

HEATEC TEC-NOTE

Publication No. 9-06-177

Resetting Siemens pressure transmitters for fuel tanks up to 35,000 gallons

NOTICE: This Tec-Note applies to transmitters installed August 21, 2006 and thereafter. Heatec Tec-Note 5-04-115 applies to transmitters installed *prior* to that date.

This document provides information on resetting Siemens pressure transmitters used on all Heatec fuel tanks with capacities up to 35,000 gallons (**Figure 1**). It applies to Siemens Sitrans P, Series DSIII transmitters 7MF4033-1CA10-1NC7-Z A01+B21+Y01+Y22 (**Figure 2**).

This document is furnished with all Heatec fuel tanks equipped with the Siemens transmitters. Applicable Siemens user's manuals are also furnished. The information in these documents

should enable users of Heatec tanks to reset the transmitters in the field.

The transmitters are preset at the Heatec factory before the tanks are shipped, but users may need to change these settings for different fuels.

The transmitters are now set to display levels in *inches* instead of *feet* as on earlier tanks. A table for converting inch-levels to gallons is included in this document.

NOTICE

This document supplements the Siemens manual and should always be used along with the Siemens manual. Be sure to read all appropriate warnings



Figure 1. Heatec fuel tank.



Figure 2. Siemens Pressure Transmitter Sitrans P.

and precautions in the Siemens manual before doing any work on Siemens transmitters. The following statement appears in the front of the Siemens manual and should be followed:

Qualified Persons

The described equipment should be installed, configured, operated, and serviced only by qualified persons thoroughly familiar with this User’s Manual. A copy of this manual accompanies the equipment. The current version of the manual, in Portable Document Format (PDF), can be downloaded from www.sea.siemens.com/ia/.

LEVEL DISPLAY

Each transmitter is normally set at Heatec to display fuel level in *inches* (with 2 digits after the decimal point) (**Figure 2**). Transmitters used on earlier tanks were set to display fuel level in *feet* (with 3 digits after the decimal point). The choice between feet and inches *cannot* be changed in the field by plant personnel.

When reading *inches* on the display you can disregard the digits after the decimal points. The amount of fuel indicated by increments smaller than one *inch* is always less than 59 gallons. And since the estimated accuracy of the transmitter is plus-or-minus one-half inch, increments smaller than one inch are not always reliable.

Incidentally, on earlier tanks that have transmitters set to display *feet*, you *should* consider the digits after the decimal point. The amount of fuel indicated by increments smaller than one *foot* could range up to 700 gallons, which is a significant amount.

SPECIFIC GRAVITY

Specific gravity is the weight of fuel compared to an equal volume of water at the same temperature. Pure water weighs 8.333 pounds per gallon and has a specific gravity of 1.000. Thus, the specific gravity of fuel equals the weight of fuel divided by the weight of water. If you don’t know the specific gravity of the fuel you use, ask your supplier.

Heatec normally sets the transmitter for a specific gravity of 0.880 before the tank is shipped. This

Commercial fuels	Specific Gravity at 60 degrees F	Transmitter Full Scale Blind Settings (Mode 6)
	0.970	566.5
No. 6 oil	0.965	563.6
	0.960	560.6
	0.955	557.7
	0.950	554.8
No. 5 oil	0.945	551.9
	0.940	549.0
	0.935	546.0
	0.930	543.1
	0.925	540.2
	0.920	537.3
	0.915	534.4
	0.910	531.4
	0.905	528.5
No. 4 oil	0.900	525.6
	0.895	522.7
	0.890	519.8
	0.885	516.8
Waste oil	0.880	513.9
	0.875	511.0
	0.870	508.1
	0.865	505.2
	0.860	502.2
	0.855	499.3
No. 2 oil	0.850	496.4
	0.845	493.5
	0.840	490.6
	0.835	487.6
	0.830	484.7

The full scale blind setting is equal to a tank height of 600 inches minus the sensor height of 16 inches multiplied by the specific gravity of the fuel.

is the specific gravity of waste oil. Other fuel oils have somewhat different specific gravities.

The *specific gravity* of fuel *can be* changed in the field by plant personnel. If the specific gravity

of actual fuel in your tank is higher than 0.88 the *transmitter* will indicate a fuel level that is *higher* than it really is. But if the specific gravity of actual fuel in your tank is lower than 0.88 the *transmitter* will indicate a fuel level that is *lower* than it really is. Incorrect indications can either lead to overflowing the tank when it is being filled or unintentionally running out of fuel.

RESETTING THE SPECIFIC GRAVITY

If you have fuel with a specific gravity different from 0.880 you should change the specific gravity setting of the transmitter.

NOTE: you cannot directly enter the numerical value for fuel specific gravity when resetting the transmitter. The numbers you actually set on the transmitter are the numbers shown in **Figure 3** for the **Full scale blind setting** .

If you need to change the transmitter setting, compare the specific gravity of *your* fuel with those shown in **Figure 3**. Choose the specific gravity with a value closest to that of *your* fuel. Use the Full Scale Blind Setting shown for that value as the new setting of your transmitter.

The transmitter has a display window (**Figure 2**) and a set of magnetic pushbuttons (**Figure 4**). Use the magnetic pushbuttons on the transmitter to reset the transmitter.

First use pushbutton M to cause Mode 6 to show in the display window. Then use the other two pushbuttons to set the appropriate number from **Figure 3**. Press pushbutton M again to save your settings.



Figure 4. Magnetic pushbuttons.

The only configuration parameter that you can use to reset fuel specific gravity is Full scale “blind setting” or Mode 6. *Do not change any other parameter!*

FUEL LEVELS Vs. GALLONS

As already noted the transmitter indicates fuel levels in inches. You may need to know how many gallons of fuel that various levels represent.

The pressure transmitter is set up to indicate the height of fuel from the bottom of the tank.

The transmitter is installed with its sensor 16 inches above the bottom of the tank. (This distance may vary plus or minus 1/4-inch.) Consequently, the transmitter indicates 16 inches when the fuel level is at the same height as the sensor. When the fuel level is 16 inches there are approximately 941 gallons of fuel in the tank.

But note that the transmitter does not actually indicate fuel levels lower than 16 inches, even though the display continues to show 16.00. **So remember, any time the transmitter display shows 16.00, the amount of fuel in the tank is somewhere between 0 and 941 gallons.**

Figure 7 shows gallons of fuel in the tank for various inch-levels that correspond to the transmitter display. This figure is applicable for Heatec single-wall fuel tanks with an inside diameter of 131.5 inches and heights up 600 inches. Volumes are approximately 4 percent less for tanks with double walls. The information shown in **Figure 5** is based on fuel at a temperature of 60 degrees F.

EFFECTS OF TEMPERATURE

The volume of fuel in your tank will change when the fuel expands or contracts as a result of temperature variations. Temperature of the fuel will vary with the ambient temperature. Its temperature can also change if a fuel pre-heater is used and heated fuel is returned to the tank.

You should make allowances for changes in volume due to temperature, *especially when filling the tank*. Accordingly, you should allow about 10 percent for expansion. **Figure 5** shows the

maximum fill levels for Heatec fuel tanks with an allowance of 10 percent for expansion.

Most ambient temperature fluctuations during a 24 hour period will have very little effect on a full tank of fuel. The temperature of the fuel will probably remain close to an average of the ambient temperatures over 24 hours. However, fuel temperatures are apt to change to a greater extent over several weeks or months, when the weather changes from one season to another.

Figure 6 shows how changes in fuel temperature affects its volume. The volumes shown for 60 degrees F correspond to the capacities of standard Heatec tanks. The temperatures should be regarded as average temperatures over a period of 24 hours.

TROUBLESHOOTING TRANSMITTERS

Pockets of air or trash trapped in the pipe where the transmitter is connected to the tank will cause erratic level readings. When filling an empty tank be sure to bleed the pipe connection at the transmitter to avoid this problem. Also bleed the connection if the tank is refilled after it was drained below the 16-inch level.

INSTALLING A NEW TRANSMITTER

All new transmitters must be programmed at the Heatec factory using special Siemens software configured for Heatec tanks.

Only two settings can be reset in the field. One is the Full Scale Blind setting, which should be set according to the specific gravity of the fuel as explained earlier.

The other is the zero setting. This setting corrects for transmitter tilt. The transmitter is normally tilted upwards for easy reading when it is installed on the tank at Heatec. If you change this tilt, you should reset the zero setting according to instructions in the Siemens manual, under the heading **6.2.5 Zero Adjustment (Position Correction)**.

Figure 5. Fill levels with allowance for expansion

Tank Capacity (gallons)	Tank Height (inches)	Maximum fill level (inches)
5,000	96	86
6,500	120	108
10,000	183	165
13,000	240	216
15,000	279	251
20000	351	316
23000	420	378
25,000	447	402
30,000	519	467
35,000	591	532

Figure 6. How fuel volumes (gallons) change with changes in fuel temperature

30 Deg F	40 Deg F	50 Deg F	60 Deg F	70 Deg F	80 Deg F	90 Deg F	100 Deg F
4,955	4,970	4,985	5,000	5,015	5,030	5,045	5,060
6,442	6,461	6,481	6,500	6,520	6,539	6,559	6,578
9,910	9,940	9,970	10,000	10,030	10,060	10,090	10,121
12,883	12,922	12,961	13,000	13,039	13,078	13,117	13,157
14,865	14,910	14,955	15,000	15,045	15,090	15,135	15,181
19,821	19,880	19,940	20,000	20,060	20,120	20,181	20,241
22,794	22,862	22,931	23,000	23,069	23,138	23,208	23,277
24,776	24,850	24,925	25,000	25,075	25,150	25,226	25,301
29,731	29,820	29,910	30,000	30,090	30,180	30,271	30,362
34,686	34,790	34,895	35,000	35,105	35,210	35,316	35,422

Figure 7. Fuel Volumes at various levels (Page 1 of 3 pages)

INCHES	GALLONS	INCHES	GALLONS	INCHES	GALLONS	INCHES	GALLONS	INCHES	GALLONS
600.00	35,276	560.00	32,924	520.00	30,573	480.00	28,221	440.00	25,869
599.00	35,217	559.00	32,866	519.00	30,514	479.00	28,162	439.00	25,810
598.00	35,159	558.00	32,807	518.00	30,455	478.00	28,103	438.00	25,752
597.00	35,100	557.00	32,748	517.00	30,396	477.00	28,045	437.00	25,693
596.00	35,041	556.00	32,689	516.00	30,337	476.00	27,986	436.00	25,634
595.00	34,982	555.00	32,630	515.00	30,279	475.00	27,927	435.00	25,575
594.00	34,923	554.00	32,572	514.00	30,220	474.00	27,868	434.00	25,516
593.00	34,865	553.00	32,513	513.00	30,161	473.00	27,809	433.00	25,458
592.00	34,806	552.00	32,454	512.00	30,102	472.00	27,751	432.00	25,399
591.00	34,747	551.00	32,395	511.00	30,043	471.00	27,692	431.00	25,340
590.00	34,688	550.00	32,336	510.00	29,985	470.00	27,633	430.00	25,281
589.00	34,629	549.00	32,278	509.00	29,926	469.00	27,574	429.00	25,222
588.00	34,571	548.00	32,219	508.00	29,867	468.00	27,515	428.00	25,164
587.00	34,512	547.00	32,160	507.00	29,808	467.00	27,457	427.00	25,105
586.00	34,453	546.00	32,101	506.00	29,750	466.00	27,398	426.00	25,046
585.00	34,394	545.00	32,042	505.00	29,691	465.00	27,339	425.00	24,987
584.00	34,335	544.00	31,984	504.00	29,632	464.00	27,280	424.00	24,928
583.00	34,277	543.00	31,925	503.00	29,573	463.00	27,221	423.00	24,870
582.00	34,218	542.00	31,866	502.00	29,514	462.00	27,163	422.00	24,811
581.00	34,159	541.00	31,807	501.00	29,456	461.00	27,104	421.00	24,752
580.00	34,100	540.00	31,748	500.00	29,397	460.00	27,045	420.00	24,693
579.00	34,041	539.00	31,690	499.00	29,338	459.00	26,986	419.00	24,634
578.00	33,983	538.00	31,631	498.00	29,279	458.00	26,927	418.00	24,576
577.00	33,924	537.00	31,572	497.00	29,220	457.00	26,869	417.00	24,517
576.00	33,865	536.00	31,513	496.00	29,162	456.00	26,810	416.00	24,458
575.00	33,806	535.00	31,455	495.00	29,103	455.00	26,751	415.00	24,399
574.00	33,747	534.00	31,396	494.00	29,044	454.00	26,692	414.00	24,341
573.00	33,689	533.00	31,337	493.00	28,985	453.00	26,633	413.00	24,282
572.00	33,630	532.00	31,278	492.00	28,926	452.00	26,575	412.00	24,223
571.00	33,571	531.00	31,219	491.00	28,868	451.00	26,516	411.00	24,164
570.00	33,512	530.00	31,161	490.00	28,809	450.00	26,457	410.00	24,105
569.00	33,454	529.00	31,102	489.00	28,750	449.00	26,398	409.00	24,047
568.00	33,395	528.00	31,043	488.00	28,691	448.00	26,339	408.00	23,988
567.00	33,336	527.00	30,984	487.00	28,632	447.00	26,281	407.00	23,929
566.00	33,277	526.00	30,925	486.00	28,574	446.00	26,222	406.00	23,870
565.00	33,218	525.00	30,867	485.00	28,515	445.00	26,163	405.00	23,811
564.00	33,160	524.00	30,808	484.00	28,456	444.00	26,104	404.00	23,753
563.00	33,101	523.00	30,749	483.00	28,397	443.00	26,046	403.00	23,694
562.00	33,042	522.00	30,690	482.00	28,338	442.00	25,987	402.00	23,635
561.00	32,983	521.00	30,631	481.00	28,280	441.00	25,928	401.00	23,576

Figure 7. Fuel Volumes at various levels (Page 2 of 3 pages)

INCHES	GALLONS	INCHES	GALLONS	INCHES	GALLONS	INCHES	GALLONS	INCHES	GALLONS
400.00	23,517	360.00	21,166	320.00	18,814	280.00	16,462	240.00	14,110
399.00	23,459	359.00	21,107	319.00	18,755	279.00	16,403	239.00	14,052
398.00	23,400	358.00	21,048	318.00	18,696	278.00	16,345	238.00	13,993
397.00	23,341	357.00	20,989	317.00	18,638	277.00	16,286	237.00	13,934
396.00	23,282	356.00	20,930	316.00	18,579	276.00	16,227	236.00	13,875
395.00	23,223	355.00	20,872	315.00	18,520	275.00	16,168	235.00	13,816
394.00	23,165	354.00	20,813	314.00	18,461	274.00	16,109	234.00	13,758
393.00	23,106	353.00	20,754	313.00	18,402	273.00	16,051	233.00	13,699
392.00	23,047	352.00	20,695	312.00	18,344	272.00	15,992	232.00	13,640
391.00	22,988	351.00	20,637	311.00	18,285	271.00	15,933	231.00	13,581
390.00	22,929	350.00	20,578	310.00	18,226	270.00	15,874	230.00	13,523
389.00	22,871	349.00	20,519	309.00	18,167	269.00	15,815	229.00	13,464
388.00	22,812	348.00	20,460	308.00	18,108	268.00	15,757	228.00	13,405
387.00	22,753	347.00	20,401	307.00	18,050	267.00	15,698	227.00	13,346
386.00	22,694	346.00	20,343	306.00	17,991	266.00	15,639	226.00	13,287
385.00	22,636	345.00	20,284	305.00	17,932	265.00	15,580	225.00	13,229
384.00	22,577	344.00	20,225	304.00	17,873	264.00	15,521	224.00	13,170
383.00	22,518	343.00	20,166	303.00	17,814	263.00	15,463	223.00	13,111
382.00	22,459	342.00	20,107	302.00	17,756	262.00	15,404	222.00	13,052
381.00	22,400	341.00	20,049	301.00	17,697	261.00	15,345	221.00	12,993
380.00	22,342	340.00	19,990	300.00	17,638	260.00	15,286	220.00	12,935
379.00	22,283	339.00	19,931	299.00	17,579	259.00	15,228	219.00	12,876
378.00	22,224	338.00	19,872	298.00	17,520	258.00	15,169	218.00	12,817
377.00	22,165	337.00	19,813	297.00	17,462	257.00	15,110	217.00	12,758
376.00	22,106	336.00	19,755	296.00	17,403	256.00	15,051	216.00	12,699
375.00	22,048	335.00	19,696	295.00	17,344	255.00	14,992	215.00	12,641
374.00	21,989	334.00	19,637	294.00	17,285	254.00	14,934	214.00	12,582
373.00	21,930	333.00	19,578	293.00	17,226	253.00	14,875	213.00	12,523
372.00	21,871	332.00	19,519	292.00	17,168	252.00	14,816	212.00	12,464
371.00	21,812	331.00	19,461	291.00	17,109	251.00	14,757	211.00	12,405
370.00	21,754	330.00	19,402	290.00	17,050	250.00	14,698	210.00	12,347
369.00	21,695	329.00	19,343	289.00	16,991	249.00	14,640	209.00	12,288
368.00	21,636	328.00	19,284	288.00	16,933	248.00	14,581	208.00	12,229
367.00	21,577	327.00	19,225	287.00	16,874	247.00	14,522	207.00	12,170
366.00	21,518	326.00	19,167	286.00	16,815	246.00	14,463	206.00	12,111
365.00	21,460	325.00	19,108	285.00	16,756	245.00	14,404	205.00	12,053
364.00	21,401	324.00	19,049	284.00	16,697	244.00	14,346	204.00	11,994
363.00	21,342	323.00	18,990	283.00	16,639	243.00	14,287	203.00	11,935
362.00	21,283	322.00	18,932	282.00	16,580	242.00	14,228	202.00	11,876
361.00	21,224	321.00	18,873	281.00	16,521	241.00	14,169	201.00	11,817

Figure 7. Fuel Volumes at various levels (Page 3 of 3 pages)

INCHES	GALLONS	INCHES	GALLONS	INCHES	GALLONS	INCHES	GALLONS	INCHES	GALLONS
200.00	11,759	160.00	9,407	120.00	7,055	80.00	4,703	40.00	2,352
199.00	11,700	159.00	9,348	119.00	6,996	79.00	4,645	39.00	2,293
198.00	11,641	158.00	9,289	118.00	6,938	78.00	4,586	38.00	2,234
197.00	11,582	157.00	9,231	117.00	6,879	77.00	4,527	37.00	2,175
196.00	11,524	156.00	9,172	116.00	6,820	76.00	4,468	36.00	2,117
195.00	11,465	155.00	9,113	115.00	6,761	75.00	4,410	35.00	2,058
194.00	11,406	154.00	9,054	114.00	6,702	74.00	4,351	34.00	1,999
193.00	11,347	153.00	8,995	113.00	6,644	73.00	4,292	33.00	1,940
192.00	11,288	152.00	8,937	112.00	6,585	72.00	4,233	32.00	1,881
191.00	11,230	151.00	8,878	111.00	6,526	71.00	4,174	31.00	1,823
190.00	11,171	150.00	8,819	110.00	6,467	70.00	4,116	30.00	1,764
189.00	11,112	149.00	8,760	109.00	6,408	69.00	4,057	29.00	1,705
188.00	11,053	148.00	8,701	108.00	6,350	68.00	3,998	28.00	1,646
187.00	10,994	147.00	8,643	107.00	6,291	67.00	3,939	27.00	1,587
186.00	10,936	146.00	8,584	106.00	6,232	66.00	3,880	26.00	1,529
185.00	10,877	145.00	8,525	105.00	6,173	65.00	3,822	25.00	1,470
184.00	10,818	144.00	8,466	104.00	6,115	64.00	3,763	24.00	1,411
183.00	10,759	143.00	8,407	103.00	6,056	63.00	3,704	23.00	1,352
182.00	10,700	142.00	8,349	102.00	5,997	62.00	3,645	22.00	1,293
181.00	10,642	141.00	8,290	101.00	5,938	61.00	3,586	21.00	1,235
180.00	10,583	140.00	8,231	100.00	5,879	60.00	3,528	20.00	1,176
179.00	10,524	139.00	8,172	99.00	5,821	59.00	3,469	19.00	1,117
178.00	10,465	138.00	8,114	98.00	5,762	58.00	3,410	18.00	1,058
177.00	10,406	137.00	8,055	97.00	5,703	57.00	3,351	17.00	999
176.00	10,348	136.00	7,996	96.00	5,644	56.00	3,292	16.00	941
175.00	10,289	135.00	7,937	95.00	5,585	55.00	3,234		
174.00	10,230	134.00	7,878	94.00	5,527	54.00	3,175		
173.00	10,171	133.00	7,820	93.00	5,468	53.00	3,116		
172.00	10,112	132.00	7,761	92.00	5,409	52.00	3,057		
171.00	10,054	131.00	7,702	91.00	5,350	51.00	2,998		
170.00	9,995	130.00	7,643	90.00	5,291	50.00	2,940		
169.00	9,936	129.00	7,584	89.00	5,233	49.00	2,881		
168.00	9,877	128.00	7,526	88.00	5,174	48.00	2,822		
167.00	9,819	127.00	7,467	87.00	5,115	47.00	2,763		
166.00	9,760	126.00	7,408	86.00	5,056	46.00	2,705		
165.00	9,701	125.00	7,349	85.00	4,997	45.00	2,646		
164.00	9,642	124.00	7,290	84.00	4,939	44.00	2,587		
163.00	9,583	123.00	7,232	83.00	4,880	43.00	2,528		
162.00	9,525	122.00	7,173	82.00	4,821	42.00	2,469		
161.00	9,466	121.00	7,114	81.00	4,762	41.00	2,411		