PCCM-4000
OWNER'S MANUAL

MILS SYSTEM AG
CH-9010 ST. GALLEN
SWITZERLAND

MILS ELEKTRONIK GMBH
A-6010 MILS/TIROL
AUSTRIA

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PCCM-4000
OWNER'S MANUAL

DESCRIPTION

Your PCCM-4000 Private Computer Cipher Machine is designed for use by diplomatic service, police, businessmen, foreign correspondents and other users who require a truly portable unit for their secure communications.

The PCCM-4000 is a powerful cipher tool having a total of over 1.59×10^{30} crypto variables composed of two independent key sets and a random initialization. The system key (SK), which is stored in a plug-in EPROM, together with the message key (MK), and the random initialization (RK) which are each composed of any four characters of the keyboard, combine to form this total variable set.

Both the message key and the random initialization must be changed for every message. The random initialization in particular ensures that like cipher is not produced should the message key inadvertently be reused and the plain text repeated.

Your PCCM-4000 has been designed with state-

of-the-art MOS solid state circuitry, constructed with high quality components throughout, and assembled with precision workmanship.

FEATURES

Your PCCM-4000 portable cipher unit allows you to encipher or decipher alphanumeric messages. The cipher alphabet is composed of 16 non-ambiguous letters which are within the outlined keyboard area. (See Figure 1.)

The unit contains a 30-character alphanumeric keyboard, 5 control function keys, a 5-character 16 segment LCD display, and 6 status indicators located on the rightmost portion of the display. Three sliding switches complete the PCM-4000 providing all necessary means to process your message.

SWITCHES

- ON/OFF Located on the right top side of the PCCM-4000. Sliding it to the right applies power and resets the unit for initialization. Sliding the switch to the left removes power from the PCCM-400 and all message information is lost.

- D/E — Decipher/encipher operation mode

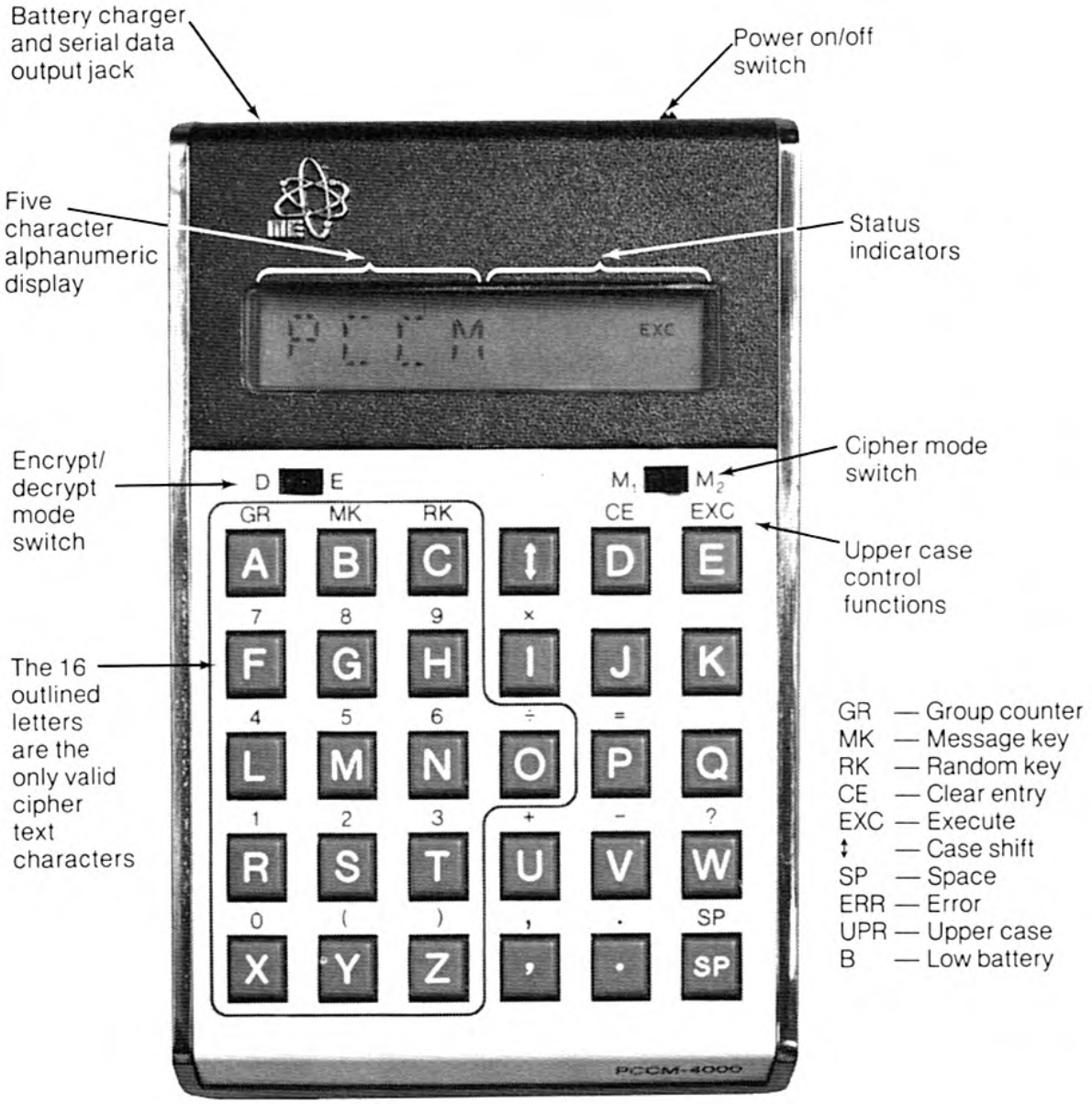
- M_1/M_2 — M_1 is the secondary operating mode for use on poor quality transmission lines where interruptions or loss of cipher information is anticipated. In this mode decipher can be continued after the occurrence of a transmission interruption or loss of cipher groups.

  M_2 is the primary operating mode and should be used for cipher operation wherever high grade transmission channels are available.

Caution: When any of the three sliding switches are operated after the initialization process or during encipher or decipher operation, the PCCM-4000 will be reset and all message information will be lost.

The Keyboard

The figure below illustrates the keyboard layout and identifies the areas described earlier:



DISPLAY

The figure below iliustrates the display portion of your PCCM-4000 in expanded size.

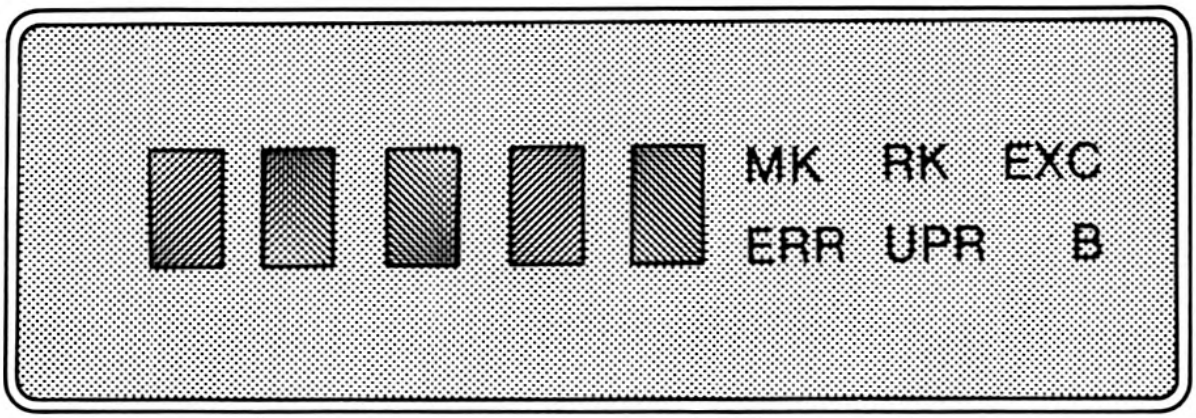


Figure 2

Each of the 16-segment display characters is capable of showing any letter, numeral, punctuation mark, or special symbol on the keyboard. The four leftmost character positions are used for plain text characters and all five positions are used for cipher text letters.

The functions of the status indicators are explained in detail in the next paragraph.

STATUS INDICATORS AND FUNCTION KEYS

MK: Following the input of any four characters representing the Message Key via the keyboard, the status indicator **MK** will light up. This is to be interpreted by you as a request to depress the function key [MK]. This action will enter the Message Key information into the processor. Depression of any other key except [MK], [CE], or [GR] will be ignored by the machine and the status indicator **ERR** will light up.

RK: Following the input of any four characters, (encipher mode) or five letters (decipher mode) representing the random initialization via the keyboard, the status indicator **RK** will light up. This is to be interpreted by you as a request to depress the function key [RK]. This action will enter the random initialization into the processor. Depression of any other key except [RK], [CE], or [GR] will be ignored by the machine and the status indicator **ERR** will light up.

EXC: Following the input of four plain characters (encipher mode) or five cipher

letters (decipher mode) the status indicator **EXC** will light up. This is to be interpreted by you as a request to depress the function key [EXC] . This action will enter the information on the display into the processor. Depression of any other key except [EXC] , [CE] or [GR] will be ignored by the machine and the status indicator **ERR** will light up.

UPR: This status indicator indicates that the PCCM-4000 is operating in the upper case mode (font depicted on the keyboard bezel). It is activated by depressing the shift key [⇕] . To return to lower case the shift key [⇕] is depressed once again.

Upper case is also automatically activated when the status indicators **MK, RK,** or **EXC** appear on the display, but the **UPR** status indicator is not lighted for automatic upshifts.

ERR: This status indicator declares a violation of a procedure. All activity up to the time the **ERR** status indicator appears on the display remains correct and valid. Whenever the next correct step in the operating procedure is done, the **ERR** status indicator will be automatically erased.

B: This status indicator provides a warning of low battery charge. After the first appearance of the **B** status indicator, approximately ten minutes of operating time remain.

CE: This function key is depressed whenever it is desired to clear the display.

GR: This function key causes a display of the number of the completed enciphered or deciphered groups.

If one's place is lost during operations, press in sequence the keys [↕] [GR]. The display will show the count of the last processed group. Any previous characters on the display will be erased by this action (see note).

The next key entry after the group count check will be interpreted as the first character of the next group. Hence, operation of GR when MK, RK, or EXC status legends are lit will require reentry of these groups.

Note: If the **EXC** and/or **UPR** status indicators are on at the time a group count check is to be made proceed as follows: Press the key [GR] and the group count will be displayed in the *rightmost* four positions.

BATTERY OPERATION

The PCCM-4000 has been supplied with three AA size rechargeable nickel-cadmium batteries. The batteries, when fully charged, will give a useful operation time in excess of seven hours. However, due to shelf life discharging, the batteries may require charging before initial operation.

With the batteries properly installed in the bottom of the PCCM-4000, charging is accomplished by plugging the AC adapter/charger AC 4100 into a convenient outlet and plugging the attached cord into the PCCM-4000 socket. The PCCM-4000 can be used while it is being charged. A full charge requires about seven hours with the power switch off and about 17 hours with the switch on for normal operation.

When the batteries become discharged the status indicator **B** will appear on the display. About ten minutes of operation remain after the **B** comes on. Do not attempt to operate the PCCM-4000 for an extensive time with the **B** status indicator on. Erratic performance can be expected.

In emergency situations, when there are no means or time to recharge the nickel cadmium batteries and the **B** status indicator has come on, conventional non-rechargeable alkaline cells may be substituted for the nickel cadmium cells (observe correct polarity).

WARNINGS

1. DO NOT CONNECT THE AC-CHARGER WHILE ALKALINE CELLS ARE INSTALLED IN THE PCCM-4000.

   Equipment damage and/or personal injury due to explosion of the cells may occur.

2. DO NOT CHARGE NICKEL-CADMIUM BATTERIES FOR LONGER THAN 72 HOURS.

3. DO NOT ATTEMPT TO OPERATE THE PCCM-4000 ON THE AC CHARGER WITHOUT NICKEL-CADMIUM BATTERIES INSTALLED.

   Erratic performance can be expected.

4. USE OF OTHER THAN THE AC ADAPTER/ CHARGER AC 4100 MAY APPLY IMPROPER VOLTAGE TO THE PCCM-4000 CIPHER UNIT AND MAY CAUSE DAMAGE.

If the PCCM is left on for an extended period of time after the batteries become discharged, one of the batteries may be driven into reverse charge. This condition is indicated by failure of the PCCM-4000 to operate after being recharged for a few minutes. The battery can usually be restored to operating condition by charging the PCCM-4000 overnight. Repeated reverse charging can permanently damage the batteries.

INITIALIZATION

In both enciphering and deciphering the PCCM-4000 is automatically initialized whenever you:

a. Turn on power

b. Change the position of the D/E mode switch

c. Change the position of the M_1/M_2 mode switch.

Any of the procedures described in the following sections may be performed following initialization.

ENCIPHERING

Step	Procedure	Comments
1	Slide ON/OFF switch to "ON"	This initializes the PCCM-4000
2	Slide the E/D switch to "E"	Encipher Mode
3	Select M_1 or M_2	M_1 is the secondary operating mode for use with low-grade transmission channels. In this mode a cryptogram can be easily deciphered after having an interruption or transmission errors. M_2 is the primary operating mode and should be used whenever high grade transmission channels are available, including examples in this section.

NOTE: The results specified in the following examples are correct only for units with the factory system key.

Step	Procedure	Comments
4	Key in four previously agreed upon Message Key characters. Every key stroke is counted as a valid character.	After the fourth character of the Message Key (MK) has been entered, the status indicator, **MK** will appear on the display.

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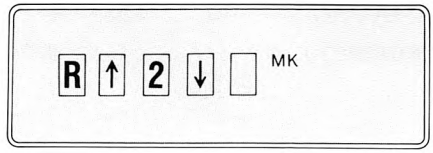
Example 1:

Press: [R] [↕] [2] [↕]

Display shows:



5	Depress function key [MK]	This will enter the Message Key into the processor and the display will be erased.
6	Key in four arbitrary characters. Every key stroke is counted as a valid character.	This is the random initialization. After the fourth character has been entered the status indicator **RK** will appear on the display.

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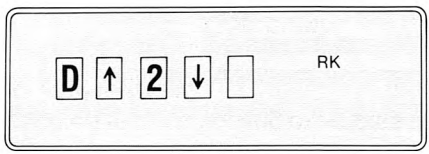
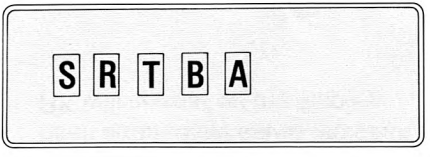
Example 2:

Press: [D] [↕] [2] [↕]

Display shows:



7	Depress function key [RK]	The status indicator **RK** will disappear from the display and the corresponding five-letter cipher group will be shown. The display contents will be:



Step	Procedure	Comments
8	Copy the contents of the display in the previously agreed upon location of your cipher message.	This cipher group will be used as the RK information by the person deciphering your message.

9	Key in the first four characters of your plain text message.	Note that the display duplicates each keystroke thus allowing verification of your entries. After the fourth character, the plain text format is complete and the status indicator **EXC** will appear on the right part of the display.

Example 3

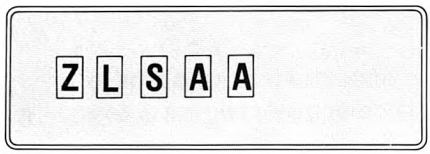
Press: [G] [O] [O] [D]

Display shows:

The **EXC** status indicator is a command to you to press the EXC key. The PCCM-4000 automatically upshifts to relieve you of pressing [↕] preceeding EXC.

> **NOTE:** If, at this or any point in any procedure, you see an error in your four characters, you may press [↕] [CE] and the display will clear for re-entry of this group.

Step	Procedure	Comments
10	Depress function key [EXC]	Note that the display changes from a four-character group to the corresponding five-character cipher group. The display contents will be:



11 Copy the contents of the display.

12 Repeat steps 9 through 11 until your plain text message is enciphered.

> **NOTE:** Fill in the last part of your plain text message to achieve a complete four-character group by adding the required number of dummy characters like space, period, or any other.

13 Turn your PCCM-4000 off

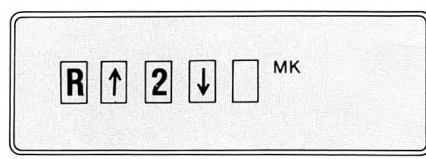
DECIPHERING

Step	Procedure	Comments
1	Slide ON/OFF switch to "ON"	This initializes the PCCM-4000
2	Slide E/D switch to "D"	This selects the decipher mode of operation.
3	Select M_1 or M_2	See step 2 under Enciphering. Note that the same mode (M_1/M_2) must be used for enciphering and deciphering of the same message.
4	Key in the four previously agreed upon mesage key characters	After the fourth character of the message key (MK) has been entered, the status indicator **MK** will appear on the display.

Example 4:

Press: [R] [↕] [2] [↕]

Display shows:

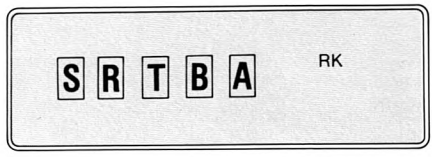


5	Depress function key [MK]	
6	Key in the five-character group located in the agreed upon position in the cipher text message.	After the fifth character has been entered the status indicator **RK** will appear on the display

Example 5:

Press: [S] [R] [T] [B] [A]

Display shows:



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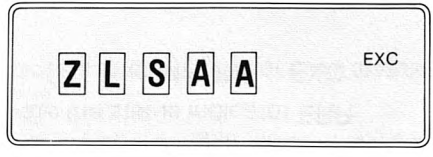
7 Depress function key [RK] Note that the display blanks.

8 Key in the first five-character group of the actual cipher text message.

Example 6

Press: [Z] [L] [S] [A] [A]

Display shows:



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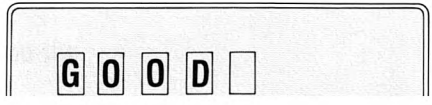
9 Depress function key [EXC] Note that the display changes to the four-character plain text group. The display will be



10 Copy the contents of the display

11 Repeat steps 8 through 10 until your cipher text message is deciphered

12 Turn your PCCM-4000 off.

ERROR RECOVERY

The PCCM-4000 has an error status indicator **ERR** which appears in the display whenever a violation of the operating procedure is made. The following violations will activate the status indicator **ERR**.

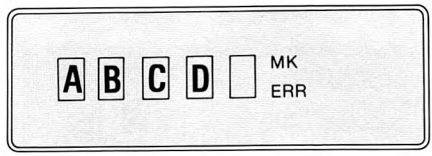
1. Keying in additional characters after **MK, RK** or **EXC** status indicators appear on the display

Example 7:

Initial Condition { Power on, E Mode, M_1 Mode

Press: [A] [B] [C] [D] [E]

Display shows:



Reason for ERR: You keyed in a fifth characer (E) after MK appeared on the display. The PCCM expects only four characters followed by MK.

NOTE: Pressing the [GR A] key accidentally anytime the MK, RK, or EXC status legends are on will cause display of the Group Count. Data entered prior to this keystroke will be cleared. If the status legend was MK or RK, the count will be 0. Group Counts can be identified because they occupy the rightmost four positions. A message group erroneously cleared in this manner, or by pressing [CE] with MK, RK, or EXC displayed, must be reentered.

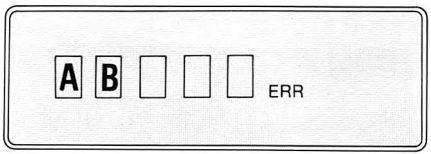
Recovery from ERR: Press [MK] . The characters A, B, C, and D will be accepted as MK and character E will be ignored.

2. Use of invalid characters in decipher Mode D (Change D/E switch and enter any MK group.)

Example 8:

Press: [A] [B] [E]

Display shows:



Reason for ERR: You selected the character E which is outside the valid set for D mode (see keyboard).

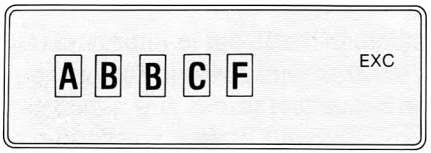
Recovery from ERR: Press additional valid characters and the ERR status indicator will disappear.

Example 9: Wrong input data (finish your RK entry first)

Wanted input: A B C F G

Wanted input: A B B C F

Display shows:



Recovery from wrong input: Press CE and re-enter

[A] [B] [C] [F] [G] [EXC]

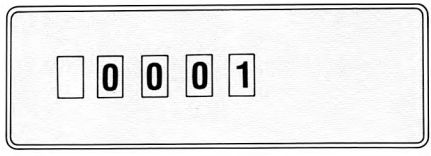
GROUP COUNT

A unique feature of the PCCM-4000 is its ability to display the number of successfully enciphered or deciphered groups. In the event that you lose your place during message processing, merely press [↕] [GR] (see note) and the display will show this count. Any characters on the display will be discarded by this action. The next key pressed after a group count check will be interpreted as the first character of the group immediately following this count.

NOTE: If the EXC and/or UPR status indicator is on at the time a group count check is to be made, the shift [↕] key need not be pressed.

Example 10:

Press: [↕] [GR]

Display shows: 

INTERRUPT

If you experience interruption during your message processing, or if you press by mistake the function key EXC with some wrong input data, recovery is still possible. The PCCM-4000 has a convenient built-in interrupt capability which enables you to continue operation at the point of interruption or processing error without beginning over again. See example 11 which was taken from the example on pages 37 and 38 of this manual.

Example 11:

Initial conditions

M_2 Mode
MK = ARTQ
RK = Arbitrary
Process the first 30 groups of message

After completing the 30th group, you quit and return the next morning to continue with group No. 31. Follow this procedure:

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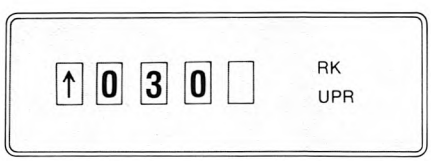
1. Reinitialize and press: [A] [R] [T] [Q]
2. Press: [MK]
3. Press: [↕]
4. Input a three-digit number equal to the last completed group, e.g.:

   Press: [0] [3] [0]

Display shows:



5. Press: [GR]. The display will blank until the internal processing is complete.

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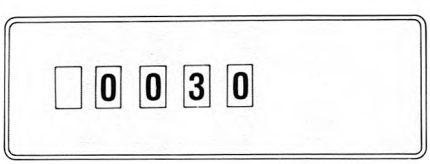
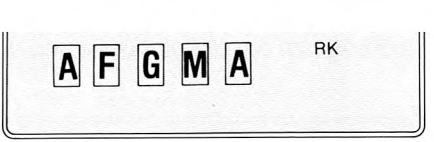
Display shows:



6. Key in the cipher group corresponding to the last completed group (e.g. No. 30).

Display shows:



7. If plain text in the upper case is required, press the shift [↕] at this time. Otherwise, skip this step. In this example do *NOT* press [↕] .
8. Press: [RK] . This will blank the display and the system will have been advanced through group 30 and ready for group 31.
9. Enter group 31 and EXECUTE as normal (five character groups for D mode or four character groups in E mode). You are now caught up.

---

10. In summary, your key sequence was as follows:

[A] [R] [T] [Q] [MK]

[↕] [0] [3] [0] [GR]

Last completed group designation

[A] [F] [G] [M] [A] [↕]* [RK]

Cipher corresponding to last complete group

*NOTE: Optional shift to achieve upper case in plain text.

[L] [M] [R] [O] [X] [EXC]

31st group (D Mode)

or

[D] [A] [T] [A] [EXC]

31st group (E Mode)

UNIQUE SYMBOLS

Two unique symbols are used on your PCCM-4000 display.

1. **Space:** when the space key is pressed, two horizontal bars are displayed in the center of the character field (e.g.: --).

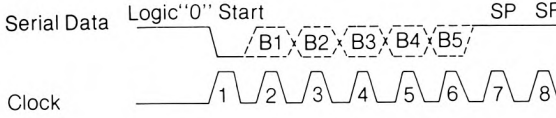
2. **Invalid translation of a cipher character:** If, by error, a combination of cipher characters are keyed into your PCCM-4000 which were not generated by a PCCM-4000, it may happen that some of the characters will be converted to nonsense plain text symbols. All such characters are displayed as a star. (e.g.: ). This may have occurred when you executed example 9.

   To you, this means that you have input one or more indecipherable cipher text characters. If you are certain you have correctly entered all the cipher text groups, the persistent appearance of this character is a likely indication that your machine contains incorrect crypto variables.

SERIAL OUTPUT

Your PCCM-4000 has been designed to provide a serial signal coded in Baudot code. This signal is for interface with devices such as external memory, hard copy printer, or paper tape perforator.

Signal Format:



These waveforms appear once for each output character; read from left to right along the display.

MESSAGE PREPARATION

It is advisable that you prepare your plain text message ahead of time to facilitate error-free encoding of the message. The best way is to write the message on a coding form such as on the following suggested forms. A sample message has been prepared to show that every character, punctuation, and space counts as a valid character. Also, shift characters must be inserted as shown.

The resulting cipher text message is normally written as a series of five-character code groups.

NOTE: The group counts for both plain and cipher text allow you to keep track of your position relative to the Group Counter in the PCCM-4000.

NOTE: The RK code group is not counted in the group count.

SELECTED EXAMPLES

It is suggested that you attempt to encipher and decipher the messages attached on the following forms. The interrupt example (11) was taken from this message. Be careful to enter the data exactly as shown and to verify correct entry before depressing [MK] [RK] or [EXC] . Also it is advisable to practice example 11 to recover to group 28 which is in the figures case. The particulars of this message are; MK: ARTQ, RK: COOL, MODE: M2.

Cleartext Work Sheet

Owner's Manual Example

Subject: _____

_____

_____

Group No. 001 to 050

Group	1	2	3	4	5	6	7	8	9	10
_00	THIS-IS-A-TEST-OF-PCCM↑-4000↓-FOR-AN-EXA									
_10	MPLE-IN-THE-OWNERS-MANUAL·-THE-UNIT-PROC									
_20	ESSES-ALPHA-AND-NUMERIC-↑(1234567890),-↓									
_30	DATA-AND-PROVIDES-USER-ENTRY-OF-SECRET-K									
_40	EYS-KNOWN-ONLY-TO-HIM.----------									
_50										
_60										
_70										
_80										
_90										
_00										
10										

Caution: Fill each field with *exactly* one character. Spaces and punctuations count as one character.

Sheet ____ of ____

Cipher Format Sheet

Date Sent _____

Group No. 001 to 050

Owner's Manual Example

RK LATRZ

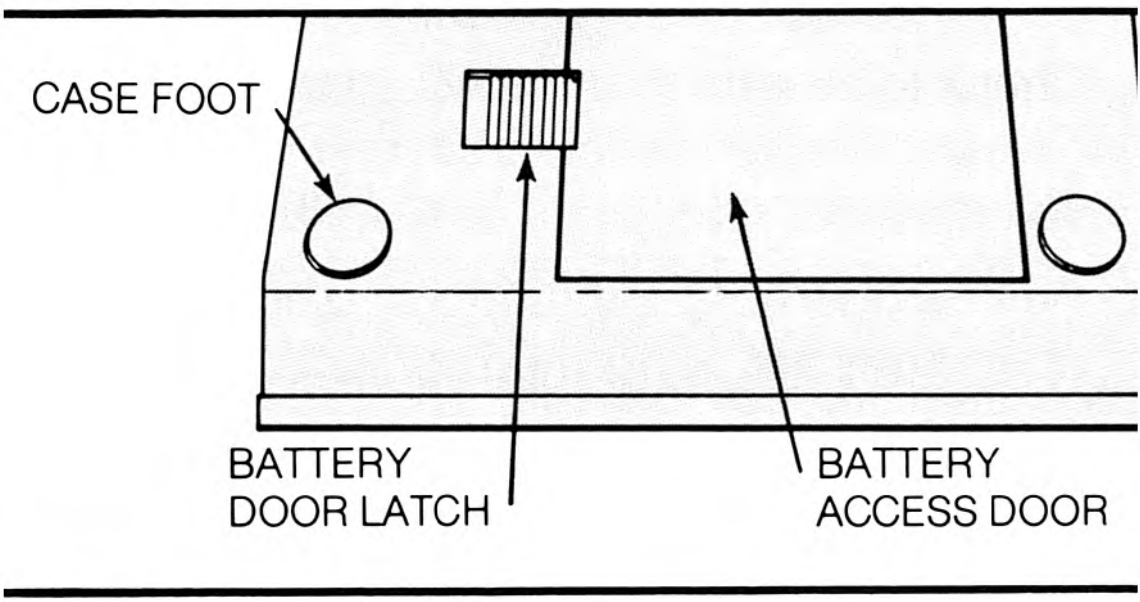
Group	1					2					3					4					5					6					7					8					9					10				
_00	R	Y	Z	T	L	O	B	L	N	M	A	X	B	C	Z	Z	A	Y	L	B	R	C	F	O	B	B	G	T	Z	R	T	H	T	O	A	X	B	C	L	L	R	T	B	T	H	G	F	F	F	X
_10	N	Z	G	O	F	M	B	F	N	Y	T	C	X	A	B	O	L	T	L	H	Y	G	A	T	S	Y	R	T	M	H	N	T	T	X	H	C	Z	A	L	M	M	G	M	M	F	Z	T	B	C	F
_20	G	X	B	C	L	H	C	R	L	M	G	T	G	H	X	G	Y	X	O	A	M	M	R	O	L	O	O	A	R	M	L	A	F	L	Z	T	F	M	A	Z	N	O	B	F	A	A	F	G	M	A
_30	L	M	R	O	X	L	F	A	N	C	M	R	A	B	G	S	S	S	G	R	S	C	F	L	N	M	R	O	B	L	O	S	F	H	A	S	L	R	H	Z	T	B	R	M	X	A	B	X	S	C
_40	H	F	T	O	A	N	C	O	N	O	T	M	Z	M	R	M	L	S	O	R	R	O	C	O	R	A	T	S	A	Z	Y	M	A	S	B	L	O	B	N	C	T	L	B	H	H	M	Y	O	A	M
_50																																																		
_60																																																		
_70																																																		
_80																																																		
_90																																																		
_00																																																		
10																																																		

Caution: Fill each field with *exactly* one character. Spaces and punctuation count as one character.

Sheet _____ of _____

Battery Replacement

The batteries can be quickly and simply removed from the PCCM—4000 by sliding the door latch as indicated. The batteries can then be removed from the PCCM-4000.



To re-insert the batteries attention should be given to the polarity of the batteries as indicated in the battery cavity.

CAUTION: INSERT BATTERIES ONLY AS INDICATED. WRONG POLARITY CAN CAUSE PERMANENT DAMAGE TO THE PCCM—4000

After insertion of the batteries place cover in position and latch it closed.

In case of difficulty:

1. Check to be sure ON—OFF switch is in the ON position.
2. If display fails to indicate or erratic characters are displayed on battery operation, recharge batteries.
3. Check to be sure that the AC adapter/ charger voltage switch is set on the correct voltage before plugging into a powered outlet.
4. Review operating instructions to be certain operations are performed correctly.

If none of these corrects the difficulty, contact Mils for further assistance.

CAUTION: USE OF OTHER THAN THE AC ADAPTER/CHARGER AC-4100 MAY APPLY IMPROPER VOLTAGE TO YOUR PCCM-4000 AND MAY CAUSE DAMAGE.

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