

PLAST CONTROL PROCON DIAGNOSTICS TOOLS for ACTUATOR MAINTENANCE

The purpose of this document is to instruct the user on the available tools to determine if the air ring actuators are responding properly.

There are several screens for feedback on how the actuators are moving and there are several ways that a trained maintenance personnel can test for individual actuator movement or a complete air ring test.

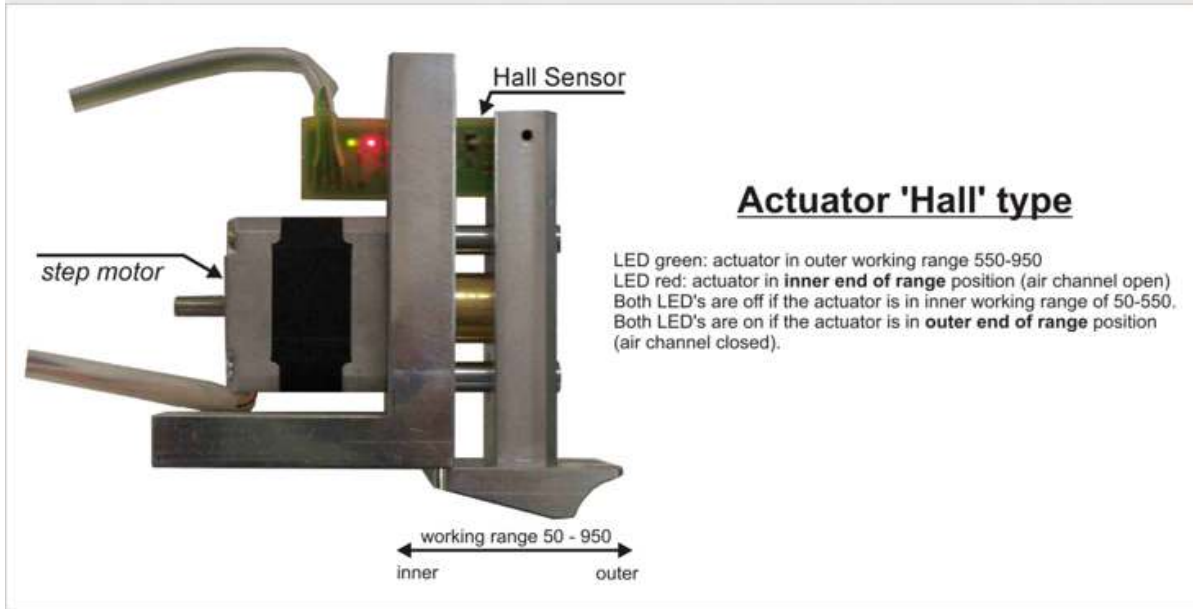
When the PRO-CON system has had maintenance performed it is absolutely imperative that the air ring access cover is secured in place to keep foreign objects from blocking the movement of the actuators. If it is required to remove the cover for maintenance then as soon as possible the access plate needs to be reinstalled after the service is completed.

If an operator is questioning whether one or more of the actuators are responding properly a simple understanding of how the actuators work and what they are capable of doing to film can generally answer most questions.

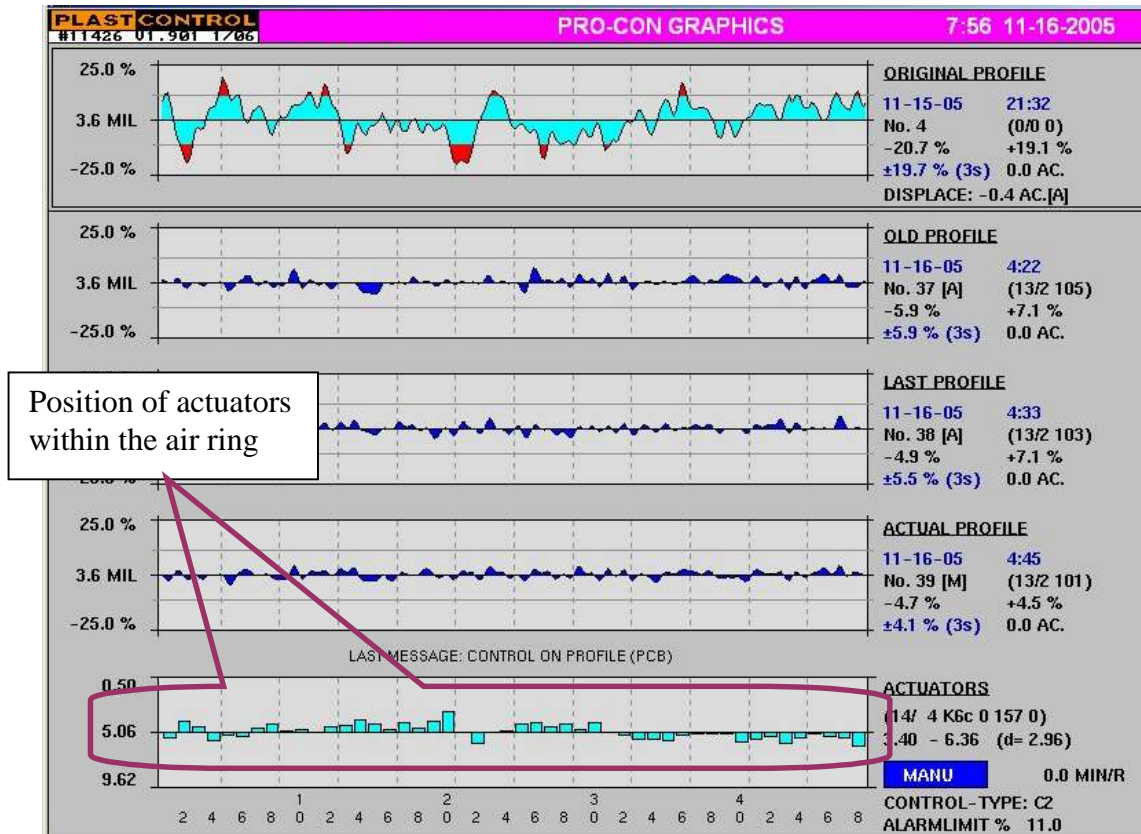
Simple description of the actuator function

There are a set number of actuators installed inside the air ring that can be automatically moved by the control system. When the system is first started all of the actuators are moved to a middle or start position, this can also be referred as the zero position in PLAST-CONTROL documentation. These actuators move a slider that is in the path of the upper chamber air flow and can vary the volume of cooling air that is delivered to the film. Because it is physically impossible to keep air from traveling from a high pressure to a low pressure area it is impossible to have one actuator in a maximum position (open or closed) and the actuator right next to it in the maximum opposite position. This is an important indication that an actuator is really not moving or the setup is incorrect. This will be explained further.

By moving these actuators based upon a profile measurement feedback the air ring will attempt to reduce the thick and thin areas in the film. This is done during the blow up of the film. By looking at the location of the actuators on PRO-CON Graphics screen most of the time the operator can tell if the actuators are moving properly or if one of them is stuck and is not moving. There is limited feedback on the actuators that indicate the real position. There are only three positions that are reported to the computer the rest of the locations are assumed. These three positions are maximum opened, maximum closed and middle or zero position.



Typical actuator



PRO-CON Graphics screen

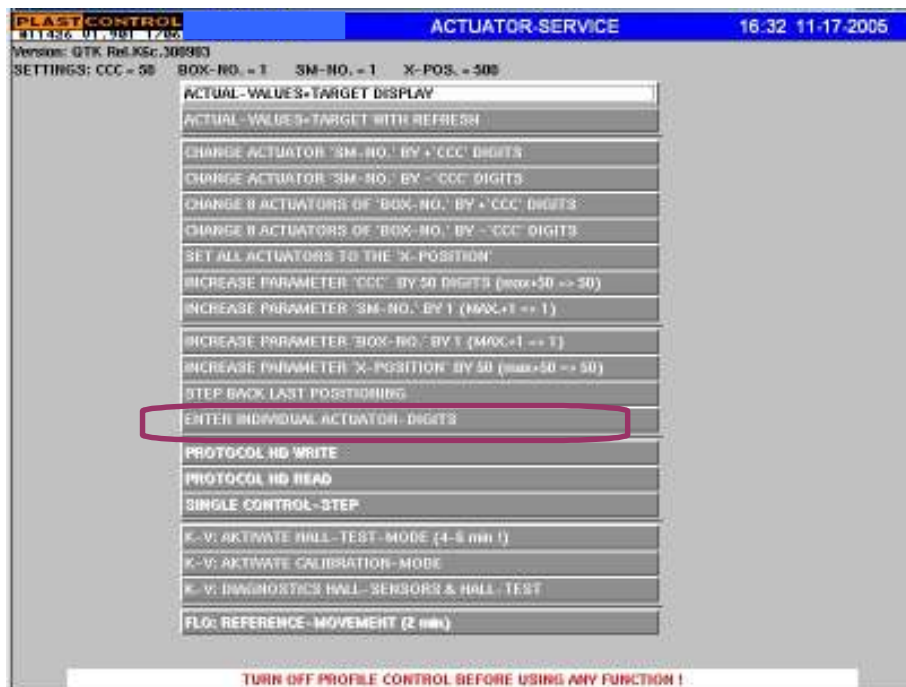
The above PRO-CON Graphics screen shows the position of all of the actuators. This example is typical and shows a good running air ring. There are no large variations in position from one actuator to another. They generally are located in the inverse location to what the Original Profile looks like at the top of the screen.

If the AUTO POSITION function has not been run and there is a twist in the film that makes the measurement point different to the controlling point then after awhile the actuators will show an up/down pattern all the way across the screen. This is not an indication that the actuators are stuck and not moving but that there is a misalignment in the measurement. If this is seen then please press ACTUATOR → MIDDLE POS button and when they are finished moving press AUTO POSITION push-button.

If only one of the actuators is in the maximum position up or down and the actuators to the left and right are in a totally different location then this could be an indication that it is not moving in the air ring but on the screen the computer shows it moving.

Since a small motion in the actuator position will cause a change in the film thickness at that location it is possible to go into a service screen on the computer and move any one of the elements to a new location by specifying how far to move the element. This should only be done by a trained personnel as this will cause a change in the films quality if the actuator does move.

A trained person will know how to enter into the service screens by entering in the required password. The proper location will be in the PROFILE-CONTROL SERVICE and then the ACTUATOR SERVICE selection to get to the screen below.



By selecting ENTER INDIVIDUAL ACTUATOR_DIGITS function it will bring you to the following screen, this will allow you to move any one or as many actuators as desired. It only makes sense in this test to move the actuator that is in question since a reaction to the film at the area of that actuator is the desired results. If more actuators are moved especially in the same area then a positive conclusion cannot be made.

PLAST CONTROL		ACTUATOR-SERVICE				16:32 11-17-2005					
No.	TGT	DIFF	No.	TGT	DIFF	No.	TGT	DIFF	No.	TGT	DIFF
1	454	0	25	510	0	49	0	0	73	0	0
2	399	0	26	511	0	50	0	0	74	0	0
3	386	0	27	516	0	51	0	0	75	0	0
4	462	0	28	573	0	52	0	0	76	0	0
5	534	0	29	786	0	53	0	0	77	0	0
6	471	0	30	598	0	54	0	0	78	0	0
7	527	0	31	678	0	55	0	0	79	0	0
8	511	0	32	599	0	56	0	0	80	0	0
9	448	0	33	546	0	57	0	0	81	0	0
10	483	0	34	687	0	58	0	0	82	0	0
11	483	0	35	565	0	59	0	0	83	0	0
12	295	0	36	614	0	60	0	0	84	0	0
13	296	0	37	573	0	61	0	0	85	0	0
14	352	0	38	585	0	62	0	0	86	0	0
15	326	0	39	535	0	63	0	0	87	0	0
16	392	0	40	597	0	64	0	0	88	0	0
17	485	0	41	571	0	65	0	0	89	0	0
18	497	0	42	563	0	66	0	0	90	0	0
19	518	0	43	644	0	67	0	0	91	0	0
20	446	0	44	658	0	68	0	0	92	0	0
21	565	0	45	571	0	69	0	0	93	0	0
22	591	0	46	528	0	70	0	0	94	0	0
23	476	0	47	538	0	71	0	0	95	0	0
24	464	0	48	575	0	72	0	0	96	0	0

By moving the cursor to the desired actuator and entering the amount of movement and pressing ENTER and then a message will be displayed asking for ENTER again or ESCAPE to cancel the selected actuator will immediately move. The column to the right of the actuator number will display the current location. The possible movement range is from 50 to 950 with 500 being the middle position. If the current position is 375 and you want to open the actuator to allow maximum air flow which will make the film thicker then enter a -325 which would move the actuator to the 50 position. At this point the actuator moves and now you must wait for a new profile update to see the reaction. Make sure there has been enough time to allow the film to go from the die to the gauge measurement location, which will vary according to the line speed.

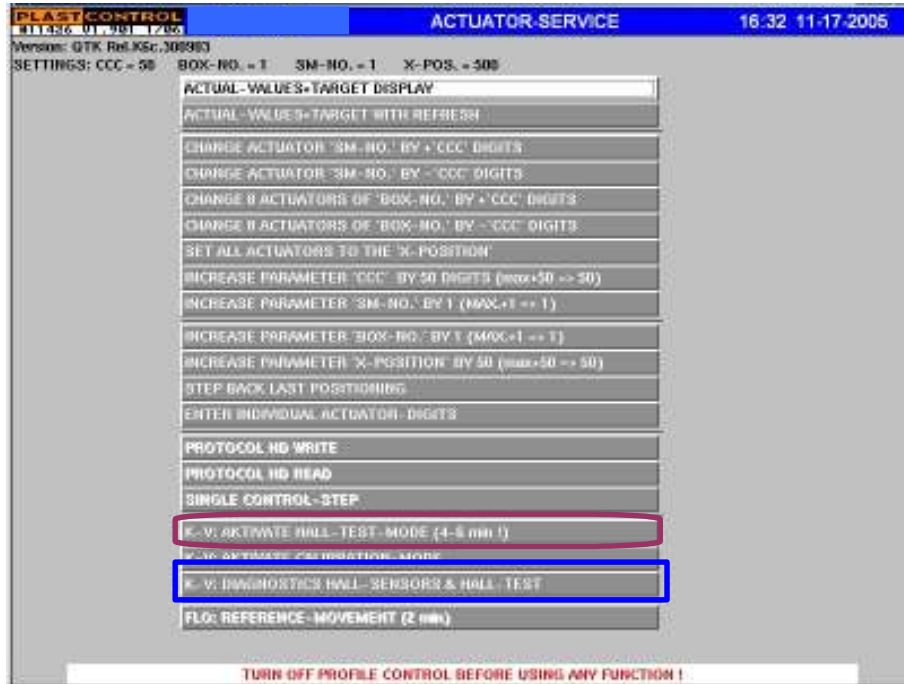
If the film then becomes thicker, profile increases near the location of the actuator then this actuator is moving. Next go back to the same screen for that actuator and enter 900 which will make the actuator move full closed. This will cause the film to become thinner in the same area. Again look at the profile display look for a reaction. If in either case no change in the film profile for that area is noticed then the actuator is probably not moving either totally or only a small amount. At this time the correct cover can be removed so the actuator can be serviced.

PLAST CONTROL			ACTUATOR-SERVICE												16:32 11-17-2005				
#11426 01.901 1706																			
No.	TGT	DIFF		No.	TGT	DIFF		No.	TGT	DIFF		No.	TGT	DIFF		No.	TGT	DIFF	
1	454	0		25	510	0		49	0	0		73	0	0					
2	399	0		26	511	0		50	0	0		74	0	0					
3	306	0		27	516	0		51	0	0		75	0	0					
4	462	0		28	573	0		52	0	0		76	0	0					
5	534	0		29	706	0		53	0	0		77	0	0					
6	471	0		30	598	0		54	0	0		78	0	0					
7	527	0		31	678	0		55	0	0		79	0	0					
8	511	0		32	599	0		56	0	0		80	0	0					
9	440	0		33	546	0		57	0	0		81	0	0					
10	403	0		34	607	0		58	0	0		82	0	0					
11	403	0		35	565	0		59	0	0		83	0	0					
12	295	0		36	614	0		60	0	0		84	0	0					
13	296	0		37	573	0		61	0	0		85	0	0					
14	352	0	50	38	585	0		62	0	0		86	0	0					
15	326	0		39	535	0		63	0	0		87	0	0					
16	392	0		40	597	0		64	0	0		88	0	0					
17	405	0		41	571	0		65	0	0		89	0	0					
18	497	0		42	563	0		66	0	0		90	0	0					
19	510	0		43	644	0		67	0	0		91	0	0					
20	446	0		44	650	0		68	0	0		92	0	0					
21	565	0		45	571	0		69	0	0		93	0	0					
22	591	0		46	528	0		70	0	0		94	0	0					
23	476	0		47	530	0		71	0	0		95	0	0					
24	464	0		48	575	0		72	0	0		96	0	0					

Example: Move actuator 14 from position 352 to 402

Full air ring test without a bubble

There is a test feature in the ACTUATOR SERVICE selection screen called K-V: AKTIVATE HALL-TEST-MODE (4-6 min!).



This test will move each actuator individually to the fully opened and fully closed position and then back to the middle position. These three points of travel have a feedback that the computer looks for as a positive indication that the actuator actually moved. Additionally the number of steps that the stepper motor took is counted and a range is compared to a typical movement. When all actuators have been tested there is an additional screen that will report the findings. Select K-V: DIAGNOSTICS HALL-SENSORS & HALL-TEST from the ACTUATOR SERVICE page. If the test is still running when this screen is selected then it will be blank. Once the test is finished it will automatically update with the new test results.

PLAST CONTROL		ACTUATOR-SERVICE										8:01 11-16-2005	
#11426 01.901 1706		STATUS K-U										QTK Re1.K6c.300903	
NR	SMPO	ST	EH	ECAL	POSZ	POSE	NR	SMPO	ST	EH	ECAL	POSZ	POSE
1	564	0	6	52	548	548	33	573	2	0	50	548	548
2	413	0	0	50	548	548	34	578	2	0	48	548	548
3	460	0	0	50	548	548	35	580	2	0	54	548	548
4	589	2	0	48	548	548	36	545	2	0	52	548	548
5	545	2	0	50	548	548	37	531	2	0	50	548	548
6	546	2	0	50	548	548	38	526	2	0	52	548	548
7	475	0	0	52	548	548	39	527	2	0	66	548	548
8	442	0	0	50	548	548	40	598	2	0	50	548	548
9	495	0	0	50	548	548	41	573	2	0	50	548	548
10	483	0	0	50	548	548	42	557	2	0	48	548	548
11	507	2	0	50	548	548	43	606	2	0	50	548	548
12	464	0	0	50	548	548	44	565	2	0	48	548	548
13	450	0	0	50	548	548	45	529	2	0	44	548	548
14	400	0	0	50	548	548	46	557	2	0	46	548	548
15	436	0	0	48	548	548	47	560	2	0	64	548	548
16	400	0	0	48	548	548	48	636	2	0	48	548	548
17	428	0	0	50	548	548	49	0	0	0	0	0	0
18	476	0	0	52	548	548	50	0	0	0	0	0	0
19	419	0	0	48	548	548	51	0	0	0	0	0	0
20	340	0	0	116	548	548	52	0	0	0	0	0	0
21	507	0	0	54	548	548	53	0	0	0	0	0	0
22	605	2	0	18	548	548	54	0	0	0	0	0	0
23	511	0	6	18	548	548	55	0	0	0	0	0	0
24	489	0	0	50	548	548	56	0	0	0	0	0	0
25	439	0	0	50	548	548	57	0	0	0	0	0	0
26	428	0	0	50	548	548	58	0	0	0	0	0	0
27	466	0	0	50	548	548	59	0	0	0	0	0	0
28	438	0	0	44	548	548	60	0	0	0	0	0	0
29	480	0	0	48	548	548	61	0	0	0	0	0	0
30	421	0	0	50	548	548	62	0	0	0	0	0	0
31	502	0	0	50	548	548	63	0	0	0	0	0	0
32	543	0	0	48	548	548	64	0	0	0	0	0	0

POSI: Z...M...E (= 0...500...1000) 'ECAL': last calib-error
 'ST': 10000222223 (calibration on 0->2) 'POSZ': steps 'M'-'Z'
 'EH': last error (0=ok 1=reset 2=>steps/calib 3=Act.->'Z' 4=Act.->'E' 5=>Stps/Test 6=ErrHysSens)

K-V: DIAGNOSTICS HALL-SENSORS & HALL-TEST screen

Description of report columns

Nr = Stepper motor number ...

SMPO = Stepper Motor POSition (target) 50..950

ST = actual STatus of the hall-sensor (0...3)

- 1 = real Zero position (fully retracted = full air to the film) reached. Stops motor
- 0 = somewhere between Zero & Middle position
- 2 = somewhere between Middle position and end position
- 3 = end position, stops motor

physically (starts left with the Zero position and stop at the right with the end position, each digit represents more or less one millimeter

1 0 0 0 0 2 2 2 2 3

- EH = Error Hall sensor
- 0 = ok.
 - 1 = Internal Reset, too many steps needed for any action.
 - 2 = Too many steps needed to get to the calibration position (=500 digits = reference)
e.g. motor sticking, but not totally stuck.
 - 3 = Zero Position reached but this was not expected (e.g. going to end position).
= SHU hall sensor or plug bad.
 - 4 = End Position reached but this was not expected (e.g. going to Zero position).
 - 5 = Too many steps needed for this Test-Cycle (timeout) = motor stuck.
 - 6 = Error in detecting Hysteresis of hall sensor in middle position
(stepping from position 0 to 2, then moving backwards (typically 50steps) before the hall sensor goes from 2 to 0 again. If more than 100 steps are needed -> error.
 - 7..9 = not used.
- ECAL = Last error of positioning (only renewed if "actuators->zero" is selected and the edge from 0 to 2 is found. The ECAL is the number of steps between the target position and the actual position actually found by tracking back when moving to the reference = calibration position
- POSZ = Steps done until the ZERO sensor was found (= range of possible movement)
relative to the reference = calibration position, typically between 420 and 580.
- POSE = steps done from the reference position to the end sensor, typically between 370 .. 500.

After this test has been run if the value under the column EH contains all 0 then the actuators are moving and they all reached the full open and close position and returned to the middle. The other columns can contain values that describe how many steps the motor took to reach those positions and will not always have the same value.

Remove the cover that the failed actuator is under and try to move the shaft of the stepper motor by hand. It should turn freely and slight clicks should be felt as it turns. If it is stuck then loosen the two hex screws that hold it in place and while the screws are loose turn the shaft. If it now turns, look for debris in the area. The actuator may need to be removed and the area may need to be vacuumed. The screws need to be fully removed before the actuator can be pulled out. Be careful of the wires that are attached to the SHU feedback board as they can be damaged and cannot be repaired. Reinstall the actuator and put the screws in with minimal torque and then go to the ENTER INDIVIDUAL ACTUATOR_DIGITS function describe at the beginning of this document. Move the actuator fully open and close. If it does not stick then tighten the screws fully and move the actuator again. If it passes the test then perform the K-V: AKTIVATE HALL-TEST-MODE (4-6 min!) again.