Starting state

Memory-

00 mov ax, 10h

01 mov bx, 11h

02 add ax, bx

03 mov 12h, ax

10h=2

11h=3

CS 00h

DS 10h

May have timing off on when PC increments forward

Unless specified assume no parallelization- will need to be used for efficiency and time sake

Start(No LED indicators mentioned)-

1. **PC goes to 00**
2. W/R block set to 00h
3. W/R block sent to MAR
4. MAR set to 00h
5. Bring R/W arm to 00h
6. MDR set to: mov ax, 10h
7. R/W block put on bus, value: mov ax, 10h
8. R/W block travel to IR
9. R/W block gantry up to IR
10. IR set to: mov ax, 10h
11. *Instruction Executed*
12. R/W block set to address 10h
13. R/W block sent from control unit to bus
14. R/W block sent to MAR
15. MAR set to value to: 10h
16. Bring R/W arm to 10h
17. MDR set to: 2
18. R/W set to 2
19. R/W block sent from MDR to bus
20. R/W block sent to ax
21. Gantry R/W block off bus into ax slot
22. **PC goes to 01**
23. W/R block set to 01h
24. W/R block sent to MAR
25. MAR set to 01h
26. Bring R/W arm to 01h
27. MDR set to: mov bx, 11h
28. R/W block put on bus, value: mov bx, 11h
29. R/W block travel to IR
30. R/W block gantry up to IR
31. IR set to: mov bx, 11h
32. *Instruction Executed*
33. R/W block set to address 11h
34. R/W block sent from control unit to bus
35. R/W block sent to MAR
36. MAR set to value to: 11h
37. Bring R/W arm to 11h
38. MDR set to: 3
39. R/W set to 3
40. R/W block sent from MDR to bus
41. R/W block sent to bx
42. Gantry R/W block off bus into bx slot
43. **PC goes to 02**
44. W/R block set to 02h
45. W/R block sent to MAR
46. MAR set to 02h
47. Bring R/W arm to 02h
48. MDR set to: add ax, bx
49. R/W block put on bus, value: add ax, bx
50. R/W block travel to IR
51. R/W block gantry up to IR
52. IR set to: add ax, bx
53. *Instruction Executed*
54. R/W block in ax sent to sub conveyor to A
55. R/W block in bx sent to sub conveyor to B
56. Addition Command Executed
57. Output send to sub conveyor to ax
58. **PC goes to 03**
59. W/R block set to 03h
60. W/R block sent to MAR
61. MAR set to 03h
62. Bring R/W arm to 03h
63. MDR set to: mov 12h, ax
64. R/W block put on bus, value: mov 12h, ax
65. R/W block travel to IR
66. R/W block gantry up to IR
67. IR set to: mov 12h, ax
68. *Instruction Executed*
69. W/R block ax sent to bus to MDR
70. MDR set to: ax
71. IR set W/R block to 12h
72. Send W/R block from IR to MAR
73. MAR set to: 12h
74. R/W head goes to 12h
75. Write ax to 12h
76. Done

Full Operation-(Mechanics of operation expanded upon- same start)

1. **PC set: 00**
2. W/R block set: 00h
3. W/R block sent from W/R storage to W/R lower i/o on hidden bus
4. Send W/R block to hidden lower Control unit i/o
5. Gantry W/R block to Control unit visible upper i/o
6. Send to MDR
7. W/R block sent to MAR
8. MAR set to 00h
9. Bring R/W arm to 00h
10. MDR set to: mov ax, 10h
11. R/W block put on bus, value: mov ax, 10h
12. R/W block travel to IR
13. R/W block gantry up to IR
14. IR set to: mov ax, 10h
15. *Instruction Executed*
16. R/W block set to address 10h
17. R/W block sent from control unit to bus
18. R/W block sent to MAR
19. MAR set to value to: 10h
20. Bring R/W arm to 10h
21. MDR set to: 2
22. R/W set to 2
23. R/W block sent from MDR to bus
24. R/W block sent to ax
25. Gantry R/W block off bus into ax slot
26. **PC goes to 01**
27. W/R block set to 01h
28. W/R block sent to MAR
29. MAR set to 01h
30. Bring R/W arm to 01h
31. MDR set to: mov bx, 11h
32. R/W block put on bus, value: mov bx, 11h
33. R/W block travel to IR
34. R/W block gantry up to IR
35. IR set to: mov bx, 11h
36. *Instruction Executed*
37. R/W block set to address 11h
38. R/W block sent from control unit to bus
39. R/W block sent to MAR
40. MAR set to value to: 11h
41. Bring R/W arm to 11h
42. MDR set to: 3
43. R/W set to 3
44. R/W block sent from MDR to bus
45. R/W block sent to bx
46. Gantry R/W block off bus into bx slot
47. **PC goes to 02**
48. W/R block set to 02h
49. W/R block sent to MAR
50. MAR set to 02h
51. Bring R/W arm to 02h
52. MDR set to: add ax, bx
53. R/W block put on bus, value: add ax, bx
54. R/W block travel to IR
55. R/W block gantry up to IR
56. IR set to: add ax, bx
57. *Instruction Executed*
58. R/W block in ax sent to sub conveyor to A
59. R/W block in bx sent to sub conveyor to B
60. Addition Command Executed
61. Output send to sub conveyor to ax
62. **PC goes to 03**
63. W/R block set to 03h
64. W/R block sent to MAR
65. MAR set to 03h
66. Bring R/W arm to 03h
67. MDR set to: mov 12h, ax
68. R/W block put on bus, value: mov 12h, ax
69. R/W block travel to IR
70. R/W block gantry up to IR
71. IR set to: mov 12h, ax
72. *Instruction Executed*
73. W/R block ax sent to bus to MDR
74. MDR set to: ax
75. IR set W/R block to 12h
76. Send W/R block from IR to MAR
77. MAR set to: 12h
78. R/W head goes to 12h
79. Write ax to 12h
80. Done

Addition animation-

1. **PC set: 00 CU set FETCH**
2. R/W block set: 00
3. R/W block PC to upper bus
4. Upper bus to MAR
5. MAR set: 00
6. R/W arm to 00h
7. MDR set: mov ax, 10h
8. R/W block set: mov ax, 10h
9. R/W block MDR to lower bus
10. R/W lower bus to IR
11. IR set: mov ax, 10h
12. R/W block set: 10h
13. R/W block IR to upper bus
14. Upper bus to MAR
15. MAR set: 10h
16. R/W arm to 10h
17. MDR set: 2
18. R/W block set: 2
19. R/W block MDR to lower bus
20. R/W lower bus to ax
21. **PC goes to 01**
22. R/W block set: 01
23. R/W block PC to upper bus
24. Upper bus to MAR
25. MAR set: 01
26. R/W arm to 01h
27. MDR set: mov bx, 11h
28. R/W block set: mov bx, 11h
29. R/W block MDR to lower bus
30. R/W lower bus to IR
31. IR set: mov bx, 11h
32. R/W block set: 11h
33. R/W block IR to upper bus
34. Upper bus to MAR
35. MAR set: 11h
36. R/W arm to 11h
37. MDR set: 3
38. R/W block set: 3
39. R/W block MDR to lower bus
40. R/W lower bus to bx
41. **PC goes to 02**
42. R/W block set: 02h
43. R/W block PC to upper bus
44. Lower bus to MAR
45. MAR set to 02h
46. Bring R/W arm to 02h
47. MDR set to: add ax, bx
48. R/W set: add ax, bx
49. R/W MDR to lower bus
50. Lower bus to IR
51. IR set: add ax, bx
52. R/W block ax to sub conveyor
53. Sub conveyor to A
54. R/W block bx to sub conveyor
55. Sub conveyor to B
56. R/W block set: 5
57. R/W block C to sub conveyor
58. Sub conveyor to ax
59. **PC goes to 03**
60. R/W block set: 03h
61. R/W block PC to upper bus
62. Upper bus to MAR
63. MAR set: 03h
64. R/W arm to 03h
65. MDR set: mov 12h, 5
66. R/W block set: mov 12h, 5
67. R/W block MDR to lower bus
68. Lower bus to IR
69. IR set: mov 12h, 5
70. W/R block ax ax to upper bus
71. Upper bus to MDR
72. MDR set to: 5
73. W/R block set: 12h
74. W/R block IR to upper bus
75. Upper bus to MAR
76. MAR set to: 12h
77. R/W head to 12h
78. Write ax to 12h

Done