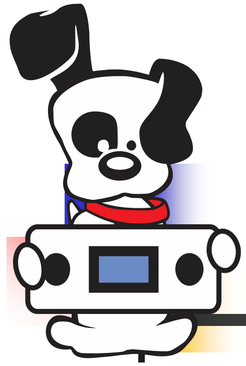
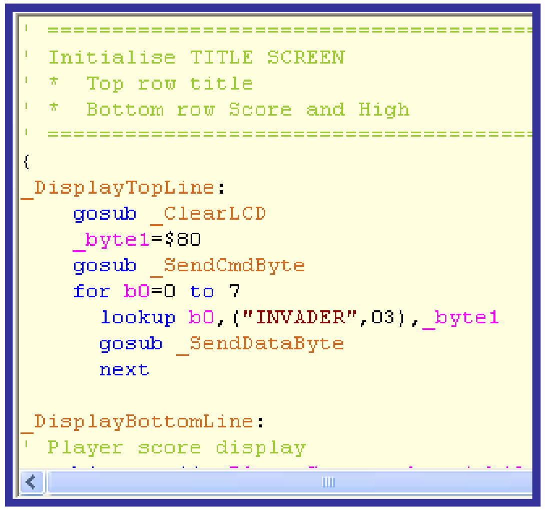


KodeKLIX for SnapCPU

Programming Overview

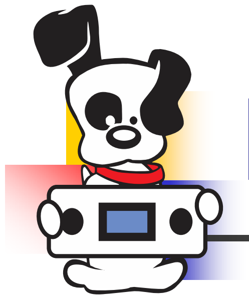
Programming Overview

- Programs (Apps) are created using sequenced instructions specific for the computer hardware (gadget)
- The instructions form the language of the microchip controller
  - PICAXE’s language is BASIC
  - The instructions control inputs and outputs to perform task(s) as designated by the App.



```
' ======================================
' Initialise TITLE SCREEN
' *  Top row title
' *  Bottom row Score and High
' ======================================
{
_DisplayTopLine:
    gosub _ClearLCD
    _byte1=$80
    gosub _SendCmdByte
    for b0=0 to 7
      lookup b0,("INVADER",03),_byte1
      gosub _SendDataByte
      next

_DisplayBottomLine:
' Player score display
```

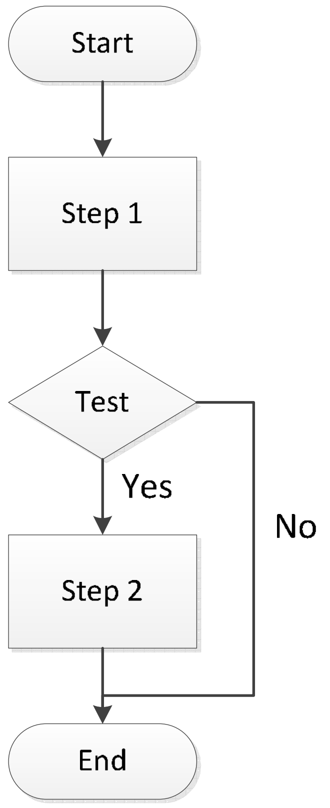


BASIC Language

- BASIC actually stands for:
  - **B**eginners
    All-purpose
    Symbolic
    Instruction
    Code
- It is an easy to understand, and easy to learn, coding language suitable for both beginners and advanced users
- PICAXE BASIC is a compacted version

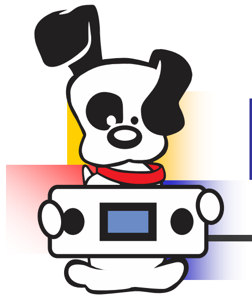
BASIC Language

- BASIC is a written way to describe logic and operations such as those shown in a flow or process chart
- BASIC concepts
  - Variables
  - Statements
  - Conditional statements
  - Loops
- Detail can best be obtained from examples or the PICAXE guides

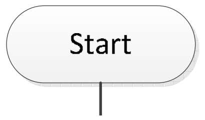


BASIC - Variables

- Variables allow you to store and change information (ie numbers or values)
- Below are examples how to use variables:
  - A = 10 ‘ A is given a value of 10
  - A=A+1 ‘ A now has value of 11
  - LET A=A / 2 ‘ A now 5, LET is optional
  - PICAXE variables are:
    - b0, b1, b2, etc which store values 0 to 255; or
    - w0, etc which store values 0 to 65535
    - w0 consists of b0 and b1



BASIC - SYMBOLs

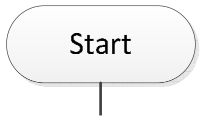


- The SYMBOL statement lets you give sensible human names to variables
- Conventionally, SYMBOLS are placed at the start of your App's code
- For example:
  - SYMBOL A = b0 ‘ from now on use A
  - SYMBOL BYTE = A

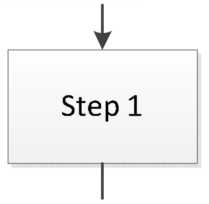
‘ you can have multiple
‘ names for a variable

BASIC - LABELs

- Labels are named locations
- Program flow can branch to locations defined by labels
- Like symbols, all label names begin with a alphabetic character, end with a colon : and usually are placed at the beginning of the coding line, eg:
  - EndGame:
  - EnemyEnd:
  - FireRockets:



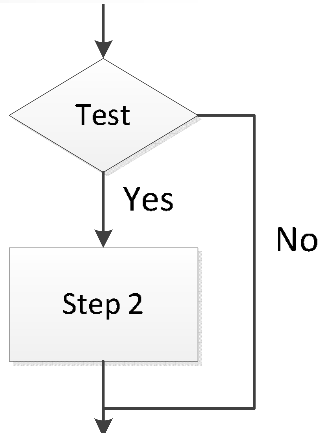
BASIC - Statements



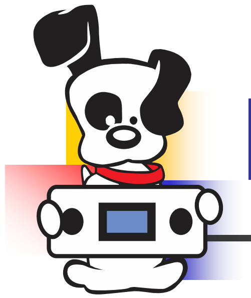
- Statements
  - Include *commands* and *functions*
  - *Commands* tell the PICAXE to do something, sometimes with parameters
  - *Functions* return a response to a variable
- Full listing of *commands* and *functions* is available in the KodeKLIX helper or other PICAXE documentation and guides
- Examples in later sections will show you the most important statements for PUP

BASIC - Conditional Statement

- Conditional statements
  - At various points in your application's code you will find that you need to make decisions about inputs, data and results
  - The basic decision frame work is the IF...THEN...ELSE... structure
  - Alternate, SELECT... CASE... ENDSELECT



```
IF variable ?? value {AND/OR variable ?? value ...} THEN
{code}
ELSEIF variable ?? value {AND/OR variable ?? value ...} THEN
{code}
ELSE
{code}
ENDIF
```



BASIC - Loops

- Infinite loops – repeat forever

```
Label:
(other program lines)
GOTO Label
```

- Counting loops – repeat for a set number

```
FOR variable = start TO end {STEP {-}increment}
(other program lines)
NEXT {variable}
```

- Conditional loops – repeat...until...

```
DO
{code}
LOOP UNTIL/WHILE variable ?? COND
```

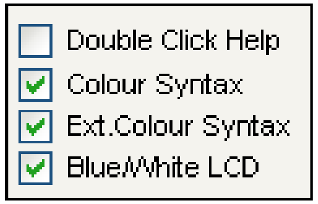
```
DO UNTIL/WHILE variable ?? COND AND/OR variable ?? COND...
{code}
LOOP
```

Programming Input/Output

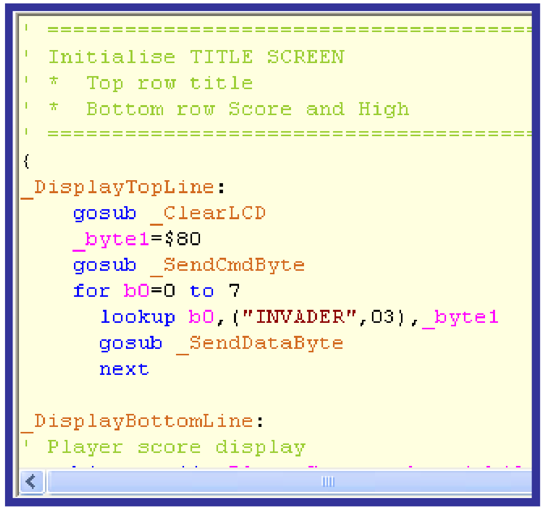
- *Commands / functions* used to control I/O
- Inputs includes:
  - User interface (Buttons, Switches, etc)
  - Electrical signals, such communications from other devices
  - Variables / data
- Outputs include:
  - LEDs, Buzzers, etc
  - High-current devices such as motors **must ONLY be** operated through a transistor

BASIC – Syntax Checking

- Syntax checking (keyword & labels only) can be performed as you enter the code on the keyboard (if selected)
- Different colours are used to identify statements, variables, constants, labels, etc
- Anything not identified defaults to black; check these uncoloured words for typing accuracy



- [ ] Double Click Help
- [x] Colour Syntax
- [x] Ext.Colour Syntax
- [x] Blue/White LCD



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    for b0=0 to 7
      lookup b0,("INVADER",03),_byte1
      gosub _SendDataByte
      next

_DisplayBottomLine:
' Player score display
```

Programming Structure

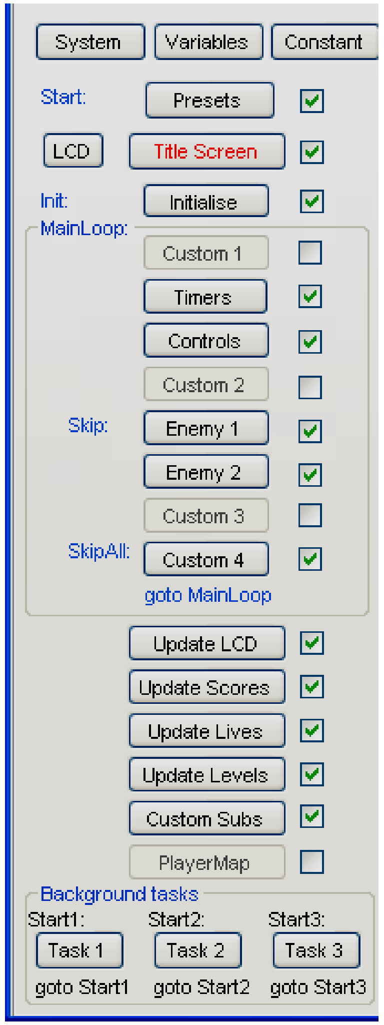
- To simplify programming, KodeKLIX imposes a structure which is helpful to beginners, but still flexible for experienced users
- Programs, just like stories, have:
  - *Beginning* to initialise conditions during start-up for the desired outcome;
  - *Middle* where conditions are monitored and responded to;
  - *End* to gracefully finish...

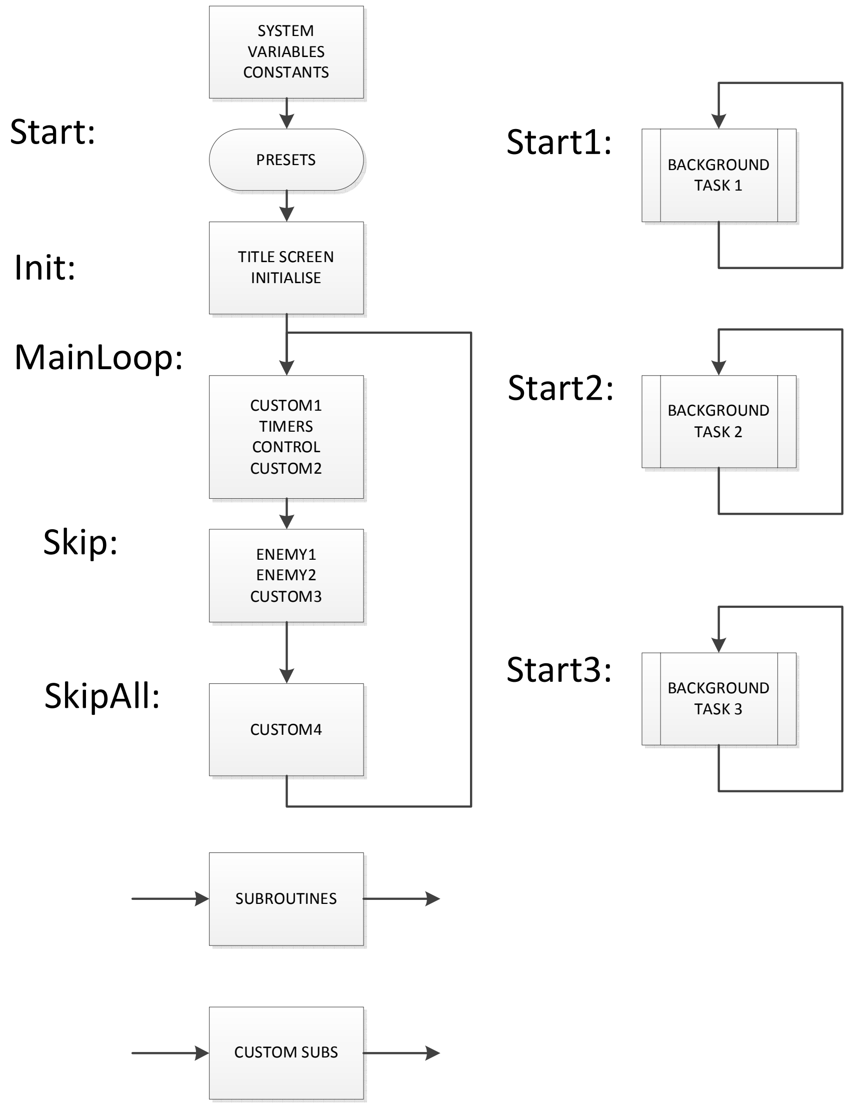
KodeKLIX Default Structure

Setup Code (runs firsts)

Mainloop Code (repeats)

Subroutine Code (called)





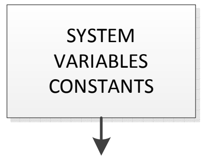
KodeKLIX – SnapCPU API #1

- API = Application Programming Interface
- An API is a structure which predefines some common labels, functions and routines to help quick start your coding experience
- The SnapCPU API includes:
  - Pre-defined input and output names
  - Predefined program structure
  - Example code for common needs

KodeKLIX – SnapCPU API #2

- SYMBOLs and labels used by the API are identified by an underscore in front of the name, eg _MainLoop, _SkipAll
- Background tasks have predefined branch back coded in to the routines
- #macro system allows for customisation of the API and simplifies coding syntax for common functions, eg
  - #print, #vprint, #cgXram
  - Hand coding may be more efficient...

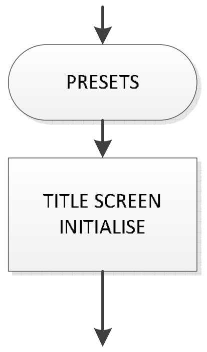
KodeKLIX – Setup and Start



- Setup section of the code consists of three groupings
  - “System” definitions are provided by KodeKLIX to name resources of the chosen gadget, eg the PUP. They are read-only.
  - “Variables” definitions are editable, though there are several snippet options, eg SYMBOL port=b0
  - “Contants” definitions are similar to the Variables except they apply to numeric constants only, eg SYMBOL A=0

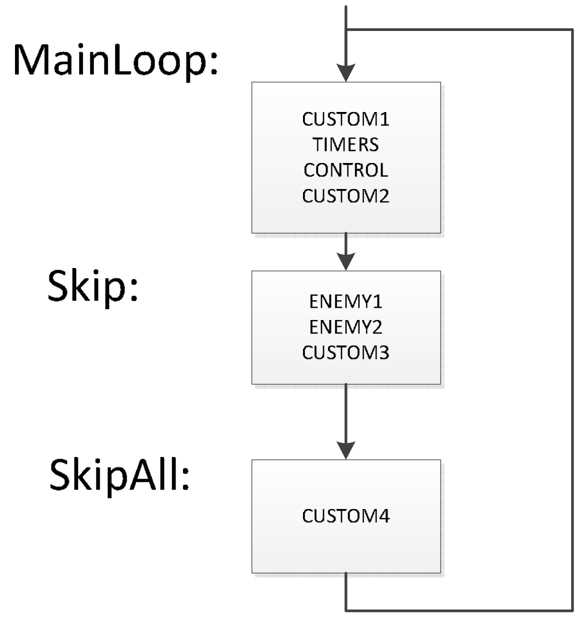
KodeKLIX – Presets & Initialise

- Start0 is the start of “runnable” application code
  - “Presets” routine allows code which runs once (at _PowerOnReset) or may run multiple times, _WarmReset
- TitleScreen is not used for SnapCPU...
- _Init is the start of application code run after the TitleScreen
  - This is where a new application code is setup for the first time...



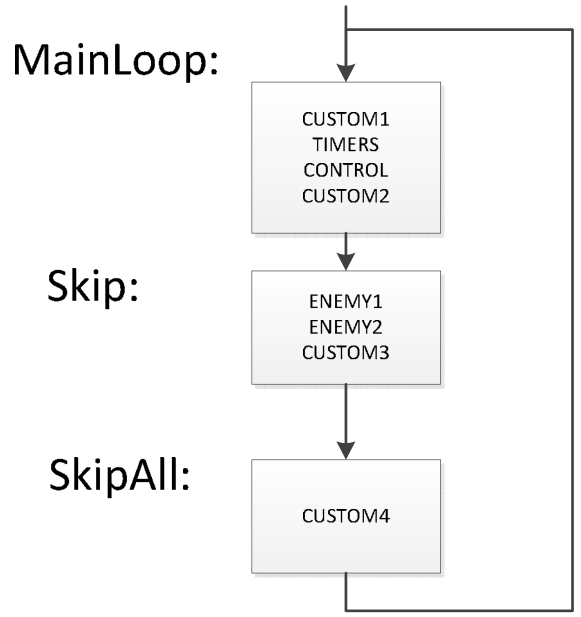
KodeKLIX – the Mainloop

- _Mainloop is the work engine of the program. This loop continues until:
  - Power is switched off
  - Your code ends
- Within the _Mainloop are:
  - Timed events
  - Checking for user model inputs
  - Custom routines
  - Note: some routines are disabled



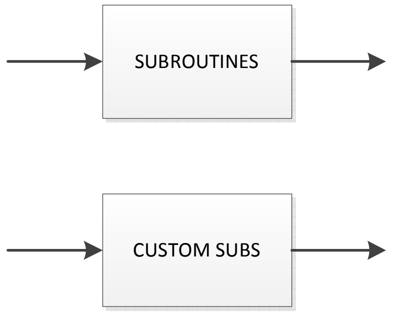
KodeKLIX – *Skip* Ahead Labels

- Default App. structure allows for sequenced instructions and exclusions
- _Skip and _SkipAll labels are predefined
- Users can define their own labels, but these may not be interchangeable with another users code
- After the Custom4 coding routine GOTO _MainLoop occurs forming an endless loop



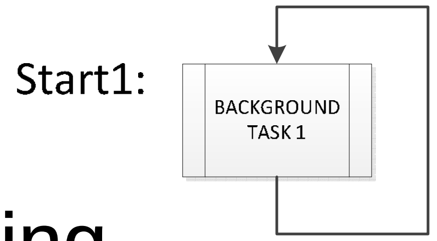
KodeKLIX – Subroutines

- Subroutines are code modules which can be called from different parts of the main program stream
  - Usually started with *GOSUB,* end with a *RETURN*
  - Some KodeKLIX subroutines can also end with a *GOTO* (or branch back)



KodeKLIX – Background Tasks

- PICAXE M2 chips are capable of running multiple tasks, the standard API is sharing time between four *programs*
  - Start0 is the main routine
  - Start1 is configured for Snap01
  - Start2 is configured for Snap02
  - Start3 is configured for Snap04
- Note: background should not stall the other routines with uninterruptable coding


Start1:
BACKGROUND TASK 1