**PARALLEL BINARY ADDER**

**Parallel Binary Adder**

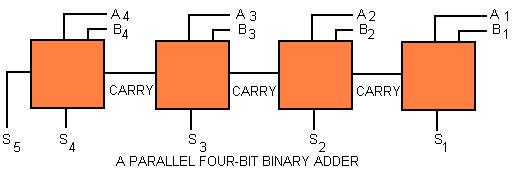
Parallel binary adder is used to add two binary numbers. The bits are added with full adders, starting from the least significant position (subscript-1), to form the sum bit and carry bit.

Example of **Four Bit  Binary Adder**

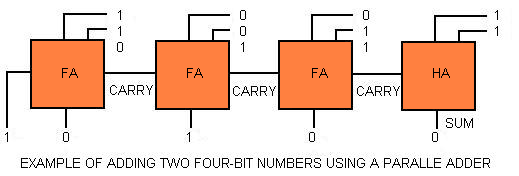
If we want to add two four-bit binary numbers, we need to construct a four bit parallel binary adder as shown below. Such an adder requires one [Half-Adder](http://www.bscshortnote.com/what-is-half-adder/) denoted by HA and three [Full-Adders](http://www.bscshortnote.com/what-is-full-adder/) denoted by FA. The binary numbers being added are A4 A3 A2 A1 and B4 B3 B2 B1 and the answer is:

                          A4 A3 A2 A1

                       + B4 B3 B2 B1

                     S5 S4 S3 S2 S1  


The first column requires only a Half-Adder. For any column above the first, there may be a carry from the preceding column. Therefore, we must use a Full-Adder for each column above the first. To illustrate how parallel binary adder of the above picture works, let us take an example. If we want to add two numbers say 9 and 11. The binary equivalent of decimal 9 is 1001 and that of decimal 11 is 1011. The given block diagram shown below shows how the binary adder works with these inputs.



As shown in the above picture, the Half-Adder adds the binary bits 1 + 1 to give a sum of 0 and a carry 1. This carry goes into the first Full-Adder which adds 0 + 1 + 1 to get a sum of 0 and a carry of 1. Now, this carry goes into the next Full-Adder that adds 0 + 0 + 1 to get a sum of 1 and a carry of 0. The last Full-Adder adds 1 + 1 + 0 to get a sum of 0 and a carry of 1. The final input of the system is 10100. The decimal equivalent of binary 10100 is 20 which is the correct decimal sum of 9 and 11. The parallel binary adder of above figure has limited capacity. The largest binary numbers that can be added using it are 1111 and 1111.

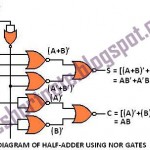
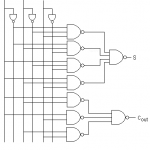
   15    1111

+ 15 + 1111

    30 11110

In order to increase the capacity, more Full-Adders can be connected to the left end of the system. For instances, to add six bit numbers, two more Full-Adders must be connected and for adding eight bit numbers, four more Full-Adders must be connected to the left end of the system given above.

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|  | |  |  |  |  | | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | They probably are. – [Andy aka](http://electronics.stackexchange.com/users/20218/andy-aka) [Mar 27 '15 at 15:14](http://electronics.stackexchange.com/questions/161947/binary-adder-and-parallel-adder#comment329508_161947) |   add a comment |

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|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| up vote 3 down vote accepted | | There is a distinction between parallel adder vs serial adder. Both are binary adders, of course, since are used on bit-represented numbers. Parallel adder is a combinatorial circuit (not clocked, does not have any memory and feedback) adding every bit position of the operands in the same time. Thus it is requiring number of bit-adders(full adders + 1 half adder) equal to the number of bits to be added. enter image description here (The image taken from [here](http://www.exploreroots.com/dc7.html))  Serial adder is a sequential circuit, consisting of a flip-flop and a full adder. At each clock cycle, it is taking the result of the previous bit addition result carry stored in the flip-flop, calculating the sum result and storing the carry to the flipflop for the next calculation. In this manner, the input data have to be fed serially, synchronized by the clock, and the result is read serially as well. enter image description here (The image taken from [here](http://www.ece.mcmaster.ca/%7Eshirani/2di4/chapter8p2.pdf))   |  |  | | --- | --- | | [share](http://electronics.stackexchange.com/a/161952)[improve this answer](http://electronics.stackexchange.com/posts/161952/edit) | answered Mar 27 '15 at 15:18  [[https://lh4.googleusercontent.com/-e2FAQvlj5CQ/AAAAAAAAAAI/AAAAAAAAAqM/TlSnekirgNE/photo.jpg?sz=32](http://electronics.stackexchange.com/users/58132/eugene-sh)](http://electronics.stackexchange.com/users/58132/eugene-sh)  [Eugene Sh.](http://electronics.stackexchange.com/users/58132/eugene-sh)  5,599623 | |
|  | | |  |  |  |  | | --- | --- | --- | --- | | |  |  | | --- | --- | |  |  | | Hahaha, we found the same image! OP wasn't asking about Serial Adders, but I guess it's good to mention the difference. – [Greg d'Eon](http://electronics.stackexchange.com/users/49251/greg-deon) [Mar 27 '15 at 15:19](http://electronics.stackexchange.com/questions/161947/binary-adder-and-parallel-adder#comment329510_161952) | | |  |  | | --- | --- | | 1 |  | | We are using the same google :) – [Eugene Sh.](http://electronics.stackexchange.com/users/58132/eugene-sh) [Mar 27 '15 at 15:20](http://electronics.stackexchange.com/questions/161947/binary-adder-and-parallel-adder#comment329511_161952) | | |  |  | | --- | --- | |  |  | | Something confused me, in first picture, it is parallel adder right? But I remember in circuits if something connected back to back, they are called serial connection. Am I remembering correct? – [berkc](http://electronics.stackexchange.com/users/69716/berkc" \o "43 reputation) [Mar 27 '15 at 15:24](http://electronics.stackexchange.com/questions/161947/binary-adder-and-parallel-adder#comment329514_161952) | | |  |  | | --- | --- | |  |  | | Strictly speaking, the result is calculated serially, since the carry is propagating as a "ripple" (this is the official name of such an adder - "carry-ripple"). But the speed of such a circuit (the time between the input is introduced and the valid result) is limited only by the propagation delay of the components. And if used in a clocked circuit, it will require one single clock. So yeah, some confusion may take place here.. – [Eugene Sh.](http://electronics.stackexchange.com/users/58132/eugene-sh) [Mar 27 '15 at 15:27](http://electronics.stackexchange.com/questions/161947/binary-adder-and-parallel-adder#comment329516_161952) | | |  |  | | --- | --- | | 1 |  | | The difference is their structure and type (one is combinatorial, the second is sequential. It's a significant difference.) – [Eugene Sh.](http://electronics.stackexchange.com/users/58132/eugene-sh) [Mar 27 '15 at 15:43](http://electronics.stackexchange.com/questions/161947/binary-adder-and-parallel-adder#comment329527_161952) |   [show **2** more comments](http://electronics.stackexchange.com/questions/161947/binary-adder-and-parallel-adder) |
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