TEST REPORT SHEET

Test reference	N056.TES.020-THETA.GN.001 v1			Test conductor	I Roji
Test parameter	General parameters	Axis designation	THETA	Mech. support	JC Mancebo
		Subsystem des.	BFR motion system	Electrical support	I Roji
Date and time	21/10/2020	Project code	N056	Metrol. support	J Álvarez
Location	AVS workshop	Associated doc	AVS.PRO.020	Client repr:	NOT PRESENT

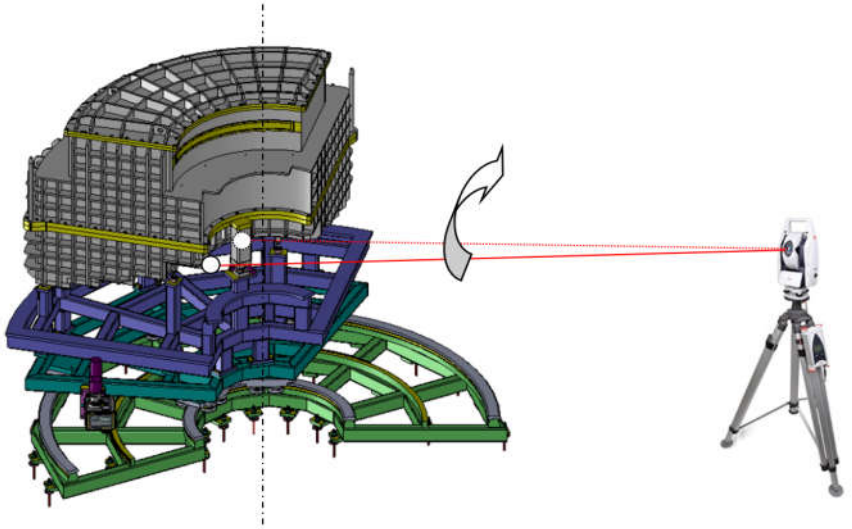
ENVIRONMENTAL CONDITIONS

Test facility	AVS workshop : PRE-FAT TESTING				
Cleanliness	Grey room	Temperature	*ambient (not controlled)*	Vacuum	*In-air*
		Pressure	*ambient (not controlled)*	Humidity	*ambient (not controlled)*

SETUP DESCRIPTION

Setup designation	CONF. 01 (MAIN)
Measuring equipment	Laser tracker
Measured position	POI*
External load	NO EXTERNAL LOAD
Reference	Motor steps
Control loop	Open loop
Motor setup	Current 12A Motor speed 688º_m/s
i_gearbox	100
i_preload	2
i_pinion_chain	30,95477387
Driver setup	Commanded in deg_motor
** see description for more details*	

Setup description:



RESULTS SUMMARY

Validation parameter	SEE DATA	Test result:	Comments: NO COMMENT	
Measured parameter	SEE DATA	Satisfactory	Client signature:	Supplier signature: PEDRO NOGUERA

TEST 1b. Limit switches position/precision											
NEGATIVE STROKE LIMIT		S1.1	S1.2	S1.3	S1.4	S1.5	S2.1	S2.2	S2.3	S2.4	S2.5
	Nominal position [deg]	**-4,5**	**-4,5**	**-4,5**	**-4,5**	**-4,5**	**-4,1**	**-4,1**	**-4,1**	**-4,1**	**-4,1**
	Measurement [deg]	-4,5579	-4,5581	-4,5577	-4,5577	-4,5573	-4,168	-4,1679	-4,1677	-4,1679	-4,1679
	Encoder reading [counts]	1883415	1883411	1883411	1883408	183408	1874664	1874667	1874663	1874667	1874668
	Encoder reading [deg]	83,557	83,556	83,556	83,556	8,137	83,168	83,169	83,168	83,169	83,169
	Pos Act [deg_M]	-732,456	-731,025	-732,4031	-733,77	-735,152	-9772,87	-9774,24	-9772,87	-9774,24	-9774,29
	Pos Act [deg]	-0,059	-0,059	-0,059	-0,059	-0,059	-0,789	-0,789	-0,789	-0,789	-0,789
POSITIVE STROKE LIMIT		S4.1	S4.2	S4.3	S4.4	S4.5	S5.1	S5.2	S5.3	S5.4	S5.5
	Nominal position [deg]	**45,1**	**45,1**	**45,1**	**45,1**	**45,1**	**45,5**	**45,5**	**45,5**	**45,5**	**45,5**
	Measurement [deg]	45,1392	45,1392	45,1392	45,1392	45,1389	45,5385	45,5385	45,5386	45,5386	45,5389
	Encoder reading [counts]	766640	766640	766639	766639	766647	757604	757604	757604	757606	757596
	Encoder reading [deg]	34,012	34,012	34,012	34,012	34,012	33,611	33,611	33,611	33,611	33,610
	Pos Act [deg_M]	613794,037	613796,787	613796,787	613795,468	613795,659	4928,78	4931,529	4931,529	4932,907	4937,034
	Pos Act [deg]	49,572	49,572	49,572	49,572	49,572	0,398	0,398	0,398	0,398	0,399

RESULTS							
		Measured	Accuracy			Objective	Measured
TEST 1a Limit switches activation	Activation S1	CONFIRMED 27/10	1,187E-03deg	TEST 1b. Maximum range		50 deg	50,096 mm
	Activation S2	CONFIRMED 27/10	4,382E-04deg	TEST 1c. Torque reduced		50 deg	NOT DONE
	Activation S3	CONFIRMED 27/10	-	TEST 1d. Maximum speed		0.1 deg/s	ACHIEVED
	Activation S4	CONFIRMED 27/10	5,367E-04deg	TEST 1e. Low speed test		-	NOT DONE
	Activation S5	CONFIRMED 27/10	6,573E-04deg				

TEST REPORT SHEET

Test reference	N056.TES.020-THETA.AC.001 v1			Test conductor	I Roji
Test parameter	Accuracy	Axis designation	THETA	Mech. support	JC Mancebo
		Subsystem des.	BFR motion system	Electrical support	I Roji
Date and time	21/10/2020	Project code	N056	Metrol. support	J Álvarez
Location	AVS workshop	Associated doc	AVS.PRO.020	Client repr:	NOT PRESENT

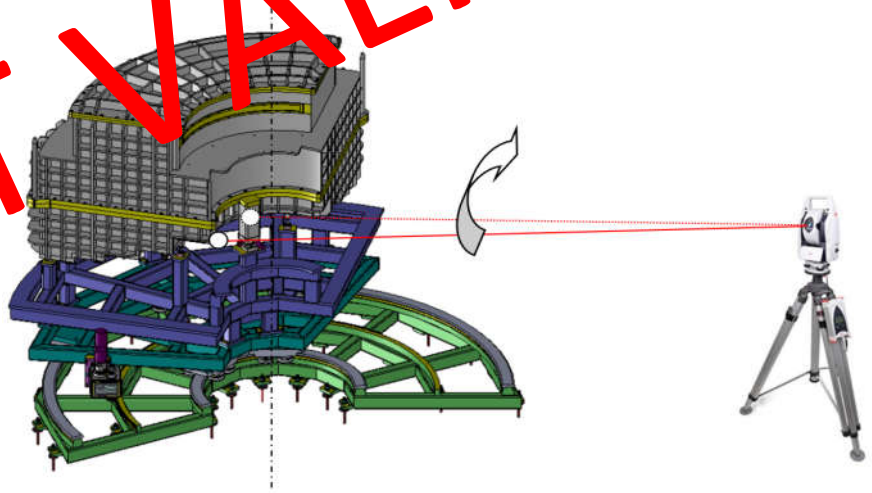
ENVIRONMENTAL CONDITIONS

Test facility	AVS workshop : PRE-FAT TESTING	Temperature	*ambient (not controlled)*	Vacuum	*In-air*
Cleanliness	Grey room	Pressure	*ambient (not controlled)*	Humidity	*ambient (not controlled)*

SETUP DESCRIPTION

Setup designation	CONF. 01 (MAIN)
Measuring equipment	Laser tracker
Measured position	POI*
External load	NO EXTERNAL LOAD
Reference	Motor steps
Control loop	Open loop
Motor setup	Current 12A Motor speed 688º_m
Reduction ratio	100
Translation ratio [chain/pinion]	2
Angular conv. ratio [chain / rotation]	30,95477387
Driver setup	Commanded in deg_motor
** see description for more details*	

Setup description:



NOT VALID

RESULTS SUMMARY

Validation parameter	0,1 deg	Test result:	Comments: THE SYSTEM ACCUMULATES AN ERROR OF APROX 0.015 EVERY TIME THERE IS A ACCELERATION/DECELERATION RAMP. POSSIBLE SOURCES: CONTROL
Measured parameter	0,176258825 deg	Not satisfactory	Client signature: / Supplier signature: PEDRO NOGUERA

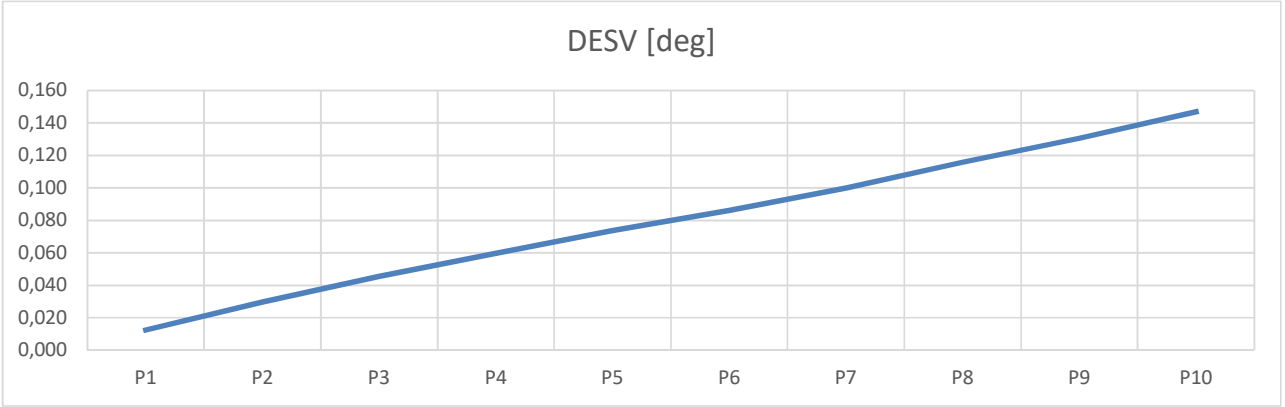
RECORDED MEASUREMENTS

		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Series 1	Target position [steps]										
	Target position [deg]	45	40	35	30	25	20	15	10	5	0
	Measurement [deg]	44,9875	39,9702	34,9545	29,9403	24,9263	19,9139	14,9002	9,8842	4,8693	-0,1469
	Encoder position [cts]	770139	882848	995452	1108055	1220750	1333583	1446332	1559083	1671595	1784243
	Encoder position [deg]	34,16678067	39,16705164	44,16266434	49,15823268	54,15788254	59,1636547	64,16570024	69,16783452	74,15936569	79,15693043
	Pos Act (deg_M)	-2019,044531	-63928,53984	-125838,0422	-187747,5445	-249657,0469	-311566,5[illegible]92	-37[illegible]76,0586	-435385,5609	-497295,0633	-559204,5656
	Pos Act (deg)	-0,163064067	-5,163059833	-10,16305617	-15,1630525	-20,16304883	-25,16[illegible]0451	-30,1[illegible]04207	-35,1630384	-40,16303107	-45,16303107
	DESV [deg]	0,013	0,030	0,045	0,060	[illegible]074	0,08[illegible]	0,100	0,116	0,131	0,147

NOT VALID

RESULTS

TOTAL ACCURACY	0,176 mm



TEST REPORT SHEET

Test reference	N056.TES.020-THETA.AC.002 v1			Test conductor	I Roji
Test parameter	Accuracy	Axis designation	THETA	Mech. support	JC Mancebo
		Subsystem des.	BFR motion system	Electrical support	I Roji
Date and time	23/10/2020	Project code	N056	Metrol. support	J Álvarez
Location	AVS workshop	Associated doc	AVS.PRO.020	Client repr:	NOT PRESENT

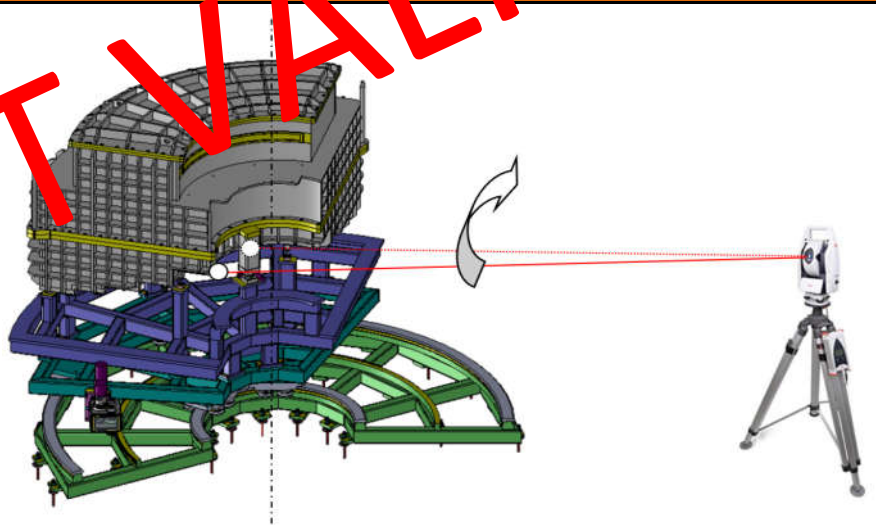
ENVIRONMENTAL CONDITIONS

Test facility	AVS workshop : PRE-FAT TESTING	Temperature	*ambient (not controlled)*	Vacuum	*In-air*
Cleanliness	Grey room	Pressure	*ambient (not controlled)*	Humidity	*ambient (not controlled)*

SETUP DESCRIPTION

Setup designation	CONF. 01 (MAIN)
Measuring equipment	Laser tracker
Measured position	POI*
External load	7,500 KG
Reference	Motor steps
Control loop	Open loop
Motor setup	Current 12A Motor speed 688º_m/s
Reduction ratio	100
Translation ratio [chain/pinion]	2
Angular conv. ratio [chain / rotation]	30,95477387
Driver setup	Commanded in deg_motor
** see description for more details*	

Setup description:



NOT VALID

RESULTS SUMMARY

Validation parameter	0,1 deg	Test result:	Comments: THE SYSTEM ACCUMULATES AN ERROR OF APROX 0.015 EVERY TIME THERE IS A ACCELERATION/DECELERATION RAMP. POSSIBLE SOURCES: CONTROL
Measured parameter	0,198382605 deg	Not satisfactory	Client signature: / Supplier signature: PEDRO NOGUERA

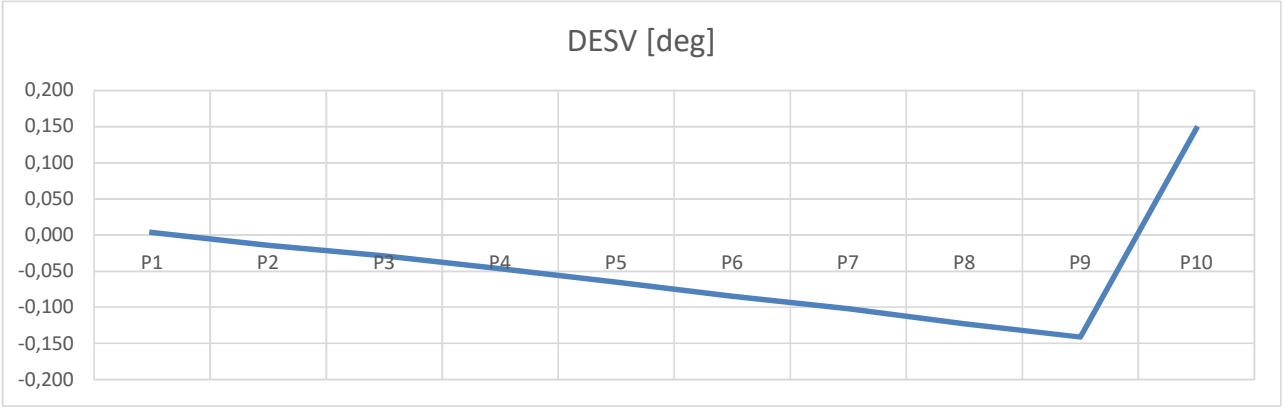
RECORDED MEASUREMENTS

		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Series 1	Target position [steps]										
	Target position [deg]	0	5	10	15	20	25	30	35	40	0
	Measurement [deg]	-0,0032	5,0145	10,0291	15,0467	20,0653	25,0848	30,1021	35,1227	40,1411	-0,1469
	Encoder position [cts]	1781120	1668435	1555855	1443096	1330384	1217579	1104939	992179	879403	1784243
	Encoder position [deg]	79,0183803	74,01917408	69,02462612	64,02213694	59,02173288	54,01720292	0199931	44,01745955	39,01421616	79,15693043
	Pos Act (deg_M)	-444945,5859	-383036,0414	-321126,4898	-259216,9383	-197307,3938	-1353 7,84	-7348 29766	-11578,75313	50330,79844	-559204,5656
	Pos Act (deg)	-35,93513458	-30,93513484	-25,93513453	-20,93513422	-15,9351344	-10,935 3417	-5,93 134429	-0,935134688	4,064865621	-45,16303107
	DESV [deg]	0,003	-0,015	-0,029	-0,047		-0,085	-0,102	-0,123	-0,141	0,147

NOT VALID

RESULTS

TOTAL ACCURACY	0,198 mm



TEST REPORT SHEET

Test reference	N056.TES.020-THETA.RP.001 v1			Test conductor	I Roji
Test parameter	Bi-directional repeatability	Axis designation	Rotation	Mech. support	JC Mancebo
		Subsystem des.	BFR motion system	Electrical support	I Roji
Date and time	21/10/2020	Project code	N056	Metrol. support	J Álvarez
Location	AVS workshop	Associated doc	AVS.PRO.020	Client repr:	NOT PRESENT

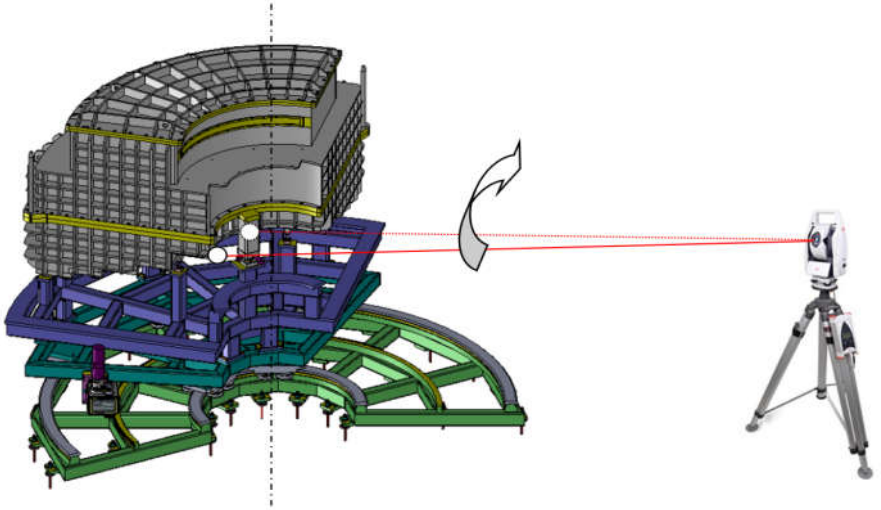
ENVIRONMENTAL CONDITIONS

Test facility	AVS workshop : PRE-FAT TESTING				
Cleanliness	Grey room	Temperature	*ambient (not controlled)*	Vacuum	*In-air*
		Pressure	*ambient (not controlled)*	Humidity	*ambient (not controlled)*

SETUP DESCRIPTION

Setup designation	CONF. 01 (MAIN)
Measuring equipment	Laser tracker
Measured position	POI*
External load	NO EXTERNAL LOAD
Reference	Motor steps
Control loop	Open loop
Motor setup	Current 12A Motor speed 688º_m/s
Reduction ratio	100
Translation ratio [chain/pinion]	2
Angular conv. ratio [chain / rotation]	30,95477387
Driver setup	Commanded in deg_motor
** see description for more details*	

Setup description:



RESULTS SUMMARY

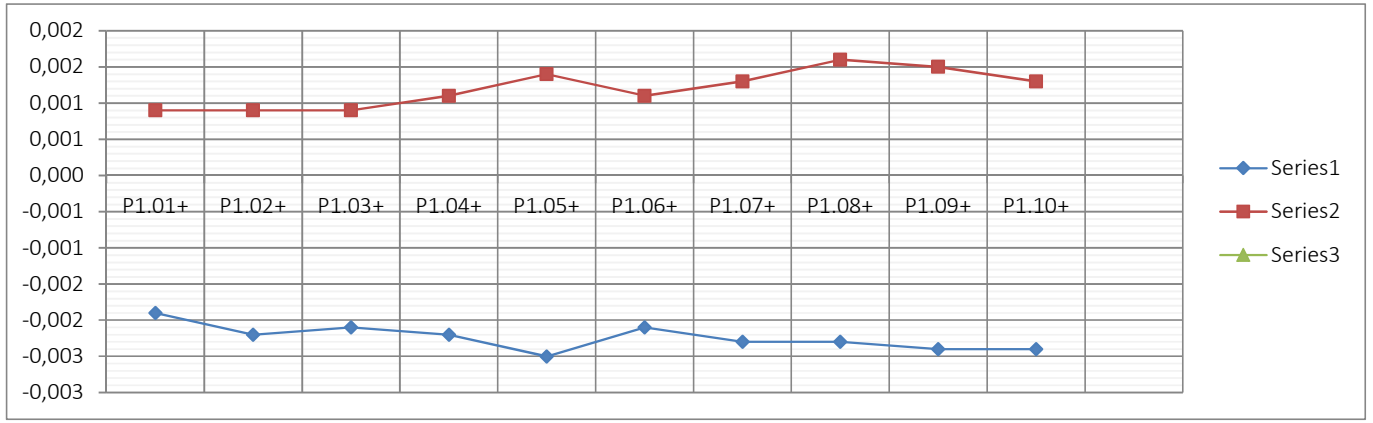
Validation parameter	0,05	Test result: Satisfactory	Comments: NO COMMENT
Measured parameter	0,015441057		Client signature: / Supplier signature: PEDRO NOGUERA

RECORDED MEASUREMENTS : POSITION 1

Direction +	from -0,5deg	P1.01+	P1.02+	P1.03+	P1.04+	P1.05+	P1.06+	P1.07+	P1.08+	P1.09+	P1.10+	
	Ext. Measurement [deg]	-0,002	-0,002	-0,002	-0,002	-0,003	-0,002	-0,002	-0,002	-0,002	-0,002	
	Target position [cts]											
	Target position [deg]	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	
	delta_P [deg]	**-0,002**	**-0,002**	**-0,002**	**-0,002**	**-0,003**	**-0,002**	**-0,002**	**-0,002**	**-0,002**	**-0,002**	
Direction -	from +0,5deg	P1.01-	P1.02-	P1.03-	P1.04-	P1.05-	P1.06-	P1.07-	P1.08-	P1.09-	P1.10-	
	Ext. Measurement [deg]	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,002	0,002	0,001	
	Target position [cts]											
	Target position [deg]	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	
	delta_P [deg]	**0,001**	**0,001**	**0,001**	**0,001**	**0,001**	**0,001**	**0,001**	**0,002**	**0,002**	**0,001**	

RESULTS

Unidirectional repeatability +	0,001 deg
Unidirectional repeatability -	0,001 deg
Backlash	0,003 deg
Bidirectional repeatability	**0,004 deg**

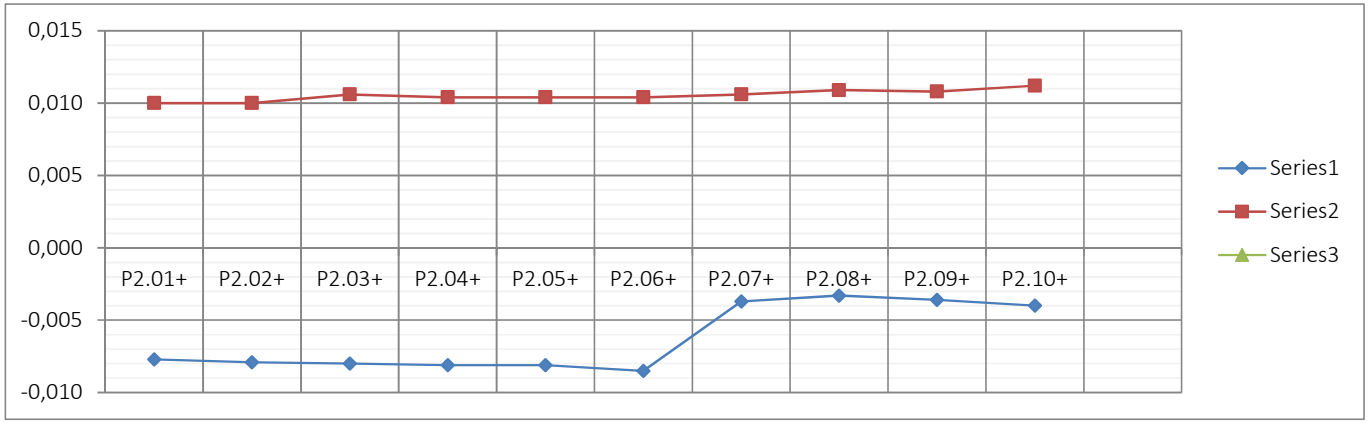


RECORDED MEASUREMENTS : POSITION 2

Direction +	from +9,5deg	P2.01+	P2.02+	P2.03+	P2.04+	P2.05+	P2.06+	P2.07+	P2.08+	P2.09+	P2.10+	
	Ext. Measurement [deg]	9,992	9,992	9,992	9,992	9,992	9,992	9,996	9,997	9,996	9,996	
	Target position [steps]											
	Target position [deg]	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	
	delta_P [deg]	**-0,008**	**-0,008**	**-0,008**	**-0,008**	**-0,008**	**-0,008**	**-0,004**	**-0,003**	**-0,004**	**-0,004**	
Direction -	from +10,5deg	P2.01-	P2.02-	P2.03-	P2.04-	P2.05-	P2.06-	P2.07-	P2.08-	P2.09-	P2.10-	
	Ext. Measurement [deg]	10,010	10,010	10,011	10,010	10,010	10,010	10,011	10,011	10,011	10,011	
	Target position [steps]											
	Target position [deg]	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	
	delta_P [deg]	**0,010**	**0,010**	**0,011**	**0,010**	**0,010**	**0,010**	**0,011**	**0,011**	**0,011**	**0,011**	

RESULTS

Unidirectional repeatability +	0,009 deg
Unidirectional repeatability -	0,002 deg
Backlash	0,017 deg
Bidirectional repeatability	**0,022 deg**

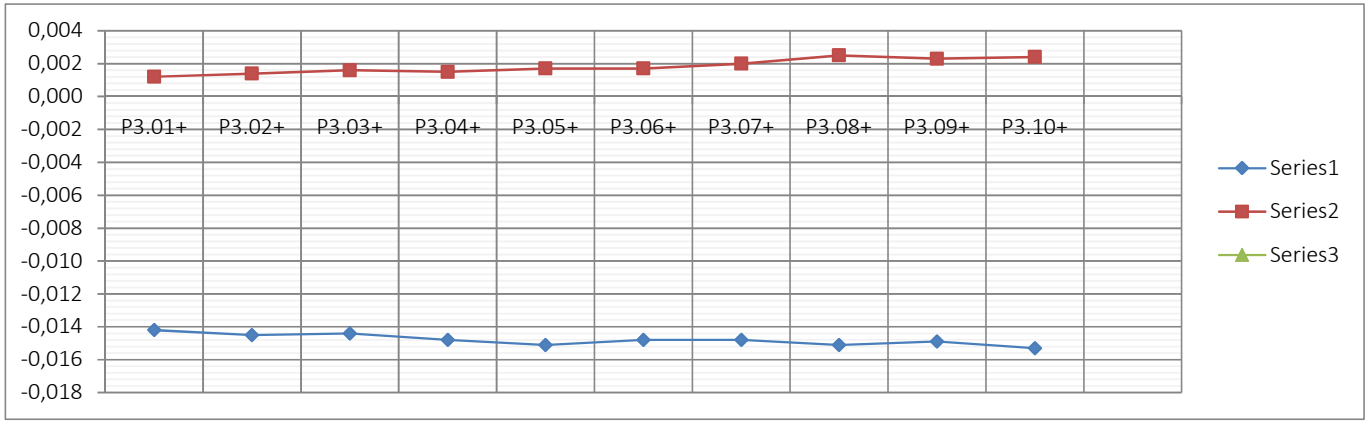


RECORDED MEASUREMENTS : POSITION 3

Direction +	from +19,5deg	P3.01+	P3.02+	P3.03+	P3.04+	P3.05+	P3.06+	P3.07+	P3.08+	P3.09+	P3.10+	
	Ext. Measurement [deg]	19,986	19,986	19,986	19,985	19,985	19,985	19,985	19,985	19,985	19,985	
	Target position [steps]											
	Target position [deg]	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	
	delta_P [deg]	**-0,014**	**-0,015**	**-0,014**	**-0,015**	**-0,015**	**-0,015**	**-0,015**	**-0,015**	**-0,015**	**-0,015**	
Direction -	from +20,5deg	P3.01-	P3.02-	P3.03-	P3.04-	P3.05-	P3.06-	P3.07-	P3.08-	P3.09-	P3.10-	
	Ext. Measurement [deg]	20,001	20,001	20,002	20,002	20,002	20,002	20,002	20,003	20,002	20,002	
	Target position [steps]											
	Target position [deg]	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	
	delta_P [deg]	**0,001**	**0,001**	**0,002**	**0,002**	**0,002**	**0,002**	**0,002**	**0,003**	**0,002**	**0,002**	

RESULTS

Unidirectional repeatability +	0,001 deg
Unidirectional repeatability -	0,002 deg
Backlash	0,017 deg
Bidirectional repeatability	**0,018 deg**

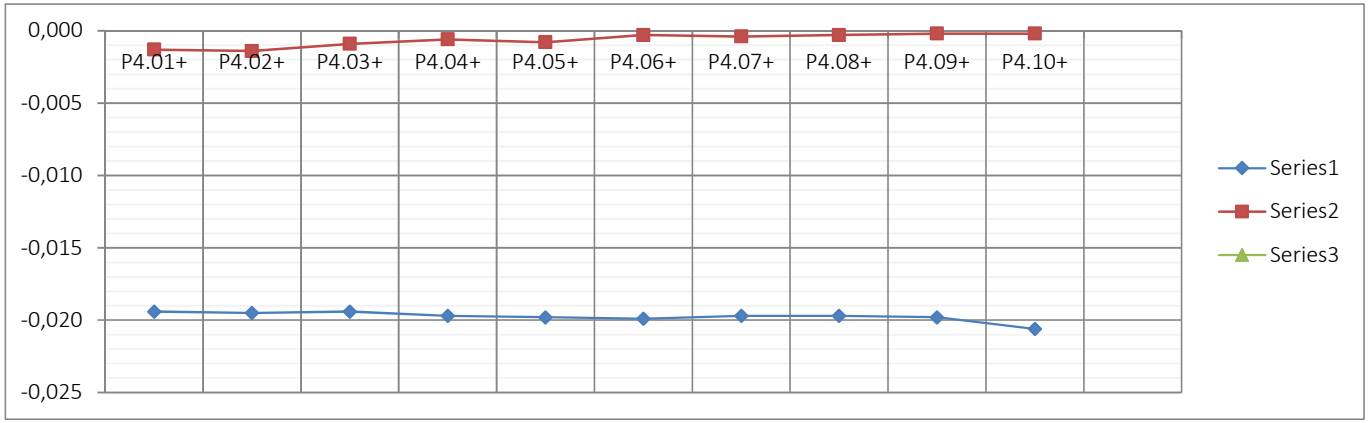


RECORDED MEASUREMENTS : POSITION 4

Direction +	from +29,5deg	P4.01+	P4.02+	P4.03+	P4.04+	P4.05+	P4.06+	P4.07+	P4.08+	P4.09+	P4.10+	
	Ext. Measurement [deg]	29,981	29,981	29,981	29,980	29,980	29,980	29,980	29,980	29,980	29,979	
	Target position [steps]											
	Target position [deg]	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	
	delta_P [deg]	**-0,019**	**-0,020**	**-0,019**	**-0,020**	**-0,020**	**-0,020**	**-0,020**	**-0,020**	**-0,020**	**-0,021**	
Direction -	from +30,5deg	P4.01-	P4.02-	P4.03-	P4.04-	P4.05-	P4.06-	P4.07-	P4.08-	P4.09-	P4.10-	
	Ext. Measurement [deg]	29,999	29,999	29,999	29,999	29,999	30,000	30,000	30,000	30,000	30,000	
	Target position [steps]											
	Target position [deg]	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	
	delta_P [deg]	**-0,001**	**-0,001**	**-0,001**	**-0,001**	**-0,001**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	

RESULTS

Unidirectional repeatability +	0,001 deg
Unidirectional repeatability -	0,002 deg
Backlash	0,019 deg
Bidirectional repeatability	**0,021 deg**



RECORDED MEASUREMENTS : POSITION 5

	from +39,5deg	P5.01+	P5.02+	P5.03+	P5.04+	P5.05+	P5.06+	P5.07+	P5.08+	P5.09+	P5.10+	
Direction +	Ext. Measurement [deg]	39,984	39,984	39,984	39,984	39,984	39,984	39,984	39,983	39,983	39,983	
	Target position [steps]											
	Target position [deg]	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	
	delta_P [deg]	**-0,016**	**-0,016**	**-0,016**	**-0,016**	**-0,016**	**-0,017**	**-0,016**	**-0,017**	**-0,017**	**-0,017**	
	from +40,5deg	P5.01-	P5.02-	P5.03-	P5.04-	P5.05-	P5.06-	P5.07-	P5.08-	P5.09-	P5.10-	
Direction -	Ext. Measurement [deg]	39,994	39,994	39,994	39,994	39,994	39,995	39,994	39,994	39,994	39,995	
	Target position [steps]											
	Target position [deg]	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	
	delta_P [deg]	**-0,006**	**-0,006**	**-0,006**	**-0,006**	**-0,006**	**-0,005**	**-0,006**	**-0,006**	**-0,006**	**-0,005**	

RESULTS

Unidirectional repeatability +	0,001 deg
Unidirectional repeatability -	0,001 deg
Backlash	0,011 deg
Bidirectional repeatability	**0,012 deg**