass because the entire page must be processed before printing starts. At the end of the process the unit returns to monitor mode.

4.9.2 DECIPHERING WITH DISPLAY

Preparation of the unit is as detailed in Section 4.9. The mode is selected by entering CTRL DD  (or CTRL D , if the display is the preferred output device, i.e., VP 2 with a VP value of 1). The bigram of the basic key and the message key may then have to be entered (see section 4.9.1 immediately above). Repeatedly pressing the space bar then brings sequential text lengths to the display. The advance sequence ///// is shown between the (plain) header and the deciphered text. Pressing the space bar beyond the end of the text causes the HC-530/535 to return to monitor mode.

4.9.3 DECIPHERING VIA THE SERIAL INTERFACE

Preparation is as described in Section 4.9; in addition it must be ensured that the VP values for the variable parameters "output speed, polarity and format" are correctly selected (Section 4.3).


To select deciphering via the serial interface, CTRL DS  Y must be entered. (This mode must be confirmed with Y (yes) since plain text will be transmitted to the peripheral device.) The bigram of the basic key and the message key may then have to be entered (see section 4.9.1 for the procedure). As confirmation of a completed input, "IN PROCESS" is displayed. After completion of processing the unit returns automatically to the monitor mode.

Should the HC-530/535 remain blocked in this mode, check to ensure that the serial output speed VP4 is not set to a VP value of 1.


4.9.4 DECIPHERING CONTINUATION

Deciphering continuation mode is needed in those rare cases where long messages to be deciphered cannot be stored as a whole*. In this mode the selection of the output device is only possible by "default". The procedure for this type of operation is as follows:

*Text is stored in plain in the HC-530/535 memory. When ciphered, the text becomes longer. Thus a long plain text, nearly filling the transmitting terminal's memory, may not fit in the receiving terminal in ciphered form. Deciphering continuation is then needed at the receiving terminal.

- (a) Input text via input mode until the memory is almost full. The input will be automatically interrupted before the memory capacity is exceeded; this is indicated by a flashing display, text alternating with asterisks.
- (b) Note the exact position where the text is interrupted (the subsequent text input must be restarted at the next character).
- (c) Enter CTRL R (return to monitor mode)
- (d) Decipher by entering CTRL D  .
- (e) When the deciphering process is finished and the message noted, clear the memory with CTRL XY. (The HC-530/535 should not be switched off in order to avoid loss of the key generator position.)
- (f) Continue text input from next character after the point where the text was interrupted.


CAUTION: SEE TPR-530 PUNCH/READER OPERATING INSTRUCTIONS BEFORE GOING FURTHER IF WORKING WITH PAPER TAPE.

- (g) When the input/transmission is finished, enter CTRL R.
- (h) For deciphering enter CTRL DC  .

For very long messages this mode of operation can be repeated by starting at (e). It is, however, not possible to repeat the operation CTRL DC for a given segment of the text. If a given segment of text is to be deciphered twice, the complete process must be repeated.

4.10

EDITOR MODE

The editor mode (CTRL R, CTRL E ) provides the possibility of controlling, searching, correcting, completing and selectively deleting the text which is stored in the text memory of the HC-530/535. To leave editor mode, enter CTRL R.

NOTE: In the editor mode the correction key WORD (or CTRL W) is not operational.

NOTE: The commands in editor mode, with the exceptions of mode selection and exit from mode, are not executed at control level (CTRL key must not be pressed). See Table 4.5 and the following information:

The following characters are accepted in editor mode and are explained in more detail in the following sections:

- T = "TOP", to display beginning of text
- B = "BOTTOM" to display end of text
- J = (JUMP) shift cursor one character from left to right in display
- = Shift cursor one character from right to left in display
- SPACE = Shift of the display forward 38 positions
- = Shift of the display backward 38 positions
- D)
DEL) = "DELETE" for deletion of the single character at the cursor position.

HC-530/535 EDITOR COMMANDS

(WITHOUT CTRL KEY)

T = TOP (SETS CURSOR + DISPLAY TO THE BEGINNING OF TEXT)

B = BOTTOM (SETS CURSOR + DISPLAY TO THE END OF TEXT)

SPACE BAR = CURSOR + TEXT SHIFTED FORWARD BY 38 CHARACTERS

< = CURSOR + TEXT SHIFTED BACK BY 38 CHAR. (< = RETURN KEY)

J = (JUMP) MOVE CURSOR TO THE RIGHT WITHIN DISPLAY

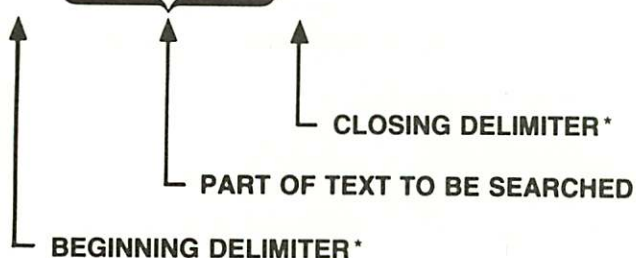
- = (JUMP) MOVE CURSOR TO THE LEFT WITHIN DISPLAY

D)
DEL = DELETE CHARACTER AT CURSOR POSITION

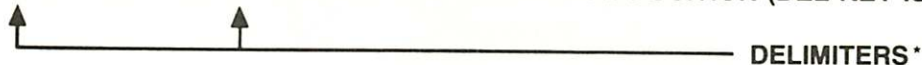
L = LOCATE MODE
I = INSERT MODE
C = CHANGE MODE

} SEE
EXAMPLES
BELOW

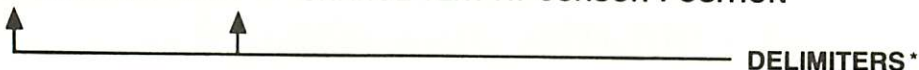
L/TEXT..... / = LOCATE



I +TEXT..... + = INSERT TEXT AT CURSOR POSITION (DEL KEY IS USABLE)



C:TEXT..... : = CHANGE TEXT AT CURSOR POSITION



* A DELIMITER PAIR CAN BE ANY PAIR OF IDENTICAL CHARACTERS WHICH ARE NOT PART OF THE INTERVENING TEXT.




Table 4.5 Editor Commands for the HC-530/535 (CTRL Key Not Necessary)

I = "INSERT" status indicator goes to "EI"*; (DEL is usable here)

C = "CHANGE" status indicator goes to "EC"

L = "LOCATE" status indicator goes to "EL"


Delimiter = Marker for text start and end; can be any character which does not appear in the text being entered or sought (normally = /).

To use editor mode a message must have been stored in the memory (otherwise "MEMORY EMPTY" is displayed). For initial selection of this mode the unit must be in monitor mode (enter CTRL R) and then CTRL E  must be entered. The status indicator then shows "E" and the beginning of the text is displayed.

The first character is underlined by the cursor. This cursor can be shifted to the left or right and acts as a positioner for corrections.

*Use CTRL K to remove any unwanted changes.

4.10.1 READING OF TEXT

By operating the space bar in editor mode the text is moved 38 characters forward and displayed. This procedure can be repeated until the end of the stored text is reached. The text can also be moved 38 characters backward by operating the new line key .

By pressing T (Top) the beginning of the stored text is displayed. The cursor will, likewise, be located at the beginning (left side) of the display.

Pressing B (Bottom) displays the end of the stored text. The cursor will be located at the end (right side) of the text displayed.

4.10.2 TEXT SEARCH

Text search can be carried out in editor mode simply by reading the text as detailed in the previous section or by the following method:

Enter L (Locate). The status indicator then goes to "EL" and the text on the display is cleared. Next a "begin delimiter", e.g., /, must be entered, which can be any character not appearing in the text being sought. Next a part of the sought text must be entered (max. 35 characters). This part must then be terminated with the same delimiter as used initially. The text sought will then be displayed with the cursor located at the end of the sought text entered.

When performing a text search, the HC-530/535 starts searching from the current cursor position. This allows efficiently searching for identical text sections. If too many undesired text sections are found in this fashion, however, the number of characters between the delimiters should be increased.

If the text is not found, "(SEARCH FAILED)" will be displayed for approximately one second followed by an automatic execution of "TOP". The text beginning is then displayed.

4.10.3 TEXT DELETION

With each operation of the D or DEL key in editor mode the character at the cursor is deleted and the text is closed up (this is only valid in the editor mode). If the entire text is deleted, the unit will return to monitor mode.

4.10.4 TEXT INSERTION

- (a) The cursor must be positioned to the right of the position where the text is to be inserted. (Use the J or - text search keys to position the cursor).
- (b) Enter I, whereupon the status indicator displays Ei
- (c) Enter "begin delimiter" as detailed in section 4.10.2 (e.g., /)
- (d) The text and cursor will move to the center of the display; this allows a check of the beginning and end of the text where insertion is desired.
- (e) Input required text. (The last character entered can be cancelled with DEL here if desired; the Ei mode remains.)

- (f) Enter "end delimiter" as before (e.g., /); the new text will be stored in memory and the status indicator will return to E. (If you ever forget which delimiter you used at the start of your text insertion, the insert mode can be exited by entering CTRL R and the unit will return to monitor mode.)

4.10.5 CHANGING TEXT



Changing the text in editor mode may be carried out as follows:

- (a) Position the cursor under the first character which is to be changed
- (b) Enter C, whereupon the status indicator changes to EC
- (c) Enter the "begin delimiter", e.g., /
- (d) Enter the new text (it will be displayed)
- (e) Enter the "end delimiter", e.g., /; the status indicator returns to E.

Should the new and old text lengths be unequal, characters can be deleted with D or inserted with I as detailed in the preceding two sections.

4.11 MEMORY EMERGENCY CLEAR

The memories of the HC-530/535 are normally cleared via the keyboard using CTRL XY:




- (a) To clear the BK memory: Enter CTRL B  CTRL XY
- (b) To clear the VP memory: Enter CTRL V  CTRL XY
- (c) To clear the text memory: Enter CTRL R CTRL XY

NOTE: When the HC-530/535 is switched off, only the text memory will be cleared. The BK, VP and station ID memories are not cleared because they are supplied power from a separate Ni-Cd accumulator mounted on the keyboard/display printed-circuit board.

However, removal of either the metal plate on the right side of the HC-530/535 or the HC-530/535 top cover* will cause activation of a microswitch (arrow, figure 4.7). This will cause the microprocessor to clear the basic key and station ID, but only if the lockable ON/OFF main switch (top right, figure 3.1) is set to OFF. If set to ON, nothing will be lost. (The variable parameters are not lost in either case.)

4.12

PLAIN TEXT OUTPUTS

The memory contents, whether plain or ciphered text, can be recalled to the display by going into editor mode CTRL R CTRL E  (Section 4.10), can be printed by entering CTRL P  (Section 4.6) or be issued from the serial port CTRL S  Y (Section 4.7).

*To remove the top cover, first release the catch on the rear of the unit (arrow, figure 4.6).

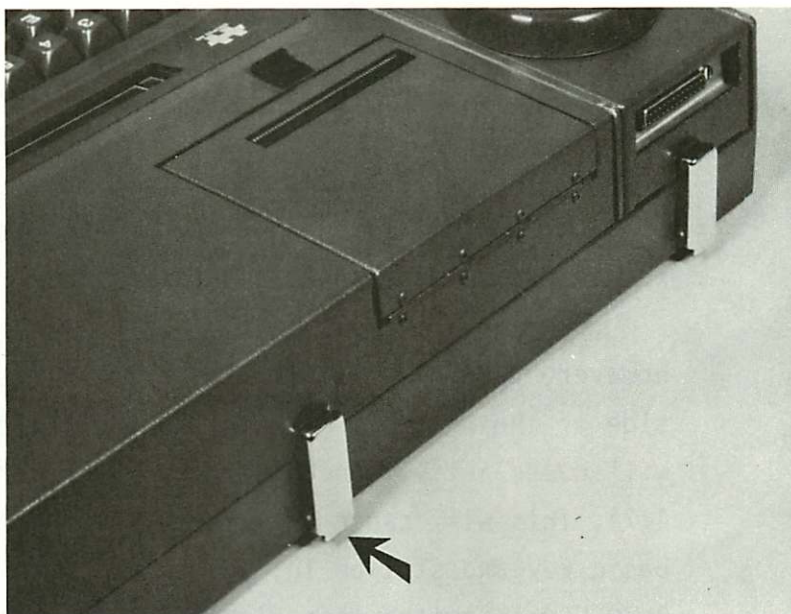


Figure 4.6 Release Catch (Arrow)

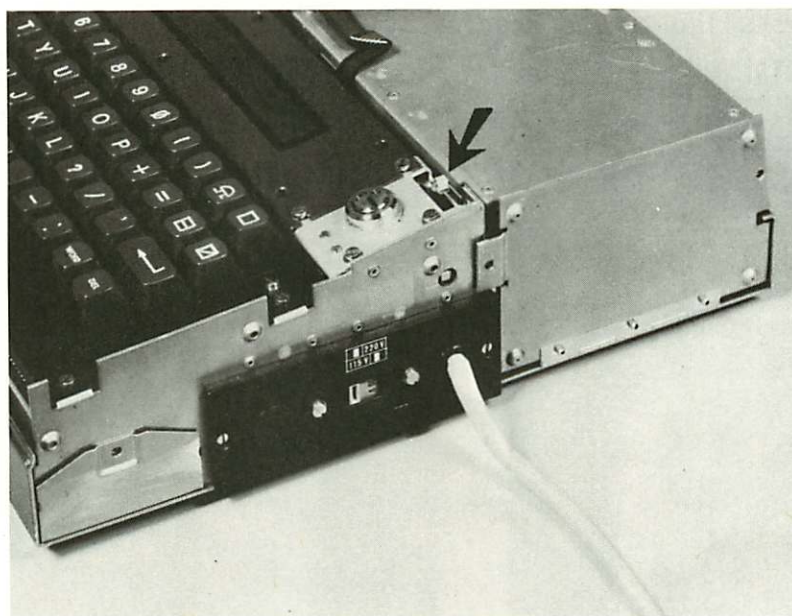



Figure 4.7 Microswitch (Arrow) Under Top Cover

5. CHECKS

5.1 GARBLED TEXT AFTER DECIPHERING

- (a) If the deciphered text is garbled from the beginning, check that the correct message key and basic key have been used.
- (b) If the deciphered text is not garbled from the beginning, an error has been made in entering the cipher text. Check the cipher text (in editor or printer mode) and correct or enter again.
- (c) If, during attempted deciphering, the ciphered text is produced unprocessed, check that the correct number of advance sequences, CTRL A (or ///// ) have been entered. Either all or none of the advance sequences must be entered.

5.2 POOR PRINTING QUALITY

If there is a poor printout, do the following:

- (a) Open the printer lid and remove the thermo paper by pulling it out gently to the rear.
- (b) From the rear, feed in the cleaning band supplied with the accessories using the paper advance button (located adjacent to the paper-cutter teeth).
- (c) Switch off the machine.
- (d) Move the cleaning band forward and backward a few times.
- (e) Remove the cleaning band and replace paper as detailed in section 6.1.

5.3 OTHER CHECKS

If no display appears in the switched-on state, it is possible that the accumulator control monitoring circuit has switched off the unit. The unit remains in this condition even when the accumulator has been recharged: to switch the unit on, the main switch (top right, Figure 3.1) must be switched to "OFF" about 3 seconds and then back to "ON".

If, despite charging, the display flashes after the unit has been switched on, the charger module should be checked (voltage selection, fuses).

Should the display not appear despite switching the unit off and then on, then the fuse on the power converter may be defective (short-circuit or over-voltage).

If, after switching on, an acoustic signal sounds from the coupler, or if the display shows false characters for a long period, then there is a faulty module. In particular, if "RAM FAILURE" is displayed, the memory printed circuit board has a fault.

6. MAINTENANCE PROCEDURES

6.1 REPLACING PRINTING PAPER

- (a) Open the printer lid by pushing the release button in the direction shown in Figure 6.1
- (b) Remove the empty paper roll



Figure 6.1 Push Printer Lid Release in the Direction of the Arrow to Free Printer Lid

- (c) Load new thermal paper roll as shown in Figure 6.2



Figure 6.2 Loading a New Thermal Paper Roll;
Paper Feed Pushbutton (Arrow)

- (d) Switch the machine to monitor mode (CTRL R)
- (e) Press the paper feed button shown in Figure 6.2 until the paper appears as shown in Figure 6.3
- (f) Close the printer cover and ensure that the paper feeds through the slot provided in the cover, Figure 6.4

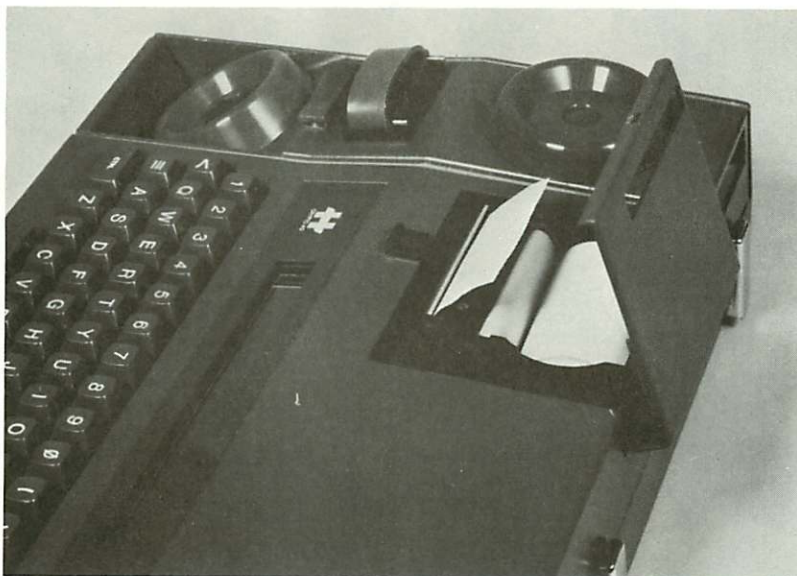


Figure 6.3 Paper Shown Coming Out of Printer



Figure 6.4 Closing Printer Lid so that Paper Passes Through Slot in Lid

6.2 HANDLING OF THE THERMO PAPER

Jujo Thermal is a heat-sensitive paper which forms clear colors when heated to 90° C or above. The following points should be carefully noted when handling and storing this product.

AVOID EXPOSURE TO DIRECT SUNLIGHT

- The paper will yellow if left near windows. Also the print color of Jujo Thermal, especially the blue-image type, will fade in direct sunlight.
- Blue images tend to fade when left exposed to conventional fluorescent light for one month, and therefore, printed Jujo Thermal should be filed soon after printing.

DO NOT STORE IN HOT, HUMID ENVIRONMENTS

Unprinted Jujo Thermal retains its printability for more than 5 years when stored in the dark at an ambient temperature of less than 30° C and a relative humidity of less than 60 %.

Unprinted Jujo Thermal retains its printability for 1 month when stored at an ambient temperature of 60° C. Printed Jujo Thermal remains readable for at least 10 years when stored (filed) at an ambient temperature of less than 30° C and a relative humidity of less than 60 %.

AVOID WETTING AND ABRASION

- If Jujo Thermal becomes wet use tissue paper to absorb the water and then let the sheet dry in air at room temperature.
- Do not rub or scratch the surface of Jujo Thermal because frictional heat will cause color formation.

AVOID CONTACT WITH PLASTICIZERS

- Prolonged direct contact with plastic material (such as PVC) causes the printed images of Jujo Thermal to fade.
- Avoid using ordinary self-adhesive cellophane tapes: some cause the printed images of Jujo Thermal to eventually fade. (Scotch "Magic" tape has been used with success, however.)

DO NOT USE SOLVENT-TYPE ADHESIVES

- Starch, PVA and CMC-type adhesives are recommended.

6.3

ACCUMULATOR MAINTENANCE

The Ni-Cd accumulator used in the HC-530/535 is, in principal, maintenance free. After long periods of either storage or use without a mains supply, however, it may be necessary to recharge the accumulator before the unit is operational (see Section 1.3.6).

Expected accumulator lifetime is from five to ten years or approximately 1000 charge/discharge cycles. As the accumulator ages, its capacity is reduced.

The accumulator may be removed as explained below.

WARNING: NICKEL-CADMIUM (NI-CD) ACCUMULATOR CELLS HAVE A VERY LOW INTERNAL IMPEDANCE. THUS NEVER ALLOW A SHORT CIRCUIT TO OCCUR ACROSS THE TERMINALS OF THE ACCUMULATOR. THE RESULTING HIGH CURRENT CAN HEAT AND MELT CONDUCTORS, PRODUCING BURNS, FIRE HAZARDS AND EQUIPMENT DAMAGE.

NOTE: The text memory is cleared if the unit is turned off or if the accumulator is removed.

To remove the accumulator, first disconnect the mains supply. Then, if you wish to save the basic key, turn the lockable ON/OFF main switch (top right, Figure 3.1) to ON. Otherwise turn it to OFF. Refer to Section 4.11. (The variable parameters are not lost in either case.)

Remove the metal plate on the right side of the HC-530/535 and slide out the accumulator pack, Figure 6.5.

The basic key, if it was saved, is now protected by the separate basic key/display printed circuit board. This is true even if the unit is now accidentally turned off. Just be sure the lockable main switch is turned ON before installing the accumulator if the basic key is to be saved.

NOTE: We do not recommend operation of the HC-530/535 without the accumulator in place. The printer, of course, is not operational when the accumulator is removed (Section 1.3.6.).

6.4

DIAGNOSTIC TEST SOFTWARE (OPTION)

The diagnostic test software checks if the unit is functioning correctly and localizes faulty modules. Diagnosis goes partly to IC level.

The diagnostic test software is optional and if supplied, is stored in an EPROM (Eraseable Programmable Read Only Memory). If used it must be positioned in socket IC5 of the EURO memory PC board.

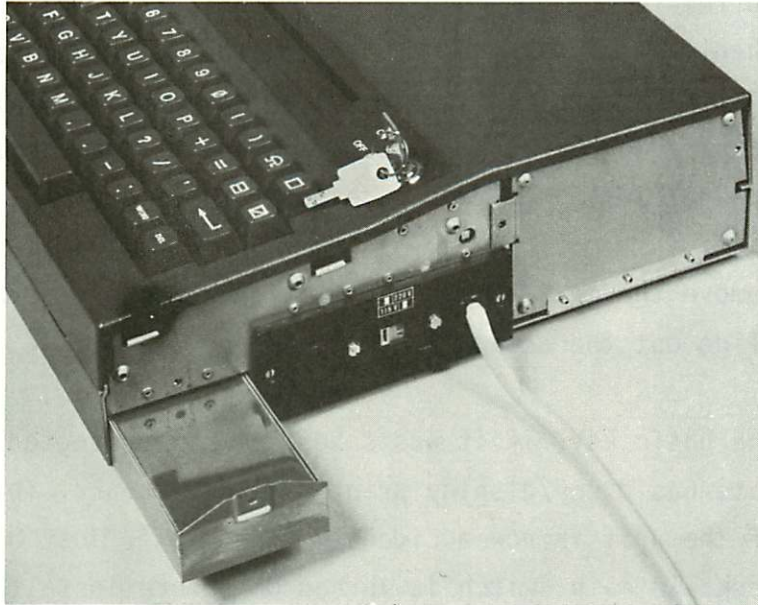



Figure 6.5 Accumulator Pack Can be Slid Out After Removing Side Plate.

6.4.1

DIAGNOSTIC TEST PROGRAM

To start the diagnostic test program place the HC-530/535 in monitor mode by entering CTRL R. Then enter CTRL T . The display will be:

SWV: - - - - TEST SURE?

(The SWV is the software version for your HC-530/535.) Now press Y. The display will be:

CONTINUOUS TEST? (Y), OR PRINT TEST? (P)

This display will remain for approximately six seconds during which you may choose one of three tests as follows:

- if you make no entry or press the space bar, a general test runs, checking the items listed in section 6.4.2 following except for the thermohead monitoring circuit and the printer. (The general test is explained in more detail in the next sections.)
- if you enter P, a printer test will be performed. If the printer passes the test, the printout will be similar to that shown at the top of figure 6.6 but longer. If the printer is defective, a protocol similar to that at the bottom of figure 6.6 will be printed.
- if you enter U, the printer thermohead monitoring circuit will be checked. If this circuit passes the test, a single dash (-) will be printed out. (The printer thermohead monitoring circuit ensures that if a fault occurs in the thermohead driving circuitry, the thermohead points will not be heated for an excessive time; this would damage the thermohead. This test activates one set of points for a time just exceeding the maximum allowable. If the monitoring circuitry does not operate, the normal text in the display - CHARACTERS ON PRINTOUT NOT ALLOWED - will be then additionally printed out: this printout serves as the fault signalization.

TEST OK

[illegible]

AUTOMATIC TEST TERMINATED

ERROR-MESSAGE PRINTOUT

[illegible]

```

ERROR          RD / IC 32
ERROR ON: MEMORY BOARD / IC 32
ERROR ON: MEMORY BOARD / IC 33
ERROR ON: MEMORY BOARD / IC 34
ERROR ON: MEMORY BOARD / IC 32
ERROR ON:          RD / IC 42
ERROR ON:          BOARD
ERROR ON:          BOARD / MK GE
AUTOMATIC TEST TERMINATED

```

PRINTER DEFECTIVE

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099
1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	

[illegible]


Figure 6.6 Test Protocols

6.4.1.1 GENERAL TEST DETAILS

The general test runs if the space bar was pressed or if no entry was made (see first item above). Once running, this test can only be interrupted by switching off the unit. The display, timing, tests performed, etc., are given in table 6.1.

NOTE: The information given in table 6.1 assumes no faults are found. For fault information, see next section.

GENERAL PART OF DIAGNOSTIC TEST

After entering CTRL R CTRL T  Y and pressing the space bar or waiting approximately 6 seconds, the following sequence will take place:

Display	Display Remains Approximately:	Tests Performed by General Part of Diagnostic Test
TEST RUNS	20 sec.	Lower address region of RAM is tested (written and then read).
POWER OFF NOT ALLOWED	20 sec.	Basic key (BK) and variable parameter (VP) part of RAM is tested (data saved and then the RAM is written and read followed by data return). CAUTION: If power is shut off during this period, the BK and VP may be lost.
TEST RUNS	100 sec.	Rest of RAM is tested. The EPROMs are read and their signatures checked.

Table 6.1 General Part of Diagnostic Test

Display	Display Remains Approximately:	Tests Performed by General Part of Diagnostic Test
(Blank, then various symbols)	10 sec.	The RAM of the display is checked; a serial output interface feedback check is made.
	8 sec.	Coupler test (beeps will be heard espe- cially if the TEA-530 headset has not been mounted on the rubber pads).
(Various symbols; then AUTOMATIC TEST TERMINATED)	35 sec.	Printer test. All printer points acti- vated. If good, then printout per top, figure 6.6.
All symbols "walk" across display one after the other	75 sec.	Display test. Test is no longer "auto- matic" in the sense that the symbols should be visually inspected for cor- rectness.
Type CHARACTER AND VERIFY ECHO	-	Keyboard-to-display test. Press each key one after the other starting at the top left of the keyboard and move to the right. Verify proper "echo" in display. After pressing the space bar once, press any other key (except CTRL which gives no "echo") and check that a space appears. Finally, press any key to finish the test and return to monitor mode.

Table 6.1 (continued)

6.4.1.2 FAULT SIGNALIZATION

Upon switch-on, a short diagnostic program runs. If difficulty with the RAM is detected, RAM FAILURE will appear in the display. The keyboard cannot then be used to start the test programs. However, the general test program will start automatically after approximately three seconds to help pinpoint the difficulty.

If the printer is not functioning, faults found will be indicated on the display. Press any key to continue the test sequence.

If a fault is detected in the keyboard, the test program will pause, produce an audible tone via the acoustic coupler, display the fault and then continue on.

When the output protocol gives a diagnosed failure associated directly with an IC number, the failure is not necessarily confined to this IC. For example when a RAM failure is diagnosed, the fault may also lie in the associated decoder. The probability that the exact IC will be diagnosed is nevertheless very high. Figure 6.6 middle shows an example of a RAM-failure printout. Figure 6.6 bottom shows a fault condition where the printer is also involved.

During the test approximately 60 % of the ICs will be diagnosed automatically. In addition approximately 35 % of the ICs will be tested half automatically in that the operator must check the print protocol and visually check the display while entering characters via the keyboard.

During the coupler test the transmitter signal is internally transmitted from the forward rubber pad to the rear rubber pad. In order to ensure that this test functions properly, the hand-set supplied with the TEA-530 Diagnostic Test Unit should ideally be placed on the rubber pads and connected as described in the TEA-530 operating instructions. (If the rubber pads are left uncovered, a failure message "ERROR ON MODEM OR ACOUSTIC PART" can be displayed and printed. Whether this happens depends on background noise and room acoustics.)

In order that the test program can be started, the following functions of the HC-530/535 must be operating properly:

- + 5V supply
- Clock generator
- Power-on detector
- Microprocessor, data and address functions
- Program part "start vector" must run correctly

For the diagnostic output, either the printer or the display must be functioning. In the case where the program recognises a printing error, an acoustic warning is transmitted via the telephone coupler during the error output.

For interrupt controlled tests it is necessary that the "low RAM field" on the memory board is functioning correctly. If it is not, some tests, (e.g., keyboard, serial interface, coupler) may be skipped. The fault will be displayed and printed out, however.

6.4.2

FUNCTIONS DIAGNOSED BY DIAGNOSTIC TEST PROGRAM

The following functions will be diagnosed:

- (a) The internal RAM of the microprocessor.
- (b) The RAM on the memory board.
- (c) The program memory: An EPROM test is carried out using a special algorithm.
- (d) The RAM for the display.
- (e) Serial input/output data.
- (f) The message key random number generator.
- (g) Printer: The printed protocol has numbered rows, characters with all printer thermal points activated and the currently-active thermo-printer temperature compensation "L", "M" or "H" (Low, Medium, High) printed on each line, Figure 6.6.
- (h) Display: This is a program-controlled test and the operator must visually check the procedure. All points are switched on and off and afterwards each character is displayed in all positions.
- (i) Keyboard: The operator must enter characters via the keyboard and check the resulting display.

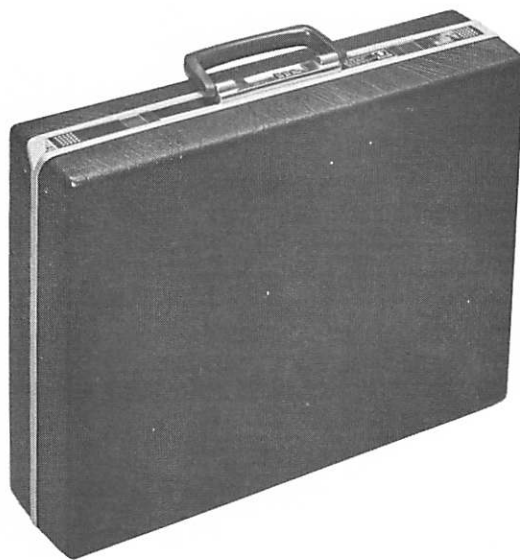
6.4.3

FUNCTIONS NOT DIAGNOSED BY DIAGNOSTIC TEST PROGRAM

The following functions are not checked by the diagnostic test program:

- (a) Power converter including power on and flash circuitry of the display
- (b) On the processor board: No check of the correct speed selection for "UART" is made. (Not possible since the transmitter and receiver are supplied on the same bit-rate generator loop.)
- (c) Real-time clock (flashing)
- (d) On the memory board: The power consumption of the non-volatile memory.
- (e) On the printer control: Paper advance (mechanical)
- (f) On the coupler: The bit-control (e.g., transmitter) crystal could be slower than the receiver crystal. The built-in ability to compensate for such differences is not internally testable because a given HC-530/535 only has one clock whereas two are needed for the test.

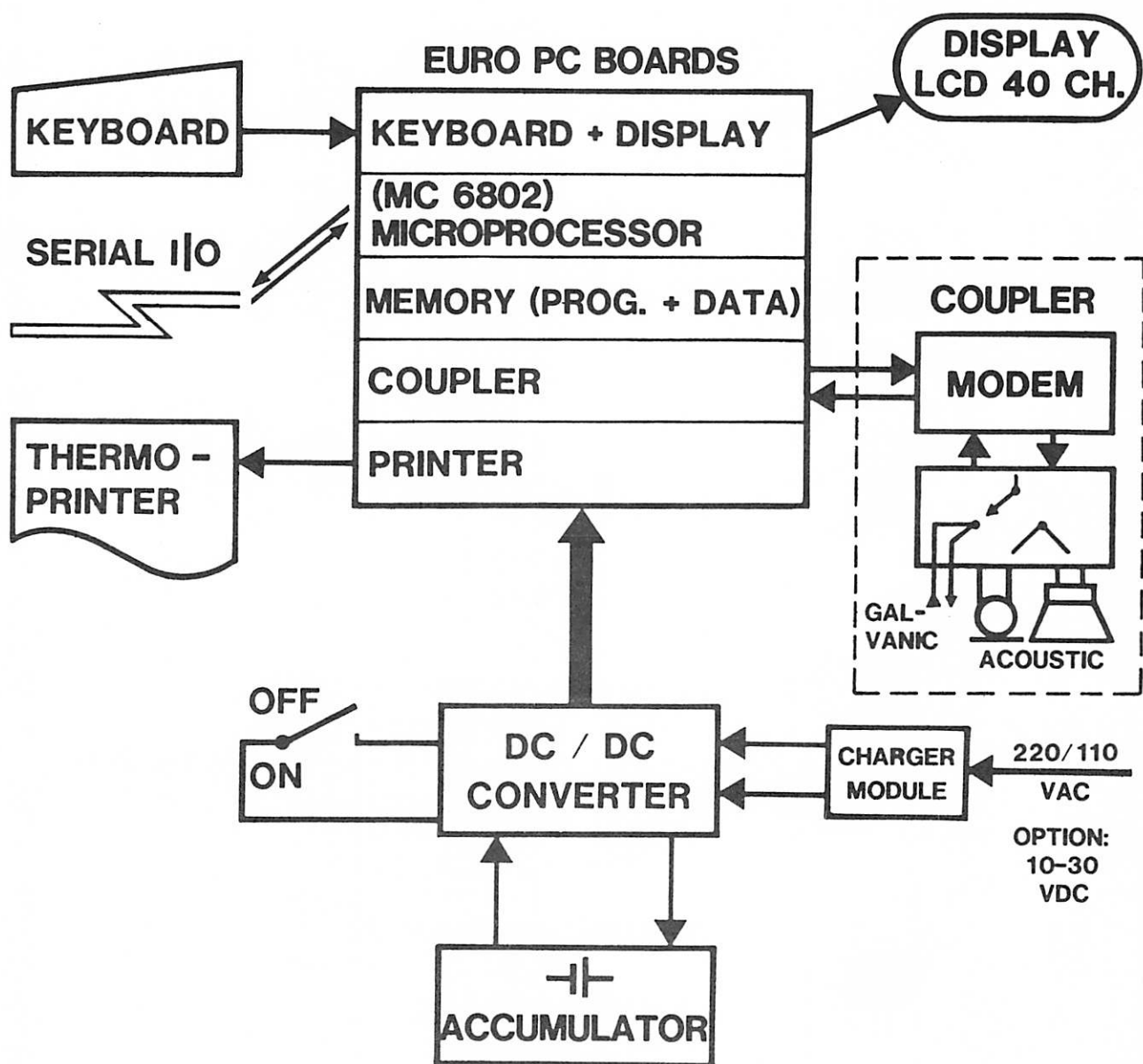
The diagnostic test program is universally applicable on the HC-530/535, i.e., it can be used on all versions of the unit, including the 2000 character and 6000 character memories and on units with and without the editor program.



Case for Civil Version (HC-530)



Case for Military Version (HC-535)



SERIAL INTERFACE PIN ASSIGNMENTS (Socket Type DB 25 S)

PIN	SIGNAL NAME	LEVEL	IN/OUT APPLICATION
1	Ground (0V)		
2	Serial Data Out	V28/V24	→ } External Printer, etc.
3	Serial Data In	V28/24	← }
4	Serial Out Busy	TTL	→ "1" = Busy
5	Tel. Data In	TTL	Test } Possibly for External Modem
6	Tel. Data Out	TTL	
7	Signal Ground		
8	Printer Busy	TTL	Test →
9	Interrupt (NMI)	TTL	Test Start
10	Tel. Out Busy	TTL	Test (Possibly Ext Modem)
11	Clock Tel.	TTL	Test →
12	Input Ready	TTL	→ }
13	Serial Data OUT	TTL	→ } TPR-530
14	Serial Data IN	TTL	← }
15	Serial Clock 16x	TTL	→
16	Serial Clock 16x	TTL	←
17	Clock Display	TTL	Test →
18	unused		
19	unused		
20	INPUT Control Register	TTL	← } Two VP Combinations
21	0V Battery		Test ← "1" = A; "0" = B
22	+ 5V		Test →
23	- 5V		Test →
24	+ V Thermal Head		Test →
25	+ V Motor		Test →

TTL ≐ 0/+5 V

V28 ≐ ± 5 V



Serial Interface Pin Assignments

Appendix A3

3B945

HC-530/535

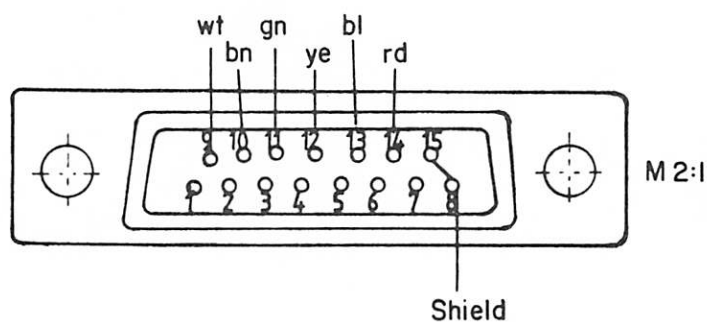
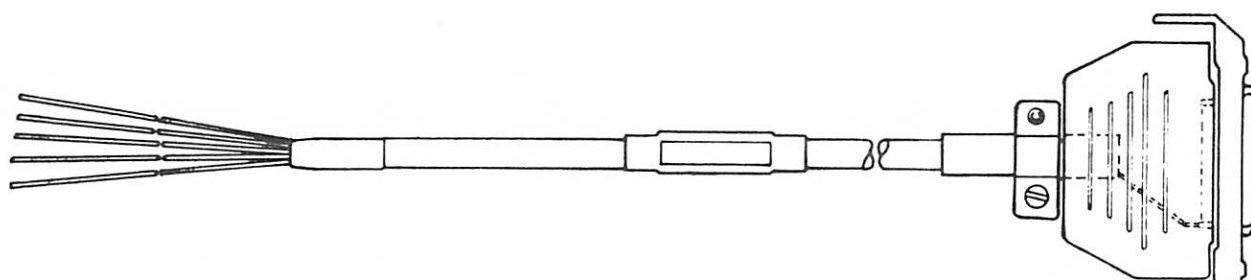
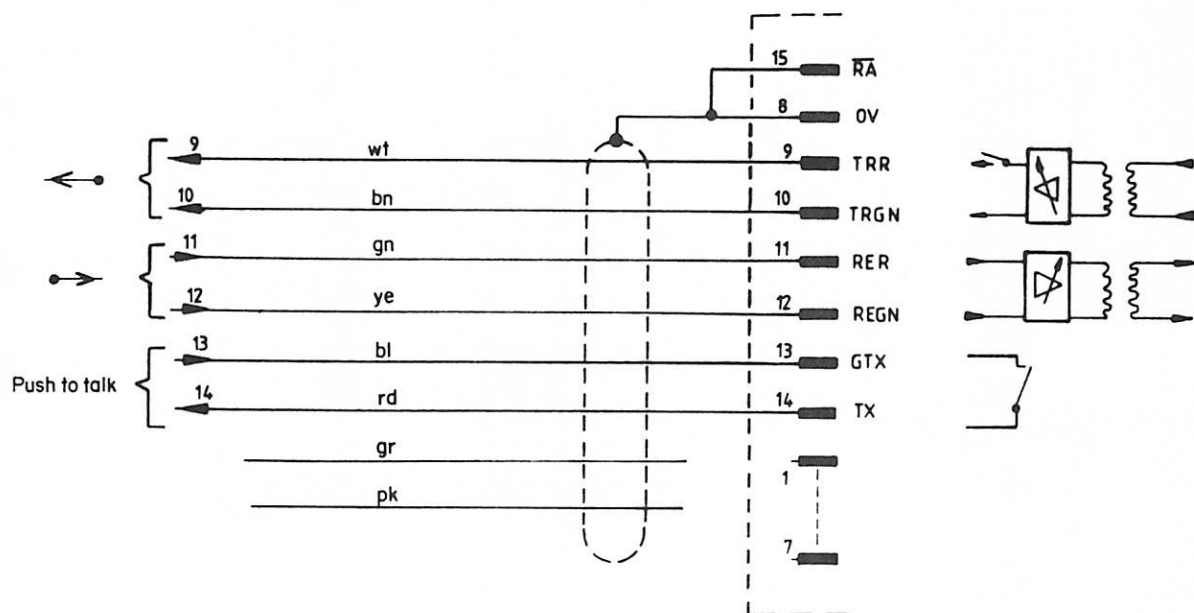
PIN ASSIGNMENTS AT GALVANIC COUPLER SOCKET

The galvanic coupler socket is a type DA 15S, 15-pole. Its assignments are:

PIN	SIGNAL	FUNCTION
1	+ 5V	Supply Voltage for TFG-530.
2	PH	"PHONE"-Manual Switchover Command from TFG-530.
3	GCO	"Galvanic Coupler On" TFG Relay Control Signal.
4	DAT	"DATA"-Manual Switchover Command from TFG-530.
5	CA	"CALL" Signal (Auto. Receive) from TFG-530.
6	RTT	"Receive-Transmit-Telephone" Audio Signal from and to TFG-530.
7	$\overline{\text{GC}}$	"Galvanic Coupler" Operating Mode ON if at 0V.
8	0V	Ground (for TFG-530 or Radio).
9	TRR	"Transmit Radio" Audio Signal, Level adjustable from - 60 to - 10 dbm. TRR-TRGN circuit closed with relay contact in TRR line but only during HC-530/535 transmission.
10	TRGN	
11	RER	"Receive-Radio" Audio Signal, min. - 60 dbm.
12	REGN	"Receive-Radio Ground".
13	GTX	"TX-ON" External Switching from N.O. (Normally-Open) contact of TX relay.
14	TX	
15	$\overline{\text{RA}}$	"Radio" Operating Mode ON if at 0V.

FOR
TFG-
530

FOR
RADIO



DHJ
vmr-go-mj



Galvanic Coupler Cable And Plug (Radio Applications)

Appendix A5

3B945

HC-530/535