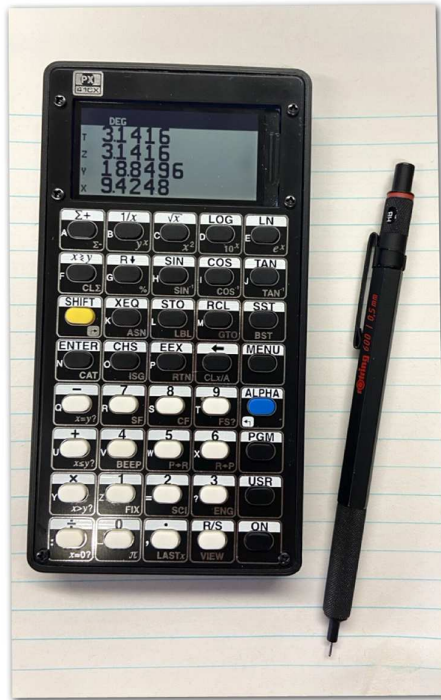


PROGRAMMABLE CALCULATOR

P X 4 10 X



User Manual

The **PX41CX** programmable calculator is a calculator that incorporates the functionalities and language of the HP-41CX calculator thanks to an emulation running on an AVR128DA microcontroller.

This manual is not intended to document the use of these features nor to present the programming language of the 41CX which are documented in manuals in PDF format on

<http://literature.hpcalc.org/#model:41CX>

and in particular:

- HP-41CX Owner's Manual Volume 1: Basic Operation (<http://literature.hpcalc.org/items/909>)
- HP-41CX Owner's Manual Volume 2: Operation in Detail (<http://literature.hpcalc.org/items/913>)

This manual therefore presents the particular functionalities of the **PX41CX**:

- calculator menu and settings,
- **PX41CX** firmware update,
- exchange of programs and data between **PX41CX** and PC

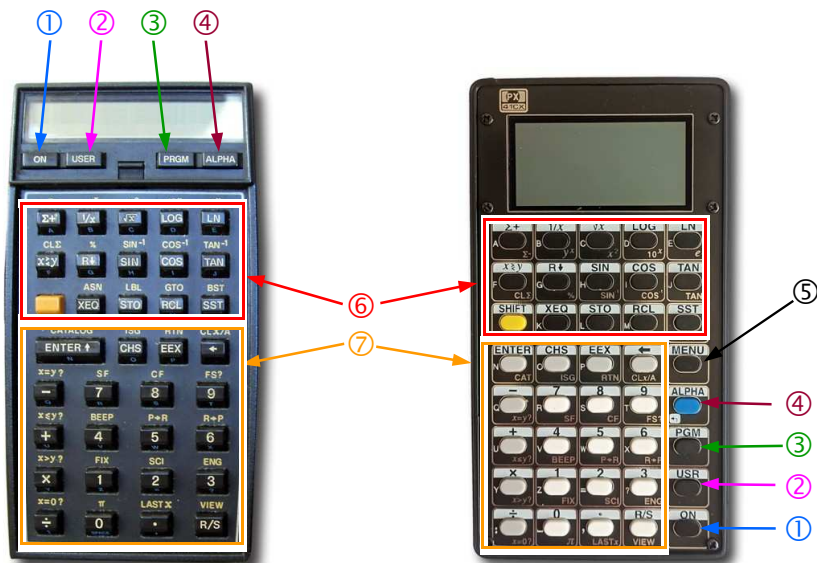
Version 0.900 Build 2024.06.27

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1- The keyboard

The keyboard of the **PX41CX** calculator (40 keys) differs little from that of the HP-41CX (39 keys) since apart from the arrangement of the ON^①, USER^②, PRGM^③, ALPHA^④ keys and the addition of the MENU^⑤ key, the other keys ^⑥^⑦ remain identical in title and positioning.



2- Menu

The MENU key of the **PX41CX** calculator provides access either to calculator setting options or to information on its internal contents.



By pressing this key the ordinary calculator screen



is replaced by a screen called “MENU” offering 5 choices:



- **DISP** allows you to choose the display mode on 1, 2 or 4 lines,
- **VIEW** to display either all registers or all flags,
- **COM** to exchange memory contents with a PC in the form of dump,
- **MORE** to access an additional MENU screen,
- **EXIT** to exit MENU mode.



In all screens of MENU mode, pressing the ON key or the MENU key returns to the standard calculator screen.



1) **DISP** offers 4 display modes :

X to display only the X register on a line of the screen,



XY to display the X and Y registers on two lines of the screen,



XA to display the X register and the ALPHA register on two lines of the screen,



XYZT to display the stack (X, Y, Z and T registers) on four lines of the screen.



RTN returns to the MENU screen

2) **VIEW** offers 2 choices :

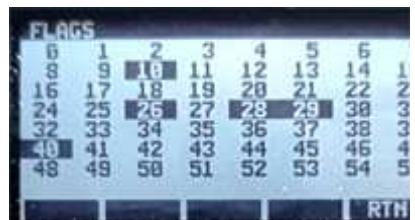
- **REGS** to view registers on one or more pages (depending on the SIZE option).
- **FLAGS** to view the flags



REGS displays 16 registers per page with PREV and NEXT choices if necessary,



FLAGS displays the flags. (on a black background if "up")



RTN returns to the higher level screen

3) **COM** offers 2 choices :

- **DUMP** to send a memory dump from the **PX41CX** to PC
- **LOAD** to receive a memory dump from a PC.



(see “Program and data exchange” page 17)

RTN returns to the higher level screen

4) **MORE** displays the rest of the MENU entitled MENU2 offering 5 choices :

- **BEEP** to choose whether a sound should be assigned to the keys or not,
- **SLEEP** to choose the delay before automatic shutdown of the **PX41CX**,
- **SPEED** to choose the processor speed (cadence in MHZ),
- **INFO** to access information regarding the **PX41CX**,
- **RTN** to return to the first MENU.



5) **BEEP** offers 2 choices :

- **OFF** = no sound when pressing a key,
- **ON** = sound emitted when pressing a key



6) **SLEEP** offers 4 options for automatic shutdown :

- **1MIN**,
- **2MIN**,
- **4MIN**,
- or **NEVER**
(no automatic shutdown)



7) **SPEED** offers 4 frequencies for speed of **PX41CX** :

- **8MHZ**,
- **16MHZ**,
- **24MHZ**,
- **32MHZ**



RTN returns to the higher level screen

8) **INFO** displays battery status and firmware version and date.

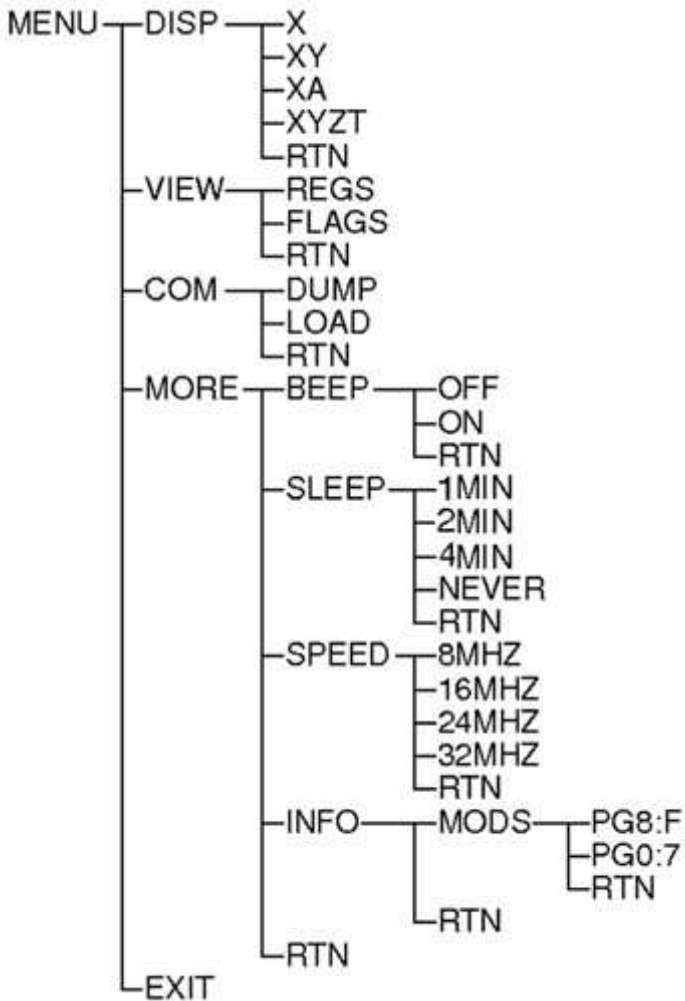


9) **MODS** allows you to consult the list of modules loaded internally.



RTN returns to the higher level screen

MENU Summary



3- Firmware update

To update the firmware of the **PX41CX** several elements are essential :

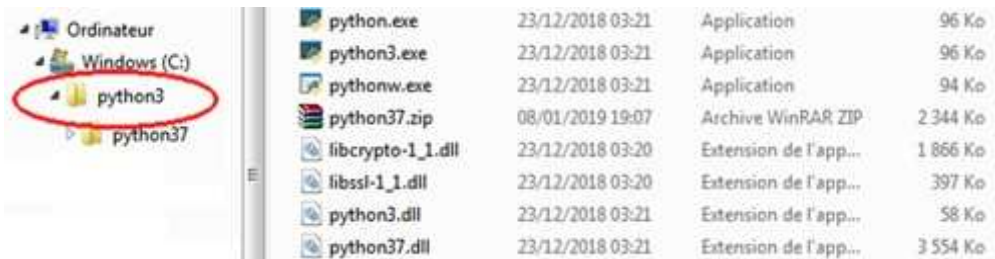
- a USB Serial cable: USB A socket on the PC side, mini USB on the calculator side
For Windows you will need to install the corresponding driver (Prolific USB-to-Serial Comm Port)



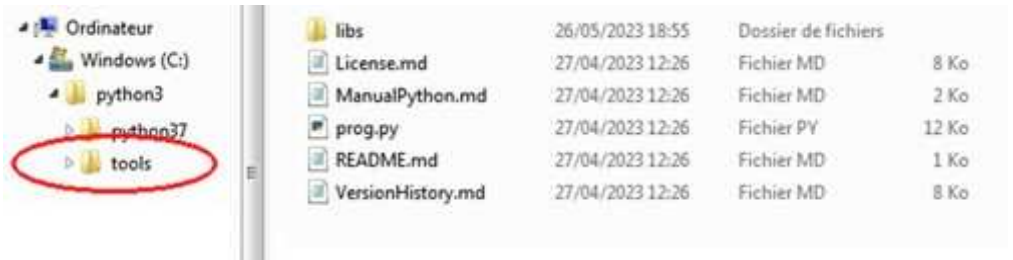
- **python 3**
python3-3.7.2.post1-embed-win32v2a.zip
- python tools for the **SerialUPDI** interface (prog.py et libs)
<https://github.com/SpenceKonde/DxCore/tree/master/megaavr/tools>
(../DxCore/blob/master/megaavr/tools/ManualPython.md)

For Windows :

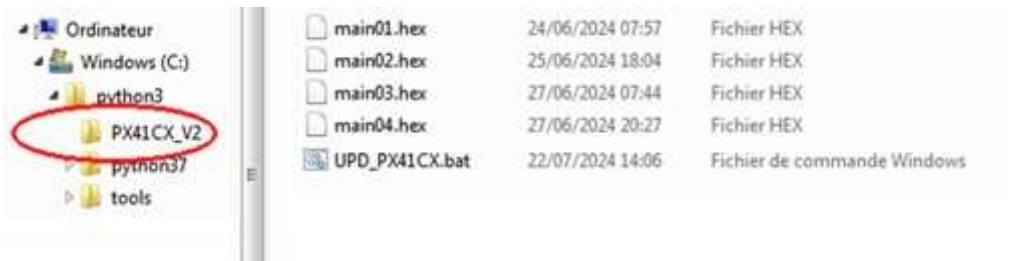
1) Install Python in c:\python3



2) Install the interface tools (prog.py and libs) in c:\python3\tools



3) Create a directory to receive updates for **PX41CX**
for example : c:\python3\PX41CX_V2



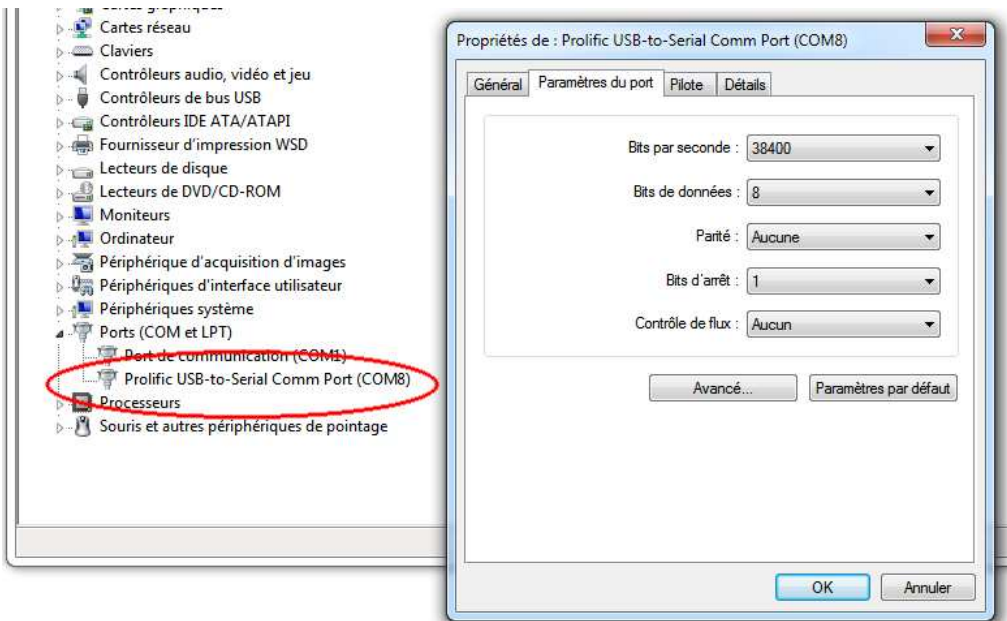
in this last directory you can keep the different firmware versions by numbering them.

To make updates easier, create a command file such as :

```
@echo off
CD..
cls
@echo +=====+
@echo !  P X 4 1 C X  :  F I R M W A R E  U P D A T E  !
@echo +=====+
SET numv=
SET /P numv=Version (01, 02, 03,...) ?
python -u tools/prog.py -t uart -u COM8 -b 38400 -d avr128da28 --fuses
5:0b11001001 6:0x04 7:0x00 8:0x00 -f PX41CX_V2/main%numv%.hex -a write -v
```

and save it as UPD_PX41CX.bat

it will be necessary to adapt this command file to the parameters of the COM port used.

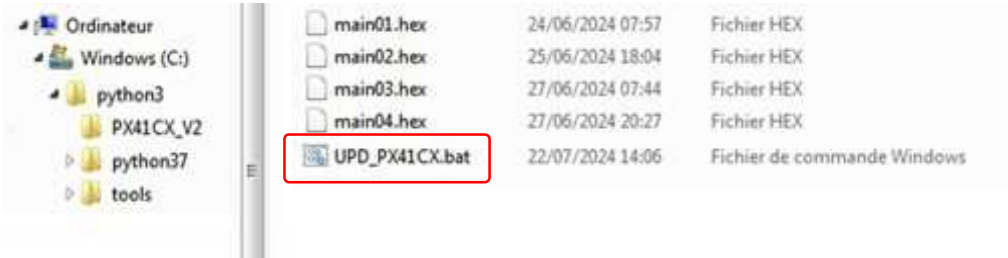


then before launching an update it is imperative to move the switch of the **PX41CX** to the right :



“firmware update” position

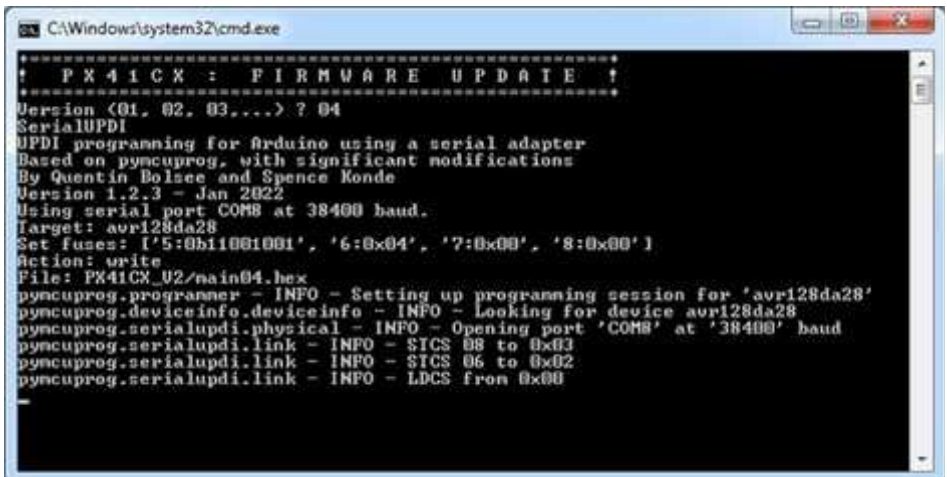
Start the update by double clicking on UPD_PX41CX.bat



then choose the file number to load



and the update runs...



until loading is complete...

```
C:\Windows\system32\cmd.exe
[*****] 49/50pyncuprog.serialupdi.n
on - INFO - Clear NUM command
[*****] 50/50
pyncuprog.programmer - INFO - Write complete.
Action took 31.23s
Verifying...
pyncuprog.programmer - INFO - Reading 62882 bytes from flash...
[*****] 123/123
pyncuprog.programmer - INFO - Verifying...
pyncuprog.programmer - INFO - Reading 5120 bytes from flash...
[*****] 10/10
pyncuprog.programmer - INFO - Verifying...
pyncuprog.programmer - INFO - Reading 25600 bytes from flash...
[*****] 50/50
pyncuprog.programmer - INFO - Verifying...
Verify successful. Data in flash matches data in specified hex-file
Action took 30.47s
pyncuprog.serialupdi.application - INFO - Leaving NUM programming mode
pyncuprog.serialupdi.application - INFO - Apply reset
pyncuprog.serialupdi.link - INFO - STCS 59 to 0x08
pyncuprog.serialupdi.application - INFO - Release reset
pyncuprog.serialupdi.link - INFO - STCS 00 to 0x08
pyncuprog.serialupdi.link - INFO - STCS 0C to 0x03
pyncuprog.serialupdi.physical - INFO - Closing port 'COM8'
Appuyez sur une touche pour continuer...
```

it will then absolutely be necessary to re-position the **PX41CX** switch to the left :



“calculator mode” position

Attention !

Each time the calculator firmware is updated, all data and programs are lost!

Update is a complete reset.

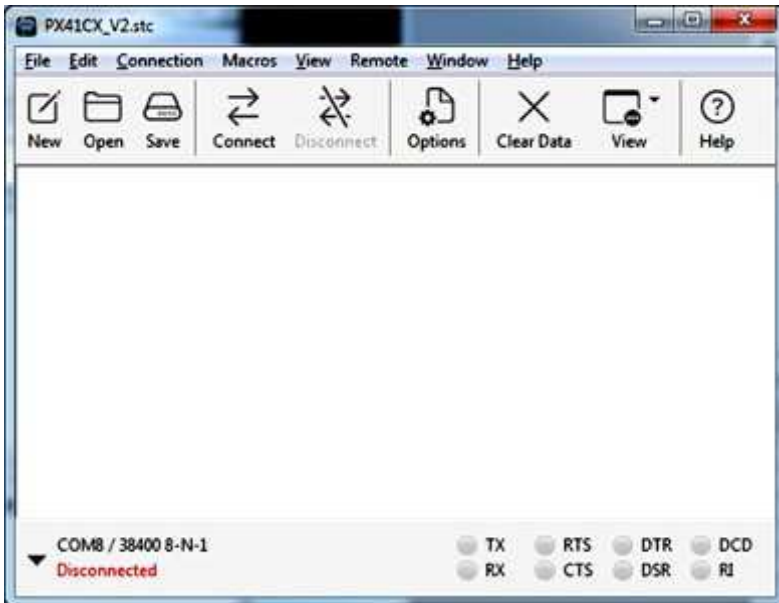
4- Program and data exchange

For the exchange between the PX41CX and a PC the cable is the same as that used for updating the firmware.



But for the “software” part you need :

- “Terminal” transfer software : **CoolTerm** from Roger Meier is most suitable (<http://freeware.the-meiers.org/>)



- DUMP decoding software (in case of DUMP from **PX41CX**)
- HP-41 program coding software (in case of sending DUMP to **PX41CX**)

DUMP

To extract a DUMP from the PX41CX and send it to the PC, you must :

1) on the calculator press:



to display the MENU screen



to display the COM screen



2) connect the SerialUSB cable between the calculator and the PC,

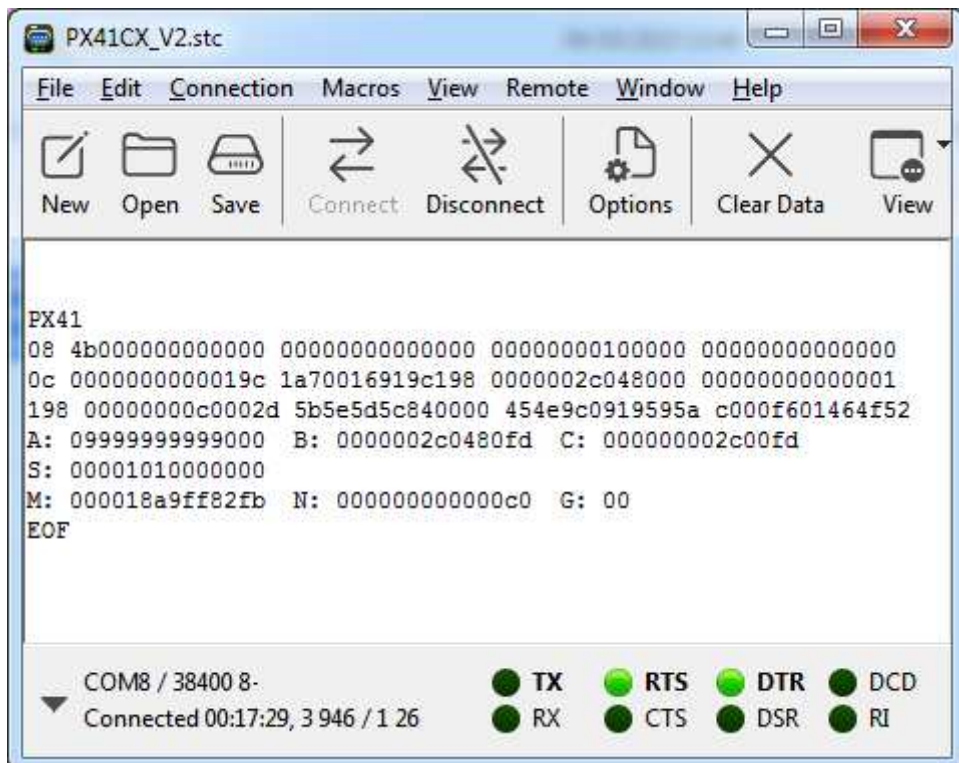
3) then on PC launch the CoolTerm program and connect to the COM port corresponding to your SerialUSB

4) on the calculator press



corresponding to the DUMP choice to start the transfer

the transfer result is displayed in CoolTerm :



this DUMP can be selected and copied to then be pasted either into a TXT file for backup or into a decoding tool.



LOAD

To load a DUMP into the **PX41CX**, you must :

1) on the calculator press :



to display the MENU screen

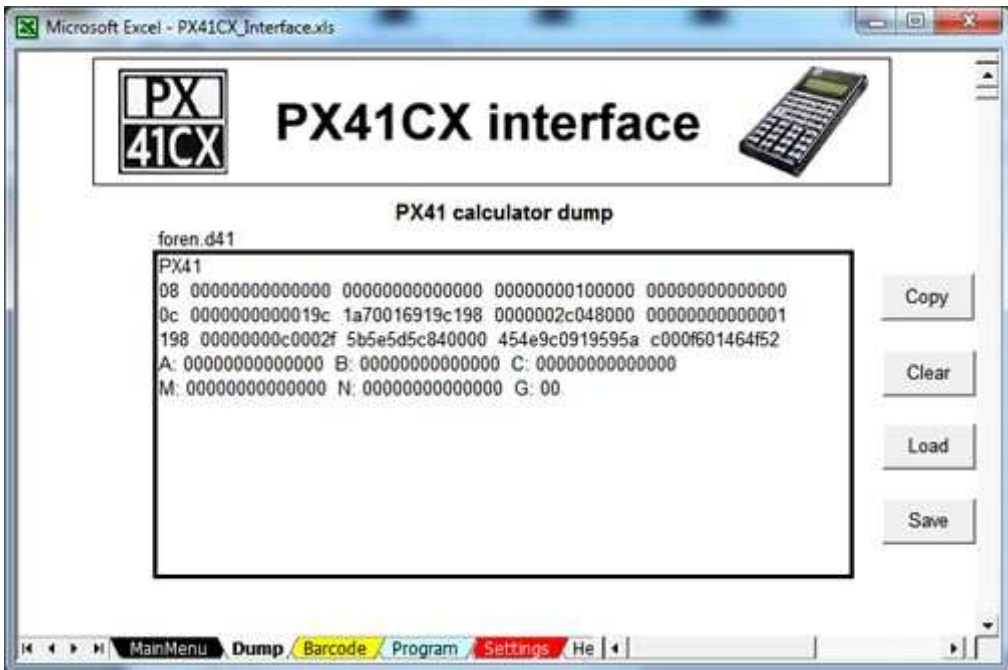


to display the COM screen



2) connect the SerialUSB cable between the calculator and the PC,
3) then on PC launch the CoolTerm program and connect to the COM port corresponding to your SerialUSB

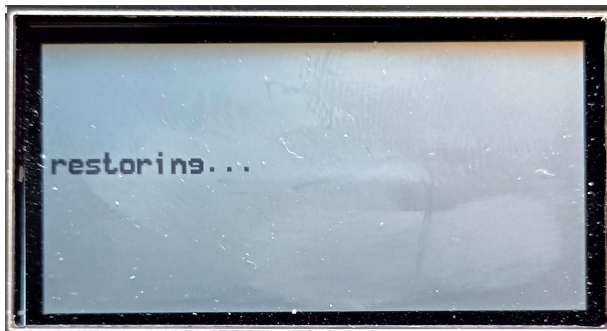
4) either from a text editor (Notepad type) or from HP-41 program coding software, copy the DUMP (CTRL + C)



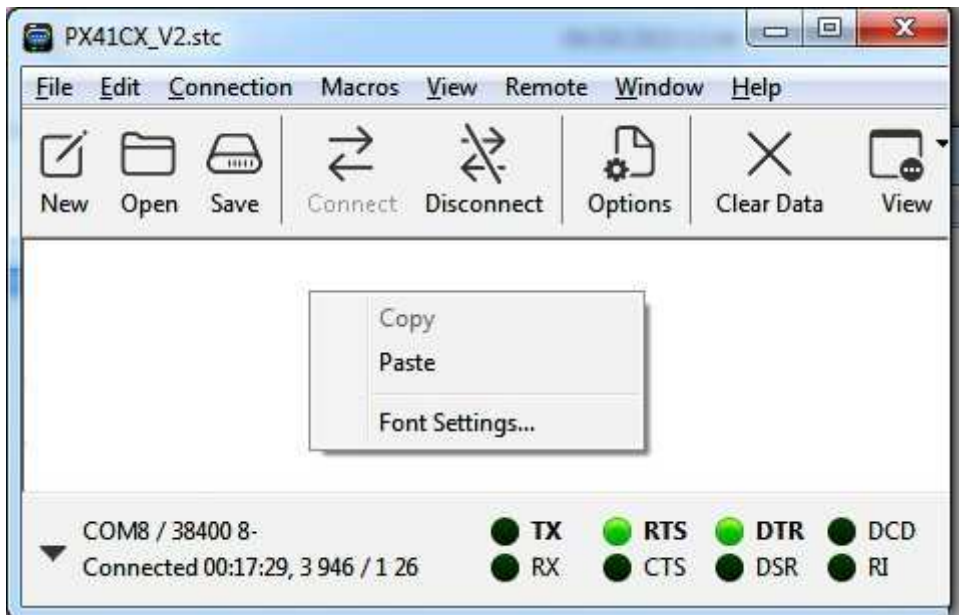
5) on the **PX41CX**, press



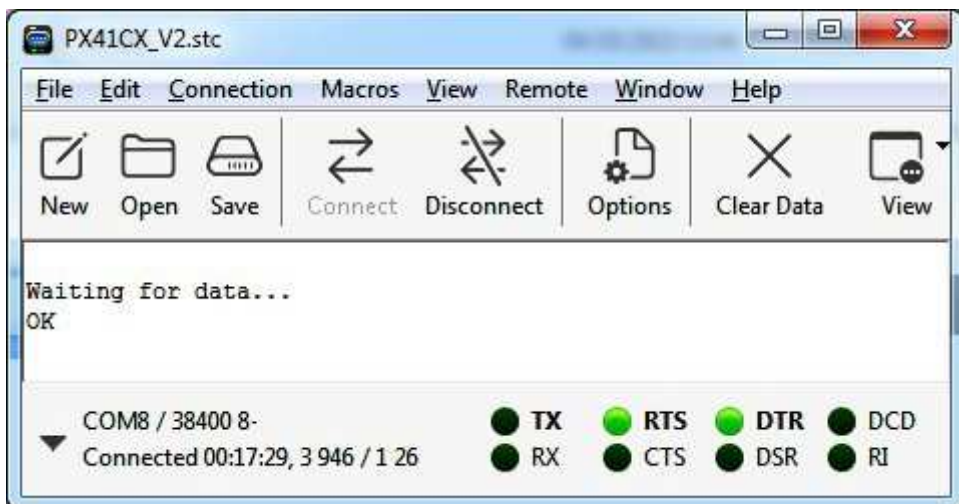
corresponding to the LOAD choice
to wait for the transfer



6) in CoolTerm, right-click to get the context menu to paste the DUMP to send to the **PX41CX**



7) Click on "Paste", the DUMP is sent



Decoding **PX41CX** dumps :

currently the only tool allowing decoding of dumps is

DM41 programming tool from Swiss Micros.

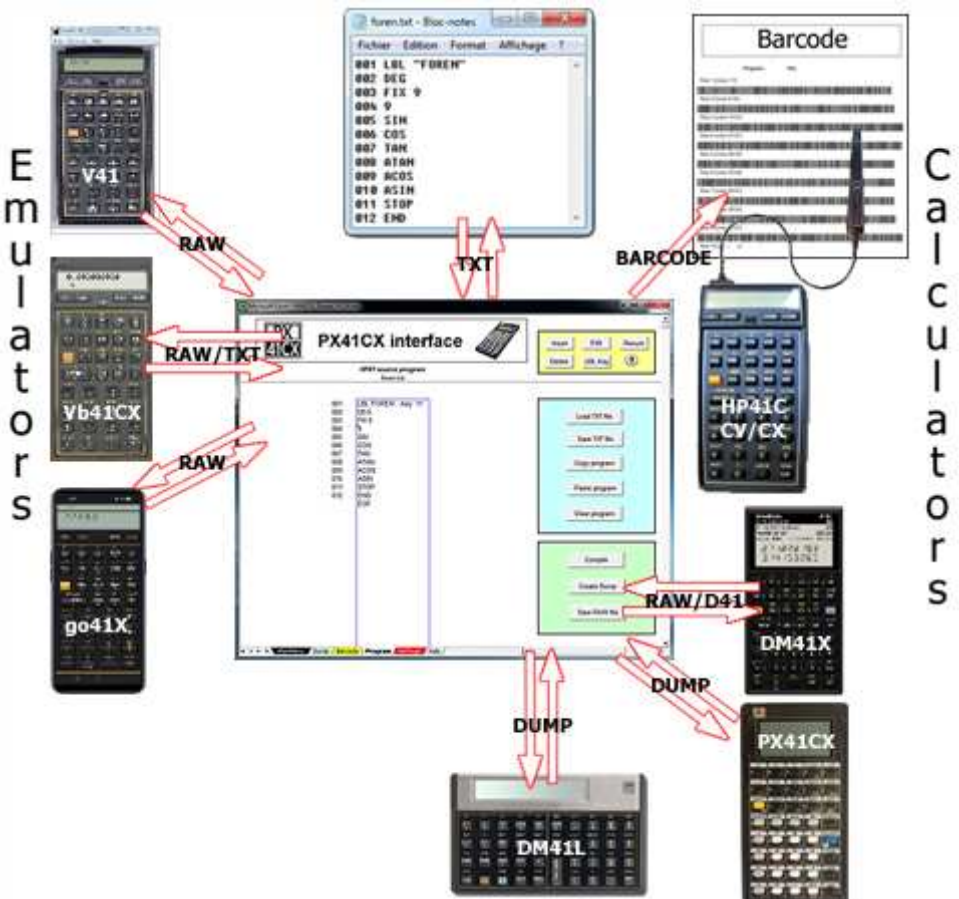
(<https://dm41.swissmicros.com/>)

Coding in **PX41CX** dumps :

The **PX41CX** interface allows HP-41 programs to be coded into dumps

PX41CX interface

(<https://clones.phweb.me/>)



5- Implemented modules

Time (CX)	
TIME 2C	CX TIME
ADATE	CLALMA
ALMCAT	CLALMX
ALMNOW	CLRALMS
ATIME	RCLALM
ATIME24	SWPT
CLK12	
CLK24	
CLKT	
CLKTD	
CLOCK	
CORRECT	
DATE	
DATE+	
DDAYS	
DMY	
DOW	
MDY	
RCLAF	
RCLSW	
RUNSW	
SETAF	
SETDATE	
SETIME	
SETSW	
STOPSW	
SW	
T+X	
TIME	
XYZALM	

X Functions (CX)		
EXT FNC 2D		CX EXT FCN
ALENG	INSREC	ASROOM
ANUM	PASN	CLRGX
APPCHR	PCLPS	ED
APPREC	POSA	EMDIRX
ARCLREC	POSFL	EMROOM
AROT	PSIZE	GETKEYX
ATOX	PURFL	RESZFL
CLFL	RCLFLAG	?REG?
CLKEYS	RCLPT	X=NN?
CRFLAS	RCLPTA	X?NN?
CRFLD	REGMOVE	X<NN?
DELCHR	REGSWAP	X<=NN?
DELREC	SAVEAS	X>NN?
EMDIR	SAVEP	X>=NN?
FLSIZE	SAVER	
GETAS	SAVERX	
GETKEY	SAVEX	
GETP	SEEKPT	
GETR	SEEKPTA	
GETREC	SIZE?	
GETRX	STOFLAG	
GETSUB	X<>F	
GETX	XTOA	
INSCHR		

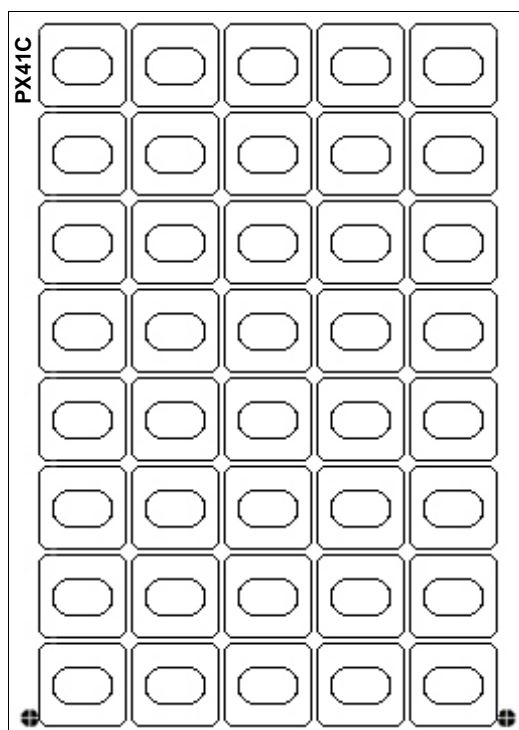
ADVANTAGE				
ADV CONV B	ADV MTRX		ADV MATH	
BININ	<i>C<>C</i>	<i>MRIJ</i>	SOLVE	D?
BINVIEW	<i>CMAXAB</i>	<i>MRIJA</i>	INTEG	BFIT
OCTIN	<i>CNRM</i>	<i>MRR+</i>	SILOOP	FIT
OCTVIEW	<i>CSUM</i>	<i>MRR-</i>	SIRTN	Y?X
HEXIN	<i>DIM?</i>	<i>MS</i>	Z?N	SZ?
HEXVIEW	<i>FNRM</i>	<i>MSC+</i>	MAGZ	VC
NOT	<i>I+</i>	<i>MSIJ</i>	e?Z	CROSS
AND	<i>I-</i>	<i>MSIJA</i>	LNZ	VS
OR	<i>J+</i>	<i>MSR+</i>	Z?1/N	VR
XOR	<i>J-</i>	<i>MSWAP</i>	SINZ	DOT
ROTXY	<i>M“M</i>	<i>MSYS</i>	COSZ	VE
BIT?	<i>MAT*</i>	<i>PIV</i>	TANZ	V-
	<i>MAT+</i>	<i>R<>R</i>	a?Z	V+
	<i>MAT-</i>	<i>R>R?</i>	LOGZ	VXY
ADV TVM	<i>MAT/</i>	<i>RMAXAB</i>	Z?1/W	UV
TVM	<i>MATDIM</i>	<i>RNRM</i>	Z?W	V?
N	<i>MAX</i>	<i>RSUM</i>	C+	VD
PV	<i>MAXAB</i>	<i>SUM</i>	C-	V*
PMT	<i>MDET</i>	<i>SUMAB</i>	CINV	TR
FV	<i>MIN</i>	<i>TRNPS</i>	C*	CT
*I	<i>MINV</i>	<i>YC+C</i>	C/	AIP
	<i>MMOVE</i>	<i>MEDIT</i>	PLY	
	<i>MNAME?</i>	<i>CMEDIT</i>	RTS	
	<i>MR</i>	<i>MP</i>	DIFEQ	
	<i>MRC+</i>	<i>MATRX</i>	CFIT	
	<i>MRC-</i>	<i>MTR</i>	A?	

STAT 1B
?BSTAT
?BSTG
*BE
?MMTUG
?MMTGD
*MT
*MD
?AOVONE
?AOVTWO
?ANOCOV
?LIN
?EXP
?LOG
?POW
?POLYP
?POLYC
?MLRXY
?MLRXYZ
?PTST
?TSTAT
?XSQEV
?EEFXSQ
?CTKK
?CTKKK
?SPEAR
?NORMD
?CHISQD
*a
*b

MATH 1D	
MATRIX	a ^Z
SIMEQ	LOGZ
VCOL	Z ^{1/W}
VMAT	Z ^W
PVT	C+
DET	C-
INV	CINV
EDIT	C*
SOLVE	C/
SOL	SINH
POLY	COSH
ROOTS	TANH
INTG	ASINH
DIFEQ	ACOSH
FOUR	ATANH
Z?N	SSS
MAGZ	SAA
e?Z	ASA
LNZ	SAS
Z?1/N	SSA
SINZ	TRANS
COSZ	*FN
TANZ	

FINANCE 1D
MONEY
IRR
MIRR
NPV
AMORT
SL
DB
SOYD
BOND
DAYS
*N
*I
*PV
*PMT
*FV
*IRR
*MIRR
*NPV
*AMORT
*SL
*DB
*SOYD
*PRC
*YLD
*DAYS
*BGN
*SIZE
*DATA
*DATA1
*OUT
*TGL
*TGL1
*Y/N
\$ENG

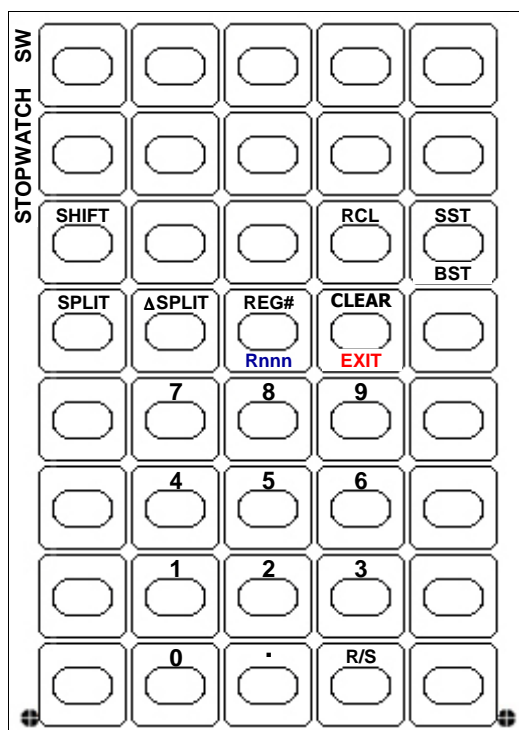
6- Keyboard overlays



Blank overlay for PX41CX

ED	A ○ a	B ○ b	C ○ c	D ○ d	E ○ e
	F ○ Σ	G ○ %	H ○ ≠	I ○ <	J ○ >
	○	K ○	L ○ INSERT	M ○ GOTO	NEXT ○ PREV.
	N ○ ↑	O ○ ↙	P ○ \$	← ○ DELREC	○
	Q ○ -	R ○ 7	S ○ 8	T ○ 9	○
	U ○ +	V ○ 4	W ○ 5	X ○ 6	1→ ○ 12→
	Y ○ *	Z ○ 1	= ○ 2	? ○ 3	←1 ○ ←12
	; ○ /	┌ ○ 0	, ○ .	+REC↓ ○ +REC↑	EXIT ○

Overlay for ED (CX EXT FCN)



Overlay for SW (TIME 2C)

