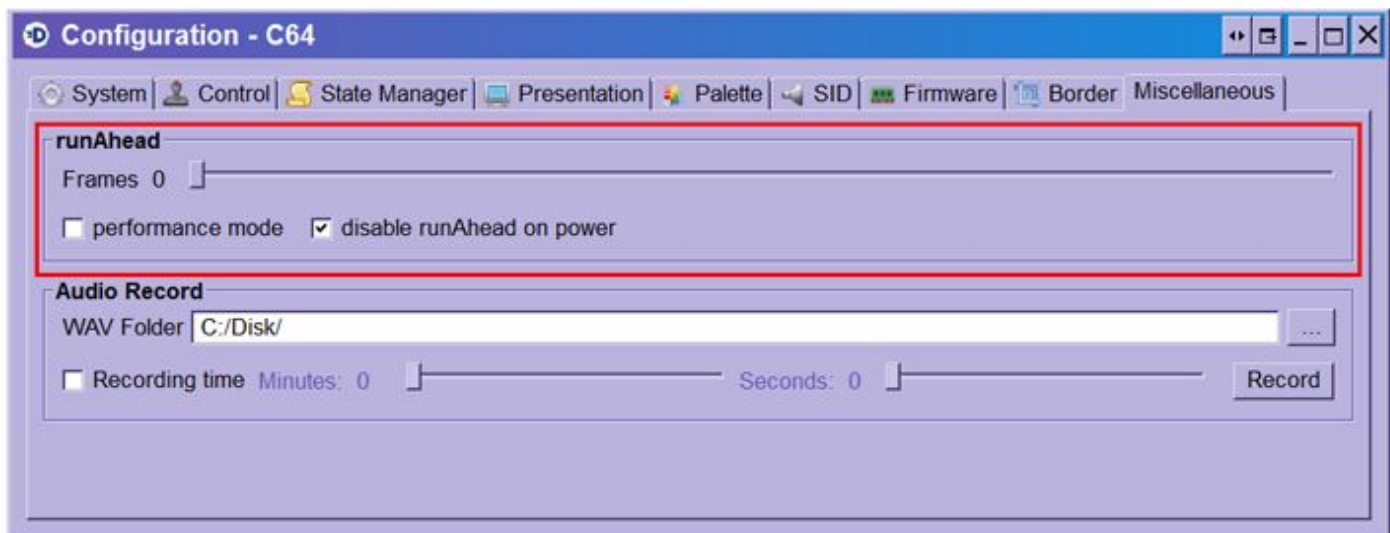


What is the RunAhead Feature and how to use it?

The RunAhead is a method, used in emulators, to minimize the input-lag and to bring the gaming-experience closer to the feeling on the real machine. Explanations how this technically works, can be found on different internet-sides.

There are different methods of using this feature:

- (1) You can set a fixed basic-value for the RunAhead in the "miscellaneous" menu, which can then also be saved in the settings. By using hotkeys (see in point 2), it is then also possible, to adjust this basic-value individually, later when a game runs.



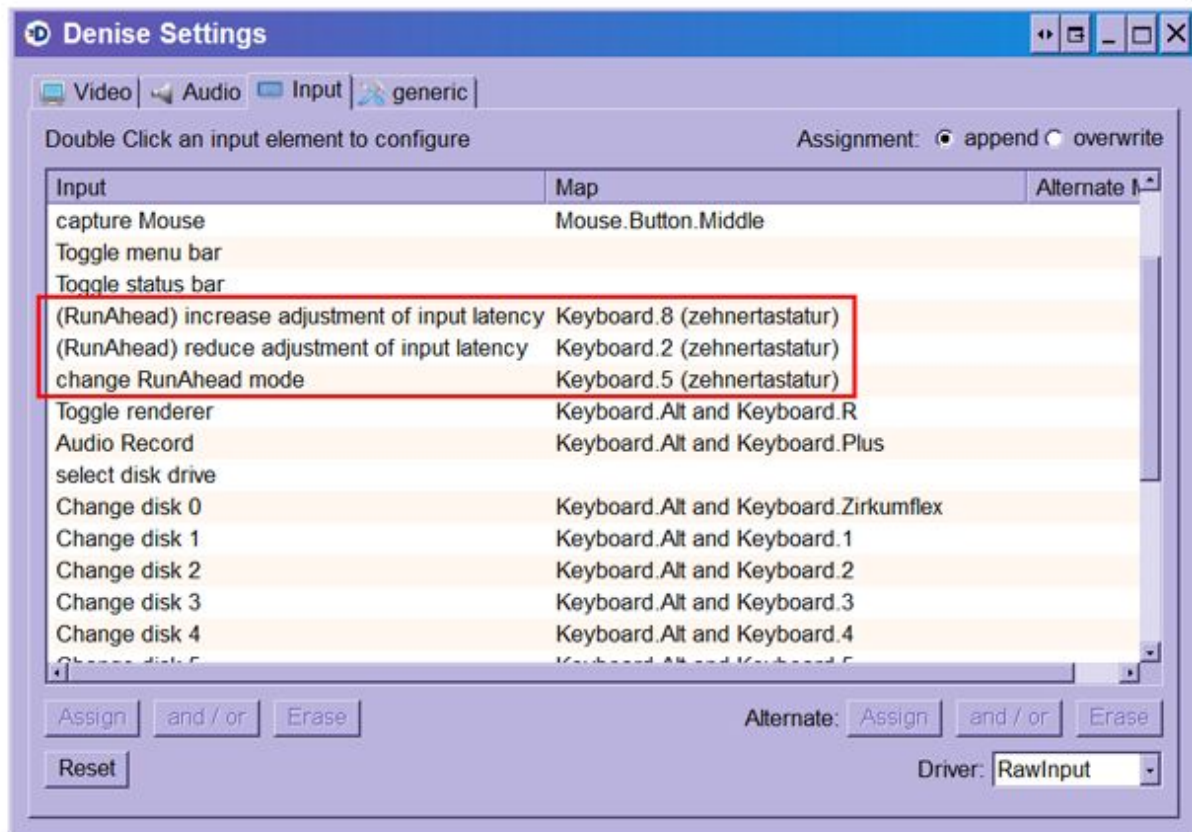
Here the user can set a frame-value with the slider. The "performance mode" is only recommended for users of very old and slow computers, because this mode does not evaluate hardware-collisions. It's only recommended to use this function, if your machine would otherwise no longer manage to realize the 50FPS fullspeed when the RunAhead is activated. RunAhead is a very CPU-intensive feature, we should not forget.

The function "disable RunAhead on power" can be used, when the RunAhead should be set to zero, every time, after the user makes a reset. Can make sense, because when looking demos for example, or using a tool, it makes no sense to have a RunAhead activated.

However, since it is the case, that some games can tolerate higher RunAhead values than others, before visible frame-jumps can be seen on the screen, it is advisable, to always adjust the RunAhead value manually to the current game.

Therefore i recommend, using the RunAhead in a way, that is described in the next point.

- (2) We let the menue-setting in the Miscellaneous-menue, described in point 1, completely deactivated. Instead, we map three hotkeys for the RunAhead settings, which we do in this menu:



The user can freely decide here, which keyboard-keys he wants to use, for mapping the RunAhead functions to them. Of course it makes sense, to use keys here, that don't exist on a real C-64 and that are not already assigned with a keyboard function. As we can see in the pic, we have here "Num8" for increasing, "Num2" for decreasing and "Num5" for switching the mode of the RunAhead.

Best way now is, to load and start a game and when the game already is running, then press "Num8" one time and we have set 1 Frame RunAhead, which means, that we have now decreased the input-lag by 20 milliseconds. When we press this key again, we have set 2 Frames, which means 40ms less lag and so on.

Experience shows here - if you have a fast reacting joystick/gamepad or fast reacting controller-adapter (polling rate around 100Hz (10ms) or better) then a RunAhead value of 2 or 3 frames corresponds almost exactly, to the feeling of gaming on a real C-64. If you go higher in the RunAhead value, it even reacts faster than on the real machine. But sooner or later, when you go higher, nearly every game will show frame-jumps in the movement of the player-sprite. Then you know, that you are too high in the frame-value and you should go back. 2 Frames the most games can handle without a problem, but there are some, which already then shows the first problems. For such games, then 1 Frame RunAhead is recommended. Overall i recommend 2 Frames for the most games.

When you change the frame-value of the RunAhead, Denise always shows you the current frame-value, that you have set in this moment, with an onscreen-message.

If your computer should be not fast enough for higher RunAhead frame-values, then the user can switch to a faster graphic-renderer in Denise. This can be done in the menu "system management" by clicking the feature "cycle accurate video". By turning off this function, Denise switches to a line-based renderer, that is alot faster, but less compatible. Nevertheless, in nearly all games, also this renderer works without a problem, only some demos shows errors with it. Therefore it's recommended for all the demos, to use the cycle accurate renderer, which also is unproblematic when it comes to speed, because in demos it would not make sense at all, to use a RunAhead.