

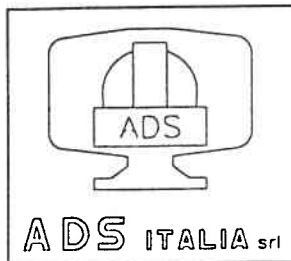
Technical Report #34

**M2/f15 and M2/f9 Hexapod Data Package**

D. Gallieni

July 1998





## MMT CONVERSION

Doc.No. : H9-DP-AD-001  
Issue : 1  
Date : October 1998



Steward Observatory

**PROGRAMME : MMT CONVERSION  
SECONDARY MIRRORS SUPPORT  
M2/F15 and M2/F9 HEXAPOD**

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**ISSUED BY : D. Gallieni**

ADS ITALIA  
SISTEMI AVANZATI

  
Signature

07 OCT. 1998  
Date



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## 1. SCOPE OF THE WORK

This document reports the informations related to the M2 Hexapod f9/f15 for the MMT upgrade.

Hexapod electromechanical parts are reported in terms of requirements fulfilment, parts and material list, assembly and workshop drawings, manufacturer's data sheets of commercial components, linear actuators testing in ambient conditions (test procedures and test results), installation and maintenance instructions and handling and transportation instructions for delivery.

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## 2. APPLICABLE DOCUMENTS

- 1.1 W.Gallieni and R. Pozzi, «MMT CONVERSION - SECONDARY MIRRORS SUPPORT - M2/F15 and M2/F9 HEXAPOD DESIGN - TECHNICAL REPORT», Doc: D00001, Issue 3, January 1997;
- 1.2 Assembly drawings: 200505, 200513, 300931 and 300930.



### 3. HEXAPOD DESCRIPTION

The f9/f15 hexapod electromechanical parts include:

- seven (7) linear actuators (six + one spare);
- fixed and mobile platforms;
- six (6) interface supports for actuator joints fixture on the platforms.

The actuator is based by a direct drive configuration with frame-less motor and encoder on the same spindle axis.

The actuator nominal length (zero nominal stroke position) is 330 mm, measured between actuator's joints ledges.

The actuator nominal stroke is  $\pm 10$  mm from the zero position.

The max angular displacements of the flex joints is  $\pm 1,0$  degree.

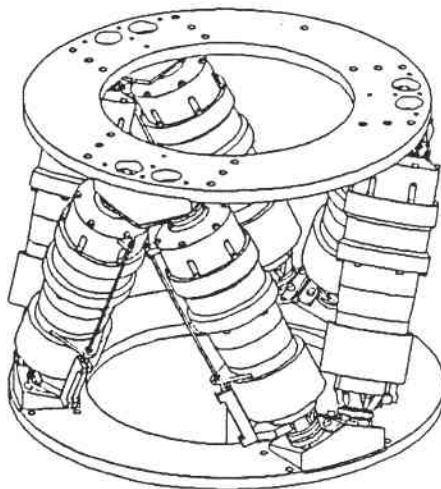
The satellite roller screw is of the re-circulating rollers type.

The motor gives 0,82 Nm continuous stall torque and 4,07 Nm peak torque.

The brake has 1,7 Nm static torque.

The incremental encoder has 3600 counts per revolution resolution, giving  $0,28 \mu\text{m}$  linear resolution on the 1 mm pitch screw.

LVDT linear position sensor gains are reported in the functional test results.





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#### 4. **LINEAR ACTUATORS**

##### 4.1. *Parts and material list*



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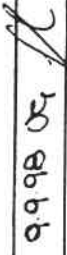


MMT HEXAPOD M2-F15  
 LINEAR ACTUATOR  
 WORKSHOP LIST

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 SISTEMI AVANZATI  
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## Parts list

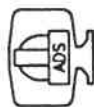
Quantity	DESIGNATION	Format A	Item	MATERIAL	Piece weight (kg)	REMARKS	Mod.
1		3	01	ALSI 303	0.68	Dwg. n° 300933	B
4+3	FLEXURE FOIL (4 Dx. +3 Sx.)						
1	ENCODER HOUSING	4	02	UN1 Anticorodal 9006/4	0.2	Dwg. n° 400690	B
1	ENCODER-BEARING SUPPORT	4	03	ALSI 303	0.36	Dwg. n° 400691	B
1	FRAMELESS MOTOR SUPPORT	3	04	UN1 Anticorodal 9006/4	0.43	Dwg. n° 300934	A
1	BUSHING	4	05	ALSI 303	0.12	Dwg. n° 400692	A
1	DISTANCE RING	4	06	ALSI 303	0.025	Dwg. n° 400693	B
1	DISTANCE RING	4	07	ALSI 303	0.008	Dwg. n° 400694	A
1	BRAKE-BEARINGS SUPPORT	3	08	ALSI 303	1.85	Dwg. n° 300935	A
1	DISTANCE RING	4	09	ALSI 303	0.015	Dwg. n° 400695	A
1	COVER	4	10	ALSI 303	0.28	Dwg. n° 400696	A
1	PROXIMITY SUPPORT	3	11	UN1 Anticorodal 9006/4	0.1	Dwg. n° 300936	A
1	PROTECTION	4	12	UN1 Anticorodal 9006/4	0.045	Dwg. n° 400698	B
1	PROTECTION RING	4	13	UN1 Anticorodal 9006/4	0.035	Dwg. n° 400699	A
1	SATELLITE ROLLER SCREW SUPPORT	3	14	UN1 Anticorodal 9006/4	0.17	Dwg. n° 300937	A
Index							
Date							
Name							
1) Quantity for 1 assembly		2) Quantity for execution					
Number of assemblies :		7		ACTUATOR ASSEMBLY DWG N°200505			
Weight for 1 ass. :		4.94 Kg.		 9.9.98			
Weight for all ass. :		34.58 Kg.		 sheet 01 of 02 FILE 400707/C			



# Parts list

MMT HEXAPOD M2-F15  
LINEAR ACTUATOR  
WORKSHOP LIST

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Quantity	DESIGNATION	Format	Item	MATERIAL	Piece weight (kg)	REMARKS	Mod.
1		A					
2							
1	FLEXURE JOINT	3	15	AISI 303	0.41	Dwg. n° 300938	B
2	RING	4	16	AISI 303	0.005	Dwg. n° 400700	A
1	LVDT SUPPORT	4	17	AISI 303	0.15	Dwg. n° 400701	A
1	BUSHING	4	18	B14	0.01	Dwg. n° 400702	A
1	STEM	4	19	INVAR	0.015	Dwg. n° 400703	A
1	BUSHING	4	20	AISI 303	0.03	Dwg. n° 400705	A
2	FLEXURE FOIL	4	21	50 Cr V4	0.003	Dwg. n° 400704	A
2	Distance plate	4	28	AISI 304	0.08	Dwg. n° 400748	A
1	Bushing	4	29	AISI 304	0.02	Dwg. n° 400749	A
1	Key	4		AISI 304	0.05	Dwg. n° 400751	A
Index						ACTUATOR ASSEMBLY DWG N°200505	
Date					Number of assemblies : 7		
Name					Weight for 1 ass. : 4.94 Kg.		
					Weight for all ass. : 34.58 Kg.		

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FILE 400707/C

1) Quantity for 1 assembly 2) Quantity for execution



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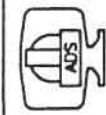
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## Parts list

MMT HEXAPOD M2-F15  
 LINEAR ACTUATOR  
 COMMERCIAL LIST

**ADS ITALIA S.R.L.**  
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 Corso Promessi Sposi 23/d - 23900 Lecco



Quantity	DESIGNATION	Item	MATERIAL	Piece weight (kg)	REMARKS	Mod.
1						
2						
1	SATELLITE ROLLER SCREW (ROLLVIS RVR 20x1)	100	X46Cr13	~ 0.65	DWG.300939/C	
1	ENCODER (HEIDENHAIN ERO 1324)	101		0.145		
1	BALL BEARING (FAG 6000 Z15)	102		0.019		
2	SNAP RING FOR HOLES Ø26 UNI 7437	103	50 Cr V 4	0.001		
1	SELF LOCKING RING (GUK M12x1)	104	Steel R490N/mm <sup>2</sup> Zinc plated	0.01		
3	GRUB SCREW M4x4 UNI 5923	105	INOX UNI 7323/8	0.002		
1	FRAMELESS BRUSHED MOTOR--ROTOR (INLAND)	106		1.08	Type QT-2404 "... WINDING	
1	FRAMELESS BRUSHED MOTOR--STATOR (INLAND)	107				
1	BRAKE (ELECTROID Type EFSB 15) Armature plate	108				
1	BRAKE (ELECTROID Type EFSB 15) Hub	109		0.54		
1	KEY 4x4x14 UNI 6604-A	110	Steel R590 N/mm <sup>2</sup>	0.001	DWG.400750	
1	SELF LOCKING RING (GUK M20x1)	111	Steel R490N/mm <sup>2</sup> Zinc plated	0.02		
2	AXIAL RADIAL BEARINGS (FAG B7004E.T.P4S.DBH)	112		0.07		
2	BELLEVILLE WASHER 25 GR 3 UNI 8737-B	113	50 Cr V 4	0.001		

Index		Number of assemblies :	6
Date		Weight for 1 ass. :	4.15 Kg.
Nome		Weight for all ass. :	24.9 Kg.

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1) Quantity for 1 assembly 2) Quantity for execution



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## Parts list

MMT HEXAPOD M2-F15  
 LINEAR ACTUATOR  
 COMMERCIAL LIST

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Quantity	DESIGNATION	Item	MATERIAL	Piece weight (kg)	REMARKS	Mod.
1	SELF LOCKING RING (GUK M10x0.75)	114	Steel R490N/mm <sup>2</sup> Zinc plated	0.008		
1	LYDT Unit (SCHAEVITZ Type 500 MHR-Miniature)	115	ANSI 400 (Housing)	0.019		
2	PROXIMITY (BAUMER Type IFR 05.26.35/L)	116	ANSI 303 (Housing)	0.02		
20	SCREW M4x15 UNI 5931	117	INOX UNI 7323/B	0.018		
2	NUT M3 ISO 4032	118	INOX ISO 3506	0.015		
2	WASHER 3.2x7x0.5 UNI 6592	119	INOX UNI 7323/B	0.005		
6	SCREW M4x20 UNI 5931	120	INOX UNI 7323/B	0.020		
4	SCREW M3x40 UNI 7688	121	INOX UNI 7323/B	0.020		
6	SCREW M4x25 UNI 5931	122	INOX UNI 7323/B	0.025		
14	SCREW M5x12 UNI 5931	123	INOX UNI 7323/B	0.025		
8	SCREW M2.5x5 UNI 7688	124	INOX UNI 7323/B	0.005		
4	NUT M5 ISO 4032	125	INOX ISO 3506	0.020		
4	WASHER 5.3x8.5x1 UNI 6592	126	INOX UNI 7323/B	0.008		
2	SCREW M4x8 UNI 6107	127	INOX UNI 7323/B	0.001		

Index		Number of assemblies :	6
Date		Weight for 1 ass. :	4.15 Kg.
Name		Weight for all ass. :	24.9 Kg.

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 sheet 07 of 03  
 FILE 400707/C