



ROOTBOX

PINOOTS VERSION 2.2

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1 Introduction

The Rootbox is a Windows PC based system that runs the Flair motion control software. It contains the following:

- 1). A Windows PC
- 2). A Root Interface Card
- 3). A Root Stepper Card (Optional)

Flair runs on the PC and communicates with the Root Interface Card (RIC). The RIC then communicates with external devices via the various connectors to give the user control of their motion control system.

WARNING: Care should be taken when plugging into the Rootbox as incorrect connections may cause damage to the Rootbox and/or the device being connected. MRMC recommends that the Rootbox is connected to external equipment while switched off to minimize the chances of damage caused by incorrect connections.

2 Front Panel

2.1 LEDs

Power LED: Off: Root Interface Card not powered.
On: Root Interface Card has 3.3V.

Running LED: Off: Root Interface Card not running.
Flashing 25Hz: Root Interface Card loaded and running.
Flashing 3Hz, 1/3 On, 2/3 Off: Failed to load first board on Rig/Head connection.

Inhibit LED: Off: Flair is running.
On: Flair is not running.

Reset LED: Off: Hardware not in reset.
On: hardware in reset.

2.2 Switches

Power: Top In: Rootbox off
Top Out: Rootbox on.

2.3 USB

Standard PC USB connection 1

Standard PC USB connection 2

Standard PC USB connection 3

3 Rear Panel

3.1 Serial A (9-way D-type Male)

- | | |
|---------|-----------|
| 1. +12V | 6. N/C |
| 2. RX | 7. E-Stop |
| 3. TX | 8. E-Stop |
| 4. N/C | 9. +5V |
| 5. GND | |

3.2 Serial B (9-way D-type Male)

- | | |
|--------|--------|
| 1. N/C | 6. N/C |
| 2. RX | 7. N/C |
| 3. TX | 8. N/C |
| 4. N/C | 9. N/C |
| 5. GND | |

3.3 Mimic 1 (25-way D-type Female)

- | | |
|--------------------------------------|---------|
| 1. A1+ | 14. A1- |
| 2. B1+ | 15. B1- |
| 3. A2+ | 16. A2- |
| 4. B2+ | 17. B2- |
| 5. A3+ | 18. A3- |
| 6. B3+ | 19. B3- |
| 7. A4+ | 20. A4- |
| 8. B4+ | 21. B4- |
| 9. Mimic GPO 1 (Open collector) LED | 22. +5V |
| 10. Mimic GPO 2 (Open collector) LED | 23. GND |
| 11. Mimic GPO 3 (Open collector) LED | 24. GND |
| 12. Mimic GPO 4 (Open collector) LED | 25. GND |
| 13. +12V | |

3.4 Mimic 2 (25-way D-type Female)

- | | |
|--------------------------------------|---------|
| 1. A5+ | 14. A5- |
| 2. B5+ | 15. B5- |
| 3. A6+ | 16. A6- |
| 4. B6+ | 17. B6- |
| 5. A7+ | 18. A7- |
| 6. B7+ | 19. B7- |
| 7. A8+ | 20. A8- |
| 8. B8+ | 21. B8- |
| 9. Mimic GPO 5 (Open collector) LED | 22. +5V |
| 10. Mimic GPO 6 (Open collector) LED | 23. GND |
| 11. Mimic GPO 7 (Open collector) LED | 24. GND |
| 12. Mimic GPO 8 (Open collector) LED | 25. GND |
| 13. +12V | |

3.5 Datalink (9-way D-type Female)

- | | |
|--------------|--------------|
| 1. Watchdog- | 6. Watchdog+ |
| 2. Data Out- | 7. Data Out+ |
| 3. Data In- | 8. Data In+ |
| 4. N/C | 9. N/C |
| 5. N/C | |

3.6 HHB (9-way D-type Female)

- | | |
|--------------|--------------|
| 1. Data Out- | 6. Data Out+ |
| 2. +12V | 7. GND |
| 3. DataIn- | 8. DataIn+ |
| 4. N/C | 9. E-Stop- |
| 5. E-Stop+ | |

3.7 Rig/Head (9-way D-type Female)

- | | |
|--------------|--------------|
| 1. Watchdog- | 6. Watchdog+ |
| 2. Data Out- | 7. Data Out+ |
| 3. Data In- | 8. Data In+ |
| 4. E-Stop+ | 9. E-Stop- |
| 5. N/C | |

3.8 Power In (3-pin XLR Male)

1. GND
2. +18V to 36V
3. Connects to Power Out Pin 3

3.9 Power Out (3-pin XLR Female)

1. GND
2. +18V to 36V
3. Connects to Power In Pin 3

3.10 LTC Out (RCA Female)

1. LTC Out (Center)
2. GND

3.11 LTC In (RCA Female)

1. LTC In (Center)
2. GND

3.12 Video Out (BNC Female)

1. Video Out (Center)
2. GND

3.13 Video In (BNC Female)

1. Video In (SD Only) (Center)
2. GND

3.14 Sync (BNC Female)

1. Video In (HD or SD) (Center)
2. GND

3.15 E-Stop (9-way D-type Female)

- | | |
|--------------------|-----------------------|
| 1. Rig E-Stop | 6. Model Mover E-Stop |
| 2. +12V | 7. N/C |
| 3. Override Switch | 8. N/C |
| 4. GND | 9. Model Mover E-Stop |
| 5. RIG E-Stop | |

3.16 MM E-Stop (DC Jack Socket)

1. Model Mover E-Stop
2. Model Mover E-Stop

3.17 Triggers (37-way D-type Female)

- | | |
|------------|------------|
| 1. Out1+ | 20. Out1- |
| 2. Out2+ | 21. Out2- |
| 3. Out3+ | 22. Out3- |
| 4. Out4+ | 23. Out4- |
| 5. Out5+ | 24. Out5- |
| 6. Out6+ | 25. Out6- |
| 7. Out7+ | 26. Out7- |
| 8. Out8+ | 27. Out8- |
| 9. Out9+ | 28. Out9- |
| 10. Out10+ | 29. Out10- |
| 11. Out11+ | 30. Out11- |
| 12. GND | 31. GND |
| 13. In1+ | 32. In1- |
| 14. In2+ | 33. In2- |
| 15. In3+ | 34. In3- |
| 16. In4+ | 35. In4- |
| 17. N/C | 36. N/C |
| 18. N/C | 37. N/C |
| 19. +12V | |

3.18 Com 1 (9-way D-type Male)

- | | |
|--------------|--------------|
| 1. DCD (In) | 6. DSR (In) |
| 2. RX (In) | 7. RTS (Out) |
| 3. TX (Out) | 8. CTS (In) |
| 4. DTR (Out) | 9. RI (In) |
| 5. GND | |

3.19 Com 2 (9-way D-type Male)

- | | |
|--------------|--------------|
| 1. DCD (In) | 6. DSR (In) |
| 2. RX (In) | 7. RTS (Out) |
| 3. TX (Out) | 8. CTS (In) |
| 4. DTR (Out) | 9. RI (In) |
| 5. GND | |

3.20 LPT (25-way D-type Female)

- | | |
|---------------|------------|
| 1. Strobe | 14. AUTOFF |
| 2. Data Out 0 | 15. ERROR |
| 3. Data Out 1 | 16. INIT |
| 4. Data Out 2 | 17. SELIN |
| 5. Data Out 3 | 18. GND |
| 6. Data Out 4 | 19. GND |
| 7. Data Out 5 | 20. GND |
| 8. Data Out 6 | 21. GND |
| 9. Data Out 7 | 22. GND |
| 10. Ack | 23. GND |
| 11. Busy | 24. GND |
| 12. PE | 25. GND |
| 13. SEL | |

4 Top Panel (Optional)

4.1 Encoders Inputs (37-way D-type Male)

1. +5V	20. GND
2. A1+	21. A1-
3. B1+	22. B1-
4. A2+	23. A2-
5. B2+	24. B2-
6. A3+	25. A3-
7. B3+	26. B3-
8. A4+	27. A4-
9. B4+	28. B4-
10. A5+	29. A5-
11. B5+	30. B5-
12. Z1+ (A6+)	31. Z1- (A6-)
13. Z2+ (B6+)	32. Z2- (B6-)
14. Z3+ (A7+)	33. Z3- (A7-)
15. Z4+ (B7+)	34. Z4- (B7-)
16. Z5+ (A8+)	35. Z5- (A8-)
17. N/C (B8+)	36. N/C (B8-)
18. GND	37. +5V
19. GND	

Note: The encoder inputs can be used as 8 mimic inputs (connections in parentheses), or 5 motor encoder inputs with zero marker pulses.

4.2 Step and Direction Outputs (37-way D-type Female)

1. +5V	20. GND
2. Step1	21. Dir1
3. Step2	22. Dir2
4. Step3	23. Dir3
5. Step4	24. Dir4
6. Step5	25. Dir5
7. Step6	26. Dir6
8. Step7	27. Dir7
9. Step8	28. Dir8
10. Step9	29. Dir9
11. Step10	30. Dir10
12. Step11	31. Dir11
13. Step12	32. Dir12
14. Step13	33. Dir13
15. Step14	34. Dir14
16. Step15	35. Dir15
17. Step16	36. Dir16
18. GND	37. +5V
19. GND	

4.3 Limit and Datum Inputs (37-way D-type Female)

1. +5V	20. GND
2. L1	21. D1
3. L2	22. D2
4. L3	23. D3
5. L4	24. D4
6. L5	25. D5
7. L6	26. D6
8. L7	27. D7
9. L8	28. D8
10. L9	29. D9
11. L10	30. D10
12. L11	31. D11
13. L12	32. D12
14. L13	33. D13
15. L14	34. D14
16. L15	35. D15
17. L16	36. D16
18. GND	37. +5V
19. GND	

4.4 Enable Outputs (37-way D-type Female)

1. +5V	20. GND
2. En1+	21. En1-
3. En2+	22. En2-
4. En3+	23. En3-
5. En4+	24. En4-
6. En5+	25. En5-
7. En6+	26. En6-
8. En7+	27. En7-
9. En8+	28. En8-
10. En9+	29. En9-
11. En10+	30. En10-
12. En11+	31. En11-
13. En12+	32. En12-
14. En13+	33. En13-
15. En14+	34. En14-
16. En15+	35. En15-
17. En16+	36. En16-
18. GND	37. +5V
19. GND	

4.5 GPO Outputs (9-way D-type Female)

- | | |
|---------|---------|
| 1. GPO1 | 6. GPO2 |
| 2. GPO3 | 7. GPO4 |
| 3. N/C | 8. N/C |
| 4. +5V | 9. N/C |
| 5. GND | |

4.6 Analogue Outputs (9-way D-type Female)

- | | |
|--------|--------|
| 1. An1 | 6. An2 |
| 2. An3 | 7. An4 |
| 3. An5 | 8. An6 |
| 4. An7 | 9. An8 |
| 5. GND | |

5 I/O Formats

The following figures show the circuits for the trigger outputs, trigger inputs, enable outputs and the limit/datum inputs.

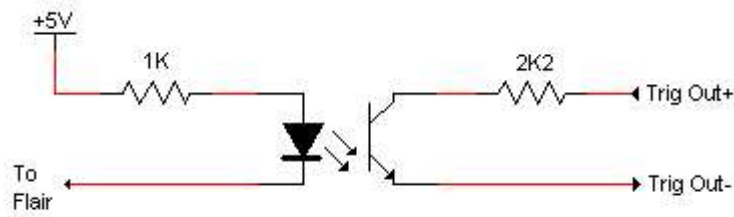


Figure 1. Trigger outputs.

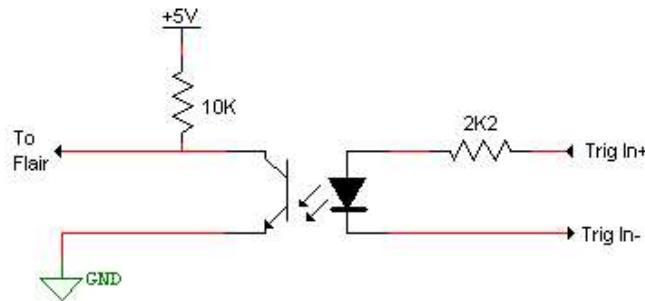


Figure 2. Trigger inputs.

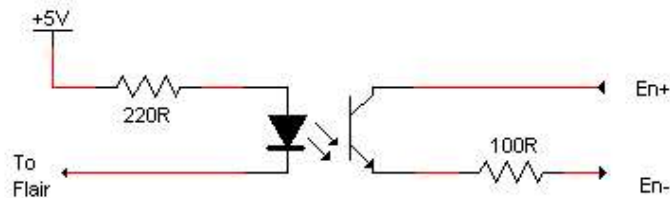


Figure 3. Enable Outputs (Stepper upgrade only).

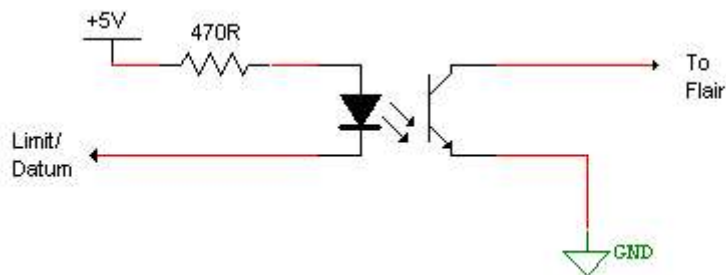
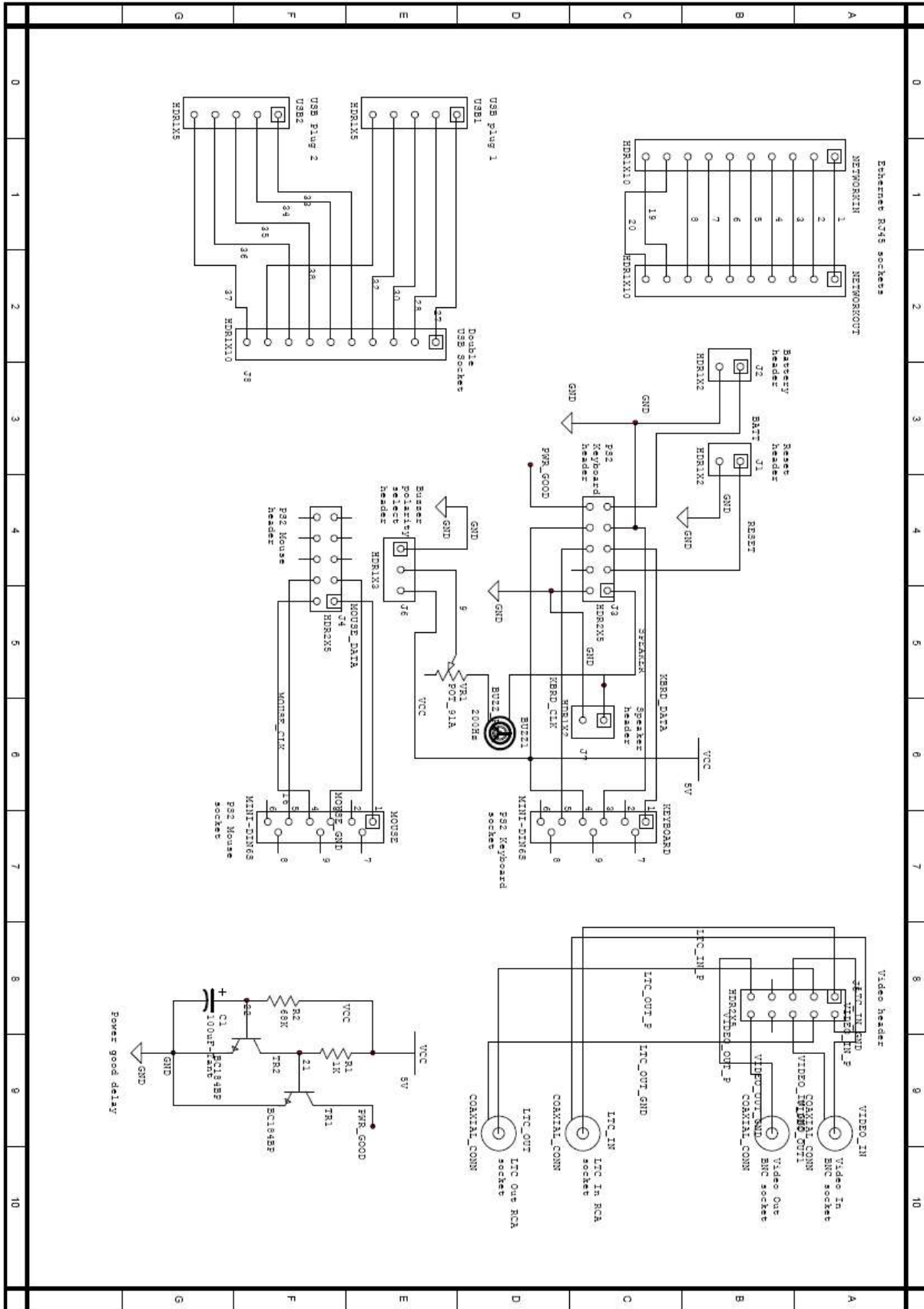


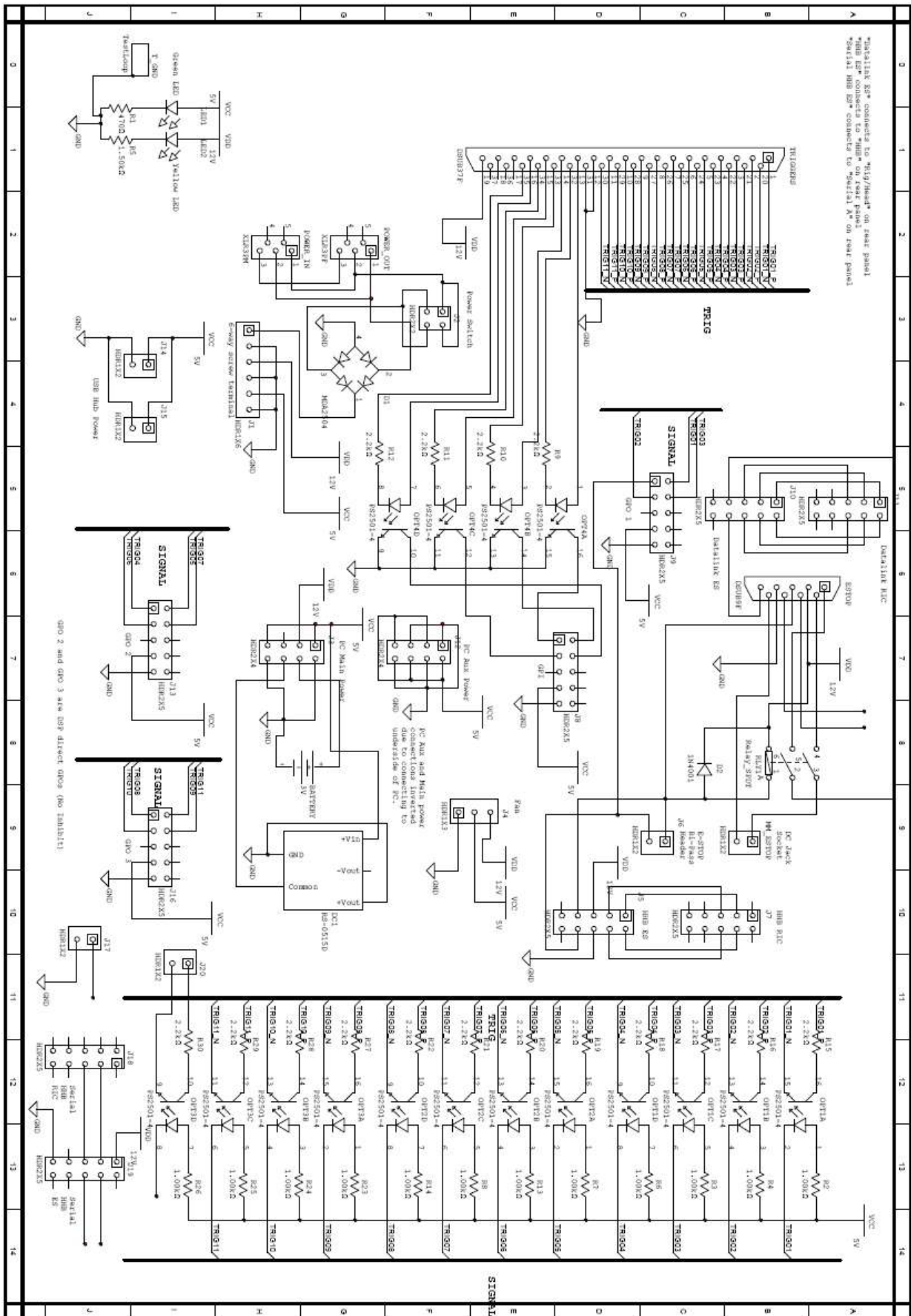
Figure 4. Limit/Datum inputs (Stepper upgrade only)..

6 Breakout Board Schematics

6.1 Breakout Board Upper



6.2 Breakout Board Lower



7 Glossary

E-Stop	Emergency Stop
GPO	General Purpose Output
LED	Light Emitting Diode
LTC	Longitudinal Time Code
N/C	No connection
RIC	Root Interface Card
RSC	Root Stepper Card
RX	Receive
TX	Transmit