This guide will show you how to restore your chipKIT bootloader, in the event that it has been erased from a chipKIT-compatible board. This operation is required if you have used MPLAB X to program the board in a generic way, causing the bootloader to be over-written.

The steps below will apply to most chipKIT-compatible boards.

What you will need:

- **chipKIT-compatible Board** Contains a microcontroller referred to as the "target device"
- **Bootloader Hex File** Downloadable from the web. In general there are two potential places to download bootloaders for your particular board:
 - 1. **Manufacturer Website:** Production versions of the bootloader are programmed by the manufacturer. Production bootloader hex files are available from the board manufacturer's web site. For example, <u>Digilent's chipKIT Product Pages</u> have a download section where you can find the bootloader hex file that ships with the board. The Production Version is always a safe choice, as the developers of MPIDE are careful to maintain backward compatibility with original production boards.
 - 2. <u>GitHub Repo</u>: Community versions are available at this GitHub repo. These versions of the bootloader are built from the latest sources available. GitHub is a developer's tool, and is particularly useful for tracking changes between multiple versions of source code. However, no special knowledge is required to acquire a bootloader hex file. Simply right-click on the hex file name, and save the file to your local disk. In some cases there will be multiple versions of a bootloader listed for the same chipKIT board, or experimental versions with unfamiliar names. If you are unsure about which version to use, you could post a question to the <u>chipKIT support</u> forum.

Board Name	Microcontroller	Manufacturer
chipKIT Pi Development Board	PIC32MX250F128B	element14
chipKIT DP32 Development Board	PIC32MX250F128B	Digilent
chipKIT Fubarino Mini Development Board	PIC32MX250F128D	Microchip
chipKIT Fubarino SD Development Board	PIC32MX795F512H	Microchip
chipKIT Max32 Development Board	PIC32MX795F512L	Digilent
chipKIT (Cerebot) MX3 Development Board	PIC32MX320F128H	Digilent
chipKIT Pro (Cerebot) MX4 Development Board	PIC32MX460F512L	Digilent
chipKIT Pro (Cerebot) MX7 Development Board	PIC32MX795F512L	Digilent
chipKIT uC32 Development Board	PIC32MX340F512H	Digilent
chipKIT Uno32 Development Board	PIC32MX320F128H	Digilent
chipKIT WF32 Development Board	PIC32MX695F512L	Digilent
chipKIT Wi-FIRE Development Board	PIC32MZ2048ECG100 or PIC32MZ2048EFG100 ¹	Digilent

• **Device Part Number** – This is particular to your board. Below is a table of some boards:

¹ The ECG was for pre-production Rev B and earlier boards.

• Device programmer and matching USB cable – From the list below.

*<u>Note</u>, if you have the chipKIT Pro "Cerebot" MX4 or MX7, these boards have an on-board programmer/debugger, so you don't need an additional programmer from the list below.

- PICkit 3 Programmer (plus one of the following):
 - PICkit 3 Programming Cable Kit (<u>Digilent Part# 240-035P</u>)
 - Male header, single row, 0.1 inch spacing (2.54mm) either straight or right angle (see examples below)
 - Straight: <u>Digi-key Part# S1131EC-06-ND</u>
 - Right Angle: <u>Digi-key Part# S1132E-06-ND</u>
- o chipKIT PGM Programmer
- MPLAB ICD 3 (including the following):
 - RJ-11 to ICSP Adapter (Microchip Part# AC164110)
- MPLAB REAL ICE (including the following):
 - o RJ-11 to ICSP Adapter (Microchip Part# AC164110)
- MPLAB IPE The "Integrated Programming Environment" Software
 - Note that if you have MPLAB X IDE installed, you may have installed the IPE during the installation. If not, do the following:
 - Go to <u>http://www.microchip.com/mplabx</u>
 - Download MPLAB X IDE and begin the installation
 - From the MPLAB X installer, you can choose to install both MPLAB X IDE and the MPLAB IPE or you can just choose to install the IPE

Preface

Before we get started, please take a moment to understand the following things. We will be using the IPE programming software with a device programmer (such as a PICkit 3) to program a bootloader hex file to the target device on your chipKIT board. It is interesting to note that the device programmer itself contains built-in software (a bootloader and firmware) with details such as memory ranges and programming algorithm. The IPE will update the device programmer software, if necessary, before attempting to program your target device.

If an update to the device programmer software is required, the IPE will perform the update automatically. During the software update, additional messages will appear in the Output window. The screen shot below (in step 5) shows an example of the additional messages. If an update to the device programmer software is not required, the additional messages will not appear.

How to Restore the chipKIT Bootloader:

1. Open MPLAB IPE

Select Devi Family:	ice and Tool		T		Results		
Device: Tool:	PIC32MX320F128	3H	▼ ▼	Apply Connect		Checksum: Pass Count: Fail Count: Total Count:	FDD2397C 0000 0000 0000
P	Program	Erase	R	ead	Verify	,	Blank Check
Source: Pl	lease click on browse	e button to import a hex	x file				Browse
SQTP:	lease click on browse	e button to import SQTP	? file				Browse
SQTP: P	lease click on browse	e button to import SQTP	? file				Browse tess
SQTP: P	ease dick on brows	e button to import SQTP	? file				± Less
SQTP: P	lease dick on browse	e button to import SQTP	? file				± Less
SQTP: P	lease dick on browst	e button to import SQTP	? file				± Less
SQTP: P	lease dick on brows 17:28:20-0700- Com	e button to import SQTP pleted loading IPE.	? file				Browse
SQTP: P	lease dick on brows 17: 28: 20-0700- Com	e button to import SQTP pleted loading IPE.	? file				± Less
SQTP: P	lease dick on brows L7: 28: 20-0700- Com	e button to import SQTP	? file				± Less

2. In the Device drop-down menu, either choose, type, or paste the device part number (from your target board) into the field. Then click the "Apply" button if needed.



3. With the USB cable appropriate for your programmer, connect the programmer into the USB port on your computer. If you have the chipKIT Pro "Cerebot" MX4 or MX7, just plug the board in directly, as the programmer is built-in on this board.



4. In the IPE, after a few seconds, your programmer should appear in the Tool drop-down menu. Select the programmer you want to use, if it's not already selected.

×I	integrated Pr	ogramming Environment v2.15	;				_ 🗆 🗵
File	View Settin	gs Help					
	- Select Devi	ce and Tool			Results		
	Family:	All Families	•				
					Checksum:	FDD2397C] .
	Device:	PIC32MX320F128H		Apply	Pass Count:	0000] .
	Tool	DICkit2 S. No. + PLID 142554018		Connect	Fail Count:	0000] .
	1001.	PICKIS 3.100 . BOR 142334018		Connect	Total Count:	0000	ון נ

5. Click the connect button (see screenshot above).

When first connected, the IPE may attempt to update the device programmer's firmware and bootloader, and/or the firmware for the type of device selected. This may take a minute or two, with progress reported in the Output window. The device programmer updates will depend upon which version of the IPE is currently running, and which version was used previously.

Note: If you see a message in red that your target device was not found, this is only a warning to remind you that the programmer is not physically connected to your target device/board. When you are ready to program the hex file, you can then connect your programmer to the target board. We'll do that in the next step.

Integrated P	rogramming Envir	onment v2.26			
le View Settir	ngs Help				
Select Dev Family: Device: Tool:	vice and Tool All Families PIC32MX320F128 PICkit3 S.No : BUI	8H R142554018	Apply Disconner	Checks Pass Cor Fail Cor Total Cor	um: FDD2397C unt: 0000 unt: 0000 unt: 0000
	Program	Erase	Read	Verify	Blank Check
Source: P SQTP: P Output Firmware Suit Firmware Suit Downloading Downloading	Please dick on browse Please dick on browse te Version01.32. ePIC32M Firmware bootloader	e button to import a hex file e button to import SQTP file 10 * X			Browse Browse t Less
Bootloader do Programming Downloading I RS download Programming Downloading AP download Programming Firmware Suit Firmware Suit Firmware type Target device	ownload complete download RS complete download AP complete download te Version01.34. ePIC32M	11 X must connect to a target d	levice to use PICkit 3.		

6. Connect the Programmer to the In-Circuit Serial Programming (ICSP) footprint on the target board (see the Appendix for examples and some notes for connecting certain boards). For chipKIT Pro "Cerebot" MX4 and MX7 boards, there is no need to do this because the programmer is built into the board.

The ICSP footprint on the target board is essentially a strip of 5 or 6 thru-holes (as seen in the example to the right). Each board will have the ICSP footprint in a different place. The size and dimensions of the thru-holes accommodate the header or right-angle connector used to connect the programmer. Notice that the pins in this example are offset, so that when you connect the header or right-angle connector, it makes a more tight and solid connection.

When you connect the programmer to the ICSP footprint, ensure that you connect the programmer's Pin 1 (usually indicated by an arrow) with the ICSP footprint Pin 1 (usually indicated by a "1" on the silkscreen, or a square outline on the pin 1 hole on the ICSP footprint, as shown in this photo.)

Note: You could have connected the programmer to the target board in Step 3 above. We prefer to connect the board in this step, to ensure that all firmware updates to the programmer have been completed. Otherwise, connection errors may be reported, depending upon how the target board is powered.



- 7. If you want to power your target board from the programmer (which will make it easier to connect the chipKIT PGM and PICkit 3) please do the following:
 - a. For chipKIT PGM Programmer, this product powers the target board by default. However, the voltage regulator on the chipKIT PGM can provide only about 100mA at 3.3V. Some chipKIT boards require a larger supply, so it is advisable to power the target via USB or the Power Jack connector.
 - b. For PICkit 3 and MPLAB ICD 3, you will need to use the Advanced Mode settings to ensure that the Power Target Circuit option is turned on. See the steps below.
 - c. For MPLAB REAL ICE, you will have to power your target via USB or the Power Jack connector, as the option to power the target board is not available. Skip ahead to step 8.

To Enable the Power Target Circuit option (which is turned off by default):

💥 Integr	ated Programming Environment	v2.26	<u> </u>
File View	/ Settings Help		
Sel	le Advanced Mode Erase All before Program	Results	
Fa	Auto Download Firmware Manual Download Firmware	Checksum: FDD2397C	
De	Hold in Reset	Pass Count: 0000	
To	oc Release from Reset	18 Connect Total Count: 0000	

In the IPE Menu, select "Settings > Advanced Mode"

In the window that appears, type in the IPE password and click "Log on" (you can select to "Remember Password" if you'd like)

Advanced Sett	ings	x
Log on to Advan	ced Mode	
Password:	*****	
	Default Password 'microchip'	
Change	Password Log on	
Remember Pas	sword	

With the new options that appear on the left side of the window, choose "Power" and enable the "Power Target Circuit from Tool" option. Note that you can also change the VDD as needed.

💥 Integrated Programming E	nvironment v2.26	
File View Settings Help		
Operate	Voltage Settings	
😝 Power	VDD: 3.3 VP: 3.3 N/A	
Memory	VDD Nom: 3.3 V/A VDD App: 3.3 V/A	
Environment	Reset Voltages	
SQTP		
Production Mode	ICSP Options Low Voltage Program	
Settings	Status	
Log out		

Click the "Operate" button and the Main Screen will re-appear.

Integrated Programming Envir File View Settings Help	ronment v2.26	X
	Select Device and Tool	Results
😂 Operate	Family: All Families	CP=OFF Checksum: FDD2397C
	Device: PIC32MX320F128H	Checksum: FDD2397C
Power	Tool: DTC/#2.5 No - BIR 142554019	Fail Count: 0000
		Total Count: 0000

8. In the Main Screen, click "Connect" (or "Disconnect" and then "Connect" again)

In this step, if you see errors such as "Unable to connect to target device" it means your target board is intermittently powered or not getting power at all. Ensure that you have a solid connection from the programmer connector/header to the target ICSP footprint. See the Appendix below for examples of how to connect. Note that you can usually tell the board is being powered if you see an LED turned on (on the target board). Most boards have a red Power LED near the power jack connector. Once your connection is solid, you can proceed to the next step.

💥 Integrated Programming Env	ronment v2.26	_ 🗆 🗙
File View Settings Help		
😫 Operate	Select Device and Tool Results Family: All Families CP=OFF Checksum: FDD239: Checksum: CP=OFF Checksum: FDD239: FDD239:	7C
Power	Device: PIC32MX320F128H Apply Pass Count: 0000 Tool: PICkit3 S.No : BUR 142554018 Disconnect Total Count: 0000 Total Count: 0000	
Memory	Program Program Erase Read Verify Blar	nk Check
Environment	Source: Please click on browse button to import a hex file SQTP: Please click on browse button to import SQTP file	Browse Browse
SQTP	Output 2014-12-10T 19:03:48-0700- Completed loading IPE.	
Production Mode	**************************************	
Settings	Target detected Device ID Revision = 50900053	
Log out		

9. Click the Browse button to locate and select your bootloader hex file. The IPE will then load and prepare the file to be programmed.

Select Dev	ice and Tool			Results		
Family:	All Families		-			55555460
Device:	PIC32MX320F128H		- Apply		Pass Count:	0000
Tool:	PICkit3 S.No : BUR 14	2554018	✓ Connect	t	Fail Count:	0000
					Total Count:	0000
	Program	France	Read	Verif	57	Riank Chark
)				ý	
ource:	:\Users\c12305\Docume	nts\Work\chipKIT\Board	l Specs\Uno32\arduino-boo	tloader.X.Uno32_8	-19-11.hex	Brows
· ·						
SOTE: D	lease dick op browse but	top to import SOTP file				Brown
SQTP:	lease click on browse but	ton to import SQTP file				Brows
SQTP:	lease dick on browse but	ton to import SQTP file				Brows Less
SQTP: P	lease dick on browse but	iton to import SQTP file				Brows
SQTP: P	lease dick on browse but	ton to import SQTP file				Brows
SQTP: P put 4-12-12T0	lease dick on browse but	ton to import SQTP file				Brows
SQTP: P put 4-12-12T0	lease dick on browse but	ed loading IPE.				Brows
SQTP: P put 4-12-12TC ding code	lease dick on browse but 09:33:17-0700- Complete 19:33:26-0700- Loading from C: Users	ton to import SQTP file ed loading IPE. hex file. Please wait chipKIT	"\Board Specs\Uno32\ardui	no-bootloader.X.Un	032_8-19-11.	Brows
SQTP: P put 4-12-12T(ding code 4-12-12T(lease dick on browse but 09:33: 17-0700- Complete 09:33:26-0700- Loading I from C: \Users 19:33:26-0700- Hex file I	ton to import SQTP file ed loading IPE. hex file. Please wait \chipKIT oaded successfully.	-\Board Specs\Uno32\ardui	no-bootloader.X.Un	032_8-19-11.	hex
SQTP: P put 4-12-12T(4-12-12T(ding code 4-12-12T(lease dick on browse but 99:33:17-0700- Complete 99:33:26-0700- Loading l from C: \Users 19:33:26-0700- Hex file l	ed loading IPE. hex file. Please wait \chipKII oaded successfully.	"\Board Specs\Uno32\ardui	no-bootloader.X.Un	032_8-19-11.	hex
SQTP: P put 4-12-12T(4-12-12T(ding code 4-12-12T(lease dick on browse but 09:33:17-0700- Complete 09:33:26-0700- Loading l from C: \Users 09:33:26-0700- Hex file l	ton to import SQTP file ed loading IPE. hex file. Please wait \chipKIT oaded successfully.	`\Board Specs\⊔no32\ardui	no-bootloader.X.Un	o32_8-19-11.	hex
SQTP: P put 4-12-12T(4-12-12T(ding code 4-12-12T(lease dick on browse but 09:33:17-0700- Complete 09:33:26-0700- Loading I from C: \Users 19:33:26-0700- Hex file I	ton to import SQTP file ed loading IPE. hex file. Please wait \chipKIT oaded successfully.	T\Board Specs\Uno32\ardui	no-bootloader.X.Un	032_8-19-11.	hex
SQTP: P put 4-12-12T(ding code 4-12-12T(lease dick on browse but 09:33:17-0700- Complete 09:33:26-0700- Loading from C: Users 19:33:26-0700- Hex file I	ton to import SQTP file ed loading IPE. hex file. Please wait \chipKIT oaded successfully.	'\Board Specs\Uno32\ardui	no-bootloader.X.Un	032_8-19-11.	hex
SQTP: P put 4-12-12TC 4-12-12TC ding code 4-12-12TC	lease dick on browse but 09:33:17-0700- Completo 09:33:26-0700- Loading i from C: \Users 19:33:26-0700- Hex file i	ton to import SQTP file ed loading IPE. hex file. Please wait \chipKIT oaded successfully.	"\Board Specs\Uno32\ardui	no-bootloader.X.Un	032_8-19-11.	hex
SQTP: P put 4-12-12TC 4-12-12TC ding code 4-12-12TC	lease dick on browse but 09:33: 17-0700- Complete 09:33:26-0700- Loading i from C: \Users 19:33:26-0700- Hex file i	ton to import SQTP file ed loading IPE. hex file. Please wait \chipKIT oaded successfully.	"\Board Specs\Uno32\ardui	no-bootloader.X.Un	032_8-19-11.	hex

10. Click the Program button.

Select Dev	rice and Tool		Results	
Family:	All Families	v		
Device:	PIC32MX320F128H	Apply	Check Pass Co	sum: FDE251C0
Tool:	PICkit3 S.No : BUR 142554018	Disconne	ect Fail Co	ount: 0000 ount: 1
	Program	Read	Verify	Blank Check
Saureau C				Browse
source: p	C: \Users\c12305\Documents\Work\chipK	IT\Board Specs\Uno32\arduino-bo	otioader.X.Uno32_8-19-11.ne	<u>D</u> rowac
SQTP:	: \Users\c12305\Documents\Work\chipK lease dick on browse button to import S	IT\Board Specs\Uno32\arduino-bo QTP file	ottoader.X.Uno32_8-19-11.ne	Browse
SQTP:	:: \Users\c12305\Documents\Work\chipK lease click on browse button to import S	IT\Board Specs\Uno32\arduino-boo QTP file	ogoader.x.uno32_8-19-11.ne	Browse
SQTP:	::\Users\c12305\Documents\Work\chipK lease click on browse button to import Si	IT\Board Specs\Uno32\arduino-boo	onoader.x.nuo32 ⁸ -13-11.ue	Browse tess
SQTP: P	:: \Users \c12305 \Documents \Work \chipK lease dick on browse button to import S 1455: 45 0 200 Londing have file. Place	UT\Board Specs\Uno32\arduino-boo QTP file	onoader.x.nuo32_8-19-11.ne	Browse Less
SQTP: P SQTP: P utput) 14-12-12T: ading code 014-12-12T:	:: \Users \c12305 \Documents \Work \chipK lease dick on browse button to import S 14:55:45-0700- Loading hex file. Please from C: \Users 14:55:45-0700- Hex file loaded successf	IT\Board Specs\Uno32\arduino-boo QTP file wait \chipKIT\Board Specs\Uno32\ardu ully.	ino-bootloader.X.Uno32_8-19	9-11.hex
SQTP: P sQTP: P utput 014-12-12T: 014-12-12T: 014-12-12T:	:: \Users \c12305 \Documents \Work \chipK lease dick on browse button to import S 14:55:45-0700- Loading hex file. Please from C: \Users 14:55:45-0700- Hex file loaded successf 14:55:55-0700- Programming	IT\Board Specs\Uno32\arduino-boo QTP file wait I\chipKIT\Board Specs\Uno32\ardu ully.	ino-bootloader.X.Uno32_8-19-11.ne	9-11.hex
SQTP: P SQTP: P utput) 014-12-12T: oading code 014-12-12T: 014-12-12T: one following pot config m	:: \Users \c12305 \Documents \Work \chipK lease dick on browse button to import S 14:55:45-0700- Loading hex file. Please from C: \Users 14:55:55-0700- Hex file loaded successf 14:55:55-0700- Programming memory area(s) will be programmed: iemory	IT\Board Specs\Uno32\arduino-boo QTP file wait hchipKIT\Board Specs\Uno32\ardu ully.	ino-bootloader.X.Uno32_8-19	9-11.hex
SQTP: P SQTP: P utput) 014-12-12T: ading code 014-12-12T: 014-12-12T: ne following pot config m infiguration evice Erased	:: \Users \c12305 \Documents \Work \chipK lease dick on browse button to import S lease dick on browse button to import S 14:55:45-0700- Loading hex file. Please from C: \Users 14:55:55-0700- Hex file loaded successf 14:55:55-0700- Programming memory area(s) will be programmed: emory memory d	IT\Board Specs\Uno32\arduino-boo QTP file wait hchipKIT\Board Specs\Uno32\ardu ully.	ino-bootloader.X.Uno32_8-19-11.ne	9-11.hex

That covers it! 🙂

Appendix

For additional notes about how to connect your programmer to your target board, see the following:

Digilent boards:

- Most ICSP footprints look like the example in Step 6.
- For chipKIT Pro (Cerebot) MX4 and MX7, these boards already have a PICkit on-board (PKOB) so you don't need to use the ICSP circuitry.

Fubarino boards:

The Fubarino boards, SD and Mini, have the ICSP pins sectioned off with the silkscreen. Note that they use only the first 5 pins of the ICSP. This is ok; just make sure you line up Pin 1 on the programmer connector to Pin 1 (the pin that is squared off) on the Fubarino. (See below for examples)





How to connect your programmer to your target board (Examples)

One of the easiest ways to connect the PICkit 3 when you don't have "Power to Target" enabled is to use a right angle connector and point the pins upward so that when the PICkit is connected to the board, there is still room to power the board via the USB or Power Jack connector.



In the image below, the PICkit 3 is connected to the target board (chipKIT Uno32) using the Digilent "PICkit 3 Programming Cable Kit." Note that chipKIT Uno32 is also being powered by the red USB cable, which is not necessary if you have enabled "Power to Target" in the Advanced settings in the IPE.



In the image below, the MPLAB REAL ICE is connected to the target board using the RJ-11 cable down to an RJ-11 socket to ICSP adapter (as seen in the image that follows this one).



In the image below, you can see the RJ-11 socket to ICSP adapter. The RJ-11 cable can be coming from either the MPLAB REAL ICE or the MPLAB ICD 3.



In the image below, the MPLAB ICD 3 is connected to the target board using the RJ-11 socket to ICSP adapter (see photo above for a better view of this adapter).

