

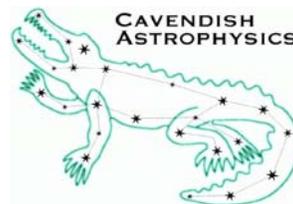
MRO Delay Line

Parts list for the MROI Metrology System

The Cambridge Delay Line Team

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Change Record

Revision	Date	Author(s)	Changes
0.1	15-12-2008	MF	First draft.
0.2	16-12-2008	MF	Added shear system information
1.0	04-02-2009	MF	Corrected Acromag part number on pages 7 and 10 Added beam expander lenses on pages 5, 9 and 11 Added beam compressor lenses on pages 5 and 9
1.1	05-02-2009	MF	Added handset power supplies on pages 7 and 9 Added VME system components on pages 8 and 10
1.2	19-02-2009	MF	Changed beam compressor achromats on pages 5 and 9 Specified VME CPU on pages 7 and 10
1.3	26-03-2009	MF	Changed supplier name for IP-DIGITAL-482 from Acromag to GE Fanuc on pages 7 and 10
1.4	16-06-2009	MF	Changed IP-DIGITAL-482 to Acromag IP470A on pages 7 & 10

Objective

This document presents the parts lists for the provision of the metrology system for the MROI Delay Line.

Scope

The general parts list is provided together with the lists of parts required for additional channels and two examples illustrating the parts for operating delay lines DL05 and DL06. Items to connect the VME System to other parts of the delay lines are not described here.

Applicable Documents

None

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1 Introduction

This document is constructed so that the general parts list provides the basic metrology system and further lists provide parts required for additional delay line channels. Two examples are provided; the first illustrating the parts required for setting up and operating delay line DL05 and the second illustrating the additional parts for setting up and operating DL06. For help with identifying the components and their placement on the metrology bench, Figure 1 is a diagram showing the first four delay line channels and is numbered to correspond with the parts listed in the tables which follow.

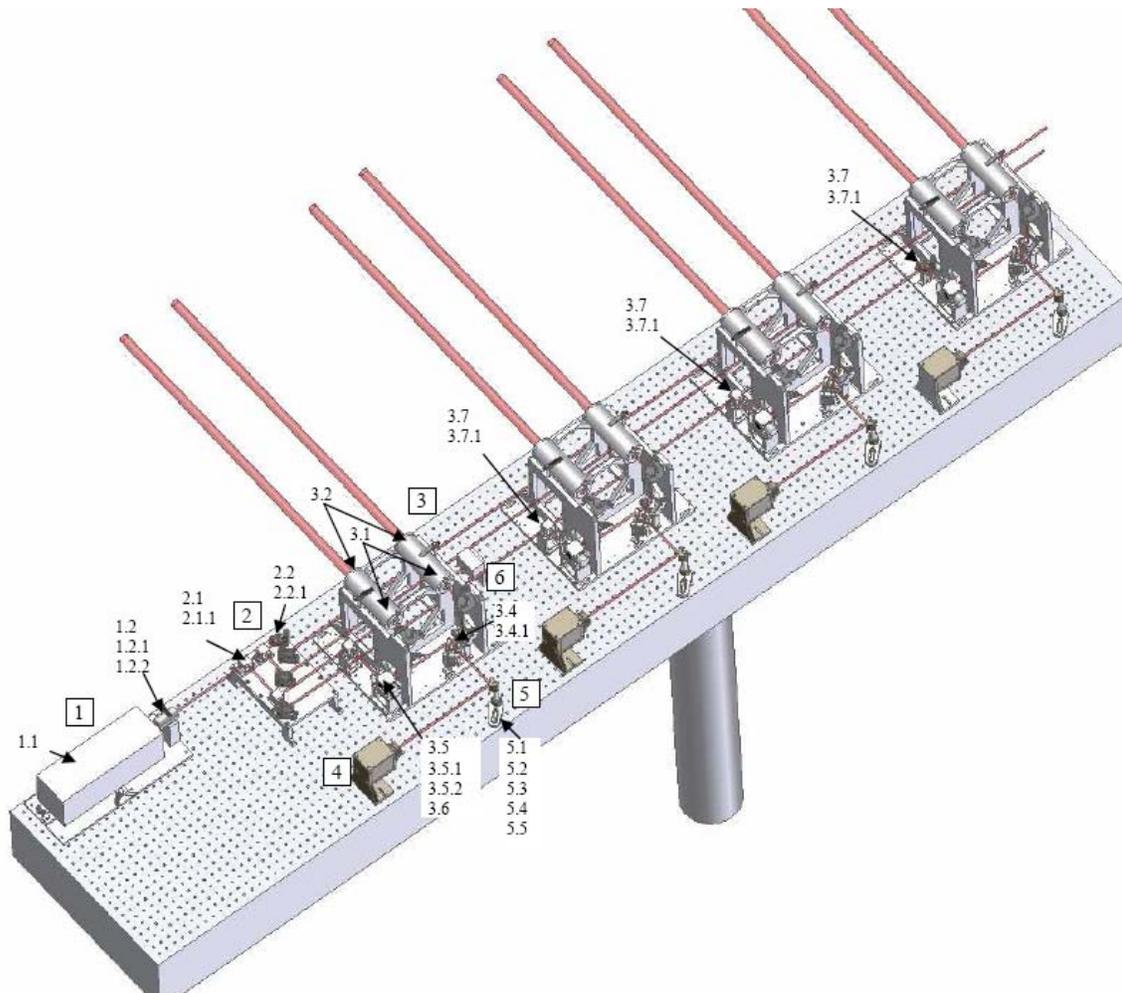


Figure 1 Layout and identification of components on the metrology bench.

In order to identify the additional components required for populating other delay line channels on the metrology bench a layout of the beam splitting arrangements is provided in Figure 2.

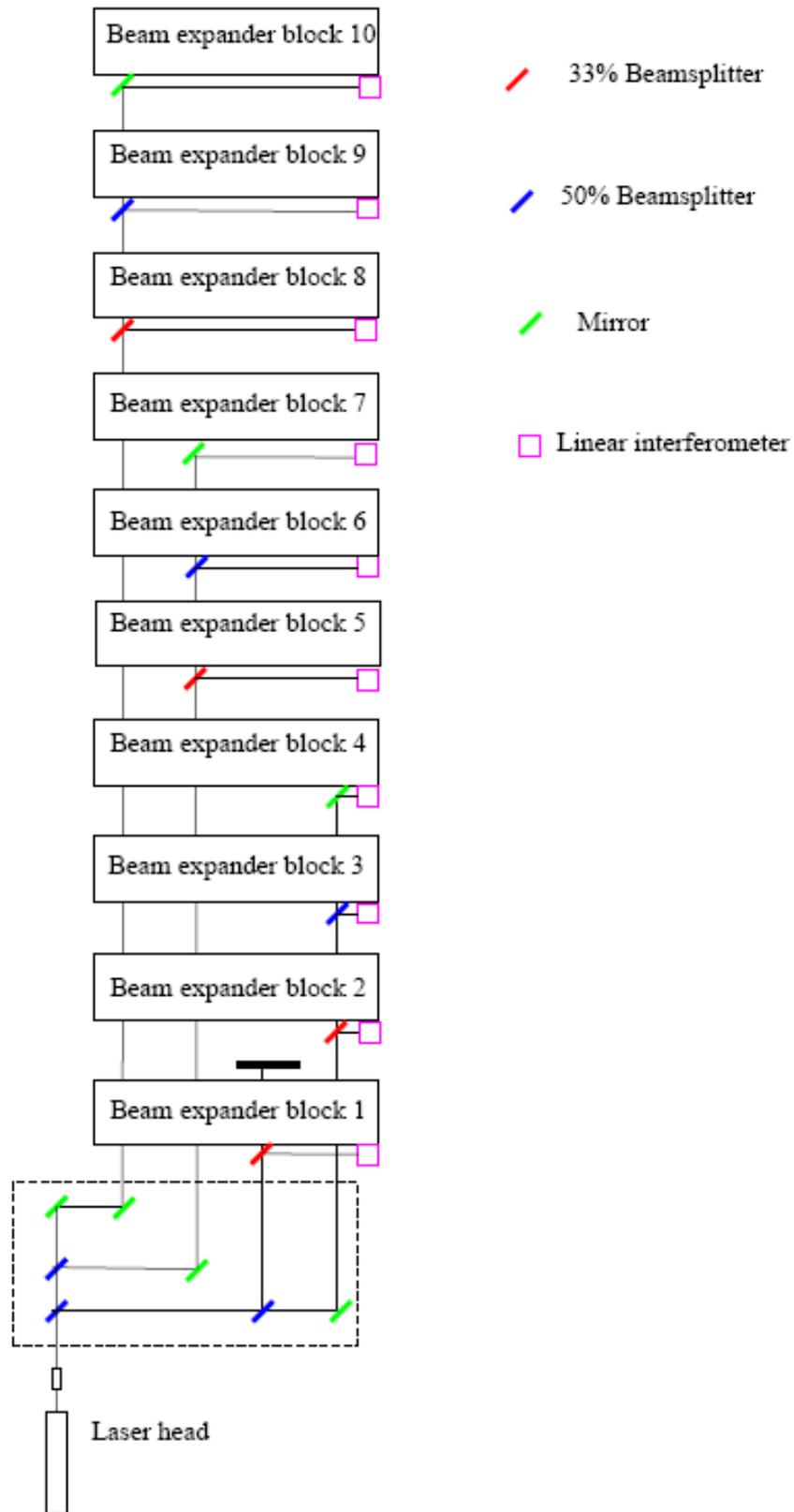


Figure 2 Beam splitting arrangement for feeding up to ten delay line channels.

2 Parts on the metrology optical table

This section lists all the parts that are mounted on the metrology bench in sets of tables which are arranged to provide the information necessary to calculate the items required for the addition of further delay line channels. Notes for superscripts are given here:

- ¹ One needed for every delay line.
- ² Number depends on no of unused laser beams up to max of 4.
- ³ One needed for every 2 delay lines.
- ⁴ These lenses are provisional while better optimized catalogue lenses are analysed.
- ⁵ These lenses are to be chosen in conjunction with beam expander lenses.

2.1 Parts required for the laser distribution

The set of parts required to provide the laser and the feed to all the delay line groups are set out in Table 1. Parts specially designed and manufactured are specified in the drawing set.

Table 1 Laser distribution parts

Part	Item	No.	Manufacturer	Part Number
1	Laser Head Assembly	1		Drawing set
1.1	Laser Head	1	Agilent	5517GL option 009
1.2	Beam compressor assembly	1		Drawing set
1.2.1	Lens Achromat 25 x 150 VIS 0 TS	1	Edmund	NT47-643
1.2.2	Lens Achromat 25 x -100 VIS 0 TS	1	Edmund	NT62-494
2	Laser beam splitter assembly	1		Drawing set
2.1	Adjustable mount for part 2.1.1	3	Agilent	10710A
2.1.1	50% beamsplitter	3	Agilent	10701A
2.2	Mirror mount	4	Newport	P100-AI38
2.2.1	Mirror 25mm	4	Thorlabs	PF10-03-P01

2.2 Parts required for each delay line beam expander assembly

The set of parts required to provide each beam expander assembly are set out in Table 2. Additional parts are required depending on the delay line position as set out in section 2.3.

Table 2 Beam expander assembly parts

Part	Item	No.	Manufacturer	Part Number
3	Beam Expander Assembly¹	1		Drawing set
3.1	Expander lens (25.4mm d -50mm f)	2	Thorlabs	ACN254-050-A1
3.2	Expander lens (50.8mm d 200mm f)	2	Thorlabs	AC 508-200-A1
3.3	Remotely steerable mirror mounts	4	Newport	AG-M100N
3.3.1	Mirror (25mm)	4	Thorlabs	PF10-03-P01
3.4	Mount, shear camera beam sampler	1	Newport	U100-ACG
3.4.1	Actuators for item 3.4	2	Newport	AJS100-0.5H
3.4.2	Beam sampler (25mm 10-90)	1	Thorlabs	BSF10-A1
3.5	Adjustable mount for part 3.5.1	1	Agilent	10711A
3.5.1	Linear interferometer	1	Agilent	10702A
3.5.2	Retro-reflector	1	Agilent	10703A
3.6	Remote sensor	1	Agilent	E1706C

2.3 Additional parts required for beam expander assembly depending on the delay line position

The parts required to divide/direct the laser for each delay line to be fed according to its position are set out in Table 3, Table 4 and Table 5.

2.3.1 For Delay Line nos. 4, 7 and 10

Table 3 Additional parts required to feed each of delay lines 4, 7 or 10

Part	Item	No.	Manufacturer	Part Number
3.7	Mirror mount	1	Newport	P100-A138
3.7.1	Mirror (25mm)	1	Thorlabs	PF10-03-P01

2.3.2 For Delay Line nos. 1, 2, 5 and 8

Table 4 Additional parts required to feed each of delay lines 1, 2, 5 or 8

Part	Item	No.	Manufacturer	Part Number
3.7	Adjustable mounts for part 3.7.1	1	Agilent	10710A
3.7.1	33% beamsplitter	1	Agilent	10700A

2.3.3 For Delay Line nos. 3, 6 and 9

Table 5 Additional parts required to feed each of delay lines 3, 6 or 9

Part	Item	No.	Manufacturer	Part Number
3.7	Adjustable mount for part 3.7.1	1	Agilent	10710A
3.7.1	50% beamsplitter	1	Agilent	10701A

2.4 Shear System parts required for each delay line

The set of parts required to provide the shear system for each delay line are set out in Table 6. Connections to the shear camera are listed in section 3.

Table 6 Parts required for the shear system of each delay line

Part	Item	No.	Manufacturer	Part Number
4	Shear camera assembly ¹	1		Drawing set
4.1	Shear camera	1	Unibrain	Fire-i BBW 1.3.
4.2	Shear camera beam compressor	1	Opticron	40940 2.5UTA
4.3	Laser filter	1	Thorlabs	FL632.8-10
5	Shear camera beam bender ¹	1		
5.1	Mirror (12.5 mm)	1	Thorlabs	PF05-03-P01
5.2	Mirror mount	1	Thorlabs	KS05
5.3	Clamping fork	1	Thorlabs	CF125
5.4	Pedestal post holder	1	Thorlabs	PH1E
5.5	Stainless steel post (75 mm)	1	Thorlabs	TR75M

2.5 Parts advised depending on which delay lines are not active

These parts are to block any laser feed that is not used. This allows for the laser beam splitter assembly to be aligned on installation of the first delay line without having to change the alignment when other delay lines are added. The beam blockers could simply be made from black card but an example of a type that could be purchased is given in Table 7.

Table 7 Beam blocker parts

Part	Item	No.	Manufacturer	Part Number
6	Beam blocker ²	1 to 4		
	Beam block	1 to 4	Thorlabs	LB1/M
	Post holder	1 to 4	Thorlabs	PH1.5E
	Clamping Fork	1 to 4	Thorlabs	CF125

2.6 Parts needed for alignment control

The parts needed to control the motorized mirrors on the beam expander assembly are listed in Table 8. There are four motorized mirrors and hence 4 controllers are specified so as to obtain independent control.

Table 8 Hand controllers for motorized mirrors

Part	Item	No.	Manufacturer	Part Number
3.3 4	Hand controllers	4	Newport	AG-UC2

3 Parts outside the inner beam combining area

The parts required that are situated outside the inner BCA or connect to parts mounted on the metrology optical table are set out in Table 9.

Table 9 Parts situated outside the inner BCA, including cable connections to metrology parts

7	Laser head power supply	1	Agilent	10884B
8	Remote receiver ¹	1-10	Agilent	E1709A
9	VME system			
9.1	VME card frame	1		(12 slot min, with power supply and fan cooling)
9.2	VME CPU plus disc drive	1	Concurrent	VP325/022-23U
9.3	Measurement board ³	1-5	Agilent	10898A
9.4	IP carrier board	1	TEWS	TVME200-10
9.5	8-channel D-A IP pack	1	Acromag	IP-220A-16
9.6	Digital IO IP pack	1	Acromag	IP470A
9.7	Low latency board	1		Drawing set
9.8	Timing and frequency processor	1	Symmetricom	TTM635VME-VCXO
10	Shear System			
10.1	Shear camera computer ¹		Eurotech	APOLLO-ICE-G-P1.8FL-512M-AC-NO_O/S
10.2	Keyboard	1		Unspecified
10.3	Monitor	1		Unspecified
10.4	KVM switch	1		Unspecified

11	Cables			
11.1	Receiver to measurement board ¹	1-10	Agilent	N1250A
11.2	Fiber optic ¹	1-10	Agilent	E1705F opt 400 (remote sensor to receiver)
11.3	Laser head to power supply and ref	1	Agilent	10881C
11.4	Firewire cable 10m ¹			Lindy 30865
11.5	Firewire repeater cable 4.5m ¹			Lindy 32908

Notes:-

¹ One needed for every delay line.

² Number depends on no of unused laser beams up to max of 4.

³ One needed for every 2 delay lines.

4 Example 1: to equip for Delay Line 5

The set of parts required to equip the first delay line (which is currently designated DL05) are set out in

Table 10 Parts required on metrology bench for channel DL05

Part	Item	No.	Manufacturer	Part Number
1	Laser Head Assembly	1		Drawing set
1.1	Laser Head	1	Agilent	5517GL option 009
1.2	Beam compressor assembly	1		Drawing set
1.2.1	Lens Achromat 25 x 150 VIS 0 TS	1	Edmund	NT47-643
1.2.2	Lens Achromat 25 x -100 VIS 0 TS	1	Edmund	NT62-494
2	Laser beam splitter assembly	1		Drawing set
2.1	Adjustable mount for part 2.1.1	3	Agilent	10710A
2.1.1	50% beamsplitter	3	Agilent	10701A
2.2	Mirror mount	4	Newport	P100-AI38
2.2.1	Mirror 25mm	4	Thorlabs	PF10-03-P01
3	Beam Expander Assembly¹	1		Drawing set
3.1	Expander lens (25.4mm d -50mm f)	2	Thorlabs	ACN254-050-A1
3.2	Expander lens (50.8mm d 200mm f)	2	Thorlabs	AC 508-200-A1
3.3	Remotely steerable mirror mounts	4	Newport	AG-M100N
3.3.1	Mirror (25mm)	4	Thorlabs	PF10-03-P01
3.4	Mount, shear camera beam sampler	1	Newport	U100-ACG
3.4.1	Actuators for item 3.4	2	Newport	AJS100-0.5H
3.4.2	Beam sampler (25mm 10-90)	1	Thorlabs	BSF10-A1
3.5	Adjustable mount for part 3.5.1	1	Agilent	10711A
3.5.1	Linear interferometer	1	Agilent	10702A
3.5.2	Retro-reflector	1	Agilent	10703A
3.6	Remote sensor	1	Agilent	E1706C
3.7	Adjustable mounts for part 3.7.1	1	Agilent	10710A
3.7.1	33% beamsplitter	1	Agilent	10700A
4	Shear camera assembly	1		Drawing set
4.1	Shear camera	1	Unibrain	Fire-i BBW 1.3.
4.2	Shear camera beam compressor	1	Opticron	40940 2.5UTA
4.3	Laser filter	1	Thorlabs	FL632.8-10
5	Shear camera beam bender	1		
5.1	Mirror (12.5 mm)	1	Thorlabs	PF05-03-P01
5.2	Mirror mount	1	Thorlabs	KS05
5.3	Clamping fork	1	Thorlabs	CF125
5.4	Pedestal post holder	1	Thorlabs	PH1E
5.5	Stainless steel post (75 mm)	1	Thorlabs	TR75M
6	Beam blocker			
	Beam block	4	Thorlabs	LB1/M
	Post holder	4	Thorlabs	PH1.5E
	Clamping Fork	4	Thorlabs	CF125
3.3 4	Hand controllers	4	Newport	AG-UC2

Table 11 Parts required outside the inner BCA to equip for operating one delay line

Part	Item	No.	Manufacturer	Part Number
7	Laser head power supply	1	Agilent	10884B
8	Remote receiver	1	Agilent	E1709A
9	VME system			
9.1	VME card frame	1		(12 slot min, with power supply and fan cooling)
9.2	VME CPU plus disc drive	1		VP325/022-23U
9.3	Measurement board	1	Agilent	10898A
9.4	IP carrier board	1	TEWS	TVME200-10
9.5	8-channel D-A IP pack	1	Acromag	IP-220A-16
9.6	Digital IO IP pack	1	Acromag	IP470A
9.7	Low latency board	1		Drawing set
9.8	Timing and frequency processor	1	Symmetricom	TTM635VME-VCXO
10	Cables			
10.1	Receiver to measurement board	1	Agilent	N1250A
10.2	Fiber optic	1	Agilent	E1705F opt 400 (remote sensor to receiver)
10.3	Laser head to power supply and ref	1	Agilent	10881C

5 Example 2: Additional items for delay line 6

Table 12 Additional items on metrology bench to provide for DL06

Part	Item	No.	Manufacturer	Part Number
3	Beam Expander Assembly¹	1		Drawing set
3.1	Expander lens (25.4mm d -50mm f)	2	Thorlabs	ACN254-050-A1
3.2	Expander lens (50.8mm d 200mm f)	2	Thorlabs	AC 508-200-A1
3.3	Remotely steerable mirror mounts	4	Newport	AG-M100N
3.3.1	Mirror (25mm)	4	Thorlabs	PF10-03-P01
3.4	Mount, shear camera beam sampler	1	Newport	U100-ACG
3.4.1	Actuators for item 3.4	2	Newport	AJS100-0.5H
3.4.2	Beam sampler (25mm 10-90)	1	Thorlabs	BSF10-A1
3.5	Adjustable mount for part 3.5.1	1	Agilent	10711A
3.5.1	Linear interferometer	1	Agilent	10702A
3.5.2	Retro-reflector	1	Agilent	10703A
3.6	Remote sensor	1	Agilent	E1706C
3.7	Adjustable mount for part 3.7.1	1	Agilent	10710A
3.7.1	50% beamsplitter	1	Agilent	10701A
4	Shear camera assembly	1		Drawing set
4.1	Shear camera	1	Unibrain	Fire-i BW 1.3.
4.2	Shear camera beam compressor	1	Opticron	40940 2.5UTA
4.3	Laser filter	1	Thorlabs	FL632.8-10
5	Shear camera beam bender	1		
5.1	Mirror (12.5 mm)	1	Thorlabs	PF05-03-P01
5.2	Mirror mount	1	Thorlabs	KS05
5.3	Clamping fork	1	Thorlabs	CF125
5.4	Pedestal post holder	1	Thorlabs	PH1E
5.5	Stainless steel post (75 mm)	1	Thorlabs	TR75M

Table 13 Additional items outside of inner BCA to provide for DL06

Part	Item	No.	Manufacturer	Part Number
8	Remote receiver	1	Agilent	E1709A
10	Cables			
10.1	Receiver to measurement board	1	Agilent	N1250A
10.2	Fiber optic	1	Agilent	E1705F opt 400 (remote sensor to receiver)

Note that an additional Agilent measurement board is not required because each board handles two channels.