SIEMENS

Installation Instructions
Document No. 129-125
September 24, 2009

RL 147 Positioning Relay Calibration

Product Description

This sheet provides the instructions to calibrate the RL 147 Positioning Relay after it has been mounted on an actuator.

Product Number

147-2000

Required Tools

- Medium flat-blade screwdriver
- Tubing, pressure gauge, and squeeze bulb (Part of Calibration kit 832-177)
- Two 5/8-inch open end wrenches
- Two 7/16-inch open end wrenches for valve stems of 1/4-inch diameter

Expected Installation Time

10 Minutes

Prerequisites

- For field installed relays, mount the positioning relay on the actuator according to the instructions that are packaged with the mounting kit.
- Check that you have the correct feedback spring(s) attached.
  - If the positioning relay is mounted on a valve, see *Tables 4 and 6.*
  - If the stroke of the No. 6 damper actuator has been adjusted, see *Table 1*.

Identify the desired operating span and the start point pressure.

NOTE: In some cases, the actuator stem travel or stroke is not identical to the nominal value of the relay feedback spring. See *Calculating The Span Setting* to determine the span setting on the feedback arm.

Installation

Setting the span (See *Figure 1*)

The positioning relay operating span can be set for spans of 3 to 12 psig (21 to 83 kPa).

For spans of 3 through 10 psig (21 to 69 kPa)

1. Check that the feedback spring is attached to the spring guide in the hole across from the span adjustment screw. This is identified as the standard location in *Figure 1.*
2. With a screwdriver, loosen the span adjustment screw. Move the spring guide on the feedback arm until the span adjustment tab is at the desired span setting reference number.

   NOTE: The line to the left of the number is the setting.
3. Tighten the span adjustment screw.
4. The feedback spring must be parallel to the actuator shaft or valve stem. Use the open end wrenches to loosen the hex nuts holding the spring arm in position on the shaft or stem. Align the feedback spring and tighten the hex nuts.
5. The feedback spring should have no slack or no stretch in it. Adjust the wing nuts and adjustment nut, if necessary.

Installation, Continued

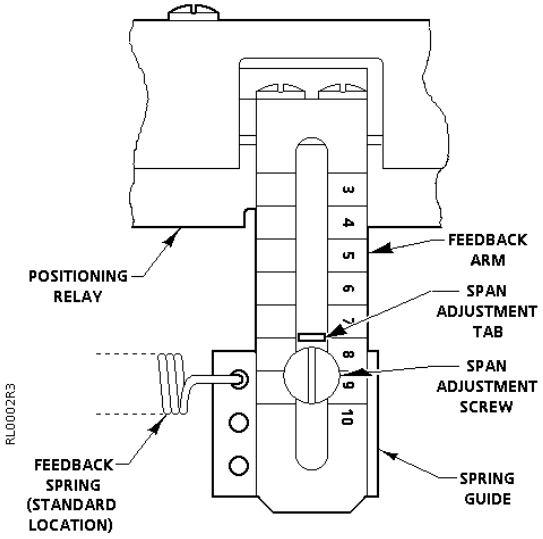

Figure 1. Span Adjustment. Shown at Span Setting 8.

For spans of 11 or 12 psig (76 or 83 kPa)

1. Move the span adjustment tab to the 10 setting on the feedback arm. Follow steps 2 and 3 for *Setting the span*.
2. Move the feedback spring one hole away from the standard location for a span of 11 psig (76 kPa) and two holes away from the standard spring location for a 12 psig (83 kPa) span. See *Figure 1*.
3. Follow steps 4 and 5 for *Setting the span*.

Adjusting the start point (see *Figure 2*)

The positioning relay can be adjusted to start actuator movement at pressures between 3 and 10 psig (21 and 69 kPa).

1. Remove the relay cover.
2. Attach tubing with a pressure gauge and squeeze bulb to the "T" port. Supply air should be attached to the "S" port. The "M" port should be attached to the connector on the actuator.
3. Using the squeeze bulb, apply pressure to the relay. Watch the valve stem or actuator shaft to see when it begins to move. Check the pressure gauge; this is the start point pressure.
4. If this is not the desired start point pressure, turn the start point adjustment nut (*Figure 2*) clockwise to increase the start point pressure and counterclockwise to decrease the pressure.
5. Repeat steps 3 and 4 until the stem or shaft begins to move at the desired pressure.

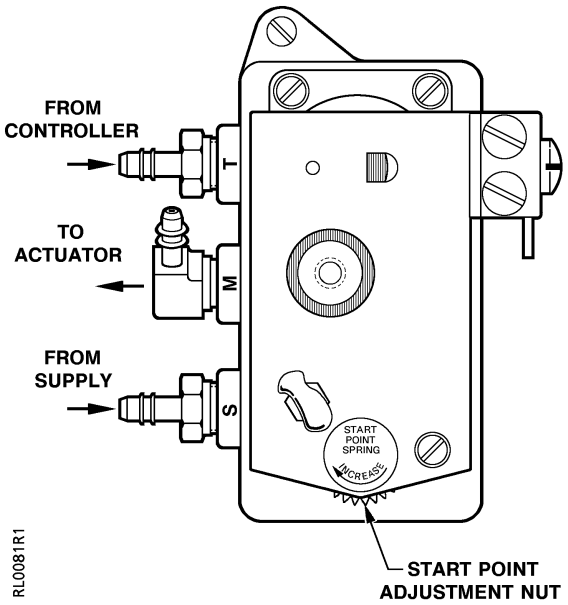

Figure 2. Start Point Adjustment

Adjusting the span

1. Using the squeeze bulb, apply pressure to the relay. Note the pressure at which the stem or shaft begin to move.
2. Continue to apply pressure until the stem or shaft completes its full stroke. Note the pressure.
3. The difference between the two pressures is the span.
4. If the span is not the desired span, move the spring guide to a higher reference number to increase the span or lower number to decrease the span. See *Figure 1* and *Setting the Span*.
5. Repeat steps 1 through 4 until you get the desired span.
6. If you have moved the spring guide, adjust the spring arm so that the spring is parallel to the stem or shaft.
7. Check the feedback spring. There should be no slack nor stretch in it. Adjust the wing nuts and adjustment nut, if necessary.
8. Fasten the relay cover. Fill in the information on the calibration label.
9. Attach the air line from the controller to the "T" port.

Installation, Continued

Table 1. Spring Selection for Adjustable Stroke of the No. 6 Damper Actuator.

Actuator Stroke	Feedback Spring			Adjusting Screw
	Color	Nominal	Max	
3-1/4 to 4 (82 to 102)	Blue	4 (102)	4-1/4 (108)	4-1/2 (114) long
2-29/32 to 3-1/4 (74 to 82)	Cadmium	3 (76)	3-1/4 (82)	1-3/4 (44) long

Dimensions in inches (millimeters).

Calculating the span setting

1. Identify the stem/stroke travel from *Tables 1, 2, 3, 5, or 6.*
2. If the stem travel matches a nominal spring travel listed in *Table 4* there is no need to calculate a new span setting.
3. If the stem travel does not match a nominal spring travel listed in *Table 4*, chose the spring(s) whose maximum allowable travel is equal to or greater than the actual stem travel.
4. Calculate the span setting with the following formula:

Formula for Span Setting

$$\text{Span setting} = \text{Desired span} \left[\frac{\text{Nominal spring travel}}{\text{Actuator stroke}} \right]$$

Example:

Determine the span setting for a valve having a desired span of 5 psig and 5/16-inch stroke.

Select a spring with a maximum allowable range equal to or larger that the stroke. Use the 1/4-inch spring with a 3/8-inch maximum allowable travel range. See *Table 4*.

$$\text{Span setting} = 5 \times \left[\frac{0.25}{0.312} \right] = 4$$

Set the span adjustment tab to line 4 on the feedback arm to provide a 5 psig span for this valve.

Table 2. Stem Travel for VF 599 Valve Bodies.

Line size in Inches (mm)	Stem Travel in Inches (mm)	
	8-inch Actuator	12-inch Actuator
1/2 through 2 (15 though 50)	3/4 (20)	–
2-1/2 (65)	3/4 (20)	3/4 (20)
3 (80)	3/4 (20)	3/4 (20)
4 (100)	–	1-1/2 (40)
5 (125)	–	1-1/2 (40)
6 (150)	–	1-1/2 (40)

Table 3. Stem Travel Listed by Valve Type.

Line Size Inches (mm)	Flowrite™ Valve Stem Travel in Inches (mm)					
	VP 591 Single Seat	VP 591 Double Seat	VP 591 WM	VP 593 Single Seat	VP 593 Double Seat	VP 593 WM
1/2 (13)	3/8 (9.5)	–	1/8 (3.2)	–	–	–
3/4 (19)	3/4 (19)	–	3/16 (4.8)	–	–	–
1 (25)	3/4 (19)	3/16 (4.8)	1/4 (6.4)	–	–	–
1-1/4 (32)	1 (25)	1/4 (6.4)	5/16 (7.9)	–	–	–
1-1/2 (38)	1 (25)	1/4 (6.4)	5/16 (7.9)	–	–	–
2 (51)	1 (25)	3/8 (9.5) N.O. 5/16 (7.9) N.C.	5/16 (7.9)	–	–	–
2-1/2 (64)	5/8 (16)	3/8 (9.5) N.O. 5/16 (7.9) N.C.	5/8 (16)	1-1/8 (29)	3/4 (19)	1 (25)
3 (76)	3/4 (19)	9/16 (14)	3/4 (19)	1-1/8 (29)	3/4 (19)	1 (25)
4 (102)	1 (25)	9/16 (14)	1 (25)	1-1/4 (32)	1-1/8	1-3/8 (35)
5 (127)	–	–	–	1-1/2 (38)	1-1/4 (32)	1-3/8 (35)
6 (152)	–	–	–	1-1/2 (38)	1-1/4 (32)	1-3/8 (35)
8 (203)	–	–	–	–	1-1/2 (38)	–

Table 4. Spring Selection.

Spring Travel Range		Recommended Springs	
Nominal Inches (mm)	**Max. Allowable Inches (mm)**	**Part No.**	**Size & Color**
5/32 (5.0)	1/4 (6.4)	147-298	Small Green
1/4 (6.4)	3/8 (9.5)	147-289	Small Cadmium Plate
3/8 (9.5)	1/2 (13)	(2)147-298	Small Green
1/2 (13)	3/4 (19)	(2)147-289	Small Cadmium Plate
3/4 (19)	1 (25)	147-290	1-3/8" Red
1 (25)	1-1/4 (32)	147-291	Long Green
1-1/4 (32)	1-5/8 (41)	147-289 plus 147-291	Small Cadmium Plate plus Long Green
1-1/2 (38)	2 (51)	(2)147-290	Small Red
1-3/4 (44)	2-1/4 (57)	147-290 plus 147-291	Small Red plus Long Green
2 (51)	2-1/2 (64)	(2)147-291	Long Green
2-3/8 (60)	N/A	147-105	2" Red
3 (76)	3-1/4 (83)	147-292	Long Cadmium Plate
3-3/4 (95)	4 (102)	147-301	3" Red
4 (102)	4-1/4 (108)	147-293	Blue
4 (102)	6 (152)	147-313	Zinc Pl. or Yell. Chr.
7 (178)	12-1/4 (311)	147-330	Zinc Plate

Table 5 Flowrite 599 Valve Body Listed by Product Number.

Flowrite Product Number	Stem Travel Inches (mm)
599-05920	3/4 (20)
599-05921	3/4 (20)
599-05922	1-1/2 (40)
599-05923	1-1/2 (40)
599-05924	1-1/2 (40)
599-05930	3/4 (20)
599-05931	3/4 (20)
599-05932	1-1/2 (40)
599-05933	1-1/2 (40)
599-05934	1-1/2 (40)
599-05940	3/4 (20)
599-05941	3/4 (20)
599-05942	1-1/2 (40)
599-05943	1-1/2 (40)
599-05944	1-1/2 (40)
599-05950	3/4 (20)
599-05951	3/4 (20)
599-05952	1-1/2 (40)
599-05953	1-1/2 (40)
599-05954	1-1/2 (40)
599-05960	3/4 (20)
599-05961	3/4 (20)
599-05962	1-1/2 (40)
599-05963	1-1/2 (40)
599-05964	1-1/2 (40)

Flowrite Product Number	Stem Travel Inches (mm)
599-05970	3/4 (20)
599-05971	3/4 (20)
599-05972	1-1/2 (40)
599-05973	1-1/2 (40)
599-05974	1-1/2 (40)
599-05980	3/4 (20)
599-05981	3/4 (20)
599-05982	1-1/2 (40)
599-05983	1-1/2 (40)
599-05984	1-1/2 (40)
599-05990	3/4 (20)
599-05991	3/4 (20)
599-05992	1-1/2 (40)
599-05993	1-1/2 (40)
599-05994	1-1/2 (40)
599-06040	3/4 (20)
599-06041	3/4 (20)
599-06042	1-1/2 (40)
599-06043	1-1/2 (40)
599-06044	1-1/2 (40)
599-06050	3/4 (20)
599-06051	3/4 (20)
599-06052	1-1/2 (40)
599-06053	1-1/2 (40)
599-06054	1-1/2 (40)

Flowrite Product Number	Stem Travel Inches (mm)
599-06060	3/4 (20)
599-06061	3/4 (20)
599-06062	1-1/2 (40)
599-06063	1-1/2 (40)
599-06064	1-1/2 (40)
599-06070	3/4 (20)
599-06071	3/4 (20)
599-06072	1-1/2 (40)
599-06073	1-1/2 (40)
599-06074	1-1/2 (40)
599-06120	3/4 (20)
599-06121	3/4 (20)
599-06122	1-1/2 (40)
599-06123	1-1/2 (40)
599-06124	1-1/2 (40)
599-06130	3/4 (20)
599-06131	3/4 (20)
599-06132	1-1/2 (40)
599-06133	1-1/2 (40)
599-06134	1-1/2 (40)
599-06140	3/4 (20)
599-06141	3/4 (20)
599-06142	1-1/2 (40)
599-06143	1-1/2 (40)
599-06144	1-1/2 (40)

Flowrite Product Number	Stem Travel Inches (mm)
599-06150	3/4 (20)
599-06151	3/4 (20)
599-06152	1-1/2 (40)
599-06153	1-1/2 (40)
599-06154	1-1/2 (40)
599-06160	3/4 (20)
599-06161	3/4 (20)
599-06162	1-1/2 (40)
599-06163	1-1/2 (40)
599-06164	1-1/2 (40)
599-06165	3/4 (20)
599-06166	3/4 (20)
599-06167	1-1/2 (40)
599-06168	1-1/2 (40)
599-06169	1-1/2 (40)
599-06170	3/4 (20)
599-06171	3/4 (20)
599-06172	1-1/2 (40)
599-06173	1-1/2 (40)
599-06174	1-1/2 (40)
599-06175	3/4 (20)
599-06176	3/4 (20)
599-06177	1-1/2 (40)
599-06178	1-1/2 (40)
599-06179	1-1/2 (40)

Table 6. Stem Travel Listed by Product Number.

Flowrite Product Number	Stem Travel Inches (mm)
591-6480	5/8 (16)
591-6490	3/4 (19)
591-6540	5/8 (16)
591-6600	1/8 (3.2)
591-6610	3/16 (4.8)
591-6620	1/4 (6.4)
591-6630	5/16 (7.9)
591-6640	5/16 (7.9)
591-6650	5/16 (7.9)
591-6720	5/8 (16)
591-6730	3/4 (19)
591-6740	1 (25)
591-6840	3/8 (9.5)
591-6850	9/16 (14)
591-6860	9/16 (14)
591-6870	5/16 (7.9)
591-6880	9/16 (14)
591-6890	9/16 (14)
591-6900	1/4 (6.4)
591-6910	1/4 (6.4)
591-6920	5/16 (7.9)
591-6930	9/16 (14)
591-6940	3/16 (4.8)
591-6950	1/4 (6.4)
591-6960	1/4 (6.4)
591-6970	3/8 (9.5)
591-6980	3/16 (4.8)
591-7000	1/4 (6.4)
591-7010	5/16 (7.9)
591-7020	3/16 (4.8)
591-7030	1/4 (6.4)
591-7040	1/4 (6.4)
591-7050	3/8 (9.5)
591-7060	3/8 (9.5)
591-7070	9/16 (14)
591-7080	9/16 (14)
591-7090	3/16 (4.8)
591-7100	5/16 (7.9)
591-7110	9/16 (14)
591-7870	3/4 (19)
591-7871	3/4 (19)
591-7872	1 (25)
591-7873	1 (25)
591-7874	1 (25)
591-7875	3/4 (19)
591-7876	3/4 (19)
591-7877	1 (25)
591-7878	1 (25)
591-7879	1 (25)
591-7971	3/8 (9.5)
591-7972	3/4 (19)
591-7973	3/4 (19)
591-7974	1 (25)
591-7975	1 (25)
591-7976	1 (25)
591-7977	3/8 (9.5)
591-7978	3/4 (19)
591-7979	3/4 (19)
591-7980	1 (25)
591-7981	1 (25)
591-7982	1 (25)
591-8016	5/8 (16)
591-8017	5/8 (16)
591-8018	3/4 (19)
591-8019	3/4 (19)
591-8020	1 (25)
591-8021	1 (25)
591-8028	5/8 (16)
591-8029	3/4 (19)
591-8030	1 (25)
591-8071	3/8 (9.5)
591-8072	3/4 (19)
591-8073	3/4 (19)
591-8074	1 (25)
591-8075	1 (25)
591-8076	1 (25)
591-8077	3/8 (9.5)
591-8078	3/4 (19)
591-8079	3/4 (19)
591-8080	1 (25)
591-8081	1 (25)
591-8082	1 (25)
591-8330	5/8 (16)
591-8331	5/8 (16)
591-8332	3/4 (19)
591-8336	5/8 (16)
591-8337	5/8 (16)
591-8338	3/4 (19)
591-8339	3/4 (19)
591-8340	1 (25)
591-8341	1 (25)
593-8342	1-1/2 (38)
593-8344	1-1/2 (38)
593-8350	1-1/8 (29)
593-8351	1-1/8 (29)
593-8352	1-1/8 (29)
593-8353	1-1/8 (29)
593-8354	1-1/8 (29)
593-8355	1-1/8 (29)
593-8356	1-1/8 (29)
593-8357	1-1/8 (29)
593-8358	1-1/4 (32)
593-8359	1-1/4 (32)
593-8360	1-1/2 (38)
593-8362	1-1/2 (38)
593-8364	1-1/8 (29)
593-8365	1-1/8 (29)
593-8366	1-1/8 (29)
593-8367	1-1/8 (29)
593-8368	1-1/8 (29)
593-8369	1-1/8 (29)
593-8370	1-1/8 (29)
593-8371	1-1/8 (29)
593-8372	1-1/4 (32)
593-8373	1-1/4 (32)
593-8374	1-1/2 (38)
593-8376	1-1/2 (38)
593-8378	1-1/4 (32)
593-8379	1-1/4 (32)
593-8380	1-1/4 (32)
593-8381	1-1/4 (32)
593-8382	1-1/2 (38)
593-8383	1-1/2 (38)
593-8388	3/4 (19)
593-8389	3/4 (19)
593-8390	3/4 (19)
593-8391	3/4 (19)
593-8392	1-1/8 (29)
593-8393	1-1/8 (29)
593-8394	1-1/4 (32)
593-8395	1-1/4 (32)
593-8396	1-1/4 (32)
593-8397	1-1/4 (32)
593-8398	1-1/4 (32)
593-8399	1-1/4 (32)
593-8400	1-1/4 (32)
593-8401	1-1/4 (32)
593-8402	1-1/2 (38)
593-8403	1-1/2 (38)
593-8404	1-1/4 (32)
593-8405	1-1/4 (32)
593-8406	1-1/4 (32)
593-8407	1-1/4 (32)
593-8410	1-1/2 (38)
593-8411	1-1/2 (38)
593-8412	1-3/8 (35)
593-8413	1-3/8 (35)
593-8415	1 (25)
593-8416	1 (25)
593-8419	1 (25)
593-8420	1 (25)
593-8421	1-3/8 (35)
593-8422	1-3/8 (35)
593-8423	1-3/8 (35)
594-8343*	1-1/2 (38)
594-8345*	1-1/2 (38)
594-8361*	1-1/2 (38)
594-8363*	1-1/2 (38)
594-8375*	1-1/2 (38)
594-8377*	1-1/2 (38)

* RL 147 is standard with this product.

References

Technical Instructions
RL147-2 *155-038P25*

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