OWNER'S MANUAL

 $Q^2 XQ^2 XQ^2 XQ^2 XQ^2$ 

LAITRAM 2

## EASY TWO STROKE PROGRAMMING

THE LAITRAM CORP. NEW ORLEANS, LA



"There was a young man at Purdue Who hunted among keys 'til blue. He was sick with syntax, And could never relax 'Til he discovered XQ2."

LAITRAM XQ2 covered by U.S. Patent 4,547,860. Other U.S. & Foreign Patents Pending. © 1985 THE LAITRAM CORPORATION

The LAITRAM CORPORATION P.O. Box 50699 New Orleans, LA 70150 Telephone (504) 733-6000 This new keyboard and its logic of operation was conceived by J.M. Lapeyre of The Laitram Several patents are pending. Corporation in 1982. It makes possible the easy use of computer keyboards having as few as 12 keys while yet permitting the continued growth in computer performance in terms of built-in commands and functions. The HP-41CX is a perfect demonstration vehicle for this new concept since its function and expandable repertoire is large and the keyboard space is necessarily limited. It is hoped that this new keyboard operating logic, which we call XQ2, will become the standard by which future keyboard simplicity of operation is measured.

Thanks to Dave Conklin, Vern Lindsay, and all the people at Firmware Specialists, Inc. in Corvallis, Oregon, for their work in the programming and implementation of The LAITRAM XQ2 KEYBOARD on the HP-41.

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This XQ2 product (module and overlay) is a prototype design. As with any new complex programming product, there may be anomalies in the code that will appear in specific instances. We at The Laitram Corporation would appreciate your communication dealing with any such instances so we can continue to improve the XQ2 product.

The XQ2 ROM, Keyboard Overlay and material in this manual are supplied without representation or warranty of any kind. The Laitram Corporation assumes no responsibility and shall have no liability, consequential or otherwise, arising from their use.

#### PREFACE

#### By Ted Wadman

#### Co-author of "An Easy Course in Programming the HP-41"

A couple of years ago while I was working for Hewlett-Packard as the technical editor of their HP-41 user newsletter: HP KEYNOTES. I was searching for a way to shorten the hours I spent keying in the HP-41 routines that people sent to us for possible publication in the newsletter. I tried taping pages of function bar codes to my desk and optical wand attachment using the for the calculator to enter the individual program lines of each routine. After a couple of months of trying this method, I came to the conclusion that I was spinning my wheels. The wand was great for code programs, but а reading in bar as replacement for keying in individual program lines it was cumbersome. Spelling functions on the keyboard was just as quick as using the wand, if not quicker.

hand-held computers get more and As more powerful, designers are faced with the problem of minimizing the number of keys while maximizing the number of functions. The standard HP-41 available all the letters of the kevboard has alphabet, allowing the user to spell any function. This is one way to solve the "more functions, less keys" dilemma, but spelling functions can be slow and it was this spelling of functions that I was trying to avoid with my optical wand experiment.



I've been working with this new sixteen-key keyboard for about two weeks now, but it took me just a few hours to realize that it is the solution I would have loved to have come across back then. I could have saved many hours of programming time using the LAITRAM XQ2 KEYBOARD. All the of the HP-41CX functions right are there. accessible with just couple of keystrokes. a Spelling functions is no longer necessary.

Anyone who is heavily into programming the HP-41 will find it worth their time to become familiar with this keyboard. It's a thoughtful design.

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Congratulations! Your LAITRAM XQ2 KEYBOARD is an exciting addition to your HP-41 computer. This new sixteen-key design for the HP-41 will reduce the time you spend spelling functions, and assigning functions to this new keyboard is easier than ever. Once you become familiar with this keyboard, you'll wonder why anyone chose to put more than sixteen keys on a hand-held computer. The LAITRAM XQ2 KEYBOARD is a greatly simplified keyboard design for the HP-41. This revolutionary design places all functions of the HP-41CX, plus some HP-IL functions (mainly printer functions), right on the keyboard. And nearly all these functions are accessible in a maximum of three keystrokes.

With the XQ2 keyboard, it is rarely necessary to spell the name of a function in order to execute that function. Every function has a "keypair" associated with it to eliminate the need to spell the name of that function. Plus, the key reassignment feature of the HP-41 has been retained and enhanced so that it is possible to assign, all at once, all the functions and programs of an application ROM to the keyboard in a few keystrokes.

If you are not particularly comfortable with the standard HP-41 keyboard, you will almost immediately appreciate the benefits of this new design. While, if you are a more experienced HP-41 user--very comfortable with the standard HP-41 keyboard--it will take you just a small amount of practice to appreciate the greater efficiency of the XQ2 keyboard.

Now, before you start, check the contents of your XQ2 product. You should have the following:



- l. A plug-in ROM.
- 2. The XQ2 keyboard overlay.
- 3. This manual.
- 4. A Quick Reference card.
- 5. A Primer Applique.

## USING THIS MANUAL

This manual is designed to give you a quick understanding of the LAITRAM XQ2 KEYBOARD. It is short enough to read in a few minutes, and it is complete. Because it is designed as a course, you should read this manual from beginning to end, working the examples along the way.

In this book we use little (boxes) to indicate keys in a keypair. Just remember that 1+ means "press the 1 key then the + key," and 5 A means "press the 5 key then press the A key." This manual doesn't attempt to explain the workings of the HP-41, but we have tailored our explanation of the LAITRAM XQ2 KEYBOARD to be understandable by the HP-41 expert and novice alike.

#### GETTING STARTED

With your HP-41 (C, CV, or CX) turned off, plug in the ROM and install the keyboard overlay. To plug in the ROM, remove one of the port covers in the top of the HP-41 and insert the ROM. (It only goes in one way.) It's important to always have





the computer OFF when installing or removing any ROM. To install the keyboard overlay, first insert the feet of the overlay, then lock the top of the overlay in place using the sliding tab located between the [USER] and [PRGM] keys. The overlay should be locked in place so it doesn't fall off when you turn over the computer.

Now turn on your HP-41.... You are ready to start.

#### CRUNCHING NUMBERS

When your HP-41 wakes up with the XQ2 ROM plugged in, only the sixteen keys indicated on the overlay are active. (See facing page.) Fifteen of these keys make up a unique four-function calculator. Now take a look at how this calculator works.

The keys on the touchpad that make up this calculator are the digit keys  $\bigcirc$  through  $\bigcirc$ , the decimal point  $\land$  and the four functions +, -,  $\checkmark$ , and  $\checkmark$ . Notice that there is no equals [=] key or [ENTER] key.

NO EQUALS [=] KEY

If you've never worked with a calculator that doesn't have an [=] key then read this section. If you are already familiar with using the [ENTER] key on your HP computer, then skip to the section titled "NO [ENTER] KEY."

Hewlett-Packard calculators use a unique system of arithmetic logic called Reverse Polish Notation (RPN). This system uses an [ENTER] key instead of an [=] key. Look at an example of how this works.

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To solve the problem (2.8 + 7.3 - 5.5) on a calculator with an ENTER key, the keystrokes would be:

## 2.8 [ENTER] 7.3 [+] 5.5 [-]

The ENTER key is used to tell the calculator when you're done keying in the first number. After you press [ENTER], pressing one of the operation keys (+, -, X, or /) tells the calculator that you're finished keying in a number and that it needs to calculate something.

The previous example demonstrates the keystrokes you would use on the standard HP-41 keyboard. The LAITRAM XQ2 KEYBOARD uses the same RPN logic but has no [ENTER] key. So keep in mind as you work through the next section that on an HP calculator, the function comes after the two numbers on which it operates.

## NO [ENTER] KEY

HP calculator users have been getting along without an [=] key for a long time, but how does one get along without an [ENTER] key? The answer to this question lies in the interesting way the decimal point key  $\land$  is represented. The arrow point near the dot  $\land$  indicates this key takes the place of the [ENTER] key.



Try this:	6.	15.	.96 12		
Solution :	15.96 🔼	12 🖊			
Answer:	1.33				

In working the above example you see that if you've already keyed in a decimal point, pressing the  $\land$  key again indicates [ENTER]. The  $\land$ key is a natural for taking the place of [ENTER] because every number has one and only one decimal point. Thus, pressing the  $\land$  key a second time while keying in a number can and, in the case of the XQ2 keyboard, does mean ENTER.

Try this:		_	27767 + 955		
Solution:	27767		955 🛨		
Answer:	28722				

Working with integers requires pressing the decimal point key ( $\bigwedge$ ) twice after you finish keying in the first integer. The first decimal point goes into the number as if you were going to

continue entering digits. The second decimal point tells the computer you've completed entering that number.

The XQ2 keyboard doesn't change the way the stack-registers\* (X, Y, Z, and T) operate. The ENTER function is still present, but it is just executed through a different keystroke (the decimal point). Notice that in the keystroke sequence 27767  $\land \land$ , if you hold down the last  $\land$  key, the display indicates that the computer is about to execute the ENTER function.

Well, those are the rules for crunching numbers on the LAITRAM XQ2 KEYBOARD. Believe it or not, you have learned all there is to calculating without an [ENTER] key or an [=] key.

Try this:	(12.7)(9) + (8.4)(12) - 16
	(11) (4.5) + 6.6
Solution:	$12.7 \textcircled{1}{0} 9 \times 8.4 \textcircled{1}{1} 12 \times 16 =$ $11 \swarrow 4.5 \times 6.6 + \checkmark$
Answer:	3.55

\* If you're not familiar with the stackregisters and the way they work, refer to the manual that comes with the computer or to the book "An Easy Course in Programming the HP-41" by Ted Wadman and Chris Coffin (available through many HP dealers).



## SIXTEEN KEYS AND OVER 250 FUNCTIONS

More than 250 functions are printed on the face of the LAITRAM XQ2 KEYBOARD. Most of the functions of the HP-41CX, plus some HP-IL functions (mainly printer functions) are available.

So far you've learned to add, subtract, multiply, and divide, but what about all those other functions? What if, for example, you wanted to calculate the square root of PI (3.141592654)?

PI is a function on the HP-41 that recalls the value 3.141592654 to the X-register. And SQRT is the function that takes the square root of the number in the X-register. On the XQ2 keyboard, these functions are both printed in the legend right under the 1 key. PI is printed in the box labeled "1" and SQRT is printed in the box labeled "2". Do you see them?

Here are the keystrokes you would use to take the square root of PI, 1 (executes the function PI) 1 (executes the function SQRT). -- EASY AS PI!

#### **KEYPAIRS**

On the XQ2 keyboard, each function has an associated "keypair" by which it can be executed. To find the first key in a function's keypair, you simply find the legend in which that function is printed and press the key associated with that legend. The second key in that function's keypair is printed next to the function in the legend.

Look at a few examples. The keypair for SIN is 34. The keypair for SDEV is  $+\times$  (the plus

key and the multiply key). The keypair for  $X\langle Y$ ? is  $\times 5$ .

What is the keypair for the LOG function? The LOG function is printed in the legend under the 4 key in the box labled "5", so its keypair is 4.5.

To execute any function, press the 🔟 (EXECUTE) key and then that function's keypair.

Try this	4.6 - SQRT $((4.6)^2 - (4)(1.3)(2.1))$
	2 (1.3)
Solution :	4.6 $\land$ $\land$ $?$ 224 $\land$ $\land$ 1.3 $\land$ 2.1 $\land$ - $?$ 12 - 2 $\land$ $\land$ 1.3 $\land$ 1.3 $\land$ 1.3 $\land$ $?$
Answer:	0.54

Notice that when you press the  $\infty$  key, four dots form a box in the right side of the display. The next key you press is displayed within this box. Work through the above keystrokes and observe how the right side of your display indicates what keys you have pressed. (Press the  $\infty$  key twice and notice the character that appears in the right side of the display. This is the character used to indicate that the  $\infty$  key has been pressed as the first of a keypair.)



The Quick Reference card that came with the XQ2 product and the Index (page 31) contain an alphabetical listing of the keypairs of all the functions on the XQ2 keyboard. This listing makes it easier to locate a particular function. The functions are printed in groups that make a single function easier to find, but until you are familiar with the layout of the keyboard it may take a little time to locate a function.

However, when you're searching for a function on the XQ2 keyboard, think back to the first time you executed the function "X $\langle =0?$ " using the old [XEQ] [ALPHA] [X] [shift] [J] [ $\leftarrow$ ] [shift] [1] [shift] [0] [ $\leftarrow$ ] [=] [space] [ $\leftarrow$ ] [shift] [0] [?] [ALPHA] method. (We're assuming you made a few typo's in executing this function for the first time.) If you keep this thought in mind while you're becoming familiar with the XQ2 keyboard, searching a little for the function "X $\langle$  =0?" and then pressing XQ XO doesn't seem bad at all.

Some functions printed on the LAITRAM XQ2 KEYBCARD may not exist in your HP-41 system. For example, if you have an HP-41C or HP-41CV and you try to key in the function "X=NN?" (21) your computer will tell you that this function is NONEXISTENT. The functions that directly compare the value in the X-register with the value in register NN are only available on the HP-41CX.

If you make a mistake while keying in a function keypair, just press the  $\mathbf{N}$  key. With the exception of the keypair  $\mathbf{N}$ , all keypairs that end in the  $\mathbf{N}$  key (for example  $\mathbf{5}$ ,  $\mathbf{N}$ , etc.) execute the backarrow [ $\leftarrow$ ] 

## ALPHA MODE

So you know about keypairs and how to execute a function. Now look at the function with the keypair NA. This is the function ALPHA; actually it's not a function at all, but it is the same as pressing the ALPHA key to put your computer into ALPHA mode.

Give it a try. Press 🙍 🔍 A. Your computer should be in ALPHA mode. Notice the small word "ALPHA" that appears in the lower right hand side of the display.

Once you're in ALPHA mode, notice that ALPHA characters and/or ALPHA functions are printed right on the face of most of the keys on the touchpad. The 26 letters of the alphabet are the [4], [5], and [6] keys. Certain located on functions frequently used in the ALPHA mode (ASTO, ARCL, PROMPT, etc.) are listed on the 7 are several "extended" 8. and 9 keys, as "extended" functions. There are also six functions on the 1, 2, and 3 keys. Punctuation marks and other ALPHA symbols are listed on the 1, 2, and 3 keys as well. Each character and function has an associated keypair. For example, the letter "A" is 4+. And, in ALPHA mode, you don't press 🔟 before you press the key or keypair for the desired function or character.



Try this:	Key the characters "LAITRAM XQ" into the ALPHA register.
Solution :	In ALPHA mode, press 454+66 44634+57059 61 XA

Some ALPHA characters and functions are accessible by pressing just one key. In the above key sequence, the SPACE character is on the  $\bigcirc$ key. The APPEND character is on the + key. To access the digit characters (0 through 9), first press the  $\land$  key, then press the respective digit key.



Notice that the shift annunciator comes on in the display when you press the  $\bigwedge$  key. Also notice that the decimal point character has the keypair 2 in ALPHA mode.

That's about all there is to ALPHA mode. You can exit ALPHA mode by pressing the ALPHA key or by pressing  $\mathbf{N}$ .

Just want to view ALPHA? -- 12 Now clear the display? -- 12 58 or 12 .

PROGRAM [PRGM] MODE

Once you understand the fact that each function on the keyboard has an associated keypair, then programming is easy. You enter or exit the PROGRAM mode by executing  $\times$  3. In PROGRAM mode, you don't have to press the key before you press the keypair to key in a function.

Before you key in a program, notice a couple of things:

- 1. There is a GTO function (4+), a GTO. function (4-), a GTO.. function (4×), and a GTO-AON function (54). On the standard keyboard, these functions are accessed through the GTO function.
- There is a LBL function (44) and a 2. LBL-AON function (55), plus there is an XEQ function (41) and an XEG-AON  $(\mathbf{N}\mathbf{B})$ . function The XEQ-AON and LBL-AON functions have been added for convenience.



Try this: Key in this short program to calculate the area of a circle (prompting for the radius, R).

> 001 LBL "AREA" 002 "R = ?" 003 PROMPT 004 X†2 005 PI 006 × 008 END

Solution: From RUN mode the keystrokes are:

```
X X 3 (PRGM mode)
4 X (GTO..)
5 5 4 + 6 3 5 5 4 + X A (LBL "AREA")
X A 6 3 2 4 1 2 ("R=?")
7 8 X A (PROMPT)
2 2 (X 1 2)
1 1 (PI)
X X (X)
4 X (GTO ..)
```

If you make a mistake keying in a program line, you can use the backarrow function ( ).

Now, get out of PRGM mode by pressing  $\[mathbb{NO}]_3$ . You can run the program by pressing  $\[mathbb{NO}]_3$ .  $\[mathbb{NO}]_8$ ,  $\[mathbb{4]+$ ,  $\[mathbb{G}]_3$ ,  $\[mathbb{5]5$ ,  $\[mathbb{4]+}$ ,  $\[mathbb{NO}]_4$ . When the prompt comes up "R=?," key in 5  $\[mathbb{NO}]_3$ . The answer should be 78.54.

Notice that in ALPHA mode you can single step (SST) through a program by pressing the key. Also notice that you can back step (BST) by pressing the key. These features are handy to use when editing a program.

ENTERING CONSTANTS IN PROCRAM MODE [CONST]

How do you key in a program line that is made up of a constant? If you press a number key, the computer is going to take that as the first key in a function keypair.

How would you key in, for example, the program:

001 LBL "AA" 002 4.79 003 ENTER 004 22 005 × 006 END

Well, there's a new function called CONST ( $\bigcirc \land \cdot$ ) to take care of constants in program lines. To enter line 002 in the above program, the keystrokes would be  $\bigcirc \land \cdot$  4.79, and line 003 would follow with  $\land \cdot$ . When a constant is followed by an arithmetic operator (-, +, X, /) it is



unnecessary to depress the  $\infty$  key before depressing the appropriate operator key, EXCEPT where the constant is PI or has been recalled from a storage register.

The EEX function (209) will automatically set your computer to CONST mode to allow you to enter ten raised to a power as a program line.

Hint: To avoid going in and out of the Constant Mode in order to enter nonpermanent constants in a program, where it is convenient dedicate storage registers 01-05 for storing up to 5 constants. In this way, you can recall any one of these registers and save keystrokes.

As you can see, keying in program lines is especially easy with the XQ2 keyboard. In PRGM mode, the XQ2 keyboard. In PRGM mode, the XQ2 keyboard. In PRGM mode, the XQ2 key is not necessary in every sequence of keystrokes, thus most functions can be keyed in with a maximum of two keystrokes. This mode of keying in functions without first pressing the XQ2 key is called XQLOK. This is also an available feature in RUN mode.

#### XQLOK

In combing over the XQ2 touchpad, you may have discovered some new functions or combinations of functions that aren't available on the standard HP-41 keyboard. Functions like XEQ-AON, that combines the pressing of the XEQ key with the turning on of ALPHA mode.

One of these new functions is XQLOK (keypair  $\mathbf{XQ}$  7). In effect, this function locks the  $\mathbf{XQ}$  key making most functions available in a maximum

of two keystrokes. Basically, the XQLOK function makes keying in functions in RUN mode the same as keying in program lines in PRGM mode. And, since you already know how to key in program lines with your XQ2 keyboard, you know how to use XQLOK in RUN mode.

Try this:	Set your HP-41 to XQLOK, and execute the function $X\langle \rangle Y$ .
Solution :	XO 7, 33

Your computer will stay in XQLOK mode until you turn it off or press 27. Most functions can be executed with just 2 keystrokes, and constants have to be preceded by the CONST function  $(0^{+})$  just like in PRGM mode.

Try this: SINt2 (45) + COSt2 (45) (degrees) with your computer in XQLOK mode. Solution: 0 1 45 10 3 4 2 2 0 1

45 XQ 3 5 2 2 XQ +

Answer: 1.00

Notice that, in XQLOK mode, when you are keying in a constant and you want to execute a function (other than ENTER, +, X, or /,) you need to press NO before you enter the keypair for the



function. In the above keystrokes, you had to press  $\textcircled{\columnation N}$  before you entered the keypairs for the SIN and COS functions.

Try this: Set SIZE equal to 5 registers.

Solution: 10 005 (or 10 -)

The keypair for SIZE is 10. Notice that the key can be used to key up an argument of 5, the + key can be used for 4, etc.

If you have an HP-41CX or a time module, you'll notice that XQLOK mode is very useful in executing some stopwatch and time functions.

## KEY ASSIGNMENTS

The XQ2 keyboard provides some improvements in the HP-41 function ASN. Three types of key assignments are available with this keyboard.

1. Single functions or programs can be assigned any of the 64 keypairs that begin with a key in the top row (-, 7, 8, or 9) and can be accessed through this keypair when the computer is in USER mode.

- 2. Single functions or programs can be assigned to any keypair labeled "OWNER'S" and can be accessed through this keypair both in and out of USER mode. There are 3 OWNER'S "slots" available for assignments: 666, A.Z., and 05.
- 3. All of the functions or programs in an entire plug-in ROM can be assigned at one time to one of the four rows of keys with just a few keystrokes.

Let's look at examples of each one of these types of key assignments on the XQ2 keyboard.

SINGLE FUNCTION KEY ASSIGNMENTS

- Try this: Assign the function ACOS to the keypair -3.
- Solution: Assuming your HP-41 is in XQLOK mode, here are the keystrokes: 4+485442 201 - 3.

Now, in USER mode, the function ACOS is available through the keypair -3 as well as 37. Out of USER mode, the keypair -3 means PRREG (XROM 29,16).

If you attempt to assign a single function to a keypair that doesn't begin with -, 7, 8, or 9 (and isn't an OWNER'S keypair,) the computer will ignore the command.

## OWNER'S KEY ASSIGNMENTS

Try this:	As an example of assigning a function to an OWNER'S key, assign the program "AA" (that you keyed in earlier) to the OWNER'S keypair 66.
Solution :	Again, assuming XQLOK, A XA 4+ 4+ XA 66 are the keystrokes.

Now, the program "AA" is available through the keypair 666 both in and out of USER mode. Three OWNER'S keypairs are available on the XQ2 keyboard: 666, 4.7, and 0.5. If you execute these keypairs without first assigning a function to them, the HP-41 will do nothing.

## ASSIGNING AN ENTIRE ROM TO THE KEYBOARD

If you have an application ROM plugged into your computer (or if you have an HP-41CX) you can assign all the functions or programs in a plug-in ROM (or a built-in XFUNCTIONS or TIME ROM) to keypairs that begin with keys in one row on the keyboard. The procedure to do this is as follows:

- 1. Execute the ASN function and turn on ALPHA.
- 2. Spell ONE of the programs or functions contained in the ROM and turn off ALPHA.
- 3. Press the 🔟 key and then one key in the row to which you wish to assign the ROM functions.

The computer will immediately begin displaying each function in the ROM along with the keypair to which that function is assigned. If a printer is attached, the computer will make a listing of this information for your reference.

## CAT 6

The function CAT 6 ("catalog 6" executed with the keystrokes  $\times$  50 6) displays a list of all the key assignments on your HP-41. If you have a printer attached and set to trace mode, you can obtain a list of all the functions assigned to the keyboard and their corresponding keypairs.

If you have the functions of an entire ROM assigned to one of the rows of the LAITRAM XQ2 KEYBOARD, the normal execution of CAT 6 will display only the title of the ROM and the row  $(-, +), \times, \text{ or } (-)$  to which it is assigned. If you wish to obtain a complete listing of the function names and where they are assigned, stop the listing while the name of the ROM is being displayed (press  $(-, +), \times)$ , and start the listing (press  $(-, +), \times)$ , and start the listing (press  $(-, +), \times)$ ). A complete list of each function in that ROM and its assigned keypair will be displayed.



#### CLEARING KEY ASSIGNMENTS

As usual, clearing key assignments is done by assigning nothing (turn on ALPHA as if to spell a function and then turn it off) to the key or row of keys that you wish to clear. Or, if you have an HP-41CX or the Extended Functions ROM and you wish to clear all the key assignments at once, you can use the function CLKEYS (keypair 51).

#### CONCLUSION

As with the standard HP-41 keyboard, becoming efficient on the LAITRAM XQ2 KEYBOARD takes a little practice. But the number of keystrokes involved in executing functions with this keyboard will be fewer in the long run. The time it takes you to key in program lines will be cut in half if you use this keyboard regularly.

Remember, sixteen keys is all anybody really needs.

#### The LAITRAM XQ2 KEYBOARD

#### Programming Exercise

As an exercise to get you started on practicing with this new keyboard, try keying in the following program. This is a program to convert a measurement in feet, inches, and sixteenths of an inch to feet and decimal feet, and vice versa. This program uses only standard HP-41 functions, so everyone can key it in.

First, get into program mode by pressing  $\infty$ 23. Press  $4\times$  and make sure you have at least 12 registers available for programming.

01	LBL "FT"	555344 XIA
02	LBL 01	44
03	INT	<b>▲·</b> 2
04	LASTX	20
05	FRC	<b>▲·</b> 3
06	1 E2	<b>X)9</b> 2
07	x	X
08	INT	<b>▲·</b> 2
09	LASTX	20
10	FRC	<b>▲•</b> 3
11	1.92	○▲ 1.92
12	/	
13	X< >Y	33
14	12	○▲ 12
15	/	
16	+	XQ +
17	+	<u>N</u> +
18	CF 22	08 22
19	RTN	43
20	FS?C 22	<b>▲</b> • <b>7</b> 22
21	GTO 01	4 <b>+</b>

- 23 -

**X2**<sup>T.M.</sup>

22 23 24	LBL "FIS" LBL 02 INT	55 53 66 42 X A 44 /
25	ΙΔςτχ	
25	ERC	
20	10	
21	12	
28	X	
29	INT	
30	LASTX	20
31	FRC	<b>▲·</b> 3
32	16	0 💽 16
33	x	
34	1 E2	2 2
35	1	
36	+	
37	1 E2	2 2
38	/	
39	+	$\overline{\mathbf{X}}$ +
40	CF 22	08 22
41	RTN	43
42	FS?C 22	<b>A</b> 7 22
43	GTO 02	4+ /
44	GTO 01	
45	END	
-		Transport Company and Company

Now assign "FT" to the keypair -9 and assign "FIS" to the keypair 9 — Do you remember how to make this type of key assignments? The keystrokes (with your calculator in PRGM mode) are /1.20 1.53 4.4 2.10 1.9, for the first key assignment, and /1.20 1.536.6 4.2 2.10 1.9 -9, for the second key assignment. Exit PRGM mode by pressing 2.3, and put your calculator into USER mode, 2.2 To convert 4.35 feet to feet, inches, and sixteenths, press 4.35  $\bigcirc$  9-. If your display is set to FIX 2, you will see the number 4.04. Set your display to FIX 4 ( $\bigcirc$  02 4). Now you should see 4.0403.

This number means "4 feet, 4 inches, and 3 sixteenths of an inch." The first two decimal places represent inches and the second two decimal places represent sixteenths.

To convert 3 feet, 7 and ll/l6 inches to feet and decimal fraction, key in 3.07ll  $\bigcirc$  -9 in USER mode. You should get 3.64 feet.

#### A Few Things To Note

#### THE NULL FUNCTION

The function with the keypair 1 is the NULL function. The NULL function is present on the standard HP-41. Whenever you press a function key on the standard keyboard and hold it down for a few moments, the word NULL will come into the display.

This function is useful in a couple of situations. First, if you want to terminate the entry of a number, but you don't want to execute ENTER and lose the value in the T-register, you can execute NULL.

A second example occurs in program mode. If you accidentally press the  $\textcircled{\mbox{N2}}$  key in program mode, then pressing  $\fbox{\mbox{N2}}$  again will clear away a program line. The easiest way to clear the accidental  $\fbox{\mbox{N2}}$  in program mode is to press the  $\fbox{\mbox{1}}$  key. This executes the NULL function.



## THE PROGRAM MODE TONE

Every time you initiate a keypair in program mode with the  $\bigcirc$  key, the calculator produces a tone. This tone is there to warn you that pressing  $\bigcirc$ again will clear a program line. If you find this tone irritating, you can turn it off by getting into RUN mode and clearing flag 26. In run mode, the keystrokes for clearing flag 26 are  $\bigcirc$  0.8 26. This disables audio capabilities of the calculator until you reset flag 26 or turn the calculator off and back on.

## LOCAL ALPHA LABELS

On the standard keyboard, local ALPHA labels (A through J and a through e) are automatically assigned to their corresponding keys in the top two rows. Whenever you run a program that contains local ALPHA labels, these labels become entry points in the program, accessible in USER mode through these automatic key assignments. It is important to note that this feature has not been retained on the LAITRAM XQ2 KEYBOARD.

Local label key assignments are used frequently in ROM programs, especially in those programs that "customize" the HP-41. The finance ROMs are all good examples. When vou run one of the cash-flow analysis programs, the top row of keys become the values n, i, PV, PMT, and FV in USER These programs turn the HP-41 into mode. a calculator," when "financial vou're using the keyboard, but these programs standard (and others that use local ALPHA labels) don't work well with the XQ2 keyboard. Eventually XQ2 compatible ROMS (that is ROMS that will work with XQ2) should become available.

But in the meantime, when you're running a program that makes use of automatic local ALPHA key assignments, it's best to revert back to the standard keyboard. Just turn off the HP-41, pull out the XQ2 ROM, remove the overlay, and you're back to the old keyboard.

## THE HP 82143 PRINTER AND HP-IL

If you have both an HP-IL module (with the printer functions switch set to disable) and an HP 82143 (non-HP-IL) printer connected to your HP-41, the LAITRAM XQ2 KEYBOARD will not work.

You can use the HP 82143 printer if the HP-IL module is not connected, and you can use HP-IL with an HP-IL printer (and any other device) connected. The only combination that doesn't work is both the HP-IL module (with the printer functions switch set to disable) and the HP 82143 printer connected at the same time.

## F29TOG

The F29TOG (keypair 30) function toggles flag 29. When flag 29 is set, the digits in numbers greater than or equal to 1000 are grouped and separated by commas (in the U.S.A.) or periods (just about everywhere else.) For example, with flag 29 set, the number one-million will be displayed as 1,000,000.00 (or 1.000.000,00 in European notation) with the display set to FIX 2. With flag 29 clear, one million will be displayed as 1000000.00 (or 1000000,00), so there is no digit grouping and separation.



## CASE

This function toggles flag 13 which sets the case of the letters on the ALPHA keyboard. Flag 13 clear means upper-case, flag 13 set means lower-case.

#### WDTH

This function toggles flag 12 which determines the width of printing on the HP 82143 printer and the HP 82162A printer.

# FUNCTIONS THAT REDEFINE THE STANDARD KEYBOARD

Generally, any function or mode of the HP-41 that uses a different internal interpretation of the standard HP-41 keyboard will not work with the LAITRAM XQ2 KEYBOARD. Text Editor mode (the function ED.) Stopwatch mode (functions SW and SWPT.) and ALMCAT (CAT 5) all revert to their standard interpretations of the keyboard when they are executed from the XQ2 keyboard. They activate keys that are not indicated on the XQ2 keyboard overlay, and thus, the full capabilities of functions accessible these are not using the LAITRAM XQ2 KEYBOARD.

## THE MAPPING OF KEY ASSIGNMENTS

When you plug in the LAITRAM XQ2 ROM, all the global functions that are assigned to the standard keyboard are transferred over to the new keyboard according to the following keycode/ keypair map. When you revert back to the standard keyboard, your global key assignments will still be there.

KEY Code	KEY PAIR	KEY CODE	KEY PAIR	KEY CODE	KEY PAIR	KEY CODE	KEY PAIR
11	77	12	87	13	97	14	$\left[ -7\right]$
-11	71	-12	81	-13	91	-14	$\overline{-11}$
21	78	22	88	23	98	24	-8
-21	72	-22	82	-23	92	-24	-2
31		32	89	33	99	34	-9
-31		-32	83	-33	93	-34	-3
41	$7 \square$	42	8/	43	9/	44	-
-41	7 -	-42	8-	-43	9-	-44	
51	74	52	84	53	94	54	-4
-51	<b>7 X</b>	-52	<b>8 X</b>	-53	<b>9</b> XQ	- 54	<u>- X</u>
61	75	62	85	63	95	64	-5
-61	70	-62	80	-63	90	-64	-0
71	76	72	86	73	96	74	-6
-71	7 🔺	-72	8	-73	9 🔺	-74	
81	<b>7×</b>	82	8 X	83	<b>9 X</b>	84	$-\mathbf{X}$
-81	7 +	-82	8+	-83	9+	-84	

## Note:

The keys coded as #15, -15, 25, -25, 35, -35 are associated with row assignments of ROMs and cannot be used in this manner.



## THE GETKEY, GETKEYX, AND PASN FUNCTIONS

The GETKEY, GETKEYX, and PASN functions utilize keycodes from the standard HP-41 keyboard. They do not switch to keypairs when you switch keyboards.

However, any function that you assign to the keyboard using the PASN function and referencing a standard keycode, will be assigned to the LAITRAM XQ2 KEYBOARD according to the previous keycode/keypair map. It will act like any key assignment in transferring between the two keyboards.

Happy "XQ2ing" and let us have your comments good and bad.

What would you think of a hand-held with only 16 keys with the power of the H.P.4lCX but the size of the H.P. 11, 12, 15?

	"BASIC		"BASIC
KEYPAIRS	FUNCTIONS"	KEYPAIRS	FUNCTIONS"
:XQ : +	+	:XQ : 9	FFX
:XQ : -	-	$\dot{1}$	END
:XQ : x	×	0 1	ENG
:XQ : /	1	<b>▲• ▲•</b>	ENTER
: 2 : 3	1 <b>/</b> X	• 4 • 2	EAX (eX)
: 4 : 7	10 <b>†</b> X (10^)	• 4 • 9	$E + X - 1 (e^{X} - 1)$
: 1 : +	ABS	+ /	FACT
: 3 : 8	ACOS	<b>▲•</b> <u>→</u>	FC?
: 7 : 9	ADV	: 🔺 : 8	FC?C
:XQ : A•	ALPHA	: 0 : 2	FIX
: / : 0	AOFF	: 🔺 : 3	FRC
: / : ×	AON	: 🔺 : 6	FS?
<b>: ▲•</b> : 4	ARCL	: 🔺 : 7	FS?C
A: 9 : 8		: / : 5	GRAD
: 💽 : 5	ASHF	• 4 • +	GTO
: 3 : 7	ASIN	: 4 : -	GTO.
: / : 🐴	ASN	• 4 • ×	GTO
: 0 : /	ASTO	: 5 : 4	GTO-AON
A: 9 : /		: 9 : 3	HMS
: 5 : 9	ATAN	: 9 : +	HMS+
: 1 : /	AVIEW (AVEW)	: 9 : -	HMS –
A: 9 : 9		: 9 : 2	HR
: 4 : /	BEEP	:XQ : 5	IND
X X	BST	: 🔺 : 2	INT
	CAT	: 1 : 6	ISG
0 0		: 2 : 0	LASTX
· - · -	CHS	: 4 : 4	LBL
	CLA	: 5 : 5	LBL-AON
		: 4 : 8	LN
. 5 . 0		: 4 : 6	LN1+X
5 7		: 4 : 5	LOG
• + • 1		: + : 4	MEAN
· × 0 · 4		: + : 8	MOD
$\cdot \times \bigcirc \cdot \land \land$		:XQ : 1	NULL
		: + : 3	OCT
	COFI	: x : 9	OFF
• 3 • -		: + : 0	ON
• + • 2		: + : 9	P-R
• / • 2	DEC	: X : 8	PACK
• 5 • +	DEL	: 5 : 6	% 0.011
1 9	DSF	0 5	ъсн

# **X2**<sup>T.M.</sup>

	"BASIC		"BASIC
KEYPAIRS	FUNCTIONS"	KEYPAIRS	FUNCTIONS"
• 1 • 1	$PI(\pi)$	• × • 3	X<=Y?
XO 3	PRGM	× · 7	X>Y?
	PROMPT (PRMT)	· · · /	X<>
A: 7 : 8		3 3	X<>Y
4	PSE	: 4 : 1	XEO
A• 1	R 1	:XO : 8	XEQ-AON
2 -	R-D	2 2 2	$X \uparrow 2 (X^2)$
+ •	R-P	: 3 : 2	YAX (YX)
/ 4	RAD		
• • • 0	RCL	<u>"TIME</u>	FUNCTIONS"
: 1 : 🔺	RDN (R♦)	: 7 : 8	ADATE
+	RND	: 8 : 3	ALMCAT
: 4 : 3	RTN	: 8 : 6	ALMNOW
+ ×	SDEV	: 7 : 4	ATIME
: 0 : 3	SCI	: 7 : 5	ATIME24
: 0 : 4	SF	: / : 7	CLK12
: + : +	Σ+	: / : 9	CLK24
: + : -	$\Sigma^{-}$	: 9 : 1	CLKT
: + : 7	ΣREG	: 9 : x	CLKTD
: 3 : 4	SIN	: 9 : 6	CLOCK
: + : 6	SIGN	: 8 : /	CORRECT
: 1 : 0	SIZE	: 9:8	DATE
: 1 : 2	SQRT (VX)	: 9:4	DATE+
: / : /	SST	: 9 : 7	DDAYS
: 0 : +	ST+	: 9: /	DMY
: 0 : -	ST-	: 9 : 5	DOW
: 0 : ×	STx	: 9 : 0	MDY
: 0 : /	ST/	: 8 : 4	RCLAF
: 0 : 0	ST0	: 8 : 7	RCLSW
:XQ : 0	STOP	: 8 : 9	RUNSW
: 3 : 6	TAN	: 8 : 2	SETAF
: 4 : 0	TONE	: / : +	SETDATE
:XQ : 2	USER	: 8 : 0	SETIME
: 1 : ×	VIEW	: 8 : 5	SETSW
X +	X=0?	: 8 : 8	STOPSW
: × : 4	X≠0?	NL	SW
: x : 2	X<0?	: 9 : 🔺•	T+X
: x : 0	X<=0?	: 9 : 9	TIME
: x : -	X>0?	: 8 : 🔺	XYZALM
: x : /	X=Y?		
: x : 🔺	X≠Y?	NI • N	tlictod
: x : 5	X <y?< td=""><td>NL. NO</td><td>L LISLEU</td></y?<>	NL. NO	L LISLEU

	1	"CX TIME				"MASS S	TORAGE
K	EYPAIRS	FUNCTIONS"	K	EYPA	IRS	FUNCTIO	DNS"
:	8:1	CLALMA		NI		CREATE	
:	8 : x	CLALMX	•			DIR	
:	8 : +	CLRALMS	•	NI		NEWM	
:	8 : -	RCLALM		NI		PURGE	
	NL	SWPT		NL		READA	
				NL		READK	
	PRINTER	K FUNCTIONS		NL		READP	
:	7 : -	ACA	:	6:		READR	
Α:	8:8		:	6:	7	READRX	
:	7:3	ACCHR		NL		READS	
:	7 : •	ACCOL		NL		READSUE	3
:	7:2	ACSPEC	Α:	7:	9	RENAME	(RNAM)
:	1:1	ACX		NL		SEC	
:	7:6	BLDSPEC	:	5 :	/	SEEKR	
. :	/ : +	FMI		NL		UNSEC	
Α:	8 9	LICT	Α:	7:	7	VERIFY	(VRFY)
:	- 0			NL		WRTA	
:	- · X	TDDAVIC		NL		WRTK	
:	- · Z	PPRHE (PPRE)		NL		WRTP	
<u>،</u> .	- · / 8 · 7			NL	~	WRIPY	
Ä :	- 1	PRELACS	:	6:	0	WRIR	
•	NI	PRKEYS	÷	6	4	WRIKX	
•	- : /	PRP		NL		VKIS	
÷	- : 8	TPRPLOT		NL.		ZERU	
	- • 0	TPPPIOTP		11	ΙΝΤΙ	ERFACE (	CONTROL
÷	- : 3	PRREG		-		FUNCTIO	NS <sup>11</sup>
÷	- : 6	PRREGX		NI		AUTOIO	
÷	- : 🗼	PRS		NI		FINDID	
:	- : 5	PRSTK	Α:	8 :	1	INA	
:	- : 4	PRX		NL		IND	
:	7:1	REGPLOT		NL		INSTAT	
:	7 : /	SKPCHR		NL		LISTEN	
:	7:0	SKPCOL		NL		LOCAL	
:	7 : x	STKPLOT		NL		MANIO	
			Α:	8 :	2	OUTA	
				NL		PWRDN	
				NL		PWRUP	
				NL		REMOTE	
				NL		SELECT	
				NL		STOPIO	
	NL: Not	t Listed		NL		IRIGGER	



"EXTENDED	"EXTENDED_
KEYPAIRS FUNCTIONS"	KEYPAIRS FUNCTIONS"
: A : + ALENG	: 3 : X SEEKPT
: / : 1 ANUM	: 3 : 1 SEEKPTA
A: $9$ : 2 APPCHR (APPC)	: 1 : 4 SIZE?
A: 9 : 3 APPREC (APRC)	: 0 : 6 STOFLAG
A: 8 : 3 ARCLREC (ARCR)	: x : 6 X<>F
: 1 : 3 AROT	: 🔺 : 9 XTOA
: 🔺 : 🗴 🗛 АТОХ	
A: 1 : 9 CLFL	" <u>CX EXTENDED</u>
: 5 : 1 CLKEYS	FUNCTIONS"
: / : 6 CRFLAS	: 2 : 5 ASROOM
: / : 3 CRFLD	: 5 : 9 CLRGX
: 2 : 🔺 DELCHR	A: 3 : 1 ED
: 2 : 6 DELREC	: 6 : 🔺 EMDIRX
: 6 : X EMDIR	: 2 : 8 EMROOM
A: 3 : 9 FLSIZE (FLSZ)	: / : 8 GETKEYX
A: 7 : 2 GETAS (GTAS)	: 2 : 9 RESZFL
: / : - GETKEY	: + : 5 ΣREG?
A: 1 : 6 GETP	: 2 : 1 X=NN?
: b : + GEIR	: 2 : + X≠NN?
A: 8: 6 GETREL (GIRC)	: 2 : 4 X <nn?< th=""></nn?<>
CETCUP (CTSP)	: 2 : x X<=NN :
A: Z . / GEISOB (GISB)	$\begin{array}{c} 2 \\ 2 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\$
1 $1 $ $1 $ $1$ $1$ $1$ $1$ $1$ $1$	: 2 : / X>=NN :
A: $9$ : 1 INSERT (INSC)	
NI PASN	"OTHER
: 5 : × PCLPS	FUNCTIONS
: 1 : 8 POSA	A: + : APPEND Alpha
: 3 : A. POSFL	:XQ : 5 INDIRECT (IND)
: 1 : 5 PSIZE	:XQ : O RUN
A: 7 : 3 PURFL (PRFL)	A: - :
: 0 : 9 RCLFLAG	:XQ : 8 XEQ-AON
: 3 : + RCLPT	:XQ : 7 XQ LOK
: 3 : / RCLPTA	: 3 : 0 F29TOG
: 5 : - REGMOVE	A: 9 : 4 CASE
: 5 : A. REGSWAP	A: 9 : 5 WDTH
A: 7 : 1 SAVEAS (SVAS)	: 6 : 6 OWNERS #1
A: I: 5 SAVEP	: 사 : / OWNERS #2
	: 0 : 5 OWNERS #3
SAVERX	
: b : 9 SAVEX	NL: Not Listed

. XQ2 XQ2 XQ2 XQ2 X  $O_2 XO_2 XO_2 XO_2 XO_2$  $\mathbf{Q}_{2} \mathbf{X}_{2} \mathbf$