

# PROGRAMMABLE CALCULATOR

# PX41CX



## 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**:

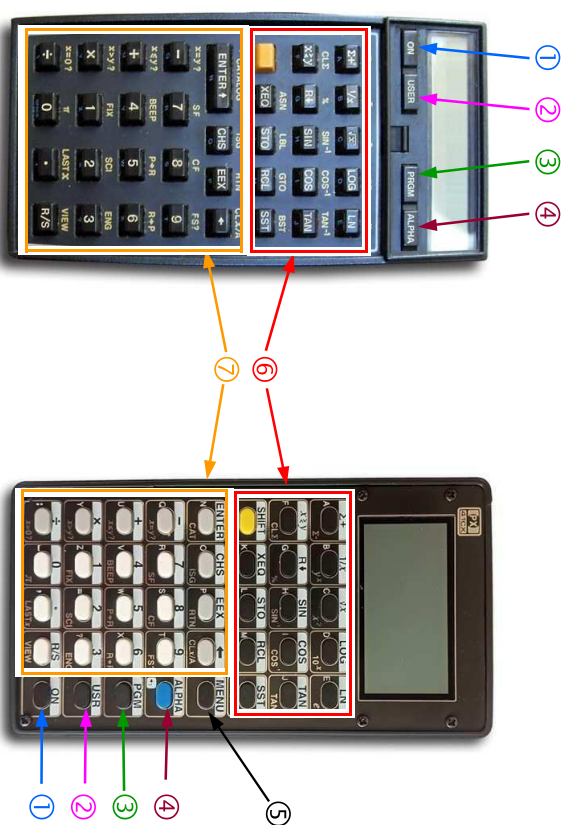
- calculator menu and settings,
- **PX41CX** firmware update,
- exchange of programs and data between **PX41CX** and PC

## 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.

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## 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.



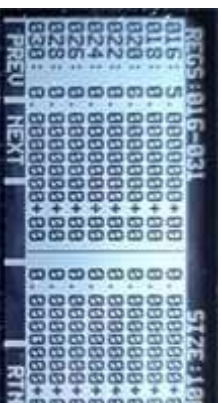
**RTN** returns to the MENU screen

2) **VIEW** offers 2 choices :

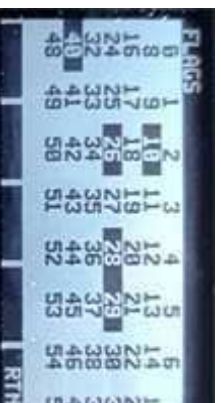
- **REGS** to view registers on one or more pages (depending on the SIZE option).
- **FLAGS** to view the flags



**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 MGH),
- **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



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



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

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

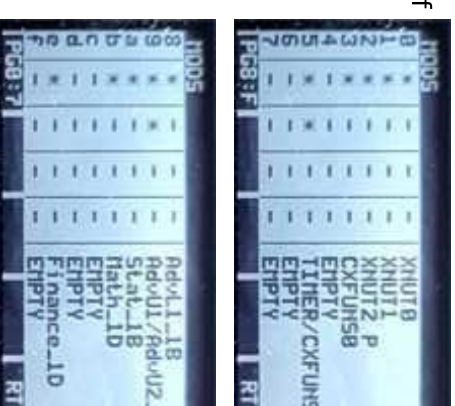


7) **SPEED** offers 4 frequencies for speed of **PX41CX** :

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



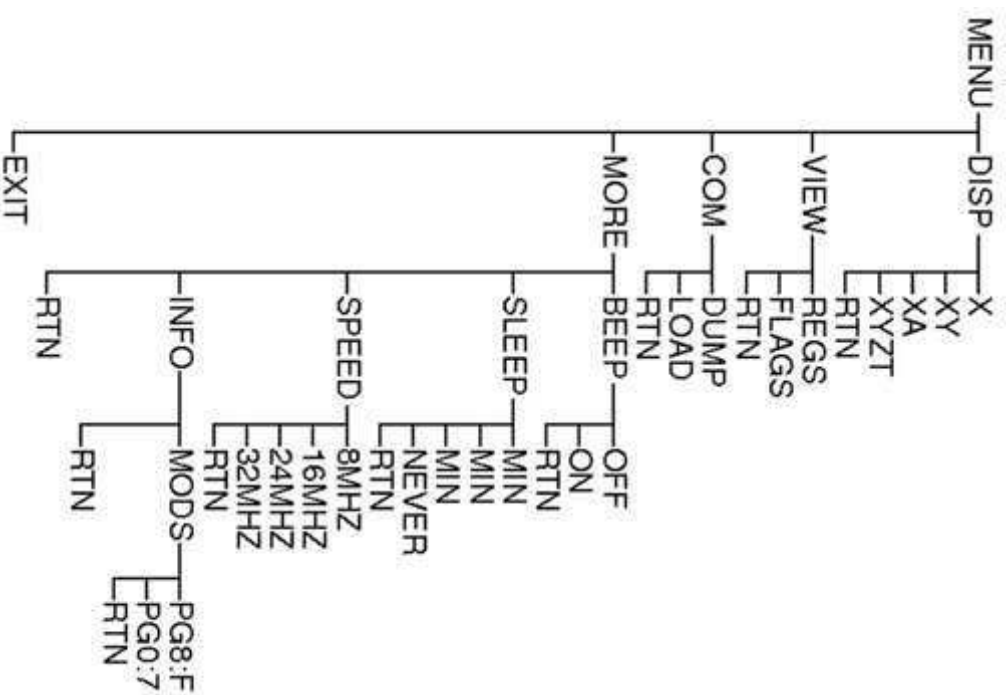
9) **MODS** allows you to consult the list of XROMs loaded internally.



**RTN** returns to the higher level screen

**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 lbs) in c:\python3\tools



3) Create a directory to receive updates for **PX41CX** for example : c:\python3\PX41CX\_V2



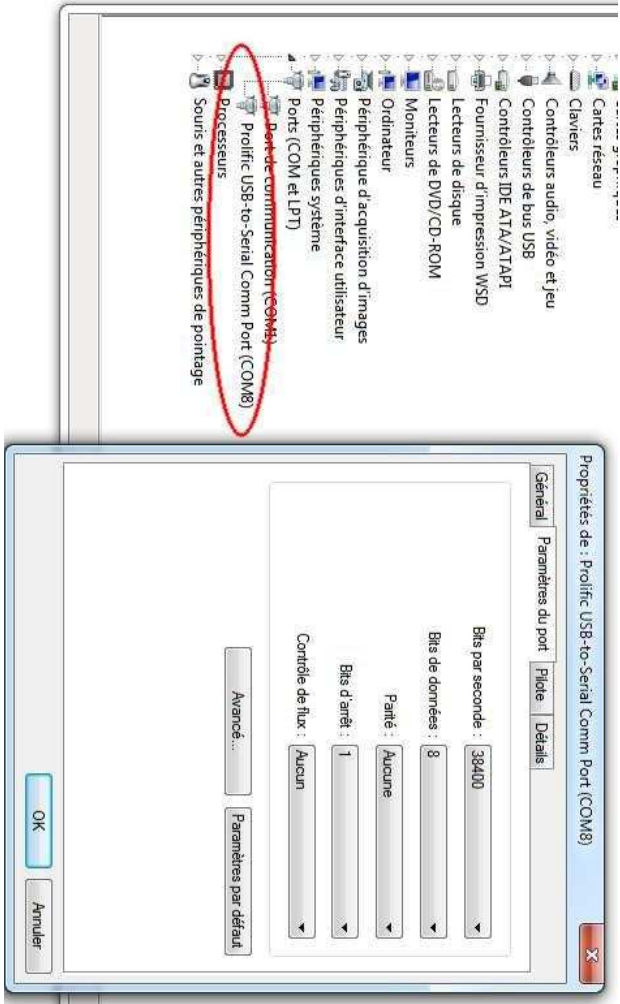
In this last directory you can keep the different firmware versions by numbering them.

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

```
@echo off
CD ..
CLS
@echo I 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...



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.



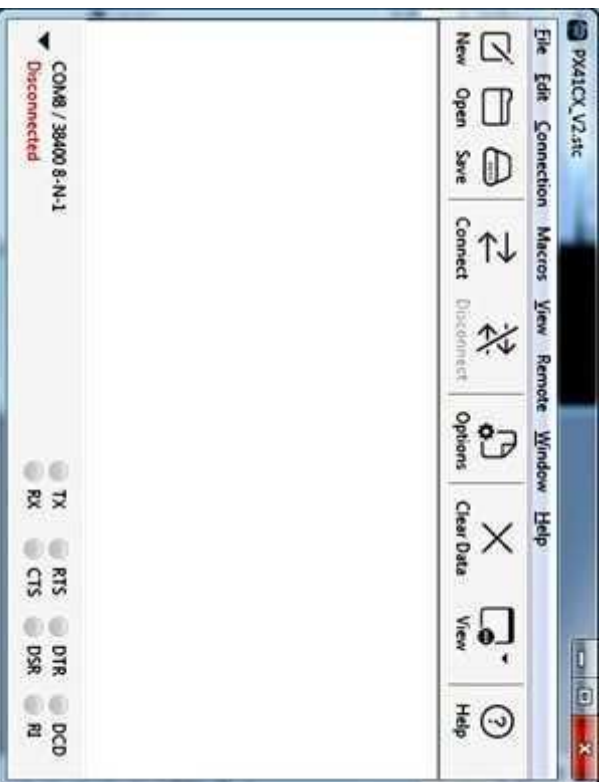
## 4- Program and data exchange

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

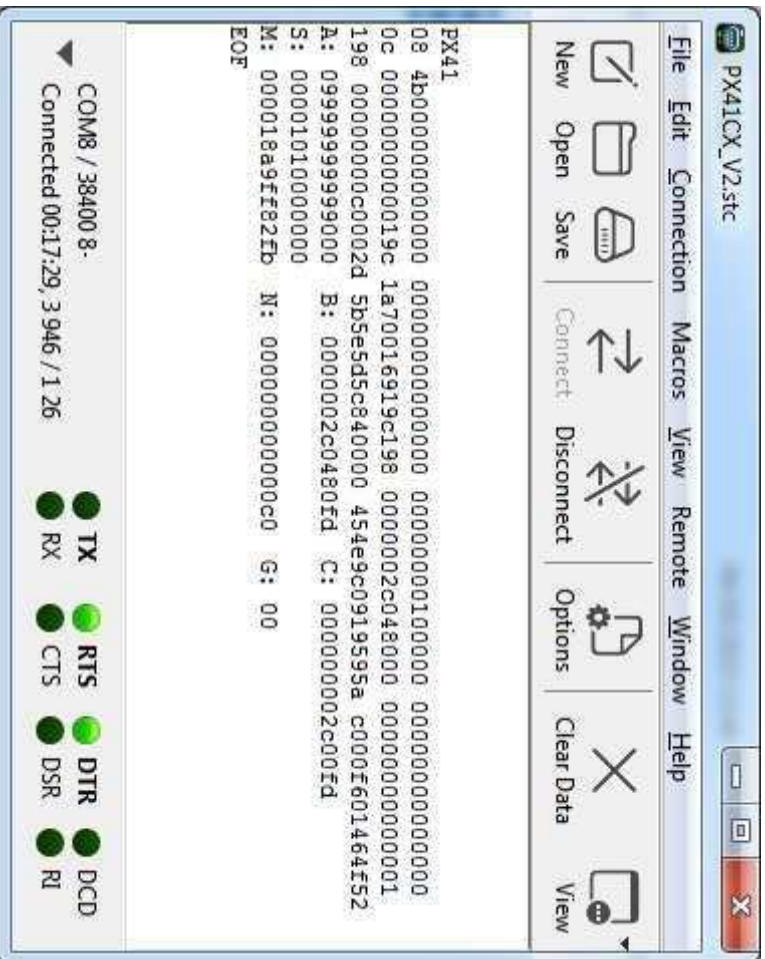


- 2) connect the SerialUSB cable between the calculator and the PC,
- 3) then on PC launch the CoolTerm program and connect to the COM port corresponding to your SerialUSB
- 4) on the calculator press



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

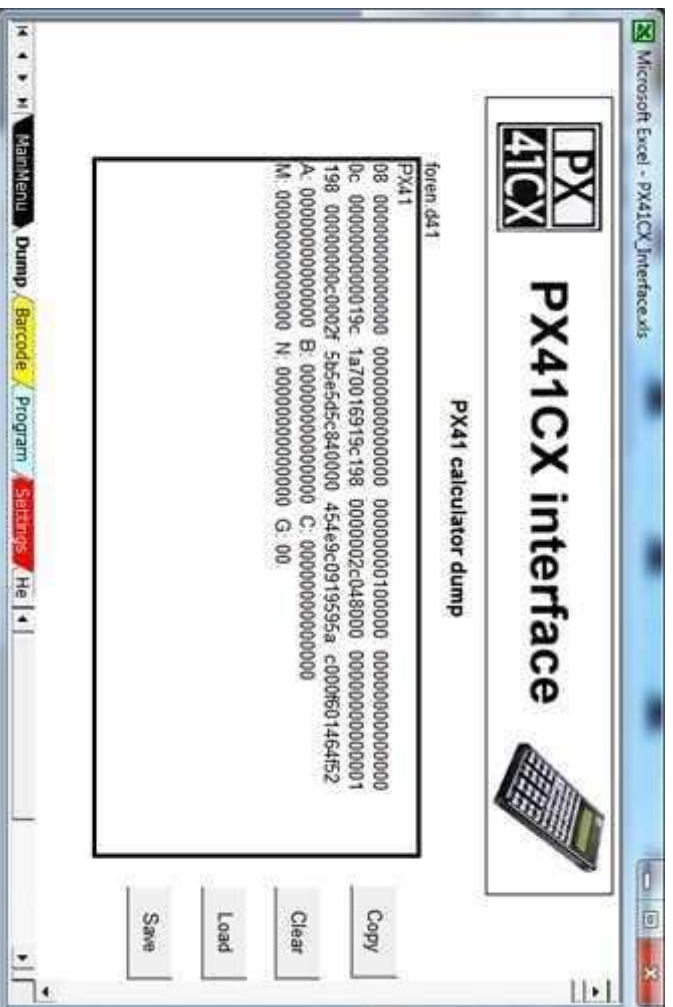


to display the COM screen



- 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)



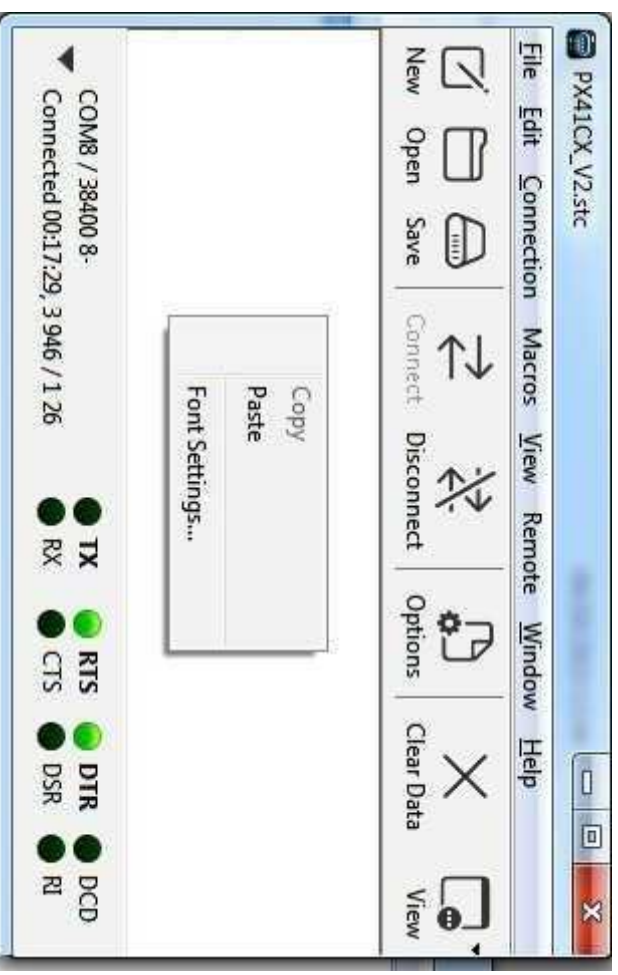
5) on the **PX41CX**, press



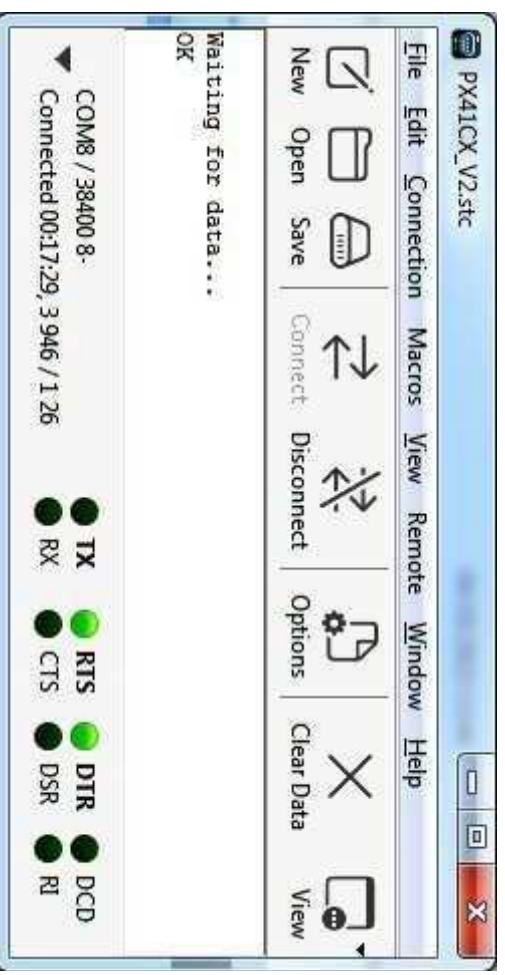
corresponding to the LOAD choice to wait for the transfer



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.

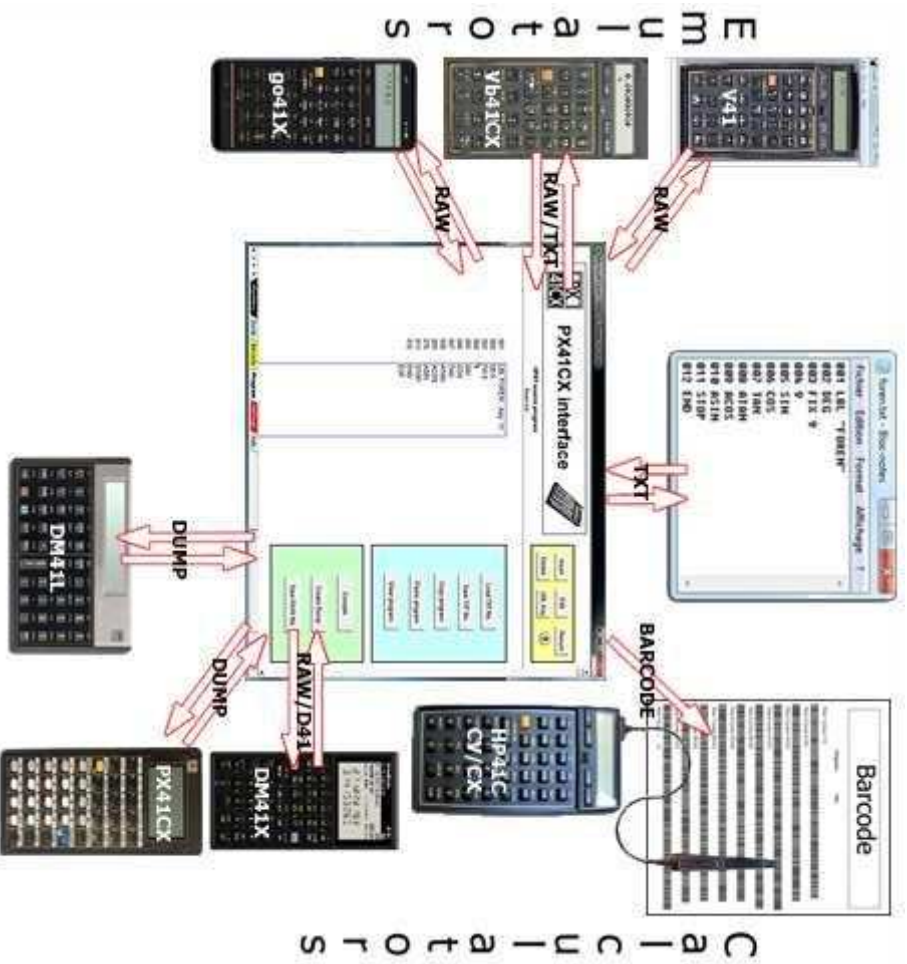
(<https://dm41.swissmicros.com/>)

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)	CX TIME	X Functions (CX)	CX EXT FCN
TIME 2C	CLALMA	ALENG	INSREC
ADATE	CLALMX	ANUM	PASN
ALMCAT	CLRALMS	APPCHR	PCLPS
ALMNOW	RCLALM	APPREC	POSA
ATIME	SWPT	ARCLREC	POSFL
ATIME24		AROT	PSIZE
CLK12		ATOX	PURFL
CLK24		CLFL	RCLFLAG
CLKT		CLKEYS	RCLPT
CLKTD		CRFLAS	RCLPTA
CLOCK		CRFLD	REGMOVE
CORRECT		DELCHR	REGSWAP
DATE		DELREC	SAVEAS
DATE+		EMDIR	SAVER
DDAYS		FLSIZE	SAVERX
DMY		GETAS	SAVERX
DOW		GETKEY	SAVERX
MDY		GETP	SEEKPT
RCLAF		GETR	SEEKPTA
RCLSW		GETREC	SIZE?
RUNSW		GETRX	STOFLAG
SETAF		GETSUB	X<>F
SETDATE		GETX	XTOA
SETIME		INSCR	
SETSW			
STOPSW			
SW			
T+X			
TIME			
XYZALM			

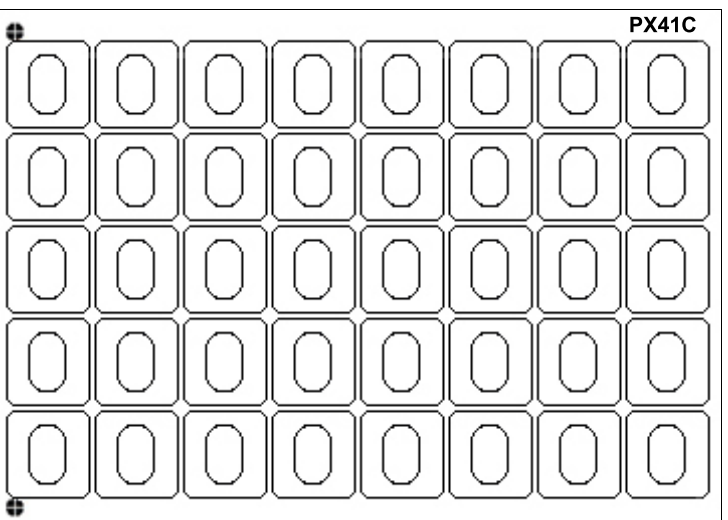
ADVANTAGE				
ADV CONV B	ADV MTRX	ADV MATH		
BININ	C<>C	MRJJ	SOLVE	D?
BINVIEW	CMAxAB	MRJJA	INTEG	BFT
OCTIN	CNRM	MRR+	SLOOP	FIT
OCTVIEW	CSUM	MRR-	SIRTN	Y?X
HEXIN	DIM?	MS	Z?N	SZ?
HEXVIEW	FNRM	MSC+	MAGZ	VC
NOT	I+	MSJ	e?Z	CROSS
AND	I-	MSJJA	LNZ	VS
OR	J+	MSR+	Z?I/N	VR
XOR	J-	MSWAP	SINZ	DOT
ROTXY	M"M	MSYS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

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

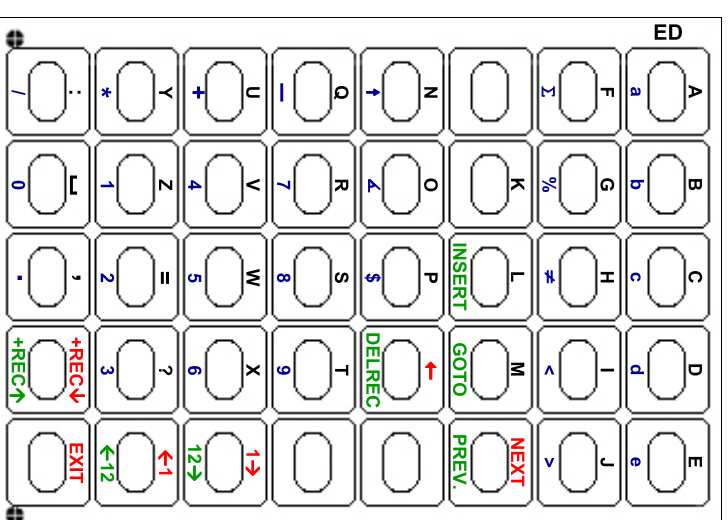
MATH ID	
MATRIX	a^Z
SIMEQ	LOGZ
VCOL	Z^I/W
VMAT	Z^W
PVT	C+
DET	C-
INV	CINV
EDIT	C*
SOLVE	C/
SOL	SINH
POLY	COSH
ROOTS	TANH
INTG	ASINH
DIFEQ	ACOSH
FOUR	ATANH
Z?N	SSS
MAGZ	SAA
e?Z	ASA
LNZ	SAS
Z?I/N	SSA
SINZ	TRANS
COSZ	*FN
TANZ	

FINANCE ID
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



Overlay for ED (CX EXT FCN)

