RetroScript Handbook v4

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Table of Contents

Introduction to RSDK and RetroScript

About RSDK

The Retro Engine Software Development Kit (Retro-Engine or RSDK) is a primarily 2D game engine with many "old school" graphics effects, including functionality akin to "Mode 7" on an SNES and palette-based graphics. RSDKv3 (previously thought to be RSDKv2 [1]), the 3rd version, was only used in the Sonic CD (2011) remaster (with a slight update for the mobile port of which will be addressed later) and was then upgraded to RSDKv4 (previously thought to be RSDKvB[1]) for the Sonic 1 and 2 mobile remasters (and likely the Sonic 3 proof-of-concept), using an updated version of RetroScript with more built-ins. Mania uses RSDKv5, the latest officially used version of RSDK, which uses a transpilable version of RetroScript[2]. Versioning for RSDK has followed the editor's version since v3[3]. RetroScript remains officially unnamed, though it was previously confused with TaxReciept[1].

[1] Christian Whitehead's reply to RDC's tweet: https://twitter.com/CFWhitehead/status/1341701486657433601

[2] CW has stated that v5 scripts get transpiled into C for use in the Game.dll file.

[3] When asked why Nexus and CD was named v3, CW stated that as of v3, the engine versions began to match the editor's.

About RetroScript

RetroScript's syntax is like that of Visual Basic. It does not use semicolons or braces and instead uses line breaks to mark expression endings. Because of it being a scripting language, it offers many benefits compared to a typical language such like C:

- Scripts are recompiled when a stage is loaded/restarted
    - Changes are incredibly easy to make and test almost instantly
- Specifically designed to create object code, making it easy to create objects

However, because of this, there are also many drawbacks which add a challenge to more experienced programmers:

- Custom variables cannot be defined. One must use the temporary built-in variables (discussed later in the handbook.)
- There are no data types other than integers. No decimal places (floats) or strings can be stored, except for passing some string constants to some built-in functions.
- User-defined functions cannot be passed any parameters. All variables are however kept the same, so it is possible to use the built-in variables as a "passing" method.
- You cannot have multiple expressions on one line. For example, `A = B + C` is invalid, but `A = B` then `A += C` is valid (discussed more in the next page).

Arithmetic

Mathematics

As previously mentioned, you cannot have more than 1 arithmetic expression in one line and they all must be done one by one. There can only ever be 1 variable on the right and another on the left. Because of this, the list of mathematical arithmetic operators is limited to the following assignment operators:

- `=` - regular assignment
- 4-function
  - `+=`
  - `-=`
  - `*=`
  - `/=` - division rounds *down* (flooring)
  - `%=` - modulo (used for remainder of division)
- Bit math
  - `<<=` - shift left
  - `>>=` - shift right
  - `&=` - AND
  - `|=` - OR
  - `^=` - XOR
- Unary
  - `++` - used as `Variable++`, equivalent to `Variable += 1`
  - `--` - used as `Variable--`, equivalent to `Variable -= 1`

Examples

Pseudo-code	RetroScript (with custom variables)

`i = 0;`
`j = 15;`
`i++;  //i is 1`
`i = j + 2; //i is 17`
	`i = 0`
	`j = 15`
	`i++  //i is 1`
	`i = j  //i is 15`
	`i += 2 //i is 17`

`x = 19;`
`y = 3;`
`d = 5;`
`x -= --d;  //x subtracted by 4`
`y -= d--;  //y subtracted by 4`
`//d is already 3`
	`x = 19`
	`y = 3`
	`d = 5`
	`d--`
	`x -= d //x subtracted by 4`
	`y -= d //y subtracted by 4`
	`d--  //d is now 3`

`i = 2;`
`i = i + 0.5; //i is 2.5`
	`i = 2`
	`i += 0.5 //oops! compiler error!`
	`//if decimals were allowed,`
	`//i would be 2.5`

Conditionals and Statements

Boolean Logic

Boolean operation is also possible but can only be used in control statements, and thus why they are in this section. There is no such boolean "or" or boolean "and" operator (`||` and && respectively). The list of operators are as follows:

- `==` - equal to (not `=` on its own)
- `>`
- `>=`
- `<`
- `<=`
- `!=`

There are, however, some functions that you can use to assign variables boolean expressions:

- `CheckEqual(A, B)`
- `CheckLower(A, B)`
- `CheckGreater(A, B)`
- `CheckNotEquals(A, B)`

All these set `CheckResult` to either 0 or 1 based on the result of the function, which can later be checked and ORed/ANDed with.

Control Statements

Since RetroScript does not use braces, there are specific keyword pairs that get used, along with small specifics for each:

- If statements:
  - `if [statement]` - `[statement]` is a single boolean expression as shown above
  - `else`
  - `endif` - use as the "ending brace"
  - **There is no such thing as a direct else-if in RetroScript.** To achieve an else-if, one must make a new if statement on a new line and close it properly.
- While statements:
  - `while [statement]` - `[statement]` is a single boolean expression as shown above
  - `loop` - use as the "ending brace"
- Switch statements:
  - `switch [variable]` - `[variable]` is the variable to check for
  - `case [int/alias]` - `[int/alias]` is an integer or alias to check if the variable is equal to
  - `endswitch` - use as the "ending brace"
  - Switches behave similarly as they do in C: `default` is optional and `break` is used in cases to stop fallthrough.
- Foreach statements:
  - `foreach (TypeName[objectName], store, type)`
    - iterates every object of type `TypeName[objectName]` and sets `store` to the object's slotID.
    - `type` is either `ALL_ENTITIES` or `ACTIVE_ENTITIES`
  - `next` - use as the "ending brace"

Examples

Pseudo-code	RetroScript (with custom variables)

`if (i == 0) {`
`    x++;`
`    y++;`
`} else if (i == 1) {`
`    x--;`
`}`
	`if i == 0`
	`    x++`
	`    y++`
	`else`
	`    if i == 1`
	`        x--`
	`    endif`
	`endif`

`while (x < 10) {`
`    x++;`
`    if (y == 5) break;`
`}`
	`while x < 10`
	`    x++`
	`    if y == 5`
	`        break`
	`    endif`
	`loop`

`switch (x) {`
`    case 1:`
`    case 2:`
`        y++;`
`    case 3:`
`        x++;`
`        break;`
`    default:`
`        z++;`
`        break;`
`}`
	`switch x`
	`case 1`
	`case 2`
	`    y++`
	`case 3`
	`    x++`
	`    break`
	`default`
	`    z++`
	`    break`
	`endswitch`

Pseudo-code	RetroScript (with custom variables)

`foreach (ArrayPos2 in TypeName[Ring]) {`
`  Object[ArrayPos2].Value0 = 1;`
`}`
	`foreach TypeName[Ring], ArrayPos2`
	`  Object[ArrayPos2].Value0 = 1`
	`floop`

`foreach (ArrayPos2 in TypeGroup[256]) {`
`  Object[ArrayPos2].XPos = Object.XPos;`
`  Object[ArrayPos2].YPos = Object.YPos;`
`}`
	`foreach TypeGroup[256], ArrayPos2`
	`  Object[ArrayPos2].XPos = Object.XPos`
	`  Object[ArrayPos2].YPos = Object.YPos`
	`floop`

Events and Functions

Events

Events are easily thought of as "default functions," and are all called periodically during gameplay. To define events, you use `event [name]` as the start and `end event` as the "closing brace". The definable events are as follows:

Sub	Description
`ObjectMain`	Called once every frame per object if priority allows for it [see priority notes]
`ObjectDraw`	Called once every frame per object if priority allows for it [see priority notes]. The ordering is based the value of `Object.DrawOrder`
`ObjectStartup`	Called once per object type and once when the stage loads. Used for loading assets and spriteFrames
`RSDKDraw`	similar to `ObjectDraw`, though only called by the editor (RetroED v2), called once a frame for each object
`RSDKLoad`	similar to `ObjectStartup`, though only called by the editor (RetroED v2), used to load any assets/sprite frames needed in `RSDKDraw`

Functions

Users can define functions by using `function [name]` to start a function and `end function` as the "closing brace." Functions can be forward declared using the preprocessor directive `reserve function [name]`. To call functions, you use the built in function `CallFunction(function)`, which means functions cannot have built in parameters, but there are ways to get around it in the example below. `return` can be used to preemptively end a function.

Examples

Pseudo-code

```
MyFunc(y);

ObjectMain() {
    x += 5; //x is 5
    MyFunc(x) //pass x (not it's value)
    //x is 7
}

MyFunc(y) {
    y += 2; //increment x
    return;
    y += 5; //this line doesn't hit
}
```

RetroScript (with custom variables)

```
reserve function MyFunc

event ObjectMain
    x += 5
    y = x
    CallFunction(MyFunc)
end event

function MyFunc
    y += 2
    return
    y += 5 //this line doesn't hit
end function
```

Preprocessor Directives

RetroScript v4 has 1 preprocessor directive that is available to use. this preprocessor directives are as follows:

Directive	Description
`#platform: [type]` `#endplatform`	Skips over lines of code if `type` does not match with what the bytecode is being compiled for. `type` can be: • `STANDARD` or `MOBILE` • `SW_RENDERING` or `HW_RENDERING` • `USE_F_FEEDBACK` or `NO_F_FEEDBACK`

Variables

RetroScript v4 has 3 formats for extra variables that are available to use. These use the keywords `public` and `private`. `public` means this variable can be accessed by any script compiled after the current one, while `private` means the variable can only be accessed by the script it was created in. the formats for the variables are as follows:

Directive	Description
`[public]/[private] alias [val] : [name]`	Creates a new alias that gets replaced by `val` on compile time. example: private alias 1 : myAlias
`[public]/[private] value [name] = [val];`	Creates a new static variable with the value of `val`. example: public value myValue = 0; static variables are not tied to an object and thus should not be used when a value is needed for every instance of an object. they are regular values that can be accessed the same as any other built-in one
`[public]/[private] table [name] [values] end table`	Creates a new table, fills the table with any values it reads until it hits the `end table` keyword. Values should be separated by `,` character, unless there is a newline, then there should not be a `,` separator. example: public table colourTable 0x600020, 0xC00040, 0xE04080 0x802040, 0xE04060, 0xE060A0 0xA04060, 0xE06080, 0xE080C0

end table

tables are closer to functions than variables, as values from them are accessed via `GetTableValue(store, index, table)` and can be set via `SetTableValue(value, index, table)` like functions their ids can be assigned to other variables for “pointer-like” functionality
example:

```
GetTableValue(temp0, temp1, myTable)
temp0 += 0x10
SetTableValue(temp0, temp1, myTable)
```

example 2:

```
switch (temp1)
case 0
    temp0 = myTable1
    break
case 1
    temp0 = myTable2
    break
end switch
GetTableValue(temp2, 2, temp0)
```

Built-ins

Audio

Function/Variable/Alias	Description
`music.volume`	Current master volume for music
`music.currentTrack`	Currently playing music track ID
`music.position`	Position of currently playing music
`engine.bgmVolume`	Sound FX Volume (ranges from 0-100)
`engine.sfxVolume`	BGM volume (ranges from 0-100), combined with `Music.Volume` to get the final output volume
`SetMusicTrack(string filePath, int trackID, int loopPoint)`	Loads the music file (has to be ogg format) from `Data/Music/[filePath]` into the `trackList` slot `trackID`, with a loop point of `loopPoint` (0 = no loop, 1 = loop from start, anything else is the sample to loop from)
`PlayMusic(int trackID)`	Plays the music track loaded into the slot `trackID`
`StopMusic()`	Stops the currently playing music track

`PauseMusic()`	Pauses the currently playing music track
`ResumeMusic()`	Resumes the music track that was paused using `PauseMusic()`
`SwapMusicTrack(string filePath, int trackID, int loopPoint, int ratio)`	Works similar to `SetMusicTrack()` & `PlayMusic()` but starts at a position based on `ratio`. `ratio` is using an 8000-based value, so 8000 = 1.0 music speed, 4000 = 0.5, etc. Used more commonly with speed shoes.
`SfxName[name]`	Use this to get the ID of an SFX based on it's name. (e.x Jump.wav has an `sfxID` of 0, so using `SfxName[Jump]` would be the same as using 0
`PlaySfx(int sfx, int loopCnt)`	Plays the sfx with index of `sfx` in gameconfig + stageconfig `loopCnt` times (recommended to use `SfxName[]`)
`StopSfx(int sfx)`	Stops the sfx with index of `sfx` in gameconfig + stageconfig (recommended to use `SfxName[]`)
`SetSfxAttributes(int sfx, int loopCnt, int pan)`	Sets the amount of times for `sfx` to loop to `loopCnt` (-1 to leave it unchanged) and the panning of `sfx` to `pan` (-100 to 100 for left to right, with 0 being balanced)

Drawing

Function/Variable/Alias	Description
`LoadSpriteSheet(string path)`	Loads a spritesheet from `Data/Sprites/[path]` and sets `Object.SpriteSheet` to the sheet's ID
`RemoveSpriteSheet(string path)`	Removes a sheet that matches `path` if it exists
`SpriteFrame(int pivotX, int pivot, int width, int height, int sprX, int sprY)`	Creates a spriteframe with the specified values
`EditSpriteFrame(int frame, int pivotX, int pivot, int width, int height, int sprX, int sprY)`	Sets spriteframe `frame` to the new values
`DrawSprite(int frame)`	Draws sprite `frame` at the object's X and Y position
`DrawSpriteXY(int frame, int XPos, int YPos)`	Draws sprite `frame` to the specified X and Y position If using `DrawSpriteScreen`XY, the position is in screen-space (`0, 0` is top left, `0, 1` is 1 px to the right, etc), otherwise the position is in world-space (`0, 0` is top left, but `0, 0x10000` is 1px to the right)

`DrawSpriteScreenXY(int frame, int XPos, int YPos)`	

`FX_SCALE`
`FX_ROTATE`
`FX_ROTOZOOM`
`FX_INK`
`FX_FLIP`
	IDs to be used for `DrawSpriteFX` and `DrawSpriteScreenFX` below.
	For `FX_INK`, see the IDs near

`DrawSpriteFX(int frame, int fx, int XPos, int YPos)`
 	
`DrawSpriteScreenFX(int frame, int fx, int XPos, int YPos)`
	Draws sprite `frame` to the specified X and Y position using the specified FX mode
	If using `DrawSpriteScreenFX`, the position is in screen-space (`0, 0` is top left, `0, 1` is 1 px to the right, etc), otherwise the position is in world-space (`0, 0` is top left, but `0, 0x10000` is 1px to the right)

`DrawTintRect(int XPos, int YPos, int width, int height)`	Draws a tint rect with a size of `width`, `height` at `XPos` & `YPos` relative to screen-space
`DrawNumbers(int startingFrame, int XPos, int YPos, int value, int digitCnt, int spacing, int showAllDigits)`	Draws values using startingFrame as the starting point at `XPos` & `YPos` (screen-space), with spacing pixels between each frame. Will only draw valid digits (or `digitCnt` digits if number is exceeded) if `showAllDigits` is 0, otherwise `digitCnt` digits will be drawn, with extras being 0

`DrawActName(int startingFrame, int XPos, int YPos, int align, int unknown, int unknown2, int spacing)`	Draws the loaded stage's act name using 26 frames starting from startingFrame (only uppercase english letters are supported), at `XPos` & `YPos` (screen-space), using alignment to determine where the text center is (0 = left, 1 = middle, 2 = right), with spacing pixels between each letter
`DrawRect(int XPos, int YPos, int width, int height, int R, int G, int B, int A)`	Draws a rect with a size of `width`, `height` at `XPos` & `YPos` (screen-space), with a colour of R, G, B and with an alpha of A
`LoadAnimation(string filePath)`	Loads an animation from `Data/Animations/[filePath]` for the object to use
`DrawObjectAnimation()`	Draws the object at its X and Y position, based on the loaded animation and `Object.Frame`/`Object.Animation`
`ClearDrawList(int layer)`	Removes all entries in `drawList layer`
`AddDrawListEntityRef(int layer, int objectPos)`	Adds `objectPos` to the `drawList layer`
`GetDrawListEntityRef(var store, int layer, int objectPos)`	Gets the value in `drawList layer` at `objectPos` and stores it in `store`
`SetDrawListEntityRef(int value, int layer, int objectPos)`	Sets the value in `drawList layer` at `objectPos` to the value of `value`

Palettes

Function/Variable/Alias	Description
`LoadPalette(string filePath, int palID, int startPalIndex, int startIndex, int endIndex)`	Loads a palette from `Data/Palettes/[filePath]` into `palID` starting from `startPalIndex`, with a file offset of `startIndex` and reading all colors through to `endIndex`
`RotatePalette(int palID, int startIndex, int endIndex, int right)`	Rotates all colours in `palID` starting from `startIndex` through to `endIndex` left one index if `right` is 0, else rotates one right
`SetScreenFade(int r, int g, int b, in a)`	Sets the fade out effect based on `r`, `g`, `b` and `a`
`SetActivePalette(int palID, int startLine, int endLine)`	Sets the active palette to `palID` for all lines from `startLine` through to `endLine`
`SetPaletteEntry(int palID, int index, int colour)`	Sets the palette entry in `palID` at `index` to the value of `colour`

`GetPaletteEntry(int palID, int index, int store)`	Gets the palette entry from `palID` at `index` and stores it in `store`
`SetPaletteFade(int dstPal, int srcPalA, int srcPalB, int blendAmount, int startIndex, int endIndex)`	Blends `srcPalA` with `srcPalB` by `blendAmount` amount, starting at palette index `startIndex` and continuing through to `endIndex` and stores the resulting colours in `dstPal`
`CopyPalette(int srcPal, int srcPalStart, int dstPal, int dstPalStart, int count)`	Copies `count` colours from `srcPal`, starting at `srcPalStart`, to `dstPal`, starting at `dstPalStart`
`ClearScreen(int clrIndex)`	Clears all pixels on screen with the colour from `clrIndex` in the active palette

Object

A NOTE ABOUT `index`: appending a + or - to an array value or a constant will offset it + or - from that value or constant from the object's object position. `[index]` is also optional, and not including it will reference the current object.

Function/Variable/Alias	Description

`temp0`
`temp1`
`temp2`
`...`
`temp7`
	Temporary values used to store values during arithmetic or other similar operations

`arrayPos0`
`arrayPos1`
`...`
`arrayPos5`
`arrayPos6`
`arrayPos7`
	Variables used for storing indexes to be used with arrays.

`tempObjectPos`	Set when `CreateTempObject()` is called, can only be used as an `arrayPos`
`CreateTempObject(int type, int propertyValue, int XPos, int YPos)`	Creates a temporary object specified by `type`, `propertyValue`, `XPos` and `YPos` near the end of the object list and sets `TempObjectPos` to the created object's `slotID`. This should only be used for misc objects like FX and objects that are destroyed quickly

`ResetObjectEntity(int slot, int type, int propertyValue, int XPos, int YPos)`	Resets the object at `slot` to the type and position specified by `type`, `propertyValue`, `XPos` and `YPos`
`checkResult`	A value that some functions set as the resulting value. Can be used with all sorts of arithmetic

`object[index].value0`
`object[index].value1`
`object[index].value2`
`...`
`object[index].value47`
	Integer values used for long-term storage. What they are used for varies on an object-by-object basis.

`object[index].entityPos`	The object's slot in the object list
`object[index].groupID`	The object's typeGroup. By default, it matches its type, but can be set to another one (0x100, 0x101 & 0x102 are never assigned by default so they're good for using for custom groups)
`object[index].type`	The object's type
`object[index].propertyValue`	The object's propertyValue (subtype)
`object[index].xpos` `object[index].ypos`	The object's position in world-space (`0x10000 (65536) == 1.0`)

`object[index].ixpos` `object[index].iypos`	The object's position in screen-space, truncated down from `XPos` (1 == 1)
`object[index].xvel` `object[index].yvel`	The object's speed on the X & Y axis (world-space)
`object[index].speed`	The object's general speed (world-space)
`object[index].state`	The object's state. Can be used any way the objects needs
`object[index].rotation`	The object's rotation, generally used with `DrawSpriteFX` and `FX_ROTATE` or `FX_ROTOZOOM` (ranges from 0-511)
`object[index].scale`	The object's scale, generally used with generally used with `DrawSpriteFX` and `FX_ROTATE` or `FX_ROTOZOOM` Uses a 9-bit bitshifted value, so `0x200 (512) == 1.0`

`PRIORITY_ACTIVE_BOUNDS`
`PRIORITY_ACTIVE`
`PRIORITY_ACTIVE_PAUSED`
`PRIORITY_XBOUNDS`
`PRIORITY_XBOUNDS_DESTROY`
`PRIORITY_INACTIVE`
`PRIORITY_BOUNDS_SMALL`
`PRIORITY_UNKNOWN`
	IDs for Object.Priority.
	`PRIORITY_ACTIVE_BOUNDS`: object will update as long as it's within 0x80 pixels of the screen border left/right and 0x100 pixels up/down
	`PRIORITY_ACTIVE`: object will always update, unless paused (or frozen)
	`PRIORITY_ACTIVE_PAUSED`: object will always update, even if paused (or frozen)
	`PRIORITY_XBOUNDS`: same as PRIORITY_ACTIVE_BOUNDS however there's no Y check so as long as it's within XBounds it'll update

	PRIORITY_XBOUNDS_DESTROY: same as PRIORITY_ACTIVE_XBOUNDS, except if the check fails the object's type will be set to blank object PRIORITY_INACTIVE: never updates or draws PRIORITY_BOUNDS_SMALL: object will update as long as it's within 0x20 pixels of the screen border left/right and 0x80 pixels up/down PRIORITY_UNKNOWN: object will always update, unless paused (or frozen), not entirely sure the difference between this and PRIORITY_ACTIVE
object[index].priority	The object's priority value, determines how the engine handles object activity, by default it's set to PRIORITY_ACTIVE_BOUNDS
object[index].drawOrder	The object's drawing layer: is 3 by default. Manages what drawList the object is placed in after ObjectMain
FLIP_NONE FLIP_X FLIP_Y FLIP_XY	IDs for Object.Direction.
object[index].direction	determines the flip of the sprites when drawing
INK_NONE INK_BLEND INK_ALPHA INK_ADD INK_SUB	IDs for Object.inkEffect

`object[index].inkEffect`	Determines the blending mode used with `DrawSpriteFX` & `FX_INK`
`object[index].alpha`	The object's transparency from 0 to 255.
`object[index].frame`	The object's frame ID
`object[index].animation`	The object's animation ID
`object[index].prevAnimation`	The last animation the object was processing during `ProcessAnimation()`
`object[index].animationSpeed`	The object's animation processing speed
`object[index].animationTimer`	The timer used to process the animations
`object[index].LookPosX` `object[index].LookPosY`	The camera offset from the player's position.
`object[index].outOfBounds`	Read-only value that is true if the object is out of the camera bounds
`object[index].spriteSheet`	The spritesheetID of the active object
`ProcessObjectControl()`	Handles control inputs
`ProcessObjectMovement()`	Handles all of object tile collisions (used almost only for player)

`C_TOUCH`
`C_BOX`
`C_BOX2`
`C_PLATFORM`
	IDs for collision type below

`BoxCollisionTest(int type, int thisObject, int thisLeft, int thisTop, int thisRight, int thisBottom, int otherObject, int otherLeft, int otherTop, int otherRight, int otherBottom)`	Checks for a collision between `thisObject` and `otherObject` using the hitbox values passed. Values can be set to 0x10000 and they will instead be loaded from the object's active hitbox. Sets `CheckResult` to 0 if there wasn't a collision, otherwise it's set to 1 (floor), 2 (LWall), 3 (RWall) or 4 (Roof)

`CSIDE_FLOOR`
`CSIDE_LWALL`
`CSIDE_RWALL`
`CSIDE_ROOF`
	IDs for cSide for the functions below

`ObjectTileCollision(int cSide, int xOffset, int yOffset, int cPlane)`	Tries to collide with the FG layer based on the position of `iXPos` + `xOffset`, `iYPos` + `yOffset`. Sets `CheckResult` to true if there was a collision, false if there wasn't. This function is best used to check if a tile is there, not to move along it

`ObjectTileGrip(int cSide, int xOffset, int yOffset, int cPlane)`	Tries to collide with the FG layer based on the position of `iXPos` + `xOffset`, `iYPos` + `yOffset`. Sets `CheckResult` to true if there was a collision, false if there wasn't. This function is better used to handle moving along surfaces
`object[index].angle`	Object's tile angle. Usually set via `ProcessObjectMovement()`
`object[index].collisionPlane`	Object collision plane (only 0 or 1)

`CMODE_FLOOR`
`CMODE_LWALL`
`CMODE_ROOF`
`CMODE_RWALL`
	IDs for CollisionMode, not to be confused with `CSIDE`

`object[index].collisionMode`	Object's active collision mode
`object[index].controlMode`	Object control mode (0 for normal)
`object[index].controlLock`	Object control lock timer
`object[index].pushing`	Object pushing flag usually set via collision functions
`object[index].visible`	Determines of the object is visible or not
`object[index].tileCollisions`	Determines if the object will interact with tiles or not

`object[index].interactions`	Determines if the object will interact with other objects or not
`object[index].gravity`	The object's gravity state. True if gravity is being applied (falling)

`object[index].up`
`object[index].down`
`object[index].left`
`object[index].right`
`object[index].jumpPress`
`object[index].jumpHold`
	Object input buffer values, generally set via `ProcessPlayerControl()`

`object[index].scrollTracking`	Determines if the camera will track the object's position or just follow it

`object[index].floorSensorL`
`object[index].floorSensorC`
`object[index].floorSensorR`
`object[index].floorSensorLC`
`object[index].floorSensorRC`
	Collision sensor result values when on floor.
	True if there was no collision, false if there was

`object[index].collisionLeft`
`object[index].collisionTop`
`object[index].collisionRight`
`object[index].`
`collisionBottom`
	The object's active hitbox values based on the loaded animation and `Object.Animation`/`Object.Frame` values

`GetObjectValue(int store, int index, int objectPos)`	Gets `Object[objectPos].Value[index]` and stores it in `store`
`SetObjectValue(int value, int index, int objectPos)`	Sets `Object[objectPos].Value[index]` to the value of `value`

`CopyObject(int destSlot, int srcSlot, bool retrieve)`	Copies an object to/from the “storage” list, this list persists even between scenes. Copying *to* the storage list example: CopyObject(0, 0, false) This copies the object in entity slot `0` to storage slot `0` Copying *from* the storage list example: CopyObject(0, 0, true) This copies the object stored in storage slot `0` back to entity slot `0`

Stages

Function/Variable/Alias	Description
`LoadStage()`	Loads a stage based on `stage.ListPos` & `stage.ActiveList`
`stage.listPos`	The stage index in the active stage list
`stage.activeList`	The active stage list to load stages from
`stage.listSize[index]`	The amount of stages that are in stage list `index`

`PRESENTATION_STAGE`
`REGULAR_STAGE`
`BONUS_STAGE`
`SPECIAL_STAGE`
	IDs for the 4 stage lists that can be used to store stages in RSDKv4

`stage.minutes`
`stage.seconds`
`stage.milliSeconds`
	The timer values for the current stage.
	These are automatically set for you as long as `stage.TimeEnabled` is true

`stage.timeEnabled`	Determines of the timer should increase or not
`stage.pauseEnabled`	Determines whether or not the player is allowed to pause the game
`stage.actNum`	The stage's current act ID

`stage.curXBoundary1`
`stage.curXBoundary2`
`stage.curYBoundary1`
`stage.curYBoundary2`
	The stage's main camera boundaries, the camera will not go beyond these

`stage.newXBoundary1`
`stage.newXBoundary2`
`stage.newYBoundary1`
`stage.newYBoundary2`
	The stage's other camera boundaries, the camera will not go beyond these, however these are used when setting new camera boundaries

`stage.deformationData0[index]`
`stage.deformationData1[index]`
`stage.deformationData2[index]`
`stage.deformationData3[index]`
	The layer deformation data arrays.
	0 & 1 are used for the FG Layer (0 being for above water, 1 being for below water), while 2 & 3 are used for BG Layers (2 being for above water, 3 being for below water)

`SetLayerDeformation(int deformID, int deformA, int deformB, int type, int offset, int count)`	Sets the deformation of the deformation data array of `deformID` based on the deform values
`stage.activeLayer[index]`	Drawable layer IDs, with index 0 being the lowest and index 3 being the highest. Any layers that are not set with this array or are set to 9 will not be drawn.
`stage.midpoint`	Any active layers above this value will draw only tiles on the high Visual Plane, otherwise they will only draw tiles on the low Visual Plane
`stage.waterLevel`	The height of the water relative to 0 in the stage layout

`STAGE_RUNNING = 1` `STAGE_PAUSED = 2`	Stage state IDs
`stage.state`	The stage's current activity state
`stage.playerListPos`	The current player ID, based on the gameconfig's player list
`stage.debugMode`	Determines if debugMode is active or not
`stage.entityPos`	The current slotID of the object being run
`GetTileLayerEntry(var store, int layer, int chunkX, int chunkY)`	Gets the chunkID of the chunk at `chunkX`, `chunkY` on tileLayer `layer` and stores it in `store`
`SetTileLayerEntry(int value, int layer, int chunkX, int chunkY)`	Sets the chunkID of the chunk at `chunkX`, `chunkY` on tileLayer `layer` and sets the index to `value`

`TILEINFO_INDEX`
`TILEINFO_DIRECTION`
`TILEINFO_VISUALPLANE`
`TILEINFO_SOLIDITYA`
`TILEINFO_SOLIDITYB`
`TILEINFO_FLAGSA`
`TILEINFO_ANGLEA`
`TILEINFO_FLAGSB`
`TILEINFO_ANGLEB`
	IDs for infoType for `Get/Set16x16TileInfo`
	
	`TILEINFO_FLAGSB` & `TILEINFO_ANGLEB` can only be used with `Get16x16TileInfo()` as they are read-only

`Get16x16TileInfo(int store, int tileX, int tileY, int infoType)`	Gets the info of `infoType` of the tile at `tileX`, `tileY` and stores it in `store`
`Set16x16TileInfo(int value, int tileX, int tileY, int infoType)`	Sets the info of `infoType` of the tile at `tileX`, `tileY` and sets it based on `value`
`Copy16x16Tile(int dst, int src)`	Copies the tileset image data of `src` into `dst`, used for animated tiles
`CheckCurrentStageFolder (string folder)`	If the loaded stage's folder matches `folder`, `CheckResult` is set to true, else it is set to false
`tileLayer[index].xsize` `tileLayer[index].ysize`	The width/height of the `tileLayer` in chunks

`TILELAYER_NOSCROLL`
`TILELAYER_HSCROLL`
`TILELAYER_VSCROLL`
`TILELAYER_3DFLOOR`
`TILELAYER_3DSKY`
	IDs for `TileLayer.Type`

`tileLayer[index].type`	The type of rendering that the `tileLayer` uses
`tileLayer[index].angle`	The angle of the tileLayer (used for 3DFloor & 3DSky rotations)
`tileLayer[index].xpos` `tileLayer[index].ypos`	The position of the tileLayer (used for 3DFloor & 3DSky rotations)

`tileLayer[index].zpos`	

`tileLayer[index].parallaxFactor`
`tileLayer[index].scrollSpeed`
`tileLayer[index].scrollPos`
	The parallax values of the tileLayer (see parallax below for more info)

`tileLayer[index].deformationOffset` `tileLayer[index].deformationOffsetW`	The offset for the deformation data arrays when rendering (0,1 for FG & 2,3 for BG)
`hParallax[index].parallaxFactor` `vParallax[index].parallaxFactor`	The scroll info's parallax factor (relative speed), which determines how many pixels the parallax moves per pixel move of the camera
`hParallax[index].scrollSpeed` `vParallax[index].scrollSpeed`	The scroll info's scroll speed (constant speed), which determines how many pixels the parallax moves per frame
`hParallax[index].scrollPos` `vParallax[index].scrollPos`	The scroll info's scroll position, which is how many pixels the parallax is offset from the starting pos

Input

Function/Variable/Alias	Description

`inputDown.up`
`inputDown.down`
`inputDown.left`
`inputDown.right`
`inputDown.buttonA`
`inputDown.buttonB`
`inputDown.buttonC`
`inputDown.buttonX`
`inputDown.buttonY`
`inputDown.buttonZ`
`inputDown.buttonL`
`inputDown.buttonR`
`inputDown.start`
`inputDown.select`
	True if the corresponding button/key has been held.
	`inputDown.buttonX` through Z and L/R are both mapped to A/B/C

`inputPress.up`
`inputPress.down`
`inputPress.left`
`inputPress.right`
`inputPress.buttonA`
`inputPress.buttonB`
`inputPress.buttonC`
`inputPress.buttonX`
`inputPress.buttonY`
`inputPress.buttonZ`
`inputPress.buttonL`
`inputPress.buttonR`
`inputPress.start`
`inputPress.select`
	True if the corresponding button/key was pressed on this frame.
	Same note as above.

`menu1.Selection` `menu2.Selection`	the current row selected by MENU_1/MENU_2
`CheckTouchRect(int x1, int y1, int x2, int y2)`	Checks if a touch input was detected between the inputted coordinates (based on screen)

Math

Function/Variable/Alias	Description
`Sin(int store, int angle)` `Cos(int store, int angle)`	Gets the value from the sin/cos512 lookup table based on `angle` and sets it in `store`
`Sin256(int store, int angle)` `Cos256(int store, int angle)`	Gets the value from the sin/cos256 lookup table based on `angle` and sets it in `store`
`ATan2(int store, int x, int y)`	Performs an arctan operation using `x` and `y` and stores the result in `store`
`GetBit(var store, int value, int pos)`	Gets bit at index `pos` from `value` and stores it in `store`
`SetBit(int value, int pos, int set)`	Sets bit at index `pos` to `set` and updates `value` accordingly
`Rand(var store, int max)`	Gets a random value from 0 to max and stores it in `store`
`Not(var value)`	Performs a NOT operation on `value` and updates it (`value = ~value`)
`Abs(var value)`	Gets the absolute number of `value` and updates `value` with the new number
`GetTableValue(var store, int index, arr array)`	Gets a value from `array` at `index` and stores it in `store`

`SetTableValue(int value, int index, arr array)`	Sets the value in `array` at `index` to `value`

`Interpolate(var store, int x, int y, int percent)`
 	
`InterpolateXY(var storeX, var storeY, int aX, int aY, int bX, int bY, int percent)`
	Linearly interpolates (LERPs) x and y by `percent` and stores the result in `store`. `percent` is 0 through 256.
	
	`InterpolateXY` does 2 at once for points (`aX, aY`) and (`bX, bY`)

3D

Function/Variable/Alias	Description

`MAT_WORLD`
`MAT_VIEW`
`MAT_TEMP`
	RSDKv4 only allow use of 3 matrices: world, view & temp.
	Passing these should only be done to parameters of type `mat`.
	RSDK matrix values are shifted 8 bits, so `0x100` (starting vals) is 1.0

`scene3D.vertexCount` `scene3D.faceCount`	Amount of active faces/vertices in each buffer respectively (max of 1024 faces and 4096 vertices)
`scene3D.projectionX` `scene3D.projectionY`	The width (X) and height (Y) of the 3DScene draw buffer. These values determine what base resolution to use for drawing functions.
`scene3D.fogColor` `scene3D.fogStrength`	The colour of the fog in RGB format and the strength of the fog (0-255). Used with `FADE_FADED` flag

`faceBuffer[index].a`
`faceBuffer[index].b`
`faceBuffer[index].c`
`faceBuffer[index].d`
	The vertex indices to use to control this face's drawing

`FACE_TEXTURED_3D`
`FACE_TEXTURED_2D`
`FACE_COLOURED_3D`
`FACE_COLOURED_2D`
`FACE_FADED`
`FACE_TEXTURED_C`
`FADE_TEXTURED_D`
`FACE_SPRITE3D`
	The different face drawing flags that can be used with `faceBuffer.flag`.

`faceBuffer[index].flag`	The active drawing flag for this face
`faceBuffer[index].color`	The colour to draw the face when drawing with `FACE_COLOURED_2D` or `FACE_COLOURED_3D` flags

`vertexBuffer[index].x`
`vertexBuffer[index].y`
`vertexBuffer[index].z`
`vertexBuffer[index].u`
`vertexBuffer[index].v`
	The vertex coordinates for the specified vertex

`SetIdentityMatrix(mat matrix)`	Sets the matrix of `matID` to the identity state
`MatrixMultiply(mat matrixA, mat matrixB)`	Multiplies `matrixA` by `matrixB` and stores the result in `matrixA`
`MatrixTranslateXYZ(mat matrix, int x, int y, int z)`	Translates `matrix` to x, y, z, all shifted 8 bits (0x100 = 1.0)
`MatrixScaleXYZ(int matrix, int x, int y, int z)`	Scales `matrix` by x, y, z, all shifted 8 bits (0x100 = 1.0)

`MatrixRotateX(mat matrix, int angle)`
`MatrixRotateY(mat matrix, int angle)`
`MatrixRotateZ(mat matrix, int angle)`
`MatrixRotateXYZ(mat matrix, int x, int y, int z)`
	Rotates `matrix` to `angle` on the specified axis, or all if using `MatrixRotateXYZ`. Angles are 512-based, similar to sin/cos

`MatrixInverse(int matrix)`	Performs an inversion on the values of `matrix`
`TransformVertices(mat matrix, int startIndex, int endIndex)`	Transforms all vertices from `startIndex` to `endIndex` using `matrix`
`Draw3DScene()`	Draws the active 3DScene data to the screen

Menus

Function/Variable/Alias	Description
`MENU_1` `MENU_2`	Menu IDs for `menu` parameters
`LoadTextFile(int menu, string filePath)`	Loads a `menu` based on the file loaded from `filePath`
`SetupMenu(int menu, int rowCount, int selectionCount, int alignment)`	Sets up `menu` with `rowCount` rows, `selectionCount` active selections and aligning to `alignment`

`AddTextMenuEntry(int menu, string text, int highlightEntry)`
 	
`EditTextMenuEntry(int menu, string text, int rowID, int highlightEntry)`
	Adds or edits an entry to `menu` with the contents of `text`, and highlighted if `highlightEntry` is set to true

`TEXTINFO_TEXTDATA`
`TEXTINFO_TEXTSIZE`
`TEXTINFO_ROWCOUNT`
	Types of data that can be fetched via `GetTextInfo()`.

`GetTextInfo(var store, int menu, int type, int index, int offset)`	Gets the data of `type` from `menu` using `index`, using `offset` if the type is `TEXTINFO_TEXTDATA`
`DrawMenu(int menu, int XPos, int YPos)`	Draws `menu` to `XPos` & `YPos` relative to the screen
`GetVersionNumber(int menu, int highlight)`	Adds a text entry with the game's version as the text, highlighted if highlight is set

Engine

Function/Variable/Alias	Description
`engine.state`	The current engine game loop state, can be set to `2` or `RESET_GAME` to restart the game
`engine.language`	The language the engine is actively using
`engine.onlineActive`	Whether or not online functionality is enabled for the engine
`engine.trialMode`	Whether or not the game is built as a "trial version" (basically always false)
`RETRO_STANDARD` `RETRO_MOBILE`	Names for the values of `engine.deviceType`
`engine.deviceType`	The current device type the game is currently running on

`EngineCallback(int callbackFuncID)`
 	
`EngineCallback2(int callbackFuncID, int param1, int param2)`
 	
`EngineCallback4(int callbackFuncID, int param1, int param2, int param3, int param4)`
	Calls the native engine function with the ID of `callbackFuncID` using no params, `2` params, or `4` params

`Print(message, bool isInt, bool addNewLine)`	Prints a message to the console & the log, if `` `isInt` `` is set then `` `message` `` will be treated as an int, otherwise it will be treated as a string. If `` `addNewLine` `` is set a `` `\n` `` character will be added to the end of the message when printed.
`saveRAM[index]`	an array of data capable of being written/read from file via `ReadSaveRAM()`/`WriteSaveRAM()`
`ReadSaveRAM()`	reads the contents of the save file on disk into SaveRAM (overwrites any existing values)
`WriteSaveRAM()`	writes the contents of SaveRAM to the save file on disk

Further Assistance

For any further questions relating to RetroScript or RSDK modding in general, join the Retro Engine Modding Server: your one stop for all RSDK modding!