5/17/04 Calibration Meeting

Feedthru connectors - hermetically sealed
stainless steel or anodized aluminu

5/18/04 Feedthru connectors:

Detoronics Corp (626) 579-7130) www.detoronics.co

4-6 weeks DT1H-10-6PN-117 is MIL-STD-3113H
8-9 weeks DS02H-14S-6P-269 is MIL-STD-3143H

Sealtron (513) 733-8400

should be sending e-mail with specs.
Contact: Dave Hallix

Hermetic Seal Technology, Inc (513) 851-4099

5/19/04 Feedthru Connector Requirements:
stainless steel or anodized aluminum
gold plated connectors 6 pins
hermetically sealed
rated for 110 AC

Cable Testing: 3 ft from either spool
UHV cleaning
bring to Al Smith for counting

Al Smith x5679 72 — 137

5/21/04 Feedthrus

① Motor Power

Deteronics # ? have 2, need 6

② Motor Control:

Ceramaseal # 16802-01-W have 4, need 6

③ Spool Encoder

Deteronics # DTH-10-6PN+117 have 1, need 6

④ Pulley Encoder

Deteronics # DS02H-145-6P-269 have 1, need 6

4pi control system

login: fourpi
password: 4piControl

open / Desktop / 4pi

open 1 - rmiregistry
open 2 - Control ← power on for electronics
open 3 - Display

Display Window

Clear to initialize system

Motor encoder is 1000/rev
Pulley encoder is puller revolution not encoder counts
steps sizes are x 1000 motor counts

Enabling 2nd Motor

go to ~/stripped - 4pi - control/src/kamland/fourpi/contr

type "emacs Control.java"

comment out (//) "new MotorDrive(1)"
uncomment "new MotorDrive(2)"

go to same as /fourpi/display

type "emacs StatusPanel.java"

uncomment "command2" and "rawMotorEncoder2"
uncomment "Command 2" and "Motor Encoder 2 [counts]

go to ~/stripped-4pi-control/src

type sh build → no errors means successful compile

Also remember to rewire multiplex box

output 1 → input 2 → output 2 → input 3 → output 3 → input 1

5/24/04 Motor Power and Control Connectors @ motor 1

Amphenol PT06E-14-18P (023) ← present connector
PT06E-14-12S (023)

Need PT08E-14-18R (023)
PT08E-14-12S (023)

Motor Control Connectors @ Feedthrough

MDC 680542 PEEK shell

* PEEK supposedly is chemical resistant

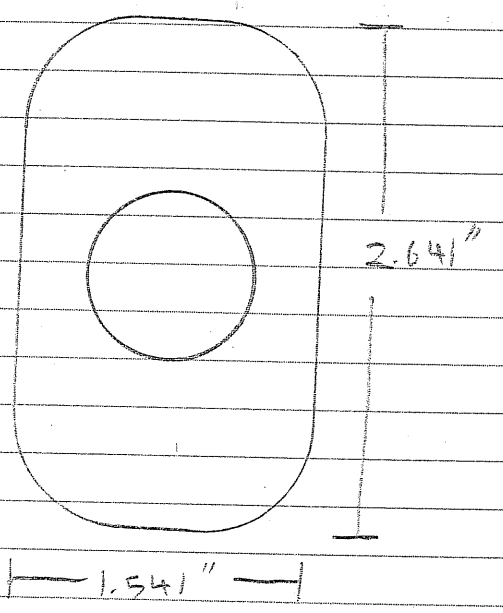
Motor Control Feedthrough:

Ceramaseal 16082-01-W

6/1/04 Kamland Meeting

1. ~~Z axis weight electropolish~~
2. ~~Ti piece from Al Smith~~
3. remaining electrical connectors
4. ~~Computer cart from Paul Vetter~~
5. ~~Arrange meeting w/ Don, Karsten and self~~

6/4/04 Check to see if 5015 type connectors will fit in existing flange



Diameter of size 14S backing flange is 1.562"

No FIT!

6/7/04 To Do List:

1. Fit o-rings to penthouse and order spares
2. Order Teflon cables for motor power and feedback, pulley encoder and spool
3. ~~Order 5015 type female connectors from Peigenesis for Karsten~~
4. Glovebox parts from hi-bay

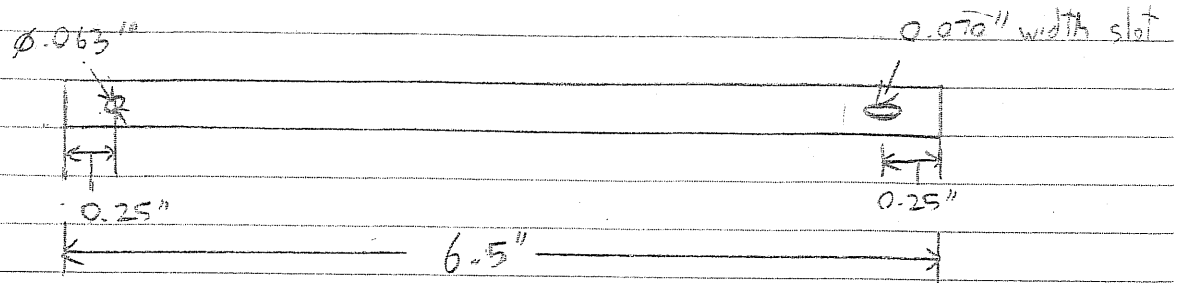
Cabling

1. Pulley Encoder to Feedthrough:
   - have Amphenol D15 Plated Backshells and D15 Female housings

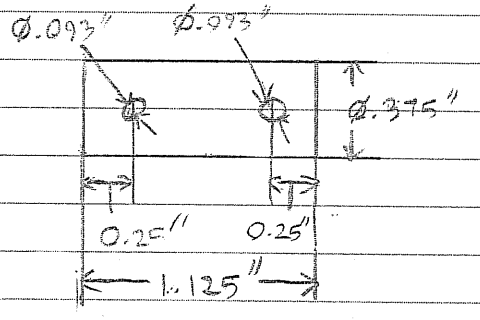
Need MTA type connector for US Digital Encoder

6/11/04 KamLAND old lab : 51-121

6/14/04 Threaded Rod 316 Stainless 1/4 - 28



Coupling 316 Stainless 1/4 - 28 thru



Round or Hex stock okay

6/16/04 Cabling:

slot

① Motor Power – Motor to In Glovebox Feed

	End	Wire	Pin	Checked
Conn is	Motor	Black #1	J	
	"	Black #2	K	
	"	Black #3	L	
	"	Green/Yellow	M	
Conn is	Feed	Black #1	A	
	"	Black #2	B	
	"	Black #3	C	
	"	Green/Yellow	D	

② Slip Ring – Slip Ring to In Glovebox Feed

	End	Wire	Pin	Checked
Conn is D9	D9	black #1	1	
	"	brown #2	2	
	"	red #3	3	
	"	orange #4	4	
	"	yellow #5	5	
	"	green #6	6	

(3) Encoder – Encoder to In Glovebox Feed

	End	Wire	Pin	Checked
Conn is				
	Encoder	Black	1	
	"	NA	2	
	"	Blue	3	
	"	Red	4	
	"	Yellow	5	
Conn is D15	Feed	Black	1	
	"	NA	2	
	"	Blue	3	
	"	Red	4	
	"	Yellow	5	

(4) Motor Feedback – Motor to In Glovebox Feed

End	Wire	Awg	Pin	Checked
Motor	White	28	A	X
"	Yellow	28	B	X
"	Green	28	C	X
"	Blue	28	D	X
"	Orange	28	E	X
"	Brown	28	F	X
"	Black	20	G	X
"	Red	20	H	X
"	Wht/Grn	20	K	X
"	Wht/Blu	20	M	X
"	Wht/Vio	28	P	X
"	Wht/Brn	28	T	X
"	Wht/Org	28	U	X
"	Red/Blue		N/A R	
"	Red/Blue		N/A S	

"	Yellow/org	28	L	X	
"	Yellow/Org	28	N	X	
Feed	White	28	5		
"	Yellow	28	6		
"	Green	28	7		
"	Blue	28	8		
"	Orange	28	9		
"	Brown	28	10		
"	Black	20	3		
"	Red	20	1		
"	Wht/Grn	20	11		
"	Wht/Blu	20	14		
"	Wht/Vio	28	18		
"	Wht/Brown	28	16		
"	Wht/Org	28	17		
"	Red/Blue		N/A	20	(R)
"	Red/Blue		N/A	21	(S)
"	Yellow/org		12		(L)
"	Yellow/Org		13		(N)

6/22/04

(5) Encoder - In Glovebox Feed to Out Glovebox Feed

cable is ~ 4 feet long

End	Wire	Pin	Checked
interchangable	Black	8	
"	~~Green~~	~~7~~	
"	Blue	6	
"	Red	5	
"	Yellow	4	

(6) Slip Ring = In Glovebox Feed to Out Glovebox Feed

End	Wire	Pin	Checked
Interchangable	green	9	
"	yellow	1	
"	orange	2	
"	red	3	
"	brown	4	
"	black	5	

Cable is 3 1/2 feet long

6/28/04 Measurements on 4 pi assembly for clearance checking of z-axis hardware

Z-axis w/o cable attachment piece: 20½"

Penthouse Base to Pin Block: 25"
Upper Spool Axis to Pin Block: ~ 31.5"
Upper Pulley Axis to Pin Block: ~ 47.5"

Calibration Meeting

1. In Glovebox Cables
   - Crimped
   - Viton sealant
   - Shielding?
2. Flanges for Feedthrus — status?
3. Backplate drawing
4. Anodize Connectors — what type of anodizing?
   → Connectors to be gold plated

Ceramised Vac side connector:

Amphenol: 97-3106A18-10S-639 size 12 contac
97-3057-1010 (676)

Amphenol Crimp Equivalent:

gold 85-*-618-10S
silver 75-*-618-10S

Crimp Contact : 9738 - 12165 $\frac{4}{5}$ (920)

6/30/04 Kamland Tools and Supplies

small screwdriver set
jewelers screwdriver set
small needlenose, 90° needlenose pliers and sidecutters
~~[illegible] 9V battery~~
solder vac
third hand alligator clip assembly
solder sponge

6/

7/7/04 Cable Assembly Procedure:

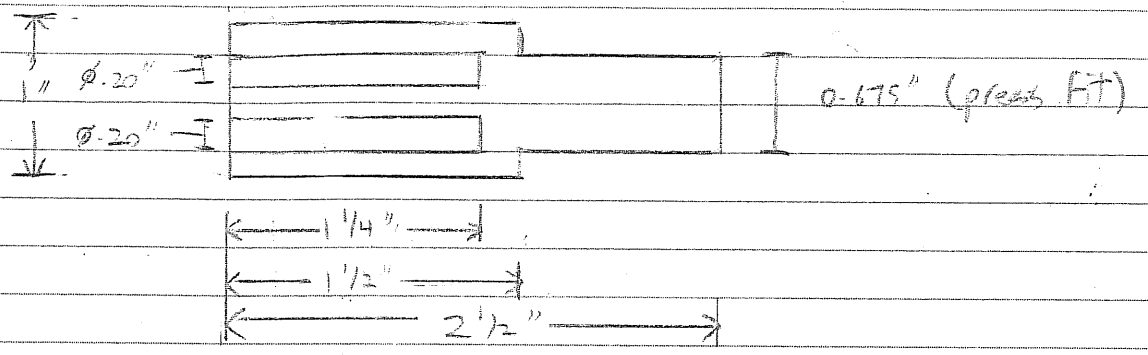
1. Cut individual wires to length
2. Create twisted pairs if necessary
3. Use shrink tubing to organize/bundle
4. Attach connectors
5. Wrap w/ helical bundling.

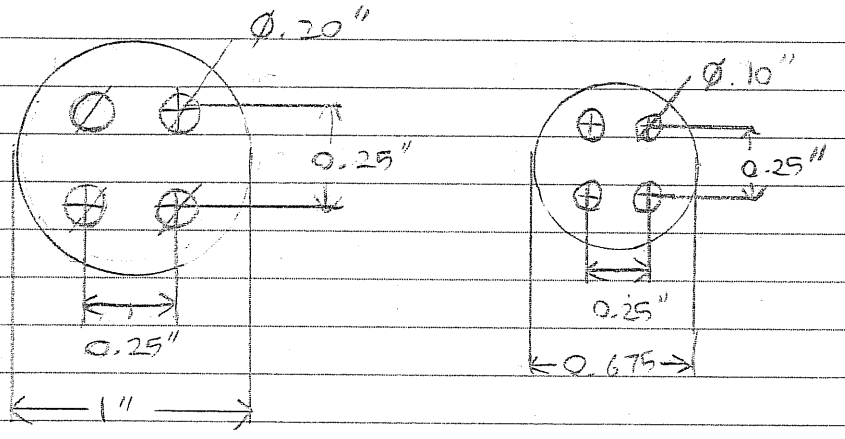
7/8/04 Cabling

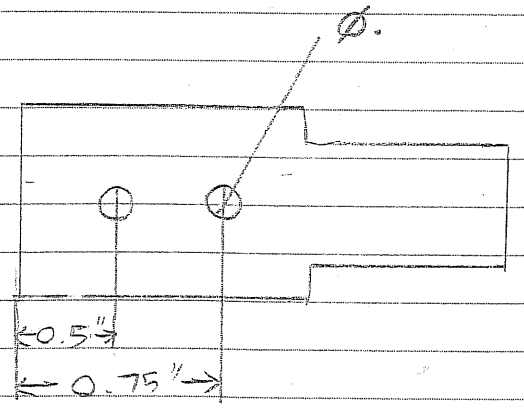
Motor Feedback — In Glovebox Feed to Out Glovebox F

	End	Wire	AWG	Pin	
	Interchangeable	yellow	28	1	
	"	yellow	28	2	
	"	Green	20	3	
	"	Brown	28	4	twisted pair
	"	Orange	28	5	
	"	Blue	28	6	twisted pair
	"	Green	28	7	
	"	Yellow	28	8	twisted pair
X	"	White	28	9	
	"	Black	20	11	
	"	Red	20	13	
	"	Blue	20	25	
	"	Brown	28	23	
	"	Orange	28	22	
	"	Purple	28	21	
		Black	22	18	
		Red	22	19	

Feedthru Insulator







7/16/04 Cabling Cont...

Motor Power : Out Glovebox Feed to Drive

End	Wire	AWG	Pin
MS18-105	Black #1	14	A
"	Black #2	14	B
"	Black #3	14	C
"	Gra/Yel	14	D

Motor Feedback : Out, Glovebox Feed to Drive

	End	Wire	AWG	Pin
1	Amp	White	22	5
2	"	Green	22	7
3	"	Orange	22	9
4	"	Black	22, 20	3, 4
5	"	Red	22, 20	1, 2
6	"	Wht/Blk	22, 20	11, 15
7	"	Wht/Org	22	17
8	"	Yellow	22	6
9	"	Blue	22	8
10	"	Brown	22	10
11	"	Wht/Yel	22	12
12	"	Wht/Red	22	14
13	"	Wht/Brown	22	16
14	"	Violet	22	18
15	"	Grey		13

End	Wire	AWG	Pin
D25	White	22	5
"	Green	"	7
"	Orange	"	9
"	Black	"	3
"	Red	"	1
"	Wht/Blk	"	11
"	Wht/Org	"	17
"	Yellow	"	6
"	Blue	"	8
"	Brown	"	10
"	Wht/Yel	"	12
"	Wht/Red	"	14
"	Wht/Brn	"	16
"	Violet	"	18
"	Gray	"	13

Encoder: Out Glovebox Feed to Readout

End	Wire	Pin	Function
D9	Yellow	1	Gnd
"	green	3	A channel
"	red	4	+5 VDC
"	black	5	B channel
RJ-11	yellow	2	Ground
"	green	3	A channel
"	red	4	+5 VDC
"	black	5	B channel

Motor Power - In Glovebox Feed to out Feed

End	Wire	AWG	Pin
custom for MS 18-105	Black	14	A
"	Grey	14	B
"	White	14	C
	Green	14	D

To Order

~~Velcro tape~~
~~Sockets for 18-105~~
~~Stainless steel 4-40 1/4" socket head cap screws~~
~~cable tags~~
o-rings for windows
~~Velcro sticky tape~~

7/26/04 Socket contacts for 18-105 :- size 12

Amphenol: MS100-033-0012
Military: M39029/30-219

~~D9 cable 15 m~~
order o-rings
~~mount for motor controller~~
~~shipping boxes~~

Shipping Cases:

Penthouse 28" x 35" x 20" 100 lbs
Drive Plate 45" x 15" x 10" 80kg, 150-200 lbs

Dimensions for Shipping:

controller box: 21" x 13" x 16"
computer monitor: 18" x 18" x 18"
computer: 13" x 9" x 8"
box w/ rotary stage: 21" x 21" x 11"

Shipping Cases:

(1)	Drive plate	45" x 15" x 15"	~80 kg = ~180
	Box of I.D.	49" x 19" x 19"	
(2)	Penthouse	28 x 35" x 20"	~40 kg = ~90
	Box of I.D	32" x 39" x 24"	
(3)	Controller Box	21" x 13" x 16"	~15 kg = ~3
	Box of I.D.	25" x 17" x 20"	

Cable: Operator Panel to GK controller

	End	Wire	Pin	Function
1bs	D9	Black	5	Gnd
	"	Red	9	+5VDC
1bs	"	~~Yellow~~ blue	3	Tx
	"	~~Blue~~ Yellow	2	Rx

5 lbs 7/28/04 Additional Cabling for Fred Gray:

(1) encoder inputs on GK controller:

RJ-11 jack
DB 9 socket
Phone cord

(2) DB 25 breakout connectors

[redacted]

Masses of Kamland Parts:

Woven Cable 31"	60.427 g
Titanium Pole Segment	
Pivot Block	
Cable Attachment	58.811 g ← aluminum
Source Attachment	
Male Bicycle Coupling	38.046 g
Snap ring	3.185 g
Collar	5.478 g
Female bicycle coupling	38.846 g
Threaded collar	56.869 g
Mating piece for cable attachment	23.235 g ← aluminum

Motor isolation box:

Depth: 6.5"
Width ID: ~~5"~~ 4.75"
Space between braces: [redacted]

Al x 7265

8/11 Items to Order:

1. ~~stainless steel cable crimper~~
2. ~~nylon cable holders~~
3. Book for Karsten
4. Thandle screws for pin block

Motor Power Cable En Glovebox

End	Wire	Pin
motor	Black #1	J
"	Black #2	K
"	Black #3	L
"	Black #4	M
Feed	Black	A
"	Grey	B
"	White	C
"	Green	D

Correspondence

J ⟺ A ⟺ U (at drive) Brown
K ⟺ B ⟺ V (at drive) Red
L ⟺ C ⟺ W (at drive) Orange
M ⟺ D ⟺ ⏚ (at drive) Black

8/12 Length from pin block flange to floor in 51 hi-bay: 3' 9½"

Shoulder Bolt: ¼" shoulder dia, 1½" shoulder length

BTC Wrench: no more than 9" overall

8/13 Encoder to Drive

End	Wire	Pin #	Function
D9	Black	9	Gnd
"	Black	8	SE (Gnd'd)
"	Red	2	A Channel
"	Green	1	+5 ADC
"	Yellow	4	B Channel
RJ-11 Recpt	Black	2	Ground
"	Red	3	A channel
"	Green	4	+5VDC
"	Yellow	5	B channel

THIS IS THE CORRECT PINOUT WRONG COLOR CODE

8/17 Things To Order:

1. Stainless steel braided sleeving: 1/4" dia outside
2. Isolation box for motor control panel:
3. Panel grommets

Distance from 1st pin to tip of Z-axis weight assembly: 8 1/2"

RJ-11 at Encoder Readout

Pin	Wire	Function
2	Black	Ground
3	Red	A channel
4	Green	+5 VDC
5	Yellow	B channel

8/19 Link: Blue wire — Gnd
Wht/Brn — Data
[illegible] — Aux

12 each 1" and 3/8" diameter, 1/16" cross section O-rings

Gearbox:

Larson Manufacturing Inc.

8/26/04 Motor Tuning Issues:

1. Encoders –

   SFR Command — 6K Series Command Reference p. 231
   Cabling

2. Torque Limiting –

   DMTLIM Command Genini Series Programmer's Reference p. 82

3. Acceleration / Deceleration Parameters

4. Tuning 6K User Guide Addendum p 7

5. Following Mode

   Ch 6 6K Series Programmers Guide

Camara Setup Info:

Axis 2120

Translated Name: Kanland-axis2120.lbl.gov
IP Address: 128.3.32.44
Ethernet Address: ØØ-4Ø-8C-5B-7F-5D

Axis 2100

Translated Name: Kanland-axis2100.lbl.gov
IP Address: 128.3.32.52
Ethernet Address: ØØ-4Ø-8C-64-DB-58

Users and Passwords

User: root admin privledges
Password: ~~[illegible]~~ 4pi#Cam

User: Kanland Viewing privledges
Password: ~~[illegible]~~ sendai03

My computer's IP Address: 128.3.32.240
4pi PC " " : 131.243.36.164

4pi computer IP Address 131.243.36.179

Bldg 51 room 8A

8/21/04 Control Circuit Installation:

Connectors:

① DB15 Female for RP240 Interface; Stop and Enable Switches Red and Green LED's

Pin	Wire	Function
2	Yellow 22 AWG	RP 240 Tx (Controller Rx)
3	Blue 22 AWG	RP 240 Rx (Controller Tx)
5	Black 22 AWG	RP 240 Gnd
9	Red 22 AWG	RP 240 +5VDC
	White	Stop Switch
	Brown	Enable Switch
	Purple	Red LED
	Green	Green LED
	Grey	Gnd
10	Orange	+5 VDC

② DB9 Female for GK Controller

Pin	Wire	Function
2	Yellow 22 AWG	Controller Rx (RP240 Tx)
3	Blue 22 AWG	Controller Tx (RP240 Rx)
5	Black 22 AWG	Controller Gnd
9	Red 22 AWG	Controller +5VDC

(3) MS 2pin male Board Power

Pin	Wire	Function
A	Red	+5VDC
B	Black	Gnd

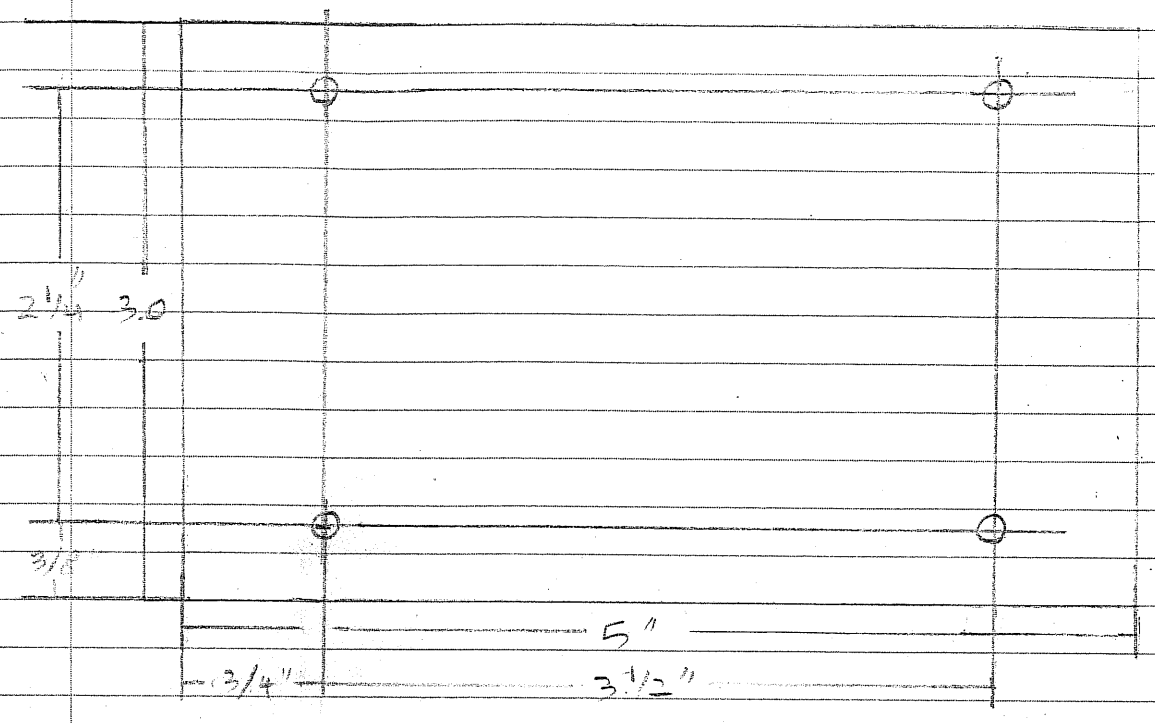
(4) MS 2 pin Female Controller Enable

Pin	Wire	Function
A	White	Enable
B	Black	Gnd

(5) MS 2 pin Male Input From Lix Aux

Pin	Wire	Function
A	Brown	Input

Layout Top View



Drill for #4 thru : #29
Drill for 4-40 tap : #43

D15 :

Relay : DF2E - L2 - DC5V

Cable GK Controller and Enable Circuit to Remote Panel

Pin	Wire	Function
2	Yellow	RP240 Tx
3	Blue	RP 240 Rx
5	Black	RP240 Gnd
9	Red	RP204 +5VDC
10	Orange	+5VDC
11	White	Stop Switch
12	Brown	Enable Switch
13	Purple	Red LED
14	Green	Green LED
15	Grey	Gnd

9/2/04 Panel LEDs (Red and Green): spot is +

High Bay Items:

IP Addresses
Flange Cover
Bag for Cable Spool.
Screws for Flange plate

Motor Power Out Feed to Drive

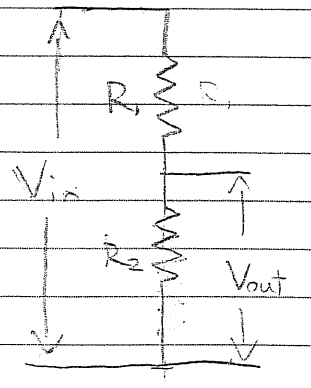
End	Wire	Pin	Function
MS 12-10S	Brown	A	
"	Red	B	
"	Orange	C	
"	Black	D	

McMaster Carr order:

O rings for instrumentation unit
bolts for pin block

x4559

9/10/04 Voltage Divider



$$V_{in} - I(R_1 + R_2) = 0$$

$$I = \frac{V_{in}}{R_1 + R_2}$$

$$V_{out} = I R_2 = \frac{V_{in} R_2}{R_1 + R_2}$$

9/13 Camera Setup

2100 Translated Name:
IP Address:

9/17 Rack enclosure for Mains Filters, etc for motor drives:

Sides: LBL 5975-53369
Top: LBL 5975-53412
Bottom: LBL 5975-53411
Front: LBL 5975-53353
Back: LBL 5975-53361

Rack Shelves:

Bud SA-1752-BT

Mains Filters:

Corcom 10EP1

Varistor:

LittelFuse V275LA20A

Vacuum Fittings for Convectron Gauges:

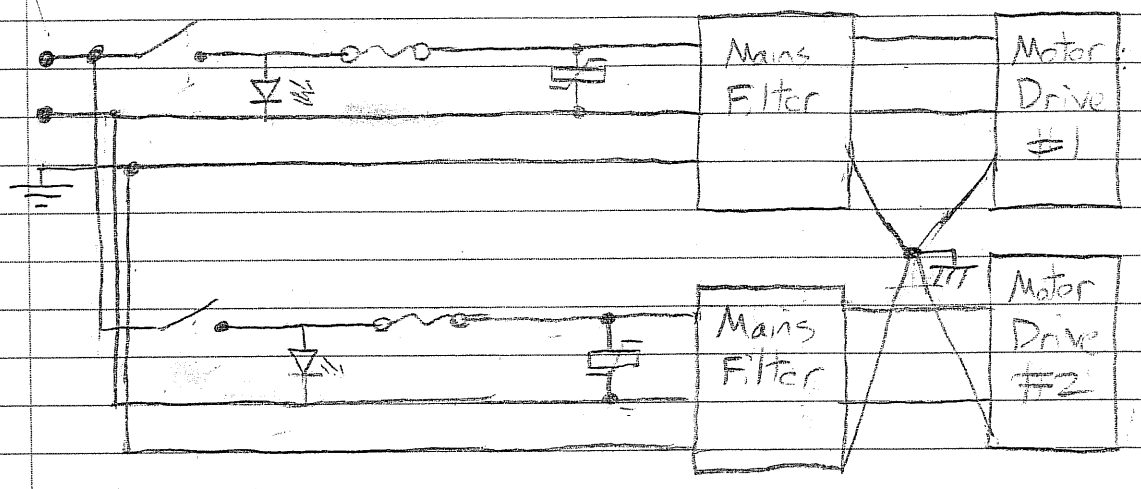
NW50 → NW40 Adapter	MDC 732005	1
NW40 → NW25 Adapter	MDC 732003	1
NW 25 T	MDC 724001	1
NW40 90°	MDC 723002	1
NW 50 90°	MDC 723003	1

NW50 centering ring assembly	SS/Viton	710003	6
NW50 Clamp		701003	6
NW40 Centering ring assembly	SS/Viton	710002	6
NW40 Clamp		701002	6
NW25 Centering ring assembly	SS/Viton	710001	6
NW25 Clamp		701001	6

NW50 Blank	K200B	4
NW40 Blank	K150B	4
NW25 Blank	K100B	4

9/21/04 Schematic for Fuses and Mains Filters

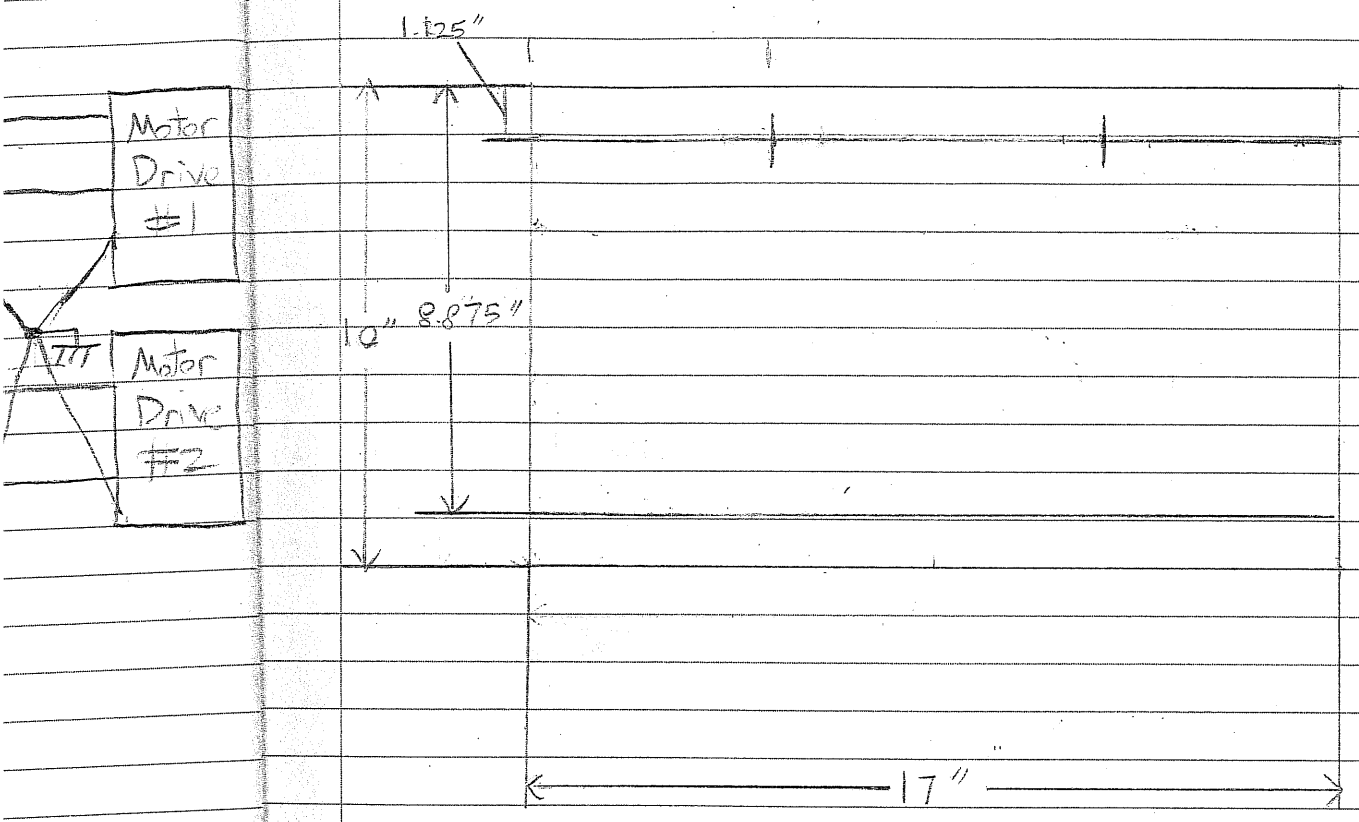
According to Jim Rice only a SPST switch and single fuse and varisitor is needed for safety

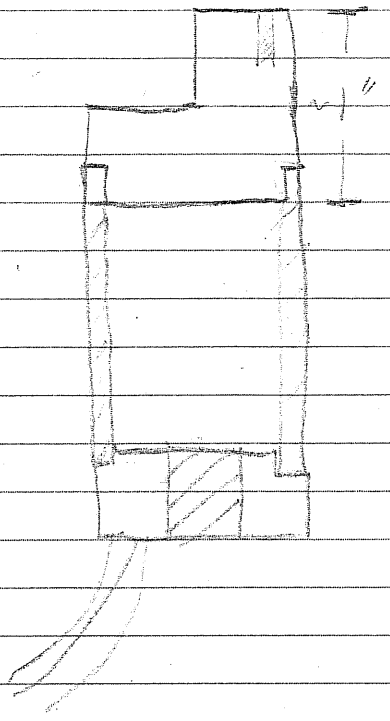


Vapor enclosure ready 9/22 – 9/23

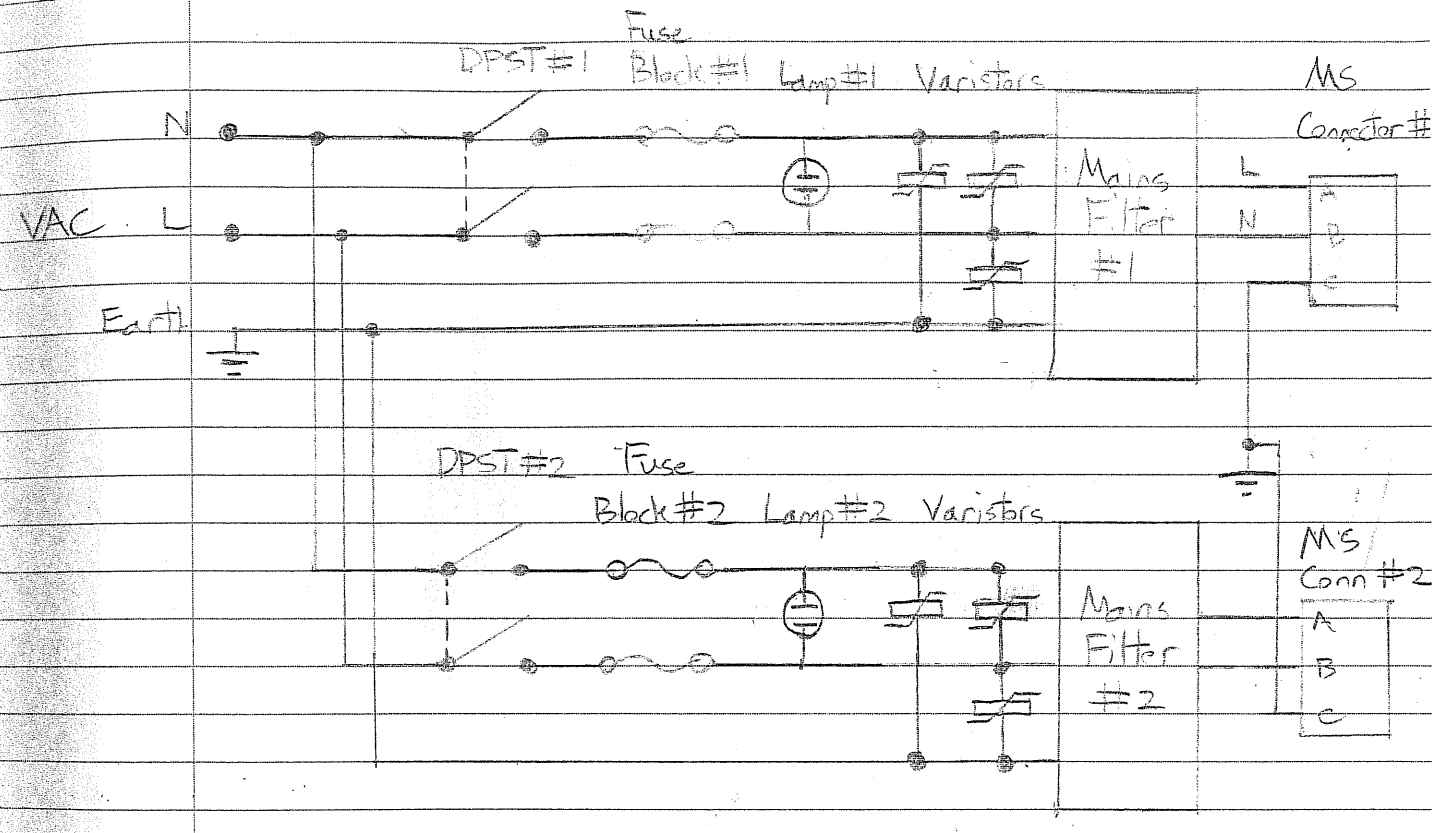
T switch and
l for

Motor Drive Panel Mount





9/29/04 Schematic for Motor Drive Fuses and Mains Filters:



Fuses: Bussman FRN-R-10
Varistors: Littelfuse V250LA20
Mains Filter: Corcom 10EP1

MS Connectors go to motor drives peak current 7.5A each

10/1/04 Items for 4p Control Electronics

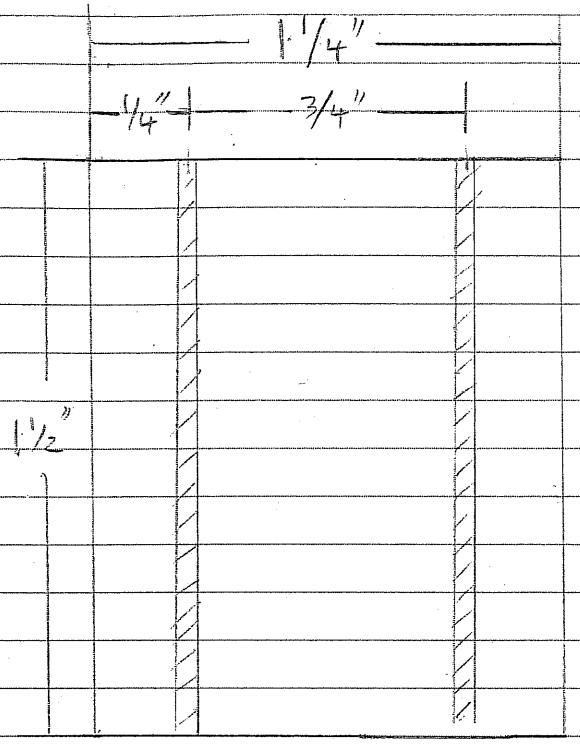
~~① Rack power strip~~
② Extension cord for Motor Drives 10 ft > 15 A
③ Cord for Drive pwr cables 16/3
④ Terminal covers for drives → machine shop
⑤ mounting rods for motor drive rack mount
~~⑥ daisy chain box for RS 232 (DB9 cables)~~
~~⑦ cables to enable circuit~~
~~⑧ additional fuses for drives FRN-R-10~~
~~⑨ LED clusters~~

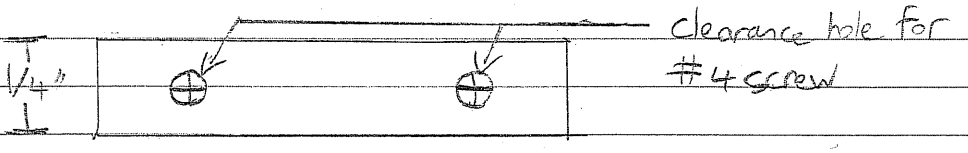
Also:

Crimper and pins for Ceramaseal D-subs

10/5/04

SIDE





TOP

Lucite cap will have 2 4-40 tapped holes spaced 3/4" apart

E-mail Fax 1 (928) 752-5173

DB9:	0.76"	0.38" ≈ 3/8
	0.65"	0.325" ≈ 5/16
	0.42"	0.215" ≈ 7/32

Bud Box: 2 1/8" x 1 5/8"

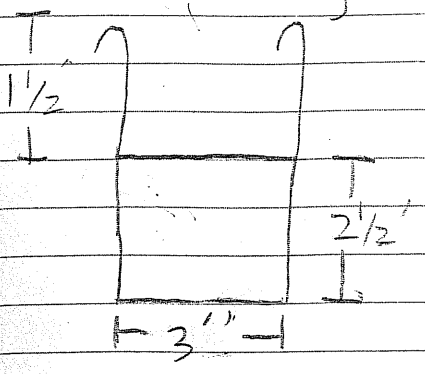
center at 1 1/16", 13/16"

Pinout of encoder cable (after several transitions at end of RJ-11 → DE-9 cable):

ground	black
A	red
+5V	green
B	yellow

Pinout on p. 26 is correct!

3/12/04 UHV Cleaning Rack



Total length of cable: ?

Length of cable that will fit on rack:

$$\frac{\text{horiz length}}{\text{cable width}} = \#\text{ of turns}$$

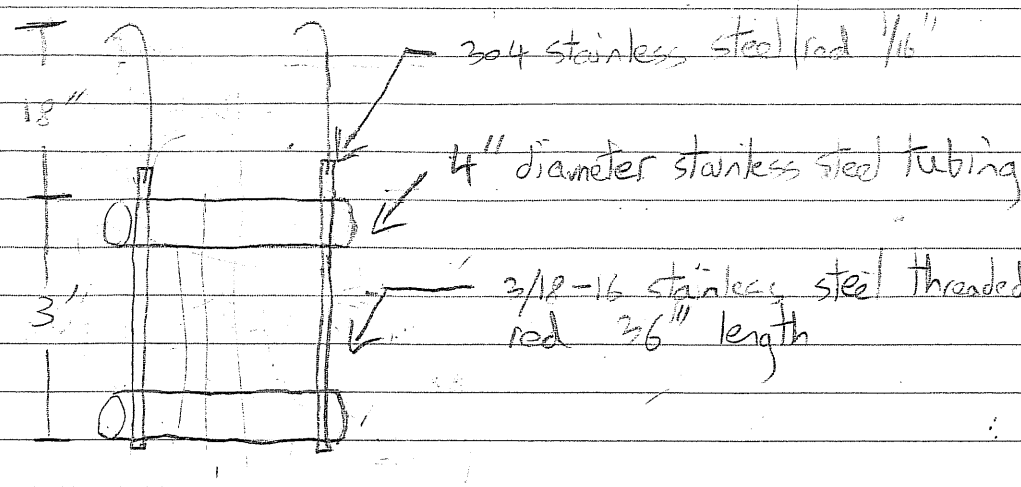
$$\frac{36''}{1''} = 36 \text{ turns}$$

cable length = # turns × vert length × 2

$= 36 \times 2\tfrac{1}{2}' \times 2$

$= 36 \times 5'$

$= \boxed{180'}$ ← should be more than enough!



Materials List:

1/16" stainless rod 3 ft
3/8-16 stainless threaded rod 6 ft
3/8-16 stainless nuts
4" diameter stainless tubing 2 lengths of 3 ft
stainless steel hose clamps
3/8" stainless rod 1 ft
stainless wire
bags ?

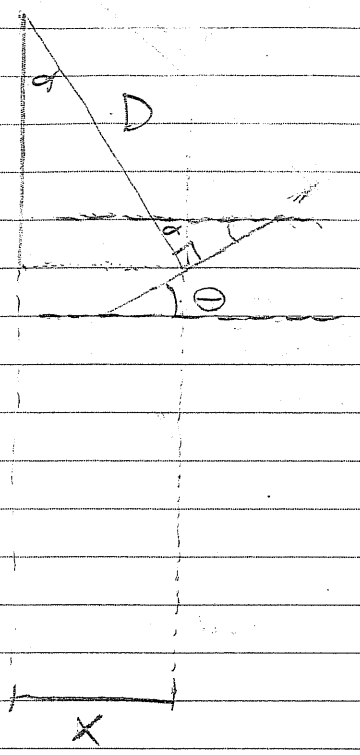
10/19/04 Engineering login password: ~~7841adf7841~~
41bbsaf@

Filing Notes:

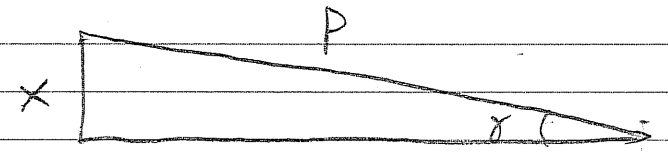
~~27A101 filed as size A should be size E~~
~~27A128 missing category code~~
~~27A108 missing category code~~

27A112 size 2 corresponds to what? → A4

George Weber 642-3557



$$x = D \sin\alpha$$



$$\frac{x}{P} = \sin\gamma$$

$$\gamma = \operatorname{asin}\left(\frac{x}{P}\right)$$

Needed Items:

plumb bob
spool
bag
scintillator

Create Log File

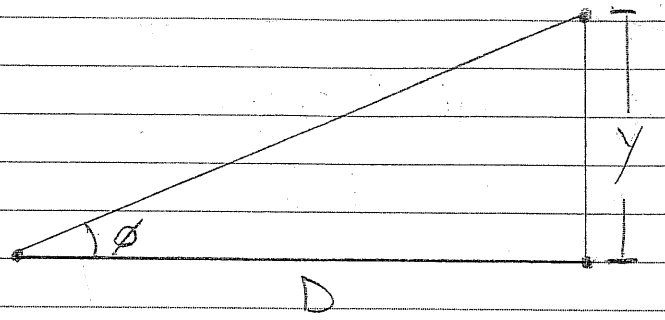
Exit control and display program
go to KamLAND/FourPi/Control/src
mv logFile logFile.something
Touch logFile

Using VNC

Vncserver
at laptop fourpi.dhcp.lbl.gov:1
Password: 4piControl

11/3/04 Transit and Pole Positioning Calculations

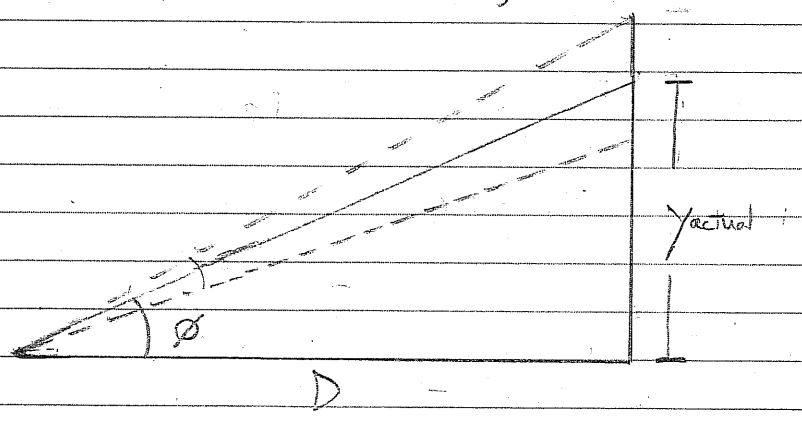
Vertical Displacement (no angular error)



$$\tan\phi = \frac{y}{D}$$

$$\boxed{y = D\tan\phi}$$

Vertical Displacement (with angular error)



$$y_{actual} = D\tan\phi$$

$$y_{measured} = y_{actual} \pm y_{error}$$
$$= D\tan(\phi \pm \varepsilon)$$

$$\pm\Delta y = y_{measured} - y_{actual}$$
$$= D\tan(\phi \pm \varepsilon) - D\tan\phi$$

$$\tan(\phi \pm \varepsilon) = \frac{\tan\phi \pm \tan\varepsilon}{1 \mp \tan\phi \cdot \tan\varepsilon}$$

Cont. below ↓

4/04 Z Axis Tests

Distance from upper pin to tip: 25.4 cm
Distance from top of flange to floor: 10.9 m

Cable 2 Log File: logFile.211040 4_2
Cable 1 Log File: logFile.211040 4_1

5/04 Transit questions:

vertical angle adjustment
levelling transit
vertical height adjustment

small angle approx $\tan\varepsilon \approx \varepsilon$

$$\tan(\phi \pm \varepsilon) \approx \frac{\tan\phi \pm \varepsilon}{1 \mp \varepsilon\tan\phi}$$

$$\Delta y = D\left[\frac{\tan\phi \pm \varepsilon}{1 \mp \varepsilon\tan\phi} - \frac{\tan\phi(1 \mp \varepsilon\tan\phi)}{1 \mp \varepsilon\tan\phi}\right]$$

$$= D\left(\frac{\cancel{\tan\phi} \pm \varepsilon - \cancel{\tan\phi} \pm \varepsilon\tan^2\phi}{1 \mp \varepsilon\tan\phi}\right)$$

$$= \frac{\pm D\varepsilon(1 + \tan^2\phi)}{1 \mp \varepsilon\tan\phi}$$

$$\Delta y = \frac{\mp D \varepsilon \sec^2 \phi}{1 \mp \varepsilon \tan \phi}$$

Z axis testing cont.

Cable 1 log File: logFile.211050 4-2

Cable 1 Test

Target	Pulley	Motor	Overshoot
210 cm	210 cm	186.18	~10 cm
310 cm	310.00	273.45	~10 cm
610 cm	609.98	529.91	~40 cm
810 cm	810.01	695.03	~42 cm
910 cm	—	—	~28 cm
1010 cm	1010.01	853.96	~35 cm
1020 cm	1020.00	861.67	~4 cm
1030 cm	1029.98	869.31	~4 cm
1040 cm	1040.00	877.15	~4 cm
1050 cm	1049.98	884.86	~4.3 cm
1060 cm	1060.00	892.89	—
1070 cm	1069.98	900.09	~4.7 cm
1071 cm	1070.98	900.85	~0.5 cm
1072 cm	1072.00	901.61	~0.5 cm
1073 cm	1073.02	902.38	~0.5 cm
1074 cm	1073.98	903.11	~0.5 cm
1075 cm	1075.01	903.89	~0.5 cm
1076 cm	1076.00	904.65	~0.5 cm
1077 cm	1076.99	905.39	~0.5 cm
1078 cm	1077.99	906.15	~0.5 cm
1079 cm	1079.01	906.91	~0.5 cm
1080 cm	1079.99	907.68	~0.5 cm

1081	1081.00	908.46	~0.5cm
1080	1080.00	907.69	~0.5cm
1079	1079.01	906.93	~0.5cm
1078	1077.99	906.16	~0.5cm
1077	1076.99	905.40	~0.5cm
1076	1075.99	904.65	~0.5cm
1075	1075.01	903.90	~0.5cm
1074	1074.00	903.14	~0.5cm
1073	1072.99	902.39	~0.5cm
1072	1072.00	901.63	~0.5cm
1071	1071.02	900.89	~0.5cm
1070	1070.01	900.12	~0.5cm
1060	1060.00	892.50	~4.7cm
1050	1049.99	884.88	~4.5cm
1040	1040.00	877.16	~4.5cm
1030	1030.01	869.33	~4.2cm
1020	1019.98	861.66	~4.3cm
1010	1009.99	853.96	~4.1cm
910	909.96	775.23	~37cm
810	810.00	694.96	~30cm
610	610.01	529.74	~46cm
310	310.01	273.12	~45cm
210	210.02	185.79	~10cm
10	10.01	8.19	~15cm
0	-0.01	-0.72	~0.6cm

11/9/04 Cable Stretch Test

Cable #1

6827 g
872.6 g
1467.5 g
1179.4 g
4102.2 g total

Test #	Weight [kg]	Pulley Encoder [cm]	Disp [mm]
	0	0	0
	1000.8		~0
	1099.9	0.06	~0
	1467.5	0.10	~2
	1179.4	0.12	~2

11/11/04 Cable Stretch Test

Because of inconclusive results on 11/9 I am repeating the stretch test using an optical transit. A scale has been attached to the cable clamp and sighted through the transit. As weight is added it should be possible to read the stretch from the scale and by using the vertical micrometer on the transit.

The cable is approx. 10 m from the glovebox assembly.

[mm]

Test #1

Weight [g]	Scale Reading [in]	Micrometer Reading [in]
0	4.800	0
-1179.4	4.840	+0.011
-872.6	4.880	+0.009
-1143.9	4.920	0
-1177.2	4.940	+0.006
-1000.8	4.960	+0.009
-1099.9	4.980	+0.011
-966.7	5.000	+0.011
-1255.4	5.020	+0.016
-867.7	5.040	+0.013
-883.2	5.060	+0.010

Removing weight ...

-883.2	5.060	+0.001
-966.7	5.040	+0.007
-867.7	5.020	+0.013
-1255.4	5.000	+0.012
-1099.9	4.980	+0.013
-1143.9	4.960	+0.009
-1000.8	4.940	+0.004

	−1177.2	4.900	+0.009
	−1179.4	4.860	+0.008
	−872.6	4.800	+0.012

Test 2	0	4.800	0
	1743.1	4.860	+0.016
	1000.8	4.900	+0.020
	883.2	4.920	+0.014
	966.7	4.960	+0.006
	736.5	4.980	−0.001
	1099.9	4.980	+0.017
	872.6	5.000	+0.015
	862.7	5.020	+0.009
	1177.2	5.040	+0.028
	1143.9	5.060	+0.009

Removing Weights ...

	−1177.2	5.040	+0.016
	−1143.9	5.020	+0.019
	−862.7	5.020	+0.006
	−1099.9	5.000	+0.007
	−736.5	4.980	+0.014
	−872.6	4.980	−0.001
	−883.2	4.960	−0.003
	−966.7	4.920	+0.014
	−1000.8	4.900	0
	−1743.1	4.800	+0.015

Micrometer Reading Error : 0.0005"
Graduation width: 0.008"

11/12/04 Distance from Z-axis assy tip to center of cable clamp pin: 44.5 cm

Distance from top of glovebox flange to floor: 109 cm

$$y = D \tan \phi$$

$$\frac{dy}{dD} = \tan \phi$$

$$\frac{dy}{d\phi} = D \frac{d}{d\phi}\left(\frac{\sin \phi}{\cos \phi}\right) = D \left[\frac{\overbrace{\cos \phi \cos \phi + \sin \phi \sin \phi}^{=1}}{\cos^2 \phi}\right]$$

$$= \frac{D}{\cos^2 \phi}$$

$$dy = \sqrt{(\tan \phi \, dD)^2 + \left(\frac{D}{\cos^2 \phi} \, d\phi\right)^2}$$

10.75 + 0.10
11.00 − 0.11

11/16/04 Z axis repeatability

Start Value:	2.030"	2m up and down
End Value:	2.054"	in 1m incr.
Start Value:	2.064"	3m up and down
End Value:	2.004"	in 1m incr.
Start Value:	2.014"	3m up at 1 rev/sec:
End Value:	2.001"	3m down at 5 rev/sec

Z axis translation:

Distance from transit to Z-axis: 42' 1/4"
= 1280.8 cm

	Translation	Deg
Cable 1	1m	6°
	2m	8.9°
	3m	13.1°
	4m	17.25°
	5m	21.2°
	6m	25°
	7m	28.5°
	6m	25°
	5m	21.2°
	4m	17.25°
	3m	13.1°
	2m	8.8°
	1m	4.4°
	0m	0°

2m up and dow
in 1m incr.

3m up and down
in 1m incr.

m up at 1 rev/
m down at 5 rev/

is : 42' 1/4"
= 1280.

horizontal 42' 10.75" (via tape)
- 10
= 42'.75"

horizontal (via pole)

① @ level = 54 1/16" ⇒ 6.12° measured

② from level (54 1/16") to 6 1/16", 48" total ⇒ 5.45' measured

① corresponds to horiz distance of 42.0175"
② corresponds to horiz distance of 41.925'

Cable 2:

Translation	Deg Measured
1m	4.5°
2m	8.9°
3m	13.2°
4m	17.35°
5m	21.35°
6m	25.2°
7m	28.75°
8m	32.1°
7m	28.75°
6m	25.2°
5m	21.35°
4m	17.35°
3m	13.2°
2m	8.8°
1m	4.5°

11/17/04 Pole Geometry Test: θ_{yz} is negative above horiz when like 1 \ 2

Position 1:

ns (1) horiz: 9.35° ccw θ_{x1}
vert: +22.1° θ_{y1}

s (2): ~~horiz:~~ 5.4° cw θ_{x2}
vert: +9.4° θ_{y2}

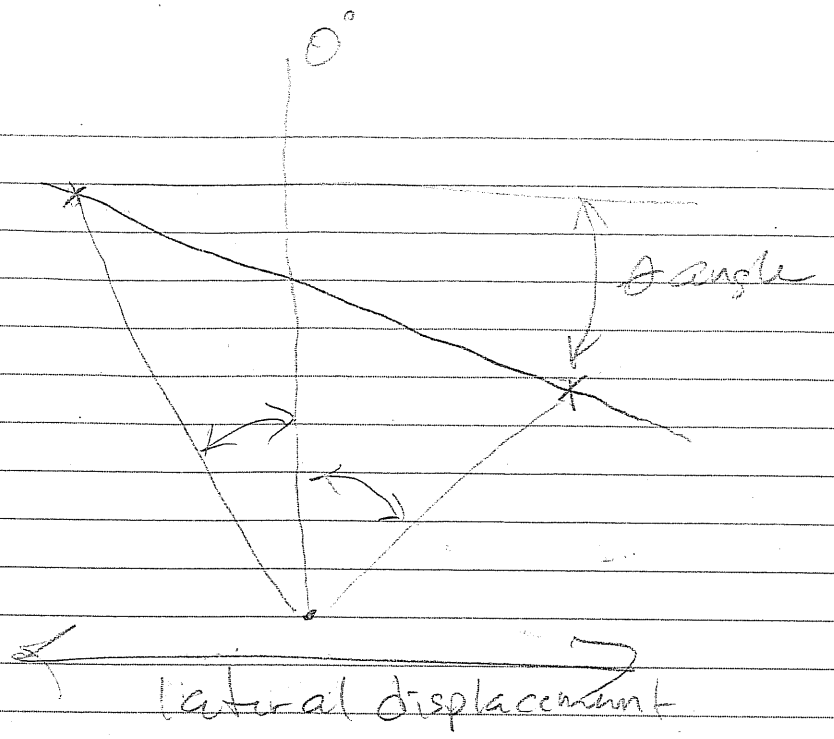
pivot block center: horiz: 0.1° cw
vert: +32.1°

Position 2:

ns: horiz: 10.75° ccw movement detected btwn readings
vert: +23.1°
s: horiz: 6.4° cw
vert: 14.15°
pivot block center: horiz: 0.1° cw
vert: +32.1°

Position 3:

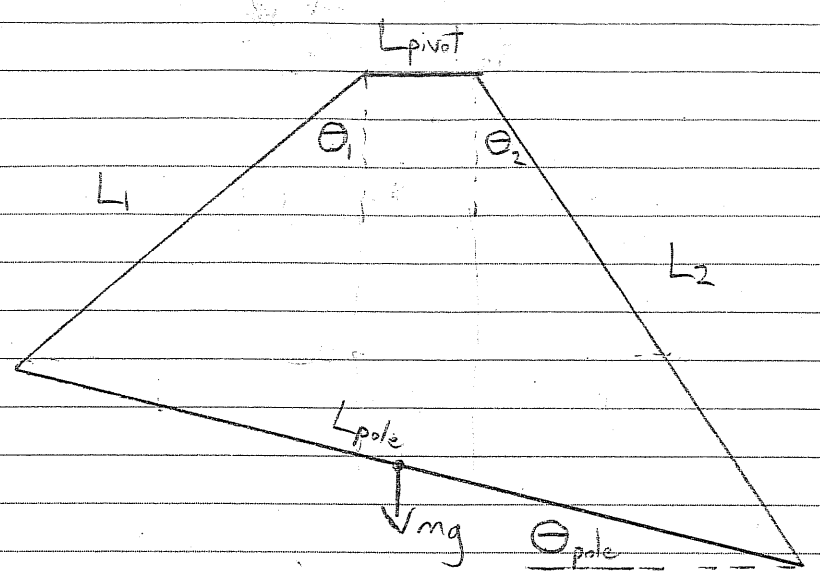
ns: horiz: 7.15° ccw
vert: +20.9°
s: horiz: 4.1° cw
vert: 4.75°
pivot block center: horiz: 0.1° cw
vert: 32.1°



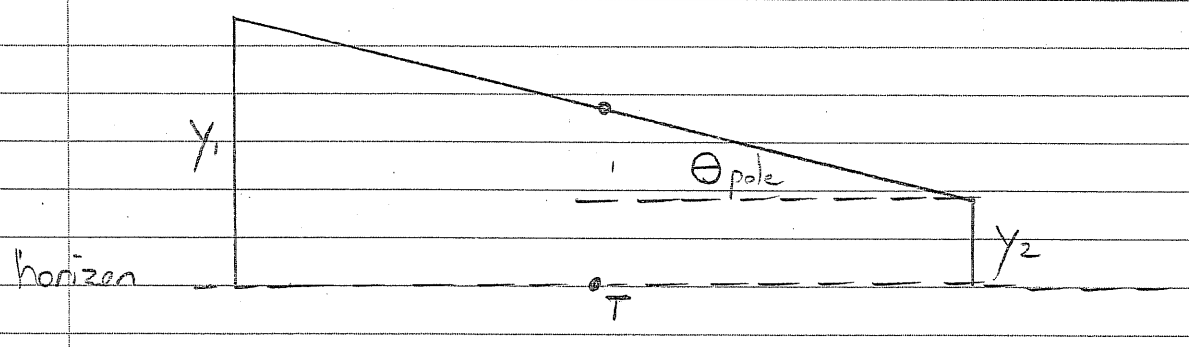
Issues:

1. retraction procedure
2. source attachments / source cage
3. simultaneous motion of upper and lower cables

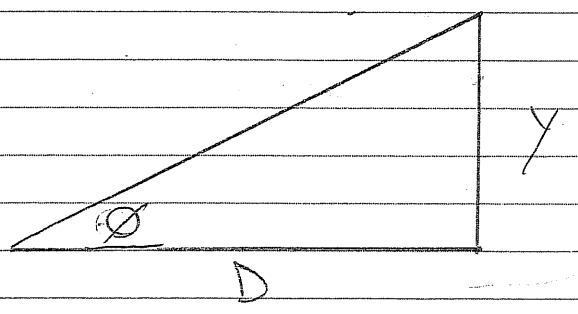
11/30/04



Pole completely above transit horizon



$$\sin\theta_{pole} = \frac{y_1 - y_2}{L_{pole}}$$



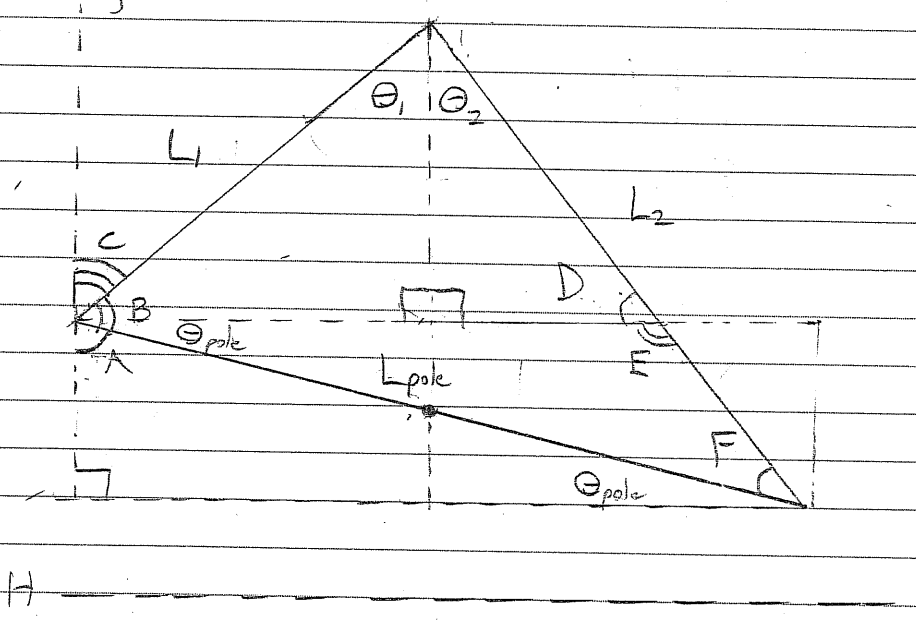
$$y = D\tan\theta_y$$

$$y_1 = D \tan \phi_1$$
$$y_2 = D \tan \phi_2$$

$$\sin \theta_{pole} = \frac{D(\tan \phi_1 - \tan \phi_2)}{L_{pole}}$$

$$\theta_{pole} = \operatorname{asin}\left[\frac{D(\tan \phi_1 - \tan \phi_2)}{L_{pole}}\right]$$

Assuming that $L_{pivot} \to 0$ ...



$$A = \frac{\pi}{2} - \theta_{pole}$$
$$B = \pi - (\theta_1 + \theta_2 + F)$$
$$C = \theta_1$$
$$D = \frac{\pi}{2} - \theta_2$$
$$E = \pi - D = \pi - \left(\frac{\pi}{2} - \theta_2\right) = \frac{\pi}{2} + \theta_2$$
$$F = \pi - E - \theta_{pole} = \pi - \left(\frac{\pi}{2} + \theta_2\right) - \theta_{pole}$$
$$= \frac{\pi}{2} - \theta_2 - \theta_{pole}$$

$$
\begin{aligned}
B &= \pi - (\theta_1 + \theta_2 + F) \\
&= \pi - \theta_1 - \theta_2 - F \\
&= \pi - \theta_1 - \theta_2 - \left(\frac{\pi}{2} - \theta_2 - \theta_{pole}\right) \\
&= \pi - \theta_1 - \cancel{\theta_2} - \frac{\pi}{2} + \cancel{\theta_2} + \theta_{pole} \\
&= \frac{\pi}{2} - \theta_1 + \theta_{pole}
\end{aligned}
$$

4pi Tests

Distance from Transit to pole: ~12.94 m

Pos #1 Clamp 2: V 90.04.47
H 0.38.42

Clamp 1: V 70.28.59
H 359.05.32

Pivot Block: V 57.35.08
H 0.02.21

Source Point: V 95.28.14
H 1.11.31

Pos #2 Source Point: V 92.30.12
H 5.16.19

Cable 2: V 87.32.04
H 3.02.58

Cable 1: V 69.09.00
H 354.49.41

Pivot Block V 57.35.08
H 0.02.58

Pos #3 Source: V: 87.14.38
H: 8.16.47

Cable 2: V: 83.05.12
H: 4.47.42

Cable 1: V: 68.06.52
H: 351.54.34

Pivot Block V: 57.34.23
H: 0.02.15

Pos #4 Source V: 80.22.33
H: 10.30.34

Cable 2: V: 77.16.06
H: 6.14.52

Cable 1: V: 66.39.15
H: 349.36.48

Pivot: V: 57.33.47
H: 0.02.53

Pos #5 Source V: 72.30.49
H: 12.24.56

Cable 2: V: 70.43.02
H: 7.11.45

Cable 1: V: 65.47.12
H: 348.41.06

Pivot: V: 57.34.29
H: 0.02.07

12/15/04 Resuming yesterday's measurements:

1. Turn on motor drives
2. Note current pulley readings
3. Check above with readings of previous day
4. Tare system with readings from #2
5. Clear / stop

Yesterday's Readings: Cable 1 474.84 cm
Cable 2 531.70 cm

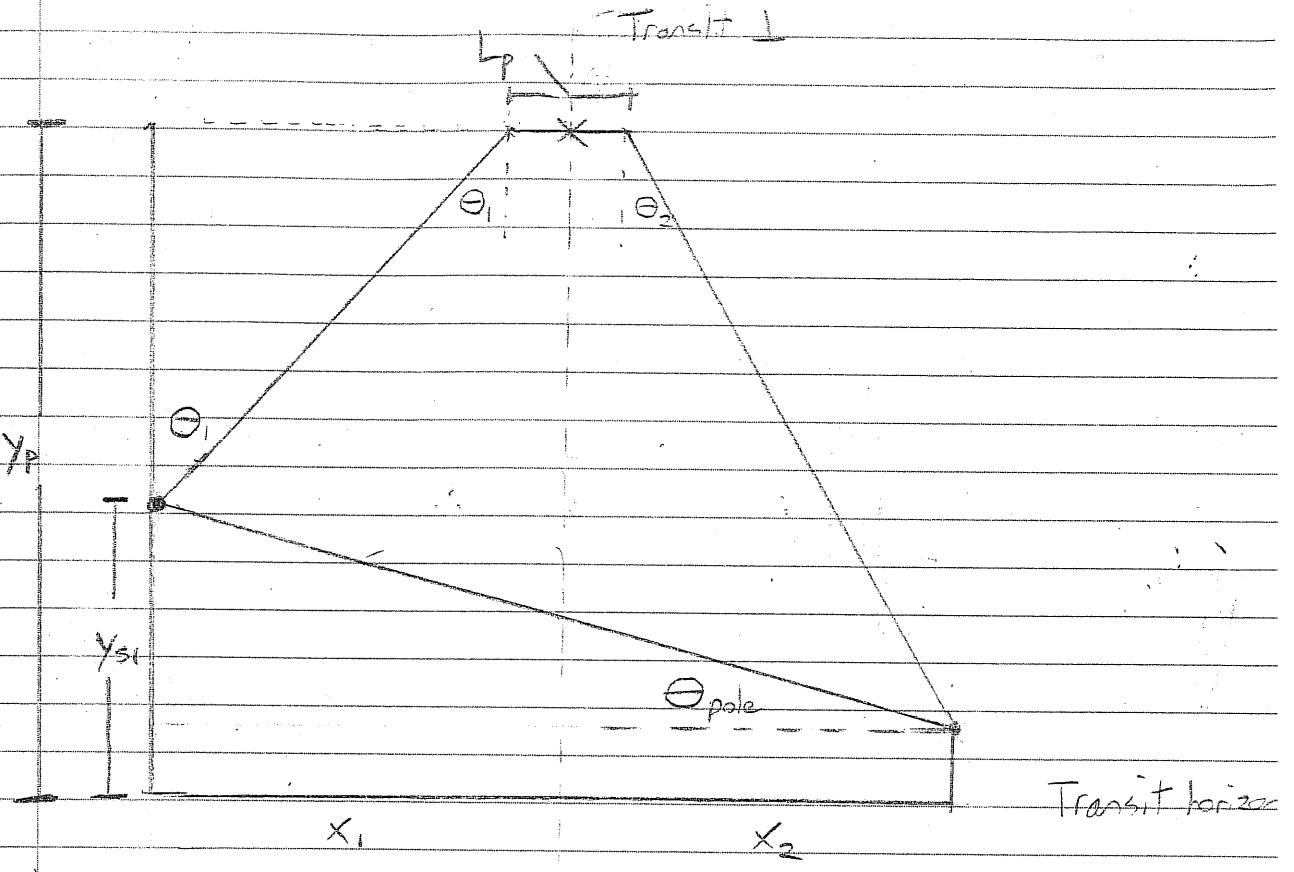
Today's Readings: Cable 1 474.85 cm
Cable 2 543.34 cm

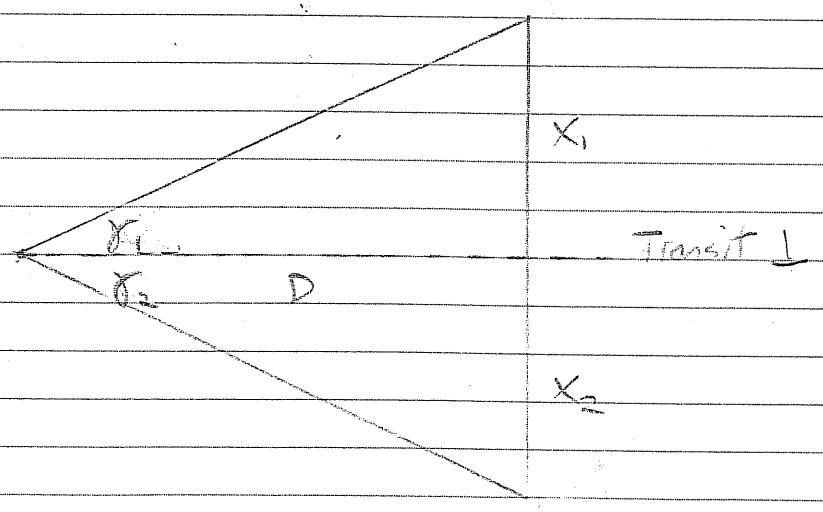
		Source	Cable 2	Cable 1	Pivot
1	V	73.07.24	71.15.35	65.56.21	57.34.59
	H	12.14.21	7.04.41	348.47.55	0.00.09
2	V.	65.16.03	65.09.35	64.43.00	57.34.21
	H	13.15.21	7.46.37	347.45.33	0.00.22
3	V	63.50.11	63.37.05	64.17.10	57.34.09
	H	13.24.23	7.51.38	347.21.50	00.00.20
4	V	62.38.43	62.35.24	64.40.14	57.33.43
	H	13.22.39	7.56.07	347.48.52	0.00.54

Gearboxes and Brakes

Electromotive MPC 23 Length is 1.876"

12/3/04 Assuming no horizontal rotations in the pole and all configurations above the transit horizon





$$\tan\gamma_1 = \frac{x_1}{D}$$

$$x_1 = D\tan\gamma_1$$

$$\tan\gamma_2 = \frac{x_2}{D}$$

$$x_2 = D\tan\gamma_2$$

$$\frac{y_1}{D} = \tan\phi_1$$

$$y_1 = D\tan\phi_1$$

$$\frac{y_2}{D} = \tan\phi_2$$

$$y_2 = D\tan\phi_2$$

$$\tan\theta_{pole} = \frac{y_1 - y_2}{x_1 + x_2}$$

$$= \frac{\cancel{D}(\tan\phi_1 - \tan\phi_2)}{\cancel{D}(\tan\gamma_1 + \tan\gamma_1)}$$

$$\boxed{\theta_{pole} = \operatorname{atan}\left(\frac{\tan\phi_1 - \tan\phi_2}{\tan\gamma_1 + \tan\gamma_2}\right)}$$

$$\frac{y_p}{D} = \tan\phi_p$$

$$y_p = D\tan\phi_p$$

$$\tan\theta_1 = \frac{x_1 - \frac{1}{2}L_p}{y_p - y_1}$$

$$= \frac{D\tan\gamma_1 - \frac{1}{2}L_p}{D\tan\phi_p - D\tan\phi_1}$$

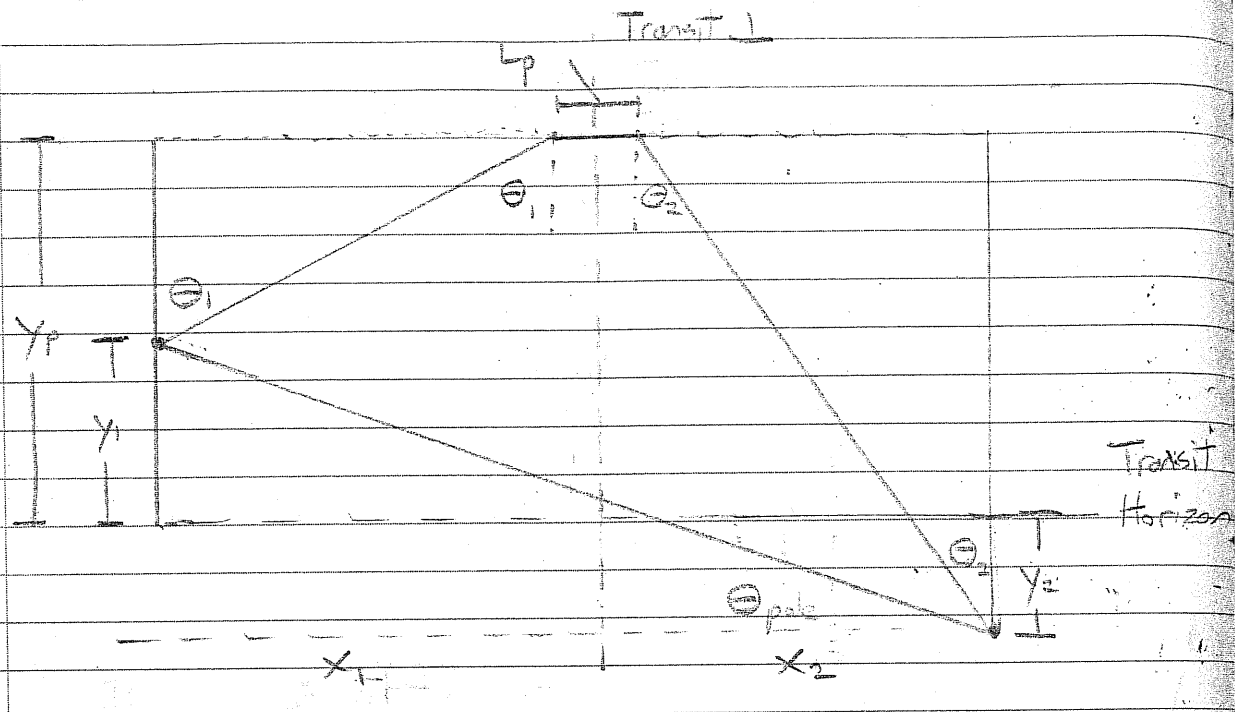
$$= \frac{\tan\gamma_1}{\tan\phi_p - \tan\phi_1} - \frac{L_p}{2D(\tan\phi_p - \tan\phi_1)}$$

$$\boxed{\theta_1 = \operatorname{atan}\left(\frac{\tan\gamma_1}{\tan\phi_p - \tan\phi_1} - \frac{L_p}{2D(\tan\phi_p - \tan\phi_1)}\right)}$$

2nd term $\to 0$ when $L_p \ll D$

$$\boxed{\theta_2 = \operatorname{atan}\left(\frac{\tan\gamma_2}{\tan\phi_p - \tan\phi_1} - \frac{L_p}{2D(\tan\phi_p - \tan\phi_2)}\right)}$$

No horizontal rotations on the pole, configurations below the transit horizon



$$\tan \theta_{pole} = \frac{Y_1 + Y_2}{X_1 + X_2}$$

$$= \frac{\cancel{D}(\tan \phi_1 + \tan \phi_2)}{\cancel{D}(\tan \gamma_1 + \tan \gamma_2)}$$

$$\theta_{pole} = \operatorname{atan}\left(\frac{\tan \phi_1 + \tan \phi_2}{\tan \gamma_1 + \tan \gamma_2}\right)$$

$$\tan\theta_1 = \frac{x_1 - \frac{1}{2}L_p}{y_p - y_1}$$

$$\theta_1 = \operatorname{atan}\left(\frac{\tan\gamma_1}{\tan\phi_p - \tan\phi_1} - \frac{L_p}{2D(\tan\phi_p - \tan\phi_1)}\right)$$

$$\tan\theta_2 = \frac{x_2 - \frac{1}{2}L_p}{y_p + y_2}$$

$$= \frac{D\tan\gamma_2 - \frac{1}{2}L_p}{D(\tan\phi_p + \tan\phi_2)}$$

Transit
horizon

$$\theta_2 = \operatorname{atan}\left(\frac{\tan\gamma_2}{\tan\phi_p + \tan\phi_2} - \frac{L_p}{2D(\tan\phi_p + \tan\phi_2)}\right)$$

Sign convention:

Vertical up $= 0°$
level $= 90°$
down $= 180°$

$\therefore$ vertical angle $= 90° -$ measured angle

General Case w/o horizontal rotation

$$\tan\Theta_{pole} = \frac{y_1 - y_2}{x_1 + x_2}$$

$$= \frac{\tan\phi_1 - \tan\phi_2}{\tan\gamma_1 + \tan\gamma_2}$$

$$\Theta_{pole} = \operatorname{atan}\left(\frac{\tan\phi_1 - \tan\phi_2}{\tan\gamma_1 + \tan\gamma_2}\right)$$

$$\tan\Theta_1 = \frac{x_1 - \frac{1}{2}L_p}{y_p - y_1}$$

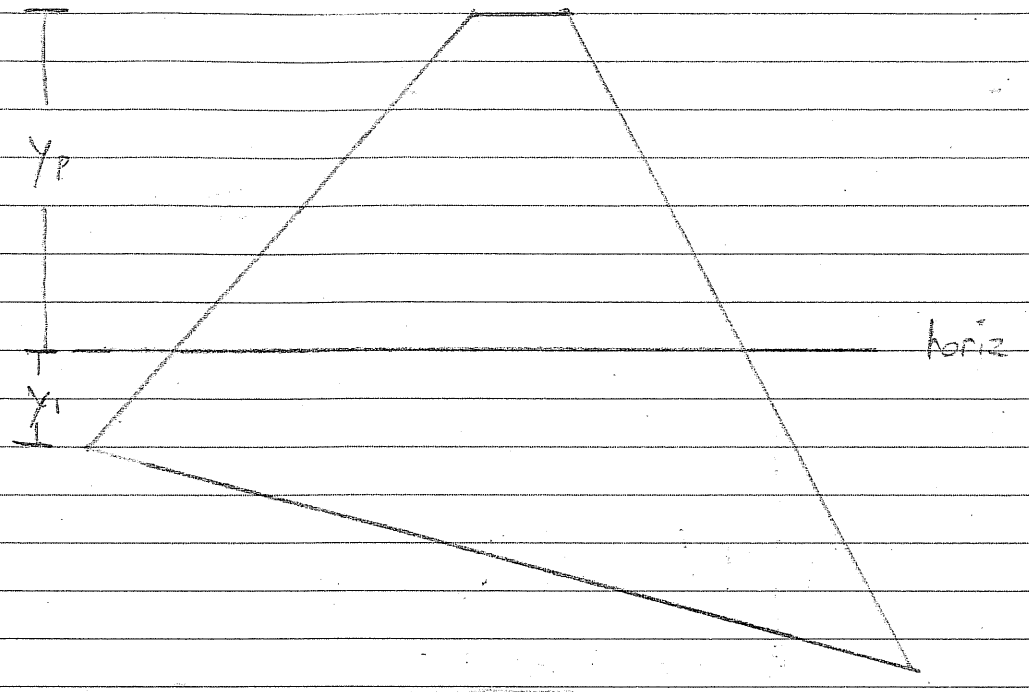
$$= \frac{\tan\gamma_1}{\tan\phi_p - \tan\phi_1} - \frac{L_p}{2D(\tan\phi_p - \tan\phi_1)}$$

$$\Theta_1 = \operatorname{atan}\left(\frac{\tan\gamma_1}{\tan\phi_p - \tan\phi_1} - \frac{L_p}{2D(\tan\phi_p - \tan\phi_1)}\right)$$

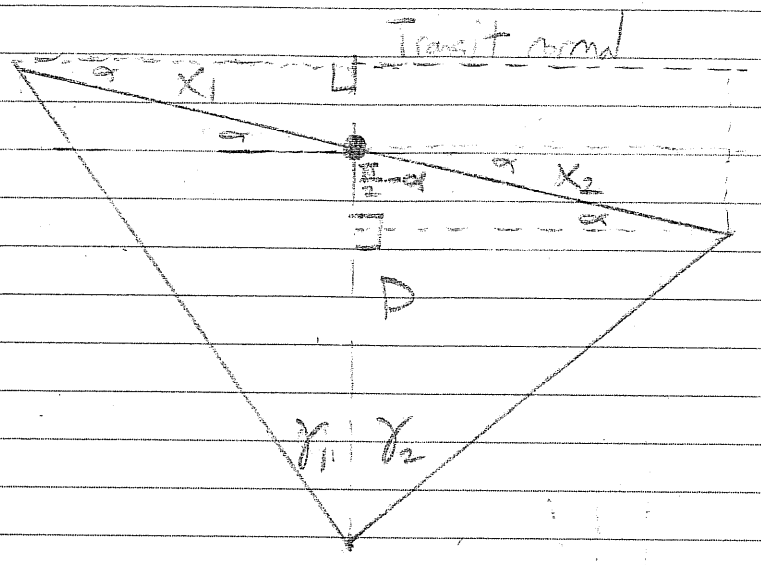
$$\tan\Theta_2 = \frac{x_2 - \frac{1}{2}L_p}{y_p - y_2}$$

$$= \frac{\tan\gamma_2}{\tan\phi_p - \tan\phi_2} - \frac{L_p}{2D(\tan\phi_p - \tan\phi_2)}$$

$$\Theta_2 = \operatorname{atan}\left(\frac{\tan\gamma_2}{\tan\phi_p - \tan\phi_2} - \frac{L_p}{2D(\tan\phi_p - \tan\phi_2)}\right)$$


y_p
horiz
y_1

Accounting for Horizontal Rotations



$$\frac{\sin\gamma_2}{x_2} = \frac{\sin\left(\pi-\left(\frac{\pi}{2}-\alpha\right)-\gamma_2\right)}{D}$$

$$= \frac{\sin\left(\frac{\pi}{2}+\alpha-\gamma_2\right)}{D}$$

$$x_2 = \frac{D\sin\gamma_2}{\sin\left(\frac{\pi}{2}+\alpha-\gamma_2\right)}$$

$$\frac{x_1}{\sin\gamma_1} = \frac{D}{\sin\left(\pi-\frac{\pi}{2}-\gamma_1-\alpha\right)}$$

$$= \frac{D}{\sin\left(\frac{\pi}{2}-\alpha-\gamma_1\right)}$$

$$x_1 = \frac{D\sin\gamma_1}{\sin\left(\frac{\pi}{2}-\alpha-\gamma_1\right)}$$

12/6/04 Electromechanical brake for 4 pi

Motor shaft diameter is 7/8"

Inertia Dynamics Brake:

PN: 8923-2551 $175.00 each

andy@electromate.com

3 lbs·in static torque, length = 1.876"

$3 \text{ lbs in} \cdot \frac{1 \text{ ft}}{12 \text{ in}} = 0.25 \text{ lbs ft}$

25 lb ft torque at gearbox output

0.4–0.5 Nm static torque ⇒ 5–6 in/lbs

Servo motor length: 4.98"
CMI gearbox length: 4.249" + 2.976" = 7.225"

Bayside Motion RX23 2.598" + 1.653" = 4.251

$B65 each

Automation Control MPC 2.83" max

John S. Minarik Electric

8923-2556

(Downtube ~ 16" long
Arm length ~ 10 1/2")

12/10/04 Bayside Motion RX23

12/16/04 Motor-Brake-Gearbox Combo

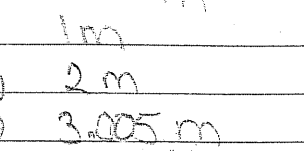
Gearbox dist to output centerline: 2.598"
Gearbox motor adapter length: 1.654" (42mm)
Motor brake length: 1.876"
Motor length: 4.98"
11.108"

Total dist from output shaft centerlines on upper and lower spools is:
24.162"

12/21/04

1/7/04

Error on Cable



m	measure	marker
(0)	0 m	18
(1)	1m	17
(2)	2 m	16
(3)	3.005 m	15
(4)	4.0075 m	14
(5)	5.01 m	13
(6)	6.015 m	12
(7)	7.02 m	11
(8)	8.025 m	10
(9)	9.025 m	9
(10)	10.030 m	8
(11)	11.030 m	7
(12)	12.0325 m	6
(13)	13.035 m	5
(14)	14.035 m	4
(15)	15.035 m	3
(16)	16.035 m	2
(17)	17.035 m	1
(18)	18.035 m	0

3.5 cm over whole length

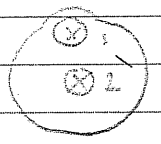
Disassemble the IU test

1) Undo connection from unit
2) With 1/16 Allen wrench remove the 4/40 screws and place in bag.

   10 screws
   2 plates

3) Loosen locknut and allen head screw to remove IU w/ 3/32 Allen wrench

4) Remove "loose" (2) button head screw and pulley and pulley center piece



6) Loosen 3 screws on retainer ring and slide off spool (3/4")

5) Unwind cable from spool. Stop at end of cable marker

7) Slide cable thru slot in retainer ring

8) Slide cable thru slot in spool

Parts List Box 1

1. 2 — 1 3/4" screw - clamp & spare
2. 4 — 1/4-28 nuts - for 1 3/4" screw
3. 18 - 4/40 - 5/16 screws - for clamp and spare
4. cable clamp w/ two plates
5. cable, two connectors, miniclamp
6. 7 - 4/40 - 3/8 screws - 2 for IU clamp
7. 6 - 4/40 nuts - 2 for clamp and 2 spares
8. IU holder - 2 pieces
9. 6 - 0-80 - screws for miniclamp 2 + 4 spares

Box 2 Downhauler Parts

Pulley Assembly:

+ Pulley body
+ Pulley
+ Bushing
- 4 10-24 3/4" flat head screws (2 spares)
- 4 10-24 nuts (2 spares)

Retainer Ring Assembly:

+ Retainer ring ~3/16" turned down
- 5 4-40 5/8" modified flat head screws (2 spares)
- 4 10-32 1 7/16" modified Filister head screw (2 spares) ~3/4" turned down

Spool and Body Assemblies

+ Knob
+ Spacer
+ 4 nylon washers (3 spares)
- 3 10-32 1 1/16" (shortened) flat head screw (2 spares)

- 10 10-32 1/4" modified Filister head screws (2 spares)
+ spool core
- end plates
+ nylon spacer
- stainless bearing plate
+ downhauler body
+ lock knob
+ nylon washer D-hole
+ nylon spacer
- 1 6-32 9/32" (shortened) Filister head screw
- 1 6-32 washer
- 4 1/4"-20 3/4" socket head cap screws
- extension plate
+ downhauler base — 6 1/4-20 1/2" socket head cap screws

Tools:

- Allen wrench set
- small flat head screw driver
- large flathead screw driver
- 1/4" nut driver
- 7/16" wrench

In Glovebox Cable Assembly:

+ cable w/ connector and connector backhalf
1 knurled screw for connector
+ ID sub connector plug half
2 4-40 1/4" vented socket head cap screws
2 1-72 1/32" flat head screw

✓ Need wrench for main cable clamp screw
✓ 1/4"-20 screw for base plate extension

2 spares

1/20/05 Stepper Motor Controller Phasing

Output	Phase
1	ref
2	+8 ms

1/25/05 MDC Rotary Stage

PN: 665413

Rose Kaslin 510-220-2451 cell
rkaslin@mdcvacuum.com

head

John Brooks jbrooks@mdcvacuum.com

Encoder — Out glovebox Feed to Motor Controller

	Wire	Pin	Fcn
Feedthru D15	Black	1	GND
	White	3	A channel
	Red	4	+5VDC
	Green	5	B channel
Controller D9	Red	1	+5VDC
	White	2	A+ channel
	Green	4	B+ channel
	Black	8	SE (grounded to pin 9)
	Black	9	GND

See p 10 and p. 26 for orig. cables.

Ignore! Go to p. 26

Compumotor GV-L3E relay mating connector

PN: 43016913-01
PCD → ELF P04260E

1/31/05

✓ Vac Fitting: SS-2-VCO-1 10.10 6 ea

Swagelok: ~~SS-2-VCO-3-BL ?~~
~~Blind~~

6:20 SS-4-VCO-4-BL ? 6 ea.
Blind nut instead of above

6:50 ✓ 2 ea SS-2-VCO-3
5.50 2 ea SS-4-VCO-4 Female nut

Motor - Gearbox Length: 6.25"
4.249" + 1.658" =

This isn't going to fit!

Bayside Motion Gearbox Combo:

Gearbox dist to output centerline: 2.598"
Gearbox motor adapter length : 1.654" (42m
Motor Length : 6.25"
10.502"

2/2 Rotary Stage Stepper Motor Wiring

Red #1
Green #2
Black #3
White #3
Red/white #4
Green/white #5

Motor: Superior Electric Slo-Syn Motor
KML062S04

3.1 V, 2.1 A

MD808
SS2000 D3
D6
Next Step Drive

LM 317

$V_{out} = 1.25V(1 + R_2/R_1) + \cancel{I_{adj} R_2}$ $I_{adj} \approx 100$
$R_2 = 240$

$1.25V(1 + R_2/R_1) = V_{out} - \cancel{I_{adj} R_2}$

$1 + R_2/R_1 = \dfrac{V_{out} - \cancel{I_{adj} R_2}}{1.25V}$

$\dfrac{R_2}{R_1} = \dfrac{V_{out} - \cancel{I_{adj} R_2} - 1.25V}{1.25V}$

$R_1 = \dfrac{1.25\, R_2}{V_{out} - \cancel{I_{adj} R_2} - 1.25V}$

$R_1(9V) = \dfrac{1.25V(240\Omega)}{9V - \cancel{(1 \cdot 10^{-4} A)(240\Omega)} - 1.25V}$

$R =$

$= \dfrac{300\, V\Omega}{7.75\, V}$

$= 38.7\,\Omega$

$$R_1(12V) = \frac{300\,V\Omega}{12V - 1.25V}$$

$$= 27.9\,\Omega$$

Motor

op

000 D3

D6

step Drive

$I_{adj} =$

$R_2 =$

/

.25V

R

2/4/05 Cabling:

ordered 2/7	Motor Power	Belden 29501
ordered 2/4	Motor Feedback	Alpha 5110/20C
ordered 2/4	Encoders	Alpha 5104C
ordered 2/7	Slip Rings	Alpha 5106C
ordered 2/7	Control Panel	Alpha 5110C
ordered 2/7	Limit Switch	Belden 8500VE-V500-8
ordered 2/7	Rotary Stage	Alpha 5056C

Belden 8444-V100.0-60

Questions :

NEMA 23 Adapter for RS90 ?
Can RS90 have 3/8" input coupling?

tgiannii@bysidemotion.com

Things to do:

- install mode to mode feeds
- check centerline to connector height
- check clearance to feedthrus!

CNT gearbox :

output shaft diameter: 0.625"
shaft length : 1.168" + 0.065" = 1.233"

Bayside RS90 :

output shaft diameter: 0.866"
shaft length : 1.457" (dim F − dim G)

Coupling Diameter: 1.150"

2/9/05 More Measurements

1 1/4" - Top thru hole for gear box

12 1/4" - Lower shaft center line to motor power feed throughs

9 5/8" - Motor feedback feed throughs from center line

3" - Inner edge to inner edge of feed throughs

O-ring for adapter plate: 2-235
1/8" width, 2 1/8" I.D.

6/24 Slip Ring Connection:

4T cable 30 AWG
Slip Ring wires 20 AWG

Parts Needed

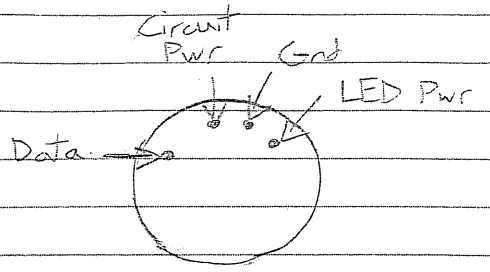
male and female contacts → Newark 46F138, 46F140
teflon heat shrink tubing → McMaster 7564K18, 19, 21
heat shrink gun → Newark 92N4506, 92N4510
Viton Tubing 0.345" OD, 0.305" ID →
5/16" or 3/8" OD, 1/4" ID McMaster 5119K33
5119K43
O-ring McMaster 9464K107

Limit switch

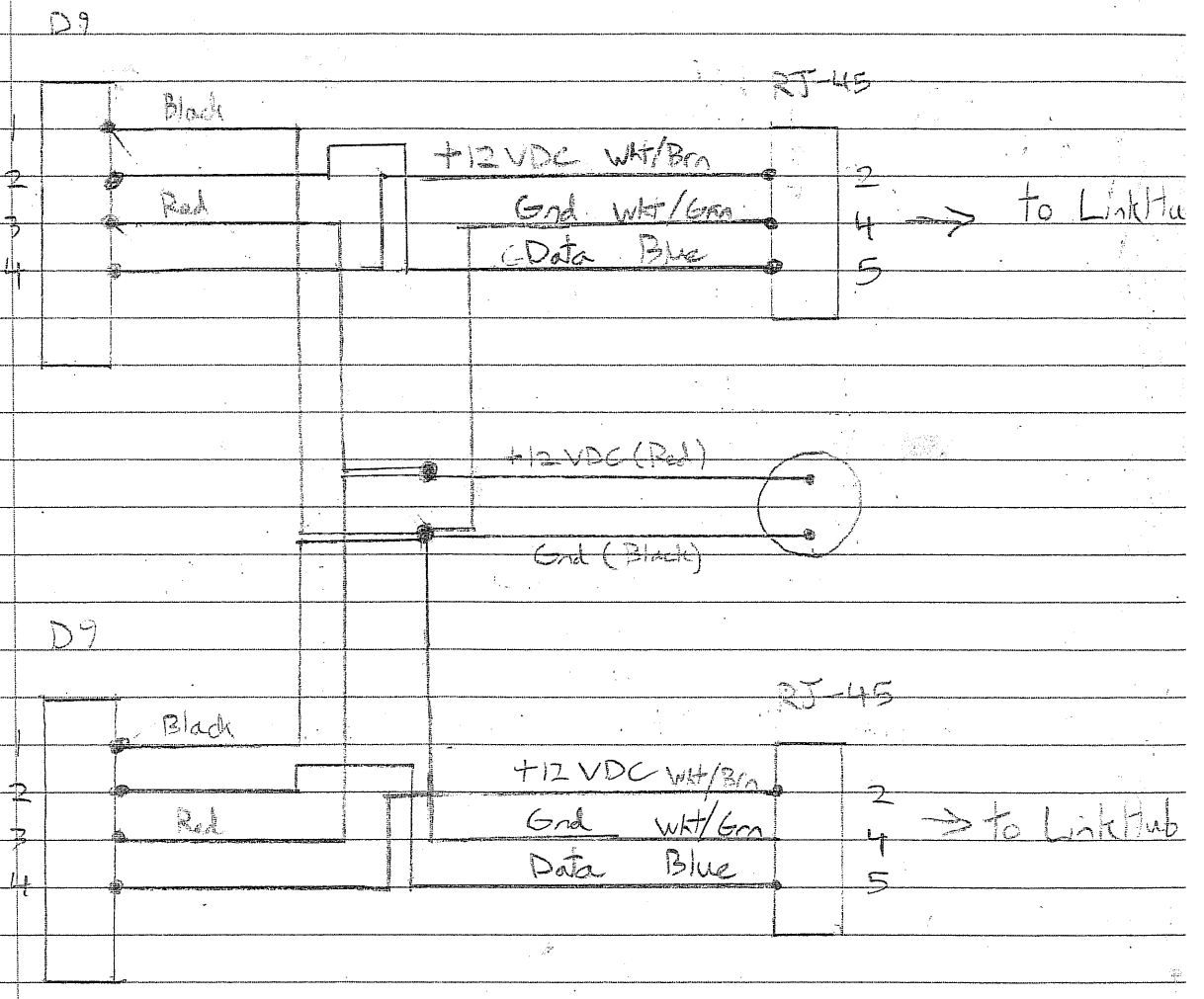
Parts Needed

Plug	26C1313	Newark
Receptacle	26C1314	Newark
Male Pin	94F9646	Newark
Female Pin	94F9644	Newark
Crimper	31F1049	Newark
Cable	McMaster 8219K54	

IU pinout



3/1/05 Instrumentation Unit Interface Box



Interface Box Pinout

Function	Wire Color	D9F Pin #	RJ-45
Gnd	Black	1	
	White/Green	—	4
Data	Blue	2	5
+12V LED	Red	3	—
+12V Circuit	White/Brown	4	2

IV Test Cable

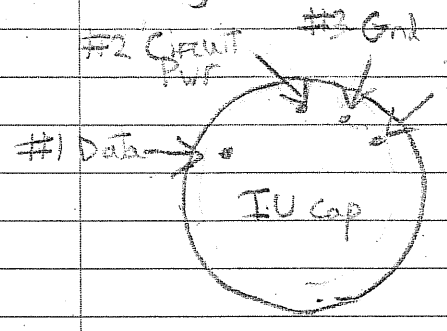
Fcn	Wire Color	D9M Pin #
Gnd	Green	1
Data	Yellow	2
+12V LED	Red	3
+12V Circuit	Orange	4

3/8/05 Dist from bolt center to edge of Lexan cover: 3/2"

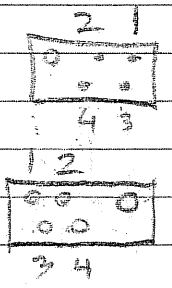
Quick release pin #1 → 0.309" dia, 5/16" 2" usable length
#2 → 0.309" dia, ~~1.320~~ " length 1" usable

Z-axis coupling: Ø0.312", Ø0.097" bore

Pigtail Cable:



Viewed head on:



Function	4π Cable Wire #*	Pigtail Conn Pin #	IU Conn Pin #
Gnd	1	1	3
Data	2	2	1
LED Pwr	3	3	4
Circuit Pwr	4	4	2

* wire #1 is nearest red tracer

Clevis pin: Ø 0.25", 1.5" usable length

To Do List 3/9/05

~~① 4-40 rod~~
~~② order Anchorage~~
~~③ Clean Catwalk~~
~~④ DB9 male - male from Jim Rice~~
~~⑤ Pigtail assembly~~
~~⑥ Limit switch~~
~~⑦ Check IV wiring~~

Cable D9M	4 Pi Cable (from tracer)
1	2
2	—
3	4
4	5
5	6
6	7

This is wrong, wires need to be checked at slip ring - 4π cable conns.

3/17/05 Slip Ring Color Codes

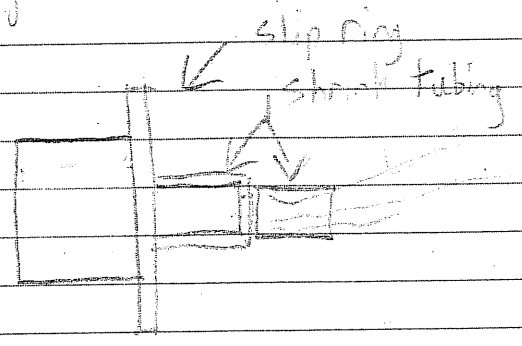
On 4T cable wire 1 is nearest rail Tower

Function	Wire	Color
Gnd	1	Black
Data	2	Brown
LED Pwr	3	Red
Circuit Pwr	4	Orange
—	5	Yellow
—	6	Green

Appears to be a short in one of the power circuits. Will edit Tomorrow

3/18/05 Short caused by pinched wire (LED Pwr, red) between slip ring and spool core.

Suggested Fix:

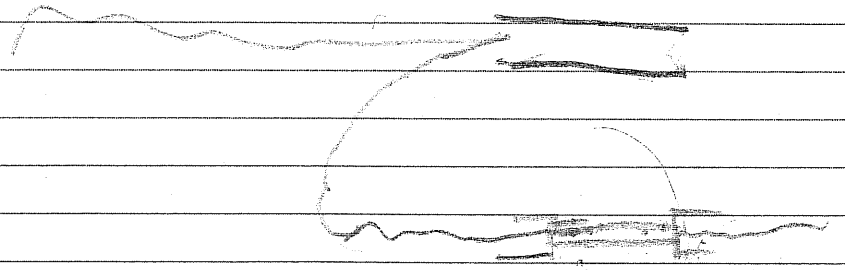


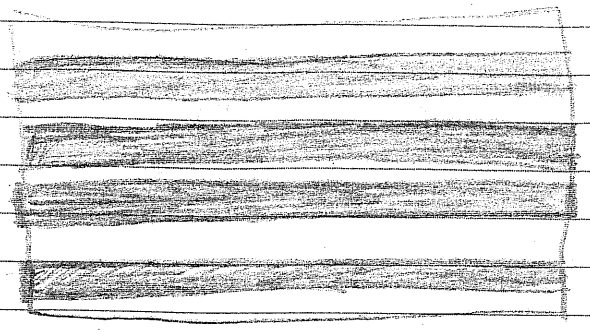
New 100' Motor Feedback Cable

Function	Wire	Amp D26M	D25F	
Ch A+	White	5	5	
Ch A−	Yellow	6	6	
Ch B+	Green	7	7	
Ch B−	Blue	8	8	
Index +	Orange	9	9	
Index −	Brown	10	10	
Ground	Black	3 4	3	
+5V	Red	1 2	1	
Hall Gnd	White/Green	15 11	11	
Hall +5V	White/Blue	14	14	
Hall Ch 3	White/Violet	18	18	
Hall Ch 1	White/Brown	16	16	
Hall Ch 2	White/Orange	17	17	
Brake	White/Red	N/A	20	(R)
Brake	White/Black	N/A	21	(S)
Thermal Switch	White/Yellow	12	12	(L)
Thermal Switch	Gray	13	13	(N)

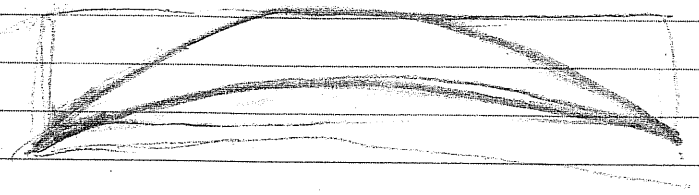
3/24/05 LTI Tech List

1. Delrin cable guide → Teflon
2. Fastener List and Spring Box
3. EZ-out set
4. Micro oil and syringes
5. Small machinist vice



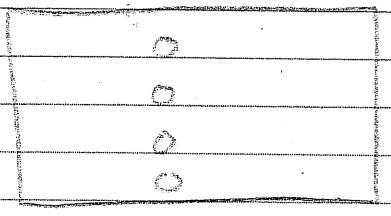


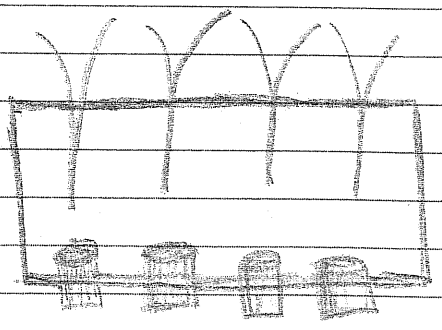
$< 1/4''$ flat stainless conductors



Shape

Issues
1) Pinch Roller
2) Winding lump.
3) Connections

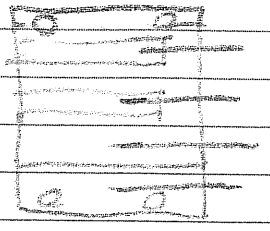




2 wires per cylinder on the pig tail

O I ~ 1/4" cylinder holes

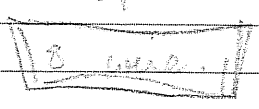
3 wires 4 unit



- 6 wires
- modify box

} shot together @ IU

or



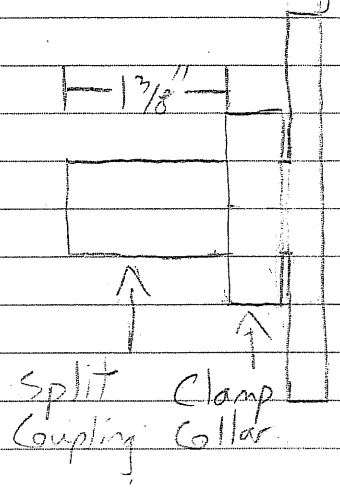
3/25/05 JBrooks@mkvac.com

In-Glovebox Encoder Cable:

En	Wire	DISF Pin #
	Black	2
	White	6
	Red	5
	Green	4

4/9/05 Spool Coupling for New Gearboxes

For proper spacing of spools to drive plate:



Clamp should be touching shoulder of output shaft, else it will interfere with the mounting plate.

Distance from coupling to drive plate: ~ 1/8"

Slip ring installation in spool core

On axis core depth: 1"

1. Cut 3 pieces of ? diameter shrink tubing 3/4" long
2. Shrink tubing onto rotating end of slip ring approx. 1/4" apart
3. Thread wires through spool
4. Fold over shrink tubed wires and insert into spools

Pole segments: 680 g each

Slip rings AC6023-6
O-rings
stubby hex keys

4/11/05 Limit switch pin out

Wire	D25M	Function
Red	21	1 Neg limit
Black	22	Gnd
White	17	2 Pos limit
Green	16	Gnd

4/13 USB Magic Box

Function	Wire Color	D9F	MS 2 pin	RJ-11
Gnd	Black	1	1B, 2B	4
Data	Blue	2	—	3
V_{LED}	Red	3	1A	—
$V_{circuit}$	Orange	4	1B	—

4/18 New In glovebox motor power cable.

Function	Wire Color	custom Conn	MS 14-16S
	white	1	A
	black	2	B
	red	3	C
	green	4	D

See p. 25

4/25/05 Cabling for 2nd IU deployment test...

Existing test cable

Function	Wire	D15M
Data (?)	Red	1
Gnd (?)	Green	2
Pwr (?)	White	3
Pwr (?)	Black	4

∴ Because this cable has male pins we know it connected directly into the external cable. No Feedthru!

∴ In glovebox cable will use pins #5-8 on D15F.

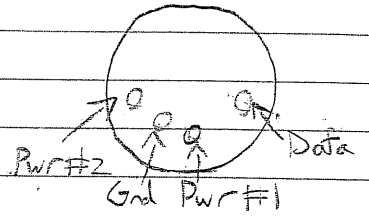
New In glovebox Cable

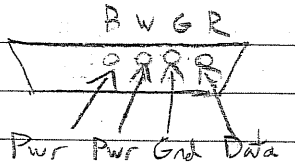
Function	Wire	D15F	IU conn *
Data	Silver	8	1
Circuit Pwr	Grey	6	2
Gnd	White	7	3
LED Pwr	Black	5	4

* see p. 94 for pin # convention

Copied from board in 137 ...

1 red
2 black
3 white
4 green





Data = silver	Red ⟺ silver
Pwr #1 = Grey	Green ⟺ white
Gnd = white	White ⟺ Grey
Pwr #2 = Black	Black ⟺ Black

New "Twin" Cable Outside Glovebox

Function	Wire	D15F (2)	D15M
Data	Red (silver)	1	1
Gnd	Green (White)	2	2
Circuit Pwr	White (Grey)	3	3
Lad Pwr	Black (Black)	4	4

~~New [illegible]~~

New test cable for 2nd IU deployment test this cable substitutes for the in glovebox cable.

Function	Wire	DISF	IU con
Data	Red	8	1
Gnd	Green	7	3
Circuit Pwr	White	6	2
LED Pwr	Black	5	4

5/6/05 Pole lengths and masses

Short coupling, source end: 10", 285.5 g

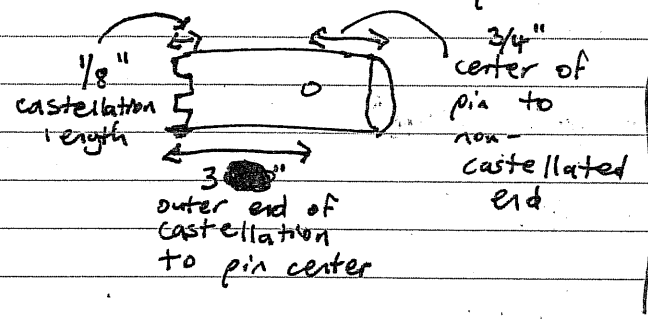
cable clamp attachment piece w/ pin and shoulder bolt: 93.2 g

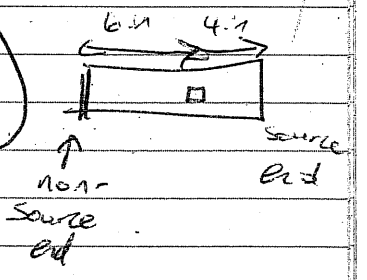
BTC coupling:

male end (external threads): 37.0 g
threaded collar: 57.6 g
female end: 38.0 g
~~retaining~~ retaining ring: 3.2 g

Total mass: 135.8 g

Non-source end cable clamp (cable 1) — 182.5 g





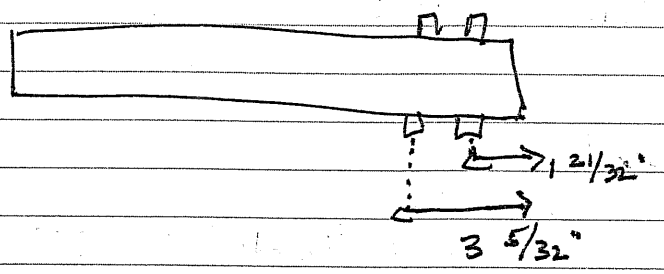
Source end cable clamp (cable 2)

Non-source end IV segment — 244.6 g
(without mounting pin)

end-to-end — 7 21/32"
(with 1/8" castellation length)

Segment 7: 665.0 g
(source pin w/o source + retaining screw: 10.9 g)

end-to-end: 35 1/2"



Segment 6: 668.7 g

end-to-end: 35 1/2"
pin 1: 1 15/16"
pin 2: 3 3/16"

Segment 5: 666.2 g

end-to-end: 35 1/2"
pin 1: 1 21/32"
pin 2: 3 3/16"

Segment 4: 665.7 g

end-to-end: 35 1/2"
pin 1: 1 21/32"
pin 2: 3 3/16"

Segment 3: 670.8 g

end-to-end: 35 1/2"
pin 1: 1 21/32"
pin 2: 3 3/16"

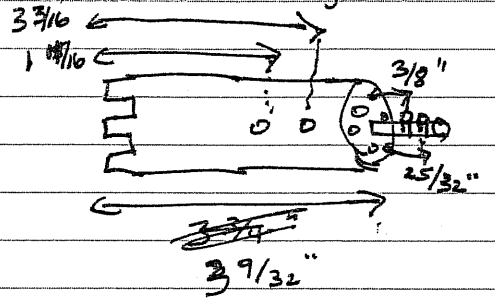
9)

Segment 2: 668.5 g

end-to-end: 35 1/2"
pin 1: 1 21/32"
pin 2: 3 3/16"

Segment 1: 666.9 g
end-to-end: 35 1/2"
pin 1: 1 31/16
pin 2: 3 3/16"

Source attachment segment: 129.4 g



Still need:
- source-end IV segment
- weighted segment
- Zax's weight.
- source mockup.

5/19/05 Panel Program:

Run (F1)
Find (F1)
INI JOG as default
Enter

5/24/05 Tools needed for Japan

- nut driver set
- DMM
- probes for DMM
- Jewels screwdrivers

Tomorrow:

pivot block
range finder
pin block