The following items have changed in 22.4 based on the feedback post publication.

Only the redlines identified in this draft are open for comment. Comments on sections outside the scope of this ballot may be deferred until the next edition/addendum of the standard. Please coordinate your comments with your company's voting member. The system also permits non-voting members and guests to submit comments by entering the ballot ID on the login page and their contact information.

The following changes were made to the document and open for comment:

1. Equation 1 got screwed up in the formatting somehow. The correct equation has replaced it.
2. Equation B.4 was mislabeled, and the label was fixed.
3. Equation 5 had an extra zero. The zero was removed.
4. Equation 4 was missing absolute value brackets.
5. Figure 3 was not calculated correctly due to the Equation 4 error.
6. Figures 4 and 5 needed to be updated to reflect the change from Figure 3.
7. Equation B.1.3 was missing absolute value brackets and was incorrectly labeled B.2.
8. Figures B.1 through B.6 require updating as they had incorrect values.

Manual of Petroleum Measurement Standards, Chapter 22.4

Testing Protocol for Pressure, Differential Pressure, and Temperature Measuring Devices

FIRST EDITION, JULY 2018

ADDENDUM 1, XXXXX, 2021

energy API

AMERICAN PETROLEUM INSTITUTE

Table 2—Minimum Required Test Points

Test Points (% of Maximum Test Value)
0% – 2% – 4% – 6% – 8% – 10% – 20% – 40% – 60% – 80% – 100%

4.1.1.1 API 22.4 Baseline Accuracy Calculation

API 22.4 Baseline Accuracy shall be calculated for each required test point in Table 2 as root mean square of linearity and the maximum repeatability and hysteresis values:

$$API\ 22.4\ BaselineAccuracy = \sqrt{(Linearity)^2 + (max(Repeatability))^2 + (max(Hysteresis))^2}$$

$$\cancel{2.4\ Baseline\ Accuracy = \sqrt{(Linearity)^2 + (\max(Repeatability))^2 + (\max(Hysteresis))^2 + y^2 + (Reference\ Accuracy)^2}} \quad (1)$$

(See Annex B.1 for an example of linearity, hysteresis, repeatability, and API 22.4 Baseline Accuracy calculations.)

4.1.1.2 Linearity Calculation

Linearity shall be calculated for each test point in Table 2 as the average of all test upscale and downscale values:

(See Annex B.1.1 for an example of linearity calculations.)

$$Linearity = \Sigma \frac{DUT - Ref}{Number\ of\ Test\ Points} \quad (2)$$

4.1.1.3 Repeatability Calculation

Repeatability shall be calculated for each test point in Table 2 as the maximum minus the minimum of all repeat test upscale and downscale values:

$$Repeatability = \left(\max\left([DUT - Ref]_{downscale\ or\ upscale} - [DUT - Ref]_{upscale\ or\ downscale}\right)\right) / 2 \quad (3)$$

Due to the limited number of test points, the transmitter repeatability error shall be reported as the maximum of these calculated values. (See Annex B.1.2 for an example of repeatability calculations.)

4.1.1.4 Hysteresis Calculation

Hysteresis shall be calculated for each test point in Table 2 as the maximum downscale minus upscale value of each repeat test:

$$Hysteresis = max\left(\left|[DUT - Ref]_{downscale} - [DUT - Ref]_{upscale}\right|\right)_{each\ repeat\ test}$$

$$\cancel{Hysteresis = \max\left([DUT - Ref]_{downscale} - [DUT - Ref]_{upscale}\right)_{each\ repeat\ test}} \quad (4)$$

Due to the limited number of test points the transmitter hysteresis shall be reported as the maximum of these calculated values. (See Annex B.1.3 for an example of hysteresis calculations.)

4.1.2 Temperature Transmitter Testing

Performance of the temperature measurement in an Electronic Flow Measurement (EFM) system is dependent on

two factors: 1) the performance of the temperature sensor (typically a Resistance Temperature Detector (RTD)), and 2) the performance of the sensor to temperature conversion electronics of either the EFM or the temperature transmitter.

RTD sensors are manufactured to specific tolerances based on their performance classification. For example, Class A and Class B RTDs have the following manufacturing tolerance:

$$ClassA\Delta T_{o_F} = \pm(0.27 + 0.0036 \times |T_{o_F}|) or \Delta T_{o_C} = \pm(0.15 + 0.002 \times |T_{o_C}|)$$
$$ClassB\Delta T_{o_F} = \pm(0.54 + 0.009 \times |T_{o_F}|) or \Delta T_{o_C} = \pm(0.30 + 0.005 \times |T_{o_C}|)$$

$$\begin{aligned} Class\ A\ \Delta T_{o_F} &= \pm\left(0.27 + 0.0036 \times \left|T_{o_F}\right|\right) or\ \Delta T_{o_C} = \pm\left(0.15 + 0.002 \times \left|T_{o_C}\right|\right) \\ Class\ B\ \Delta T_{o_F} &= \pm\left(0.54 + 0.0009 \times \left|T_{o_F}\right|\right) or\ \Delta T_{o_C} = \pm\left(0.30 + 0.005 \times \left|T_{o_C}\right|\right) \end{aligned} \quad (5)$$

where

$\left|T_{o_F}\right|$ is the absolute value of temperature $\left|T_{o_F}\right|$ in °F;

$\left|T_{o_C}\right|$ is the absolute value of temperature $\left|T_{o_C}\right|$ in °F;

T_{o_F} is the maximum temperature error at temperature T_{o_F};

T_{o_C} is the maximum temperature error at temperature T_{o_C}.

NOTE 1 For RTD sensor measuring electronics that are calibrated to a precision input resistance source, this manufacturing specification can be used to estimate the additional temperature performance uncertainty of the RTD. For example, a Class B RTD operating at 68 °F (20 °C) will add approximately ± 0.7 °F (± 0.4 °C) temperature measurement uncertainty to the measuring electronics uncertainty. A Class A RTD will have approximately half the uncertainty of a Class B RTD.

NOTE 2 To minimize the impact of sensor uncertainty, the sensor can be characterized and the characterized sensor used during calibration of the EFM/transmitter electronics.

The measuring electronics shall be calibrated prior to the start of testing and the combined performance of the input (RTD or other) sensor through to the output of the measuring electronics shall be tested at four ambient temperatures and the test temperatures shown in Table 3. If the temperature difference is within the appropriate Class specification, the uncertainty of the Class as stated in Equation (5) may be utilized. If the temperature difference is outside the appropriate Class specification, the manufacturer should be contacted to determine the cause of the discrepancy.

The electronics shall be allowed to stabilize at the ambient temperature prescribed for each test at a minimum of one hour prior to commencing. The RTD/Sensor temperature shall be calculated from the reference standard temperature if a characterized sensor is used. The temperature difference shall be calculated from the RTD/Sensor temperature, if available.

Table 3—Electronics Ambient Temperature and Sensor Temperature Test Points

1. Baseline Test—Electronics Ambient Temperature Approximately 70 °F/21 °C						
Test Temperature	Temperature of Reference Standard	RTD/Sensor Characterized Temperature (If Available)	EFM/ Transmitter Reading	Temperature Difference	Class A Spec	Class B Spec
	°F/°C	°F/°C	°F/°C	°F/°C	°F/°C	°F/°C
0 °F/–18 °C						
32 °F/0 °C						
68 °F/20 °C						
104 °F/40 °C						
140 °F/60 °C						
2. Hot Test—Electronics Ambient Temperature Approximately 140 °F/60 °C						

Test Temperature	Temperature of Reference Standard	RTD/Sensor Characterized Temperature (If Available)	EFM/ Transmitter Reading	Temperature Difference	Class A Spec	Class B Spec
	°F/°C	°F/°C	°F/°C	°F/°C	°F/°C	°F/°C
32 °F/0 °C						
68 °F/20 °C						
104 °F/40 °C						
3. Cold Test—Electronics Ambient Temperature Approximately 40 °F/40 °C						
Test Temperature	Temperature of Reference Standard	RTD/Sensor Characterized Temperature (If Available)	EFM/ Transmitter Reading	Temperature Difference	Class A Spec	Class B Spec

Repeatability/Hysteresis Calculation				
	Repeatability			
Test Point	Upscale	Downscale	Test Point	Hysteresis
0%		0.0235		
2%	0.0224	0.0282	2%	0.0582
4%	0.0202	0.0205	4%	0.0427
6%	0.0255	0.0040	6%	0.0657
8%	0.0132	0.0106	8%	0.0264
10%	0.0113	0.0143	10%	0.0460
20%	0.0192	0.0263	20%	0.0466
40%	0.0308	0.0080	40%	0.0321
60%	0.0264	0.0138	60%	0.0597
80%	0.0161	0.0175	80%	0.0510
100%	0.0283			

Repeatability/Hysteresis Calculation				
Test Point			Test Point	Hysteresis
0%		0.0235		
2%	0.0224	0.0282	2%	0.0430
4%	0.0202	0.0205	4%	0.0427
6%	0.0255	0.0040	6%	-0.0127
8%	0.0132	0.0106	8%	0.0264
10%	0.0113	0.0143	10%	0.0053
20%	0.0192	0.0263	20%	0.0466
40%	0.0308	0.0080	40%	0.0321
60%	0.0264	0.0138	60%	0.0207
80%	0.0161	0.0175	80%	0.0510
100%	0.0283			

Figure 3—Section 6.4.1, API 22.4 Baseline Accuracy—Repeatability/Hysteresis Calculations

Summary Calculations																				
Test Point		Linearity			Repeatability			Hysteresis			API 22.4 Baseline Accuracy									Ref. Std.
	Ref. Value	UOM	% MVT	% Reading	UOM	% MVT	% Reading	UOM	% MVT	% Reading	UOM		% MVT		% Reading					% Reading
0%	0.0	0.0040	0.004%		0.0308	0.031%					+/-	0.0311	+/-	0.031%						See Note
2%	2.0	-0.0014	-0.001%	-0.072%	0.0308	0.031%	1.542%	0.0582	0.058%	2.910%	+/-	0.0659	+/-	0.066%	+/-	3.294%	+/-	0.025%		
4%	4.0	0.0015	0.002%	0.038%	0.0308	0.031%	0.771%	0.0427	0.043%	1.068%	+/-	0.0527	+/-	0.053%	+/-	1.318%	+/-	0.025%		
6%	6.0	-0.0056	-0.006%	-0.094%	0.0308	0.031%	0.514%	0.0657	0.066%	1.095%	+/-	0.0728	+/-	0.073%	+/-	1.213%	+/-	0.025%		
8%	8.0	-0.0107	-0.011%	-0.134%	0.0308	0.031%	0.386%	0.0264	0.026%	0.330%	+/-	0.0420	+/-	0.042%	+/-	0.525%	+/-	0.025%		
10%	10.0	-0.0070	-0.007%	-0.070%	0.0308	0.031%	0.308%	0.0460	0.046%	0.460%	+/-	0.0558	+/-	0.056%	+/-	0.558%	+/-	0.025%		
20%	20.0	-0.0127	-0.013%	-0.063%	0.0308	0.031%	0.154%	0.0466	0.047%	0.233%	+/-	0.0573	+/-	0.057%	+/-	0.287%	+/-	0.025%		
40%	40.0	0.0027	0.003%	0.007%	0.0308	0.031%	0.077%	0.0321	0.032%	0.080%	+/-	0.0446	+/-	0.045%	+/-	0.112%	+/-	0.025%		
60%	60.0	-0.0050	-0.005%	-0.008%	0.0308	0.031%	0.051%	0.0597	0.060%	0.099%	+/-	0.0674	+/-	0.067%	+/-	0.112%	+/-	0.025%		
80%	80.0	-0.0074	-0.007%	-0.009%	0.0308	0.031%	0.039%	0.0510	0.051%	0.064%	+/-	0.0601	+/-	0.060%	+/-	0.075%	+/-	0.025%		
100%	100.0	0.0053	0.005%	0.005%	0.0308	0.031%	0.031%				+/-	0.0313	+/-	0.031%	+/-	0.031%	+/-	0.025%		

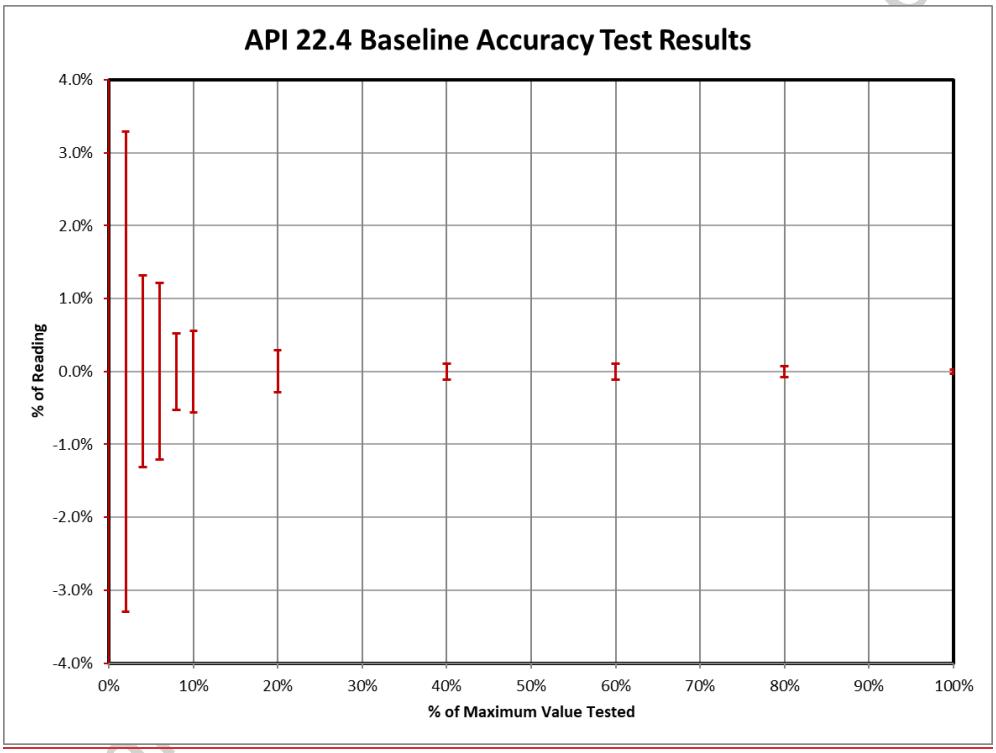
NOTE Reference Standard Accuracy at zero points only apply to devices where the zero is determined by using a

reference standard.

Summary Calculations																			
Test Point		Linearity			Repeatability			Hysteresis			API 22.4 Baseline Accuracy							Ref. Std.	
	Ref. Value	UOM	% MVT	% Reading	UOM	% MVT	% Reading	UOM	% MVT	% Reading	UOM		% MVT		% Reading			% Reading	
0%	0.0	0.0040	0.004%		0.0235	0.024%					+/-	0.0238	+/-	0.024%				See Note	
2%	2.0	-0.0014	-0.001%	-0.072%	0.0282	0.028%	1.408%	0.0430	0.043%	2.150%	+/-	0.0514	+/-	0.051%	+/-	2.571%	+/-	0.025%	
4%	4.0	0.0015	0.002%	0.038%	0.0205	0.021%	0.513%	0.0427	0.043%	1.068%	+/-	0.0474	+/-	0.047%	+/-	1.185%	+/-	0.025%	
6%	6.0	-0.0056	-0.006%	-0.094%	0.0255	0.025%	0.425%	-0.0127	-0.013%	-0.212%	+/-	0.0290	+/-	0.029%	+/-	0.484%	+/-	0.025%	
8%	8.0	-0.0107	-0.011%	-0.134%	0.0132	0.013%	0.164%	0.0264	0.026%	0.330%	+/-	0.0314	+/-	0.031%	+/-	0.392%	+/-	0.025%	
10%	10.0	-0.0070	-0.007%	-0.070%	0.0143	0.014%	0.143%	0.0053	0.005%	0.053%	+/-	0.0168	+/-	0.017%	+/-	0.168%	+/-	0.025%	
20%	20.0	-0.0127	-0.013%	-0.063%	0.0263	0.026%	0.132%	0.0466	0.047%	0.233%	+/-	0.0550	+/-	0.055%	+/-	0.275%	+/-	0.025%	
40%	40.0	0.0027	0.003%	0.007%	0.0308	0.031%	0.077%	0.0321	0.032%	0.080%	+/-	0.0446	+/-	0.045%	+/-	0.112%	+/-	0.025%	
60%	60.0	-0.0050	-0.005%	-0.008%	0.0264	0.026%	0.044%	0.0207	0.021%	0.034%	+/-	0.0339	+/-	0.034%	+/-	0.056%	+/-	0.025%	
80%	80.0	-0.0074	-0.007%	-0.009%	0.0175	0.017%	0.022%	0.0510	0.051%	0.064%	+/-	0.0544	+/-	0.054%	+/-	0.068%	+/-	0.025%	
100%	100.0	0.0053	0.005%	0.005%	0.0283	0.028%	0.028%				+/-	0.0288	+/-	0.029%	+/-	0.029%	+/-	0.025%	

NOTE Reference Standard Accuracy at zero points only apply to devices where the zero is determined by using a reference standard.

Figure 4—Section 6.4.1, API 22.4 Baseline Accuracy—Summary Calculations



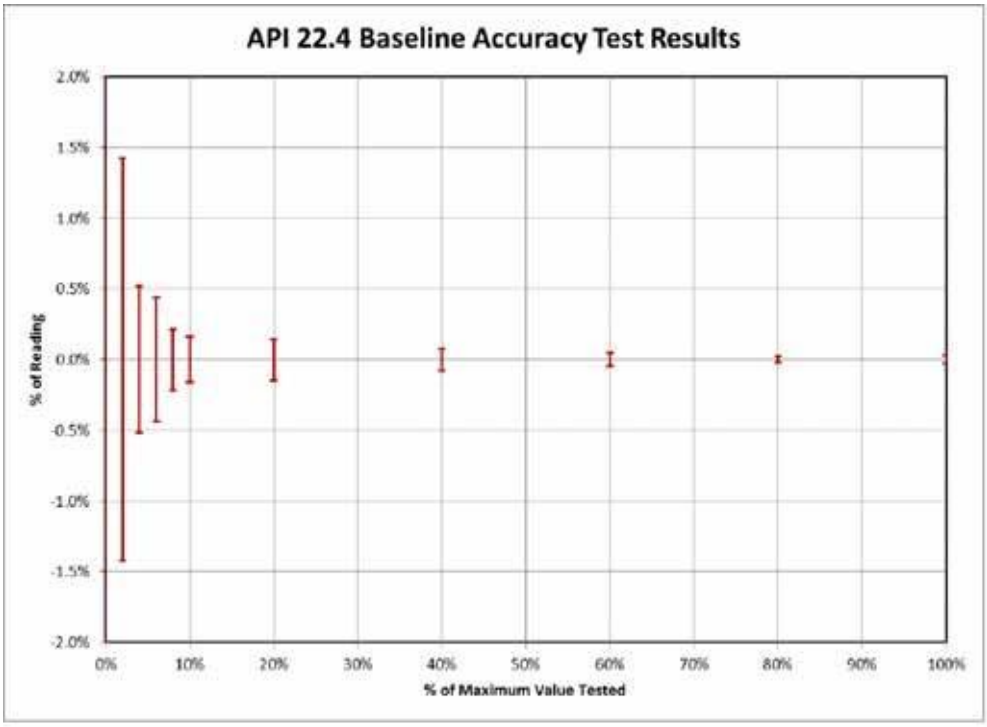


Figure 5—Section 6.4.1, API 22.4 Baseline Accuracy—Test Results

Annex B
(normative)

Linearity, Hysteresis, Repeatability, API 22.4 Baseline Accuracy and Calculations

B.1 Example Calculations

Figure B.1 shows an example report of the API 22.4 Baseline Accuracy test results including the calculated test error and the reference standard percentage of reading accuracy at each test point. Examples of the calculation of linearity, hysteresis, repeatability, and API 22.4 Baseline Accuracy are provided.

Test Cycle		1			2			3			Ref. Std.	
Test Point		Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	% Reading	
1	0%	-0.0010	-0.0200	-0.0190	-0.0023	0.0033	0.0057	0.0013	0.0300	0.0287		
2	2%	1.9980	1.9800	-0.0180	1.9977	2.0133	0.0157	2.0033	2.0100	0.0067	+/-	0.025%
3	4%	3.9977	3.9700	-0.0277	4.0000	4.0233	0.0233	4.0013	4.0033	0.0020	+/-	0.025%
4	6%	5.9967	6.0200	0.0233	5.9987	6.0100	0.0113	5.9967	6.0100	0.0133	+/-	0.025%
5	8%	7.9993	7.9667	-0.0327	7.9973	7.9667	-0.0307	7.9977	8.0067	0.0090	+/-	0.025%
6	10%	9.9967	10.0200	0.0233	10.0007	10.0133	0.0127	9.9990	10.0100	0.0110	+/-	0.025%
7	20%	20.0023	19.9667	-0.0357	20.0027	20.0300	0.0273	20.0010	19.9800	-0.0210	+/-	0.025%
8	40%	40.0013	39.9733	-0.0280	40.0010	39.9900	-0.0110	40.0020	39.9767	-0.0253	+/-	0.025%
9	60%	59.9970	60.0333	0.0363	60.0023	60.0167	0.0143	59.9990	60.0300	0.0310	+/-	0.025%
10	80%	79.9980	80.0067	0.0087	79.9967	80.0100	0.0133	79.9983	79.9967	-0.0017	+/-	0.025%
11	100%	100.0007	100.0100	0.0093	99.9997	99.9733	-0.0263	100.0013	100.0267	0.0253	+/-	0.025%
12	80%	80.0010	80.0133	0.0123	80.0033	79.9667	-0.0367	79.9973	79.9967	-0.0007	+/-	0.025%
13	60%	60.0007	59.9667	-0.0340	59.9970	59.9800	-0.0170	59.9973	60.0167	0.0193	+/-	0.025%
14	40%	39.9990	39.9700	-0.0290	40.0027	40.0033	0.0007	39.9997	39.9900	-0.0097	+/-	0.025%
15	20%	20.0000	20.0067	0.0067	20.0003	20.0133	0.0130	19.9980	19.9700	-0.0280	+/-	0.025%
16	10%	9.9997	10.0000	0.0003	10.0020	10.0200	0.0180	10.0033	9.9933	-0.0100	+/-	0.025%
17	8%	8.0023	7.9900	-0.0123	8.0017	7.9767	-0.0250	8.0020	8.0100	0.0080	+/-	0.025%
18	6%	5.9997	6.0033	0.0037	5.9993	6.0000	0.0007	6.0007	5.9933	-0.0073	+/-	0.025%
19	4%	3.9997	3.9667	-0.0330	3.9980	4.0167	0.0187	4.0007	3.9900	-0.0107	+/-	0.025%
20	2%	2.0007	1.9700	-0.0307	2.0027	2.0267	0.0240	1.9973	1.9700	-0.0273	+/-	0.025%
21	0%	-0.0013	0.0033	0.0047	-0.0033	-0.0200	-0.0167	-0.0033	-0.0167	-0.0133		

Test Cycle		1			2			3			Ref. Std.	
Test Point		Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	% Reading	
1	0%	0.0013	0.0133	0.0120	-0.0013	0.0033	0.0046	-0.0033	-0.0200	-0.0167		
2	2%	1.9987	2.0167	0.0180	2.0023	1.9800	-0.0223	2.0007	2.0233	0.0226	+/-	0.025%
3	4%	4.0000	4.0167	0.0167	3.9987	3.9867	-0.0120	4.0003	3.9767	-0.0236	+/-	0.025%
4	6%	5.9993	5.9833	-0.0160	5.9973	6.0267	0.0294	5.9983	6.0333	0.0350	+/-	0.025%
5	8%	7.9987	7.9733	-0.0254	7.9991	8.0000	0.0009	7.9977	7.9800	-0.0177	+/-	0.025%
6	10%	10.0027	10.0200	0.0173	10.0020	9.9967	-0.0053	10.0033	10.0000	-0.0033	+/-	0.025%
7	20%	20.0000	19.9767	-0.0233	19.9980	19.9700	-0.0280	20.0030	20.0133	0.0103	+/-	0.025%
8	40%	39.9967	39.9700	-0.0267	40.0020	39.9967	-0.0053	39.9983	40.0333	0.0350	+/-	0.025%
9	60%	60.0030	60.0300	0.0270	59.9990	59.9733	-0.0257	60.0013	60.0167	0.0154	+/-	0.025%
10	80%	79.9970	79.9867	-0.0103	80.0027	80.0033	0.0006	80.0017	79.9700	-0.0317	+/-	0.025%
11	100%	100.0030	99.9767	-0.0263	100.0013	100.0133	0.0120	99.9997	100.0300	0.0303	+/-	0.025%
12	80%	80.0033	79.9967	-0.0066	80.0023	79.9867	-0.0156	80.0007	80.0200	0.0193	+/-	0.025%
13	60%	60.0027	59.9700	-0.0327	59.9983	59.9933	-0.0050	59.9990	59.9900	-0.0090	+/-	0.025%
14	40%	40.0013	40.0067	0.0054	39.9973	39.9933	-0.0040	40.0013	40.0133	0.0120	+/-	0.025%
15	20%	20.0000	20.0233	0.0233	19.9993	19.9700	-0.0293	19.9990	19.9700	-0.0290	+/-	0.025%
16	10%	9.9987	9.9700	-0.0287	10.0033	10.0033	0.0000	9.9987	9.9767	-0.0220	+/-	0.025%
17	8%	7.9990	8.0000	0.0010	8.0030	8.0000	-0.0030	8.0003	7.9800	-0.0203	+/-	0.025%
18	6%	5.9987	5.9700	-0.0287	6.0027	5.9800	-0.0227	6.0007	5.9700	-0.0307	+/-	0.025%
19	4%	3.9990	4.0067	0.0077	3.9993	4.0300	0.0307	3.9970	3.9867	-0.0103	+/-	0.025%
20	2%	2.0020	1.9900	-0.0120	1.9993	2.0200	0.0207	2.0023	1.9667	-0.0356	+/-	0.025%
21	0%	0.0027	0.0300	0.0273	-0.0033	0.0133	0.0166	0.0030	-0.0167	-0.0197		

Figure B.1—Example of Transmitter Digital Test Results

B.1.1 Linearity Calculation

Linearity is calculated for each percentage of MVT point as the average of all test upscale and downscale values:

$$Linearity = \Sigma \frac{DUT - Ref}{Number\ of\ Test\ Points} \tag{B.1}$$

Linearity is calculated at each percentage of Span Test Point using the associated Test Values.

where

DUT is the Device Under Test Value;

Ref is the Reference Standard Value.

Test Cycle		1			2			3			Ref. Std.
Test Point		Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	% Reading
		UOM	UOM	UOM	UOM	UOM	UOM	UOM	UOM	UOM	Accuracy
1	0%	0.0013	0.0133	0.0120	-0.0013	0.0033	0.0046	-0.0033	-0.0200	-0.0167	
2	2%	1.9987	2.0167	0.0180	2.0023	1.9800	-0.0223	2.0007	2.0233	0.0226	+/- 0.025%
3	4%	4.0000	4.0167	0.0167	3.9987	3.9867	-0.0120	4.0003	3.9767	-0.0236	+/- 0.025%
4	6%	5.9993	5.9833	-0.0160	5.9973	6.0267	0.0294	5.9983	6.0333	0.0350	+/- 0.025%
5	8%	7.9987	7.9733	-0.0254	7.9991	8.0000	0.0009	7.9977	7.9800	-0.0177	+/- 0.025%
6	10%	10.0027	10.0200	0.0173	10.0020	9.9967	-0.0053	10.0033	10.0000	-0.0033	+/- 0.025%
7	20%	20.0000	19.9767	-0.0233	19.9980	19.9700	-0.0280	20.0030	20.0133	0.0103	+/- 0.025%
8	40%	39.9967	39.9700	-0.0267	40.0020	39.9967	-0.0053	39.9983	40.0333	0.0350	+/- 0.025%
9	60%	60.0030	60.0300	0.0270	59.9990	59.9733	-0.0257	60.0013	60.0167	0.0154	+/- 0.025%
10	80%	79.9970	79.9867	-0.0103	80.0027	80.0033	0.0006	80.0017	79.9700	-0.0317	+/- 0.025%
11	100%	100.0030	99.9767	-0.0263	100.0013	100.0133	0.0120	99.9997	100.0300	0.0303	+/- 0.025%
12	80%	80.0033	79.9967	-0.0066	80.0				80.0200	0.0193	+/- 0.025%
13	60%	60.0027	59.9700	-0.0327	59.9				59.9900	-0.0090	+/- 0.025%
14	40%	40.0013	40.0067	0.0054	39.9				40.0133	0.0120	+/- 0.025%
15	20%	20.0000	20.0233	0.0233	19.9				19.9700	-0.0290	+/- 0.025%
16	10%	9.9987	9.9700	-0.0287	10.0033	10.0033	0.0000	9.9987	9.9767	-0.0220	+/- 0.025%
17	8%	7.9990	8.0000	0.0010	8.0030	8.					25%
18	6%	5.9987	5.9700	-0.0287	6.0027	5.					25%
19	4%	3.9990	4.0067	0.0077	3.9993	4.					25%
20	2%	2.0020	1.9900	-0.0120	1.9993	2.					25%
21	0%	0.0027	0.0300	0.0273	-0.0033	0.0133	0.0166	0.0030	-0.0167	-0.0197	

Linearity (Test Cycle 1)

$$= \frac{-0.0120 + 0.0273}{2} = 0.0197$$

Linearity (All Test Cycles)

$$= \frac{0.0164 + 0.0106 - 0.0182}{3} = 0.0040$$

Linearity/Repeatability/Hysteresis Calculations for Each Test Cycle

Test Cycle	1			2			3			Ref. Std.
Test Point	Ref. Value	Hysteresis	Linearity	Ref. Value	Hysteresis	Linearity	Ref. Value	Hysteresis	Linearity	% Reading
0%	0.0		0.0197	0.0		0.0106	0.0		-0.0182	+/- 0.025%
2%	2.0	-0.0300	0.0030	2.0	0.0430	0.0088	2.0	-0.0582	0.0065	+/- 0.025%
4%	4.0	-0.0090	0.0122	4.0	0.0427	0.0094	4.0	0.0133	-0.0170	+/- 0.025%
6%	6.0	-0.0127	-0.0224	6.0	-0.0521	0.0034	6.0	-0.0657	0.0021	+/- 0.025%
8%	8.0	0.0264	-0.0122	8.0	-0.0039	-0.0011	8.0	-0.0026	-0.0190	+/- 0.025%
10%	10.0	-0.0460	-0.0057	10.0	0.0053	-0.0027	10.0	-0.0187	-0.0126	+/- 0.025%
20%	20.0	0.0466	0.0000	20.0	-0.0013	-0.0287	20.0	-0.0393	-0.0093	+/- 0.025%
40%	40.0	0.0321	-0.0106	40.0	0.0013	-0.0047	40.0	-0.0230	0.0235	+/- 0.025%
60%	60.0	-0.0597	-0.0028	60.0	0.0207	-0.0154	60.0	-0.0244	0.0032	+/- 0.025%
80%	80.0	0.0037	-0.0084	80.0	-0.0162	-0.0075	80.0	0.0510	-0.0062	+/- 0.025%
100%	100.0		-0.0263	100.0		0.0120	100.0		0.0303	+/- 0.025%

Summary Calculations

Test Point		Linearity			Repeatability			Hysteresis			API 22.4 Baseline Accuracy			Ref. Std.
	Ref. Value	UOM	% MTV	% Reading	UOM	% MTV	% Reading	UOM	% MTV	% Reading	UOM	% MTV	% Reading	% Reading
0%	0.0	0.0040	0.004%		0.0235	0.024%					+/- 0.0238	+/- 0.024%		
2%	2.0	-0.0014	-0.001%	-0.072%	0.0282	0.028%	1.408%	0.0430	0.043%	2.150%	+/- 0.0514	+/- 0.051%	+/- 2.571%	+/- 0.025%
4%	4.0	0.0015	0.002%	0.038%	0.0205	0.021%	0.513%	0.0427	0.043%	1.068%	+/- 0.0474	+/- 0.047%	+/- 1.185%	+/- 0.025%
6%	6.0	-0.0056	-0.006%	-0.094%	0.0255	0.025%	0.425%	-0.0127	-0.013%	-0.212%	+/- 0.0290	+/- 0.029%	+/- 0.484%	+/- 0.025%
8%	8.0	-0.0107	-0.011%	-0.134%	0.0132	0.013%	0.164%	0.0264	0.026%	0.330%	+/- 0.0314	+/- 0.031%	+/- 0.392%	+/- 0.025%
10%	10.0	-0.0070	-0.007%	-0.070%	0.0143	0.014%	0.143%	0.0053	0.005%	0.053%	+/- 0.0168	+/- 0.017%	+/- 0.168%	+/- 0.025%
20%	20.0	-0.0127	-0.013%	-0.063%	0.0263	0.026%	0.132%	0.0466	0.047%	0.233%	+/- 0.0550	+/- 0.055%	+/- 0.275%	+/- 0.025%
40%	40.0	0.0027	0.003%	0.007%	0.0308	0.031%	0.077%	0.0321	0.032%	0.080%	+/- 0.0446	+/- 0.045%	+/- 0.112%	+/- 0.025%
60%	60.0	-0.0050	-0.005%	-0.008%	0.0264	0.026%	0.044%	0.0207	0.021%	0.034%	+/- 0.0339	+/- 0.034%	+/- 0.056%	+/- 0.025%
80%	80.0	-0.0074	-0.007%	-0.009%	0.0175	0.017%	0.022%	0.0510	0.051%	0.064%	+/- 0.0544	+/- 0.054%	+/- 0.068%	+/- 0.025%
100%	100.0	0.0053	0.005%	0.005%	0.0283	0.028%	0.028%				+/- 0.0288	+/- 0.029%	+/- 0.029%	+/- 0.025%

Test Cycle		1			2			3			Ref. Std.	
Test Point		Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	% Reading	
1	0%	0.0013	0.0133	0.0120	-0.0013	0.0033	0.0046	-0.0033	-0.0200	-0.0167		
2	2%	1.9987	2.0167	0.0180	2.0023	1.9800	-0.0223	2.0007	2.0233	0.0226	+/-	0.025%
3	4%	4.0000	4.0167	0.0167	3.9987	3.9867	-0.0120	4.0003	3.9767	-0.0236	+/-	0.025%
4	6%	5.9993	5.9833	-0.0160	5.9973	6.0267	0.0294	5.9983	6.0333	0.0350	+/-	0.025%
5	8%	7.9987	7.9733	-0.0254	7.9991	8.0000	0.0009	7.9977	7.9800	-0.0177	+/-	0.025%
6	10%	10.0027	10.0200	0.0173	10.0020	9.9967	-0.0053	10.0033	10.0000	-0.0033	+/-	0.025%
7	20%	20.0000	19.9767	-0.0233	19.9980	19.9700	-0.0280	20.0030	20.0133	0.0103	+/-	0.025%
8	40%	39.9967	39.9700	-0.0267	40.0020	39.9967	-0.0053	39.9983	40.0333	0.0350	+/-	0.025%
9	60%	60.0030	60.0300	0.0270	59.9990	59.9733	-0.0257	60.0013	60.0167	0.0154	+/-	0.025%
10	80%	79.9970	79.9867	-0.0103	80.0027	80.0033	0.0006	80.0017	79.9700	-0.0317	+/-	0.025%
11	100%	100.0030	99.9767	-0.0263	100.0013	100.0133	0.0120	99.9997	100.0300	0.0303	+/-	0.025%
12	80%	80.0033	79.9967	-0.0066	80.0				80.0200	0.0193	+/-	0.025%
13	60%	60.0027	59.9700	-0.0327	59.9				59.9900	-0.0090	+/-	0.025%
14	40%	40.0013	40.0067	0.0054	39.9				40.0133	0.0120	+/-	0.025%
15	20%	20.0000	20.0233	0.0233	19.9				19.9700	-0.0290	+/-	0.025%
16	10%	9.9987	9.9700	-0.0287	10.0033	10.0033	0.0000	9.9987	9.9767	-0.0220	+/-	0.025%
17	8%	7.9990	8.0000	0.0010	8.0030	8.						25%
18	6%	5.9987	5.9700	-0.0287	6.0027	5.						25%
19	4%	3.9990	4.0067	0.0077	3.9993	4.						25%
20	2%	2.0020	1.9900	-0.0120	1.9993	2.						25%
21	0%	0.0027	0.0300	0.0273	-0.0033	0.0133	0.0166	0.0030	-0.0167	-0.0197		

Linearity (Test Cycle 1)
= 0.0120+ 0.0273 = 0.0197
2

Linearity (All Test Cycles)
= 0.0197 + 0.0106 - 0.0182 = 0.0040
3

Linearity/Repeatability/Hysteresis Calculations for Each Test Cycle

Test Cycle		1			2			3			Ref. Std.	
Test Point		Ref. Value	Hysteresis	Linearity	Ref. Value	Hysteresis	Linearity	Ref. Value	Hysteresis	Linearity	% Reading	
	0%	0.0		0.0197	0.0		0.0106	0.0		-0.0182	+/-	0.025%
	2%	2.0	-0.0300	0.0030	2.0	0.0430	-0.0008	2.0	-0.0582	0.0065	+/-	0.025%
	4%	4.0	-0.0090	0.0122	4.0	0.0427	0.0094	4.0	0.0133	-0.0170	+/-	0.025%
	6%	6.0	-0.0127	-0.0224	6.0	-0.0521	0.0034	6.0	-0.0657	0.0021	+/-	0.025%
	8%	8.0	0.0264	-0.0122	8.0	-0.0039	-0.0011	8.0	-0.0026	-0.0190	+/-	0.025%
	10%	10.0	-0.0460	-0.0057	10.0	0.0053	-0.0027	10.0	-0.0187	-0.0126	+/-	0.025%
	20%	20.0	0.0466	0.0000	20.0	-0.0013	-0.0287	20.0	-0.0393	-0.0093	+/-	0.025%
	40%	40.0	0.0321	-0.0106	40.0	0.0013	-0.0047	40.0	-0.0230	0.0235	+/-	0.025%
	60%	60.0	-0.0597	0.0028	60.0	0.0207	-0.0154	60.0	-0.0244	0.0032	+/-	0.025%
	80%	80.0	0.0037	-0.0084	80.0	-0.0162	-0.0075	80.0	0.0510	-0.0062	+/-	0.025%
	100%	100.0		-0.0263	100.0		0.0120	100.0		0.0303	+/-	0.025%

Summary Calculations

Test Point		Linearity			Repeatability			Hysteresis			API 22.4 Baseline Accuracy						Ref. Std.	
	Ref. Value	UOM	% MTV	% Reading	UOM	% MTV	% Reading	UOM	% MTV	% Reading	UOM		% MTV		% Reading		% Reading	
0%	0.0	**0.0040**	0.004%		0.0308	0.031%					+/-	0.0311	+/-	0.031%				
2%	2.0	0.0014	-0.001%	-0.072%	0.0308	0.031%	1.542%	0.0582	0.058%	2.910%	+/-	0.0659	+/-	0.066%	+/-	3.294%	+/-	0.025%
4%	4.0	0.0015	0.002%	0.038%	0.0308	0.031%	0.771%	0.0427	0.043%	1.068%	+/-	0.0527	+/-	0.053%	+/-	1.318%	+/-	0.025%
6%	6.0	-0.0056	-0.006%	-0.094%	0.0308	0.031%	0.514%	0.0657	0.066%	1.095%	+/-	0.0728	+/-	0.073%	+/-	1.213%	+/-	0.025%
8%	8.0	-0.0107	-0.011%	-0.134%	0.0308	0.031%	0.386%	0.0264	0.026%	0.330%	+/-	0.0420	+/-	0.042%	+/-	0.525%	+/-	0.025%
10%	10.0	-0.0070	-0.007%	-0.070%	0.0308	0.031%	0.308%	0.0460	0.046%	0.460%	+/-	0.0558	+/-	0.056%	+/-	0.558%	+/-	0.025%
20%	20.0	-0.0127	-0.013%	-0.063%	0.0308	0.031%	0.154%	0.0466	0.047%	0.233%	+/-	0.0573	+/-	0.057%	+/-	0.287%	+/-	0.025%
40%	40.0	0.0027	0.003%	0.007%	0.0308	0.031%	0.077%	0.0321	0.032%	0.080%	+/-	0.0446	+/-	0.045%	+/-	0.112%	+/-	0.025%
60%	60.0	-0.0050	-0.005%	-0.008%	0.0308	0.031%	0.051%	0.0597	0.060%	0.099%	+/-	0.0674	+/-	0.067%	+/-	0.112%	+/-	0.025%
80%	80.0	-0.0074	-0.007%	-0.009%	0.0308	0.031%	0.039%	0.0510	0.051%	0.064%	+/-	0.0601	+/-	0.060%	+/-	0.075%	+/-	0.025%
100%	100.0	0.0053	0.005%	0.005%	0.0308	0.031%	0.031%				+/-	0.0313	+/-	0.031%	+/-	0.031%	+/-	0.025%

Figure B.2—Example of Transmitter Digital Test Results Linearity Calculations

B.1.2 Repeatability Calculation

Repeatability is calculated for each percentage of span point as the maximum minus the minimum of all repeat test upscale and downscale values:

$$Repeatability = \left(\max\left(\left[DUT - Ref\right]_{upscale\ or\ downscale} - \min\left[DUT - Ref\right]_{upscale\ or\ downscale}\right)\right) / 2 \qquad \text{(B.2)}$$

Repeatability is calculated at each percentage of Span Point using the associated Upscale and Downscale Test

Values.

where

DUT is the Device Under Test Value;

Ref is the Reference Standard Value.

Test Cycle		1			2			3			Ref. Std.
Test Point		Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	% Reading
1	0%	-0.0010	-0.0200	-0.0190	-0.0023	0.0033	0.0057	0.0013	0.0300	0.0287	
2	2%	1.9980	1.9800	-0.0180	1.9977	2.0133	0.0157	2.0033	2.0100	0.0067	+/- 0.025%
3	4%	3.9977	3.9700	-0.0277	4.0000	4.0233	0.0233	4.0013	4.0033	0.0020	+/- 0.025%
4	6%	5.9967	6.0200	0.0233	5.9987	6.0100	0.0113	5.9967	6.0100	0.0133	+/- 0.025%
5	8%	7.9993	7.9667	-0.0327	7.9973	7.9667	-0.0307	7.9977	8.0067	0.0090	+/- 0.025%
6	10%	9.9967	10.0200	0.0233	10.0007	10.0133	0.0127	9.9990	10.0100	0.0110	+/- 0.025%
7	20%	20.0023	19.9667	-0.0357	20.0027	20.0300	0.0273	20.0010	19.9800	-0.0210	+/- 0.025%
8	40%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.025%
9	60%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.025%
10	80%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.025%
11	100%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.025%
12	80%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.025%
13	60%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.025%
14	40%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.025%
15	20%	20.0000	20.0067	0.0067	20.0003	20.0133	0.0130	19.9980	19.9700	-0.0280	+/- 0.025%
16	10%	9.9997	10.0000	0.0003	10.0020	10.0200	0.0180	10.0033	9.9933	-0.0100	+/- 0.025%
17	8%	8.0023	7.9900	-0.0123	8.0017	7.9767	-0.0250	8.0020	8.0100	0.0080	+/- 0.025%
18	6%	5.9997	6.0033	0.0037	5.9993	6.0000	0.0007	6.0007	5.9933	-0.0073	+/- 0.025%
19	4%	3.9997	3.9667	-0.0330	3.9980	4.0167	0.0187	4.0007	3.9900	-0.0107	+/- 0.025%
20	2%	2.0007	1.9700	-0.0307	2.0027	2.0267	0.0240	1.9973	1.9700	-0.0273	+/- 0.025%
21	0%	-0.0013	0.0033	0.0047	-0.0033	-0.0200	-0.0167	-0.0033	-0.0167	-0.0133	

Upscale Repeatability
(Max (-0.0357, 0.0273, -0.0210) - Min (-0.0357, 0.0273, -0.0210))/2 = 0.0315

Downscale Repeatability
(Max (0.0067, 0.0130, -0.280) - Min (0.0067, 0.0130, -0.280))/2 = 0.0205

Repeatability/Hysteresis Calculation

Test Point	Upscale Repeatability	Downscale Repeatability	Test Point	Hysteresis
0%	+/-	+/- 0.0107		
2%	+/- 0.0168	+/- 0.0273	2%	0.0083
4%	+/- 0.0255	+/- 0.0258	4%	-0.0047
6%	+/- 0.0060	+/- 0.0055	6%	-0.0107
8%	+/- 0.0208	+/- 0.0165	8%	0.0203
10%	+/- 0.0062	+/- 0.0140	10%	0.0053
20%	+/- 0.0315	+/- 0.0205	20%	0.0423
40%	+/- 0.0083	+/- 0.0146	40%	0.0157
60%	+/- 0.0110	+/- 0.0267	60%	-0.0117
80%	+/- 0.0075	+/- 0.0245	80%	0.0037
100%	+/- 0.0258		Max Hysteresis	0.0423
Max Repeatability		+/- 0.0315	Test Hysteresis	#N/A

Test Cycle		1			2			3			Ref. Std.
Test Point		Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	% Reading
1	0%	0.0013	0.0133	0.0120	-0.0013	0.0033	0.0046	-0.0033	-0.0200	-0.0167	
2	2%	1.9987	2.0167	0.0180	2.0023	1.9800	-0.0223	2.0007	2.0233	0.0226	+/- 0.025%
3	4%	4.0000	4.0167	0.0167	3.9987	3.9867	-0.0120	4.0003	3.9767	-0.0236	+/- 0.025%
4	6%	5.9993	5.9833	-0.0160	5.9973	6.0267	0.0294	5.9983	6.0333	0.0350	+/- 0.025%
5	8%	7.9987	7.9733	-0.0254	7.9991	8.0000	0.0009	7.9977	7.9800	-0.0177	+/- 0.025%
6	10%	10.0027	10.0200	0.0173	10.0020	9.9967	-0.0053	10.0033	10.0000	-0.0033	+/- 0.025%
7	20%	20.0000	19.9767	-0.0233	19.9980	19.9700	-0.0280	20.0030	20.0133	0.0103	+/- 0.025%
8	40%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.025%
9	60%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.025%
10	80%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.025%
11	100%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.025%
12	80%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.025%
13	60%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.025%
14	40%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.025%
15	20%	20.0000	20.0233	0.0233	19.9993	19.9700	-0.0293	19.9990	19.9700	-0.0290	+/- 0.025%
16	10%	9.9987	9.9700	-0.0287	10.0033	10.0033	0.0000	9.9987	9.9767	-0.0220	+/- 0.025%
17	8%	7.9990	8.0000	0.0010	8.0030	8.0000	-0.0030	8.0003	7.9800	-0.0203	+/- 0.025%
18	6%	5.9987	5.9700	-0.0287	6.0027	5.9800	-0.0227	6.0007	5.9700	-0.0307	+/- 0.025%
19	4%	3.9990	4.0067	0.0077	3.9993	4.0300	0.0307	3.9970	3.9867	-0.0103	+/- 0.025%
20	2%	2.0020	1.9900	-0.0120	1.9993	2.0200	0.0207	2.0023	1.9667	-0.0356	+/- 0.025%
21	0%	0.0027	0.0300	0.0273	-0.0033	0.0133	0.0166	0.0030	-0.0167	-0.0197	

Upscale Repeatability
(Max (-0.0233,-0.0280,0.0103) - Min (-0.0233,-0.0280,0.0103))/2 = 0.0192

Upscale Repeatability
(Max (0.0233,-0.0293,-0.0290) - Min (0.0233,-0.0293,-0.0290))/2 = 0.0263

Repeatability/Hysteresis Calculation

Test Point	Repeatability Upscale	Repeatability Downscale	Test Point	Hysteresis
0%		0.0235		
2%	0.0224	0.0282	2%	0.0582
4%	0.0202	0.0205	4%	0.0427
6%	0.0255	0.0040	6%	0.0657
8%	0.0132	0.0106	8%	0.0264
10%	0.0113	0.0143	10%	0.0460
20%	0.0192	0.0263	20%	0.0466
40%	0.0308	0.0080	40%	0.0321
60%	0.0264	0.0138	60%	0.0597
80%	0.0161	0.0175	80%	0.0510
100%	0.0283			

Figure B.3—Example of Transmitter Digital Test Results Repeatability Calculations

B.1.3 Hysteresis Calculation

Hysteresis is calculated for each percentage of span point as the maximum downscale minus upscale value of each repeat test:

$$Hysteresis = max\left(\left|[DUT - Ref]_{downscale} - [DUT - Ref]_{upscale}\right|\right)_{each\ report\ test}$$

$$\cancel{Hysteresis = \max\left(\left[DUT - Ref\right]_{downscale} - \left[DUT - Ref\right]_{upscale}\right)_{each\ report\ test}}$$

(B.~~2~~3)

Hysteresis is calculated at each percentage of Span Point.

where

DUT is the Device Under Test Value;

Ref is the Reference Standard Value.

Test Cycle		1			2			3			Ref. Std.
Test Point		Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	% Reading
1	0%	-0.0010	-0.0200	-0.0190	-0.0023	0.0033	0.0057	0.0013	0.0300	0.0287	
2	2%	1.9980	1.9800	-0.0180	1.9977	2.0133	0.0157	2.0033	2.0100	0.0067	+/ 0.025%
3	4%	3.9977	3.9700	-0.0277	4.0000	4.0233	0.0233	4.0013	4.0033	0.0020	+/ 0.025%
4	6%	5.9967	6.0200	0.0233	5.9987	6.0100	0.0113	5.9967	6.0100	0.0133	+/ 0.025%
5	8%	7.9993	7.9667	-0.0327	7.9973	7.9667	-0.0307	7.9977	8.0067	0.0090	+/ 0.025%
6	10%	9.9967	10.0200	0.0233	10.0007	10.0133	0.0127	9.9990	10.0100	0.0110	+/ 0.025%
7	20%	20.0023	19.9667	-0.0357	20.0027	20.0300	0.0273	20.0010	19.9800	-0.0210	+/ 0.025%
8	40%	40.0013	39.9733	-0.0280	40.0010	39.9900	-0.0110	40.0020	39.9767	-0.0253	+/ 0.025%
9	60%	59.9970	60.0333	0.0363	60.0			0		0.0310	+/ 0.025%
10	80%	79.9980	80.0067	0.0087	79.9			7		-0.0017	+/ 0.025%
11	100%	100.0007	100.0100	0.0093	99.9			7		0.0253	+/ 0.025%
12	80%	80.0010	80.0133	0.0123	80.0			7		-0.0007	+/ 0.025%
13	60%	60.0007	59.9667	-0.0340	59.9			7		0.0193	+/ 0.025%
14	40%	39.9990	39.9700	-0.0290	40.0027	40.0033	0.0007	39.9997	39.9900	-0.0097	+/ 0.025%
15	20%	20.0000	20.0067	0.0067	20.0003	20.0133	0.0130	19.9980	19.9700	-0.0280	+/ 0.025%
16	10%	9.9997	10.0000	0.0003	10.0020	10.0200	0.0180	10.0033	9.9933	-0.0100	+/ 0.025%
17	8%	8.0023	7.9900	-0.0123	8.0017	7.9767	-0.0250	8.0020	8.0100	0.0080	+/ 0.025%
18	6%	5.9997	6.0033	0.0037	5.9993	6.0000	0.0007	6.0007	5.9933	-0.0073	+/ 0.025%
19	4%	3.9997	3.9667	-0.0330	3.9980	4.0167	0.0187	4.0007	3.9900	-0.0107	+/ 0.025%
20	2%	2.0007	1.9700	-0.0307	2.0027	2.0267	0.0240	1.9973	1.9700	-0.0273	+/ 0.025%
21	0%	-0.0013	0.0033	0.0047	-0.0033	-0.0200	-0.0167	-0.0033	-0.0167	-0.0133	

Hysteresis (Test Cycle 1)
(Downscale - Upscale)
= 0.0067 - (-0.0357) = 0.0423

Repeatability/Hysteresis Calculation				
Test Point	Upscale Repeatability	Downscale Repeatability	Test Point	Hysteresis
0%	+/-	+/- 0.0107		
2%	+/- 0.0168	+/- 0.0273	2%	0.0083
4%	+/- 0.0255	+/- 0.0258	4%	-0.0047
6%	+/- 0.0060	+/- 0.0055	6%	-0.0107
8%	+/- 0.0208	+/- 0.0165	8%	0.0203
10%	+/- 0.0062	+/- 0.0140	10%	0.0063
20%	+/- 0.0315	+/- 0.0205	20%	0.0423
40%	+/- 0.0085	+/- 0.0148	40%	0.0157
60%	+/- 0.0110	+/- 0.0267	60%	-0.0117
80%	+/- 0.0075	+/- 0.0245	80%	0.0027
100%	+/- 0.0258	+/-	Max Hysteresis	0.0423
Max Repeatability		+/- 0.0315	Test Hysteresis	#N/A

Linearity/Repeatability/Hysteresis Calculations for Each Test Cycle										
Test Cycle		1			2			3			Ref. Std.
Test Point		Ref. Value	Hysteresis	Linearity	Ref. Value	Hysteresis	Linearity	Ref. Value	Hysteresis	Linearity	% Reading
	0%	0.0		-0.0072	0.0		-0.0055	0.0		0.0077	
	2%	2.0	-0.0127	-0.0243	2.0	0.0083	0.0198	2.0	-0.0340	-0.0103	+/ 0.025%
	4%	4.0	-0.0053	-0.0303	4.0	-0.0047	0.0210	4.0	-0.0127	-0.0043	+/ 0.025%
	6%	6.0	-0.0197	0.0135	6.0	-0.0107	0.0060	6.0	-0.0207	0.0030	+/ 0.025%
	8%	8.0	0.0203	-0.0225	8.0	0.0057	-0.0278	8.0	-0.0010	0.0085	+/ 0.025%
	10%	10.0	-0.0130	0.0118	10.0	0.0053	0.0153	10.0	-0.0210	0.0005	+/ 0.025%
	20%	20.0	0.0423	-0.0146	20.0	-0.0143	0.0202	20.0	-0.0070	-0.0245	+/ 0.025%
	40%	40.0	-0.0010	-0.0285	40.0	0.0117	-0.0052	40.0	0.0157	-0.0175	+/ 0.025%
	60%	60.0	-0.0703	0.0012						2	+/ 0.025%
	80%	80.0	0.0037	0.0105						2	+/ 0.025%
	100%	100.0		0.0093						3	+/ 0.025%

Hysteresis (All Test Cycles)
Max of (0.0423, -0.0143, -0.0070) =

Test Cycle		1			2			3			Ref. Std.
Test Point		Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	% Reading
1	0%	0.0013	0.0133	0.0120	-0.0013	0.0033	0.0046	-0.0033	-0.0200	-0.0167	
2	2%	1.9987	2.0167	0.0180	2.0023	1.9800	-0.0223	2.0007	2.0233	0.0226	+/- 0.025%
3	4%	4.0000	4.0167	0.0167	3.9987	3.9867	-0.0120	4.0003	3.9767	-0.0236	+/- 0.025%
4	6%	5.9993	5.9833	-0.0160	5.9973	6.0267	0.0294	5.9983	6.0333	0.0350	+/- 0.025%
5	8%	7.9987	7.9733	-0.0254	7.9991	8.0000	0.0009	7.9977	7.9800	-0.0177	+/- 0.025%
6	10%	10.0027	10.0200	0.0173	10.0020	9.9967	-0.0053	10.0033	10.0000	-0.0033	+/- 0.025%
7	20%	20.0000	19.9767	-0.0233	19.9980	19.9700	-0.0280	20.0030	20.0133	0.0103	+/- 0.025%
8	40%	39.9967	39.9700	-0.0267	40.0020	39.9967	-0.0053	39.9983	40.0333	0.0350	+/- 0.025%
9	60%	60.0030	60.0300	0.0270	59.9			167		0.0154	+/- 0.025%
10	80%	79.9970	79.9867	-0.0103	80.0			700		-0.0317	+/- 0.025%
11	100%	100.0030	99.9767	-0.0263	100.0			300		0.0303	+/- 0.025%
12	80%	80.0033	79.9967	-0.0066	80.0			200		0.0193	+/- 0.025%
13	60%	60.0027	59.9700	-0.0327	59.9					-0.0090	+/- 0.025%
14	40%	40.0013	40.0067	0.0054	39.9973	39.9933	-0.0040	40.0013	40.0133	0.0120	+/- 0.025%
15	20%	20.0000	20.0233	0.0233	19.9993	19.9700	-0.0293	19.9990	19.9700	-0.0290	+/- 0.025%
16	10%	9.9987	9.9700	-0.0287	10.0033	10.0033	0.0000	9.9987	9.9767	-0.0220	+/- 0.025%
17	8%	7.9990	8.0000	0.0010	8.0030	8.0200	-0.0030	8.0003	7.9800	-0.0203	+/- 0.025%
18	6%	5.9987	5.9700	-0.0287	6.0027	5.9800	-0.0227	6.0007	5.9700	-0.0307	+/- 0.025%
19	4%	3.9990	4.0067	0.0077	3.9993	4.0300	0.0307	3.9970	3.9867	-0.0103	+/- 0.025%
20	2%	2.0020	1.9900	-0.0120	1.9993	2.0200	0.0207	2.0023	1.9667	-0.0356	+/- 0.025%
21	0%	0.0027	0.0300	0.0273	-0.0033	0.0133	0.0166	0.0030	-0.0167	-0.0197	

Hysteresis (Test Cycle 1)
(Downscale - Upscale)
= 0.0233 - (-0.0233) = 0.0466

Repeatability/Hysteresis Calculation				
	Repeatability			
Test Point	Upscale	Downscale	Test Point	Hysteresis
0%		0.0235		
2%	0.0224	0.0282	2%	0.0582
4%	0.0202	0.0205	4%	0.0427
6%	0.0255	0.0040	6%	0.0657
8%	0.0132	0.0106	8%	0.0264
10%	0.0113	0.0143	10%	0.0460
20%	0.0192	0.0263	20%	0.0466
40%	0.0308	0.0080	40%	0.0321
60%	0.0264	0.0138	60%	0.0597
80%	0.0161	0.0175	80%	0.0510
100%	0.0283			

Linearity/Repeatability/Hysteresis Calculations for Each Test Cycle										
Test Cycle		1			2			3			Ref. Std.
Test Point		Ref. Value	Hysteresis	Linearity	Ref. Value	Hysteresis	Linearity	Ref. Value	Hysteresis	Linearity	% Reading
	0%	0.0		0.0197	0.0		0.0106	0.0		-0.0182	+/- 0.025%
	2%	2.0	-0.0300	0.0020	2.0	0.0430	-0.0008	2.0	-0.0582	-0.0065	+/- 0.025%
	4%	4.0	-0.0090	0.0122	4.0	0.0427	0.0094	4.0	0.0133	-0.0170	+/- 0.025%
	6%	6.0	-0.0127	-0.0224	6.0	-0.0521	0.0034	6.0	-0.0657	0.0021	+/- 0.025%
	8%	8.0	0.0264	-0.0122	8.0	-0.0039	-0.0011	8.0	-0.0026	-0.0190	+/- 0.025%
	10%	10.0	-0.0460	-0.0057	10.0	-0.0053	-0.0027	10.0	-0.0187	-0.0126	+/- 0.025%
	20%	20.0	0.0466	0.0000	20.0	-0.0013	-0.0287	20.0	-0.0393	-0.0093	+/- 0.025%
	40%	40.0	0.0321	-0.0100	40.0	0.0013	-0.0047	40.0	-0.0230	0.0	+/- 0.025%
	60%	60.0	-0.0597							032	+/- 0.025%
	80%	80.0	0.0037							062	+/- 0.025%
	100%	100.0								303	+/- 0.025%

Hysteresis (All Test Cycles)
Max Abs. Value (0.0466, -0.0013, -0.0393) = 0.0466

Figure B.4—Example of Transmitter Digital Test Results Hysteresis Calculations

B.1.4 API 22.4 Baseline Accuracy and Summary Calculation

API 22.4 Baseline Accuracy is calculated for each percentage of span point as root mean square of Linearity and the maximum Repeatability and Hysteresis values as shown in Figure B.6. The Reference Standard accuracy for each test point is reported.

$$API\ 22.4\ Baseline\ Accuracy = \sqrt{(Linearity)^2 + (max(Repeatability))^2 + (max(Hysteresis))^2}$$

$$\cancel{Reference\ Accuracy = \sqrt{(Linearity)^2 + (\max(Repeatability))^2 + (\max(Hysteresis))^2}} \quad \text{(B.4)}$$

Test Cycle		1			2			3			Ref. Std.
Test Point		Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	% Reading
1	0%	-0.0010	-0.0200	-0.0190	-0.0023	0.0033	0.0057	0.0013	0.0300	0.0287	
2	2%	1.9980	1.9800	-0.0180	1.9977	2.0133	0.0157	2.0033	2.0100	0.0067	+/- 0.025%
3	4%	3.9977	3.9700	-0.0277	4.0000	4.0233	0.0233	4.0013	4.0033	0.0020	+/- 0.025%
4	6%	5.9967	6.0200	0.0233	5.9987	6.0100	0.0113	5.9967	6.0100	0.0133	+/- 0.025%
5	8%	7.9993	7.9667	-0.0327	7.9973	7.9667	-0.0307	7.9977	8.0067	0.0090	+/- 0.025%
6	10%	9.9967	10.0200	0.0233	10.0007	10.0133	0.0127	9.9990	10.0100	0.0110	+/- 0.025%
7	20%	20.0023	19.9667	-0.0357	20.0027	20.0300	0.0273	20.0010	19.9800	-0.0210	+/- 0.025%
8	40%	40.0013	39.9733	-0.0280	40.0010	39.9900	-0.0110	40.0020	39.9767	-0.0253	+/- 0.025%
9	60%	59.9970	60.0333	0.0363	60.0023	60.0167	0.0143	59.9990	60.0300	0.0310	+/- 0.025%
10	80%	79.9980	80.0067	0.0087	79.9967	80.0100	0.0133	79.9983	79.9967	-0.0017	+/- 0.025%
11	100%	100.0007	100.0100	0.0093	99.9997	99.9733	-0.0263	100.0013	100.0267	0.0253	+/- 0.025%
12	80%	80.0010	80.0133	0.0123	80.0033	79.9667	-0.0367	79.9973	79.9967	-0.0007	+/- 0.025%
13	60%	60.0007	59.9667	-0.0340	59.9970	59.9800	-0.0170	59.9973	60.0167	0.0193	+/- 0.025%
14	40%	39.9990	39.9700	-0.0290	40.0027	40.0033	0.0007	39.9997	39.9900	-0.0097	+/- 0.025%
15	20%	20.0000	20.0067	0.0067	20.0003	20.0133	0.0130	19.9980	19.9700	-0.0280	+/- 0.025%
16	10%	9.9997	10.0000	0.0003	10.0020	10.0200	0.0180	10.0033	9.9933	-0.0100	+/- 0.025%
17	8%	8.0023	7.9900	-0.0123	8.0017	7.9767	-0.0250	8.0020	8.0100	0.0080	+/- 0.025%
18	6%	5.9997	6.0033	0.0037	5.9993	6.0000	0.0007	6.0007	5.9933	-0.0073	+/- 0.025%
19	4%	3.9997	3.9667	-0.0330	3.9980	4.0167	0.0187	4.0007	3.9900	-0.0107	+/- 0.025%
20	2%	2.0007	1.9700	-0.0307	2.0027	2.0267	0.0240	1.9973	1.9700	-0.0273	+/- 0.025%
21	0%	-0.0013	0.0033	0.0047	-0.0033	-0.0200	-0.0167	-0.0033	-0.0167	-0.0133	

Test Cycle		1			2			3			Ref. Std.
Test Point		Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	Ref. Value	DUT Value	Difference	% Reading
1	0%	0.0013	0.0133	0.0120	-0.0013	0.0033	0.0046	-0.0033	-0.0200	-0.0167	
2	2%	1.9987	2.0167	0.0180	2.0023	1.9800	-0.0223	2.0007	2.0233	0.0226	+/- 0.025%
3	4%	4.0000	4.0167	0.0167	3.9987	3.9867	-0.0120	4.0003	3.9767	-0.0236	+/- 0.025%
4	6%	5.9993	5.9833	-0.0160	5.9973	6.0267	0.0294	5.9983	6.0333	0.0350	+/- 0.025%
5	8%	7.9987	7.9733	-0.0254	7.9991	8.0000	0.0009	7.9977	7.9800	-0.0177	+/- 0.025%
6	10%	10.0027	10.0200	0.0173	10.0020	9.9967	-0.0053	10.0033	10.0000	-0.0033	+/- 0.025%
7	20%	20.0000	19.9767	-0.0233	19.9980	19.9700	-0.0280	20.0030	20.0133	0.0103	+/- 0.025%
8	40%	39.9967	39.9700	-0.0267	40.0020	39.9967	-0.0053	39.9983	40.0333	0.0350	+/- 0.025%
9	60%	60.0030	60.0300	0.0270	59.9990	59.9733	-0.0257	60.0013	60.0167	0.0154	+/- 0.025%
10	80%	79.9970	79.9867	-0.0103	80.0027	80.0033	0.0006	80.0017	79.9700	-0.0317	+/- 0.025%
11	100%	100.0030	99.9767	-0.0263	100.0013	100.0133	0.0120	99.9997	100.0300	0.0303	+/- 0.025%
12	80%	80.0033	79.9967	-0.0066	80.0023	79.9867	-0.0156	80.0007	80.0200	0.0193	+/- 0.025%
13	60%	60.0027	59.9700	-0.0327	59.9983	59.9933	-0.0050	59.9990	59.9900	-0.0090	+/- 0.025%
14	40%	40.0013	40.0067	0.0054	39.9973	39.9933	-0.0040	40.0013	40.0133	0.0120	+/- 0.025%
15	20%	20.0000	20.0233	0.0233	19.9993	19.9700	-0.0293	19.9990	19.9700	-0.0290	+/- 0.025%
16	10%	9.9987	9.9700	-0.0287	10.0033	10.0033	0.0000	9.9987	9.9767	-0.0220	+/- 0.025%
17	8%	7.9990	8.0000	0.0010	8.0030	8.0000	-0.0030	8.0003	7.9800	-0.0203	+/- 0.025%
18	6%	5.9987	5.9700	-0.0287	6.0027	5.9800	-0.0227	6.0007	5.9700	-0.0307	+/- 0.025%
19	4%	3.9990	4.0067	0.0077	3.9993	4.0300	0.0307	3.9970	3.9867	-0.0103	+/- 0.025%
20	2%	2.0020	1.9900	-0.0120	1.9993	2.0200	0.0207	2.0023	1.9667	-0.0356	+/- 0.025%
21	0%	0.0027	0.0300	0.0273	-0.0033	0.0133	0.0166	0.0030	-0.0167	-0.0197	

Figure B.5—Example Test Results

Linearity/Repeatability/Hysteresis Calculations for Each Test Cycle										
Test Cycle	1			2			3			Ref. Std.
Test Point	Ref. Value	Hysteresis	Linearity	Ref. Value	Hysteresis	Linearity	Ref. Value	Hysteresis	Linearity	% Reading
0%	0.0		-0.0072	0.0		-0.0055	0.0		0.0077	
2%	2.0	-0.0127	-0.0243	2.0	0.0083	0.0198	2.0	-0.0340	-0.0103	+/- 0.025%
4%	4.0	-0.0053	-0.0303	4.0	-0.0047	0.0210	4.0	-0.0127	-0.0043	+/- 0.025%
6%	6.0	-0.0197	0.0135	6.0	-0.0107	0.0060	6.0	-0.0207	0.0030	+/- 0.025%
8%	8.0	0.0203	-0.0225	8.0	0.0057	-0.0278	8.0	-0.0010	0.0085	+/- 0.025%
10%	10.0	-0.0230	0.0118	10.0	0.0053	0.0153	10.0	-0.0210	0.0005	+/- 0.025%
20%	20.0	0.0423	-0.0145	20.0	-0.0143	0.0202	20.0	-0.0070	-0.0245	+/- 0.025%
40%	40.0	-0.0010	-0.0285	40.0	0.0117	-0.0052	40.0	0.0157	-0.0175	+/- 0.025%
60%	60.0	-0.0703	0.0012	60.0	-0.0313	-0.0013	60.0	-0.0117	0.0252	+/- 0.025%
80%	80.0	0.0037	0.0105	80.0	-0.0500	-0.0117	80.0	0.0010	-0.0012	+/- 0.025%
100%	100.0		0.0093	100.0		-0.0263	100.0		0.0253	+/- 0.025%

Linearity/Repeatability/Hysteresis Calculations for Each Test Cycle										
Test Cycle	1			2			3			Ref. Std.
Test Point	Ref. Value	Hysteresis	Linearity	Ref. Value	Hysteresis	Linearity	Ref. Value	Hysteresis	Linearity	% Reading
0%	0.0		0.0197	0.0		0.0106	0.0		-0.0182	+/- 0.025%
2%	2.0	-0.0300	0.0030	2.0	0.0430	-0.0008	2.0	-0.0582	-0.0065	+/- 0.025%
4%	4.0	-0.0090	0.0122	4.0	0.0427	0.0094	4.0	0.0133	-0.0170	+/- 0.025%
6%	6.0	-0.0127	-0.0224	6.0	-0.0521	0.0034	6.0	-0.0657	0.0021	+/- 0.025%
8%	8.0	0.0264	-0.0122	8.0	-0.0039	-0.0011	8.0	-0.0026	-0.0190	+/- 0.025%
10%	10.0	-0.0460	-0.0057	10.0	0.0053	-0.0027	10.0	-0.0187	-0.0126	+/- 0.025%
20%	20.0	0.0466	0.0000	20.0	-0.0013	-0.0287	20.0	-0.0393	-0.0093	+/- 0.025%
40%	40.0	0.0321	-0.0106	40.0	0.0013	-0.0047	40.0	-0.0230	0.0235	+/- 0.025%
60%	60.0	-0.0597	-0.0028	60.0	0.0207	-0.0154	60.0	-0.0244	0.0032	+/- 0.025%
80%	80.0	0.0037	-0.0084	80.0	-0.0162	-0.0075	80.0	0.0510	-0.0062	+/- 0.025%
100%	100.0		-0.0263	100.0		0.0120	100.0		0.0303	+/- 0.025%

Repeatability/Hysteresis Calculation				
Test Point	Upscale Repeatability	Downscale Repeatability	Test Point	Hysteresis
0%	+/-	+/- 0.0107		
2%	+/- 0.0168	+/- 0.0273	2%	0.0083
4%	+/- 0.0255	+/- 0.0258	4%	-0.0047
6%	+/- 0.0060	+/- 0.0055	6%	-0.0107
8%	+/- 0.0208	+/- 0.0165	8%	0.0203
10%	+/- 0.0062	+/- 0.0140	10%	0.0053
20%	+/- 0.0315	+/- 0.0205	20%	0.0423
40%	+/- 0.0085	+/- 0.0148	40%	0.0157
60%	+/- 0.0110	+/- 0.0267	60%	-0.0117
80%	+/- 0.0075	+/- 0.0245	80%	0.0037
100%	+/- 0.0258	+/-	Max Hysteresis	0.0423
Max Repeatability		+/- 0.0315		

Repeatability/Hysteresis Calculation				
	Repeatability			
Test Point	Upscale	Downscale	Test Point	Hysteresis
0%		0.0235		
2%	0.0224	0.0282	2%	0.0582
4%	0.0202	0.0205	4%	0.0427
6%	0.0255	0.0040	6%	0.0657
8%	0.0132	0.0106	8%	0.0264
10%	0.0113	0.0143	10%	0.0460
20%	0.0192	0.0263	20%	0.0466
40%	0.0308	0.0080	40%	0.0321
60%	0.0264	0.0138	60%	0.0597
80%	0.0161	0.0175	80%	0.0510
100%	0.0283			

Summary Calculations																		
Test Point		Linearity			Repeatability			Hysteresis			Reference Accuracy				Ref Std.
Ref. Value			% URL	% Reading		% URL	% Reading		% URL	% Reading		% URL	% Reading		% Reading
0%	0.0	-0.0017	0.017%		+/- 0.0315	+/- 0.315%		+/- 0.0423	+/- 0.423%		+/- 0.0528	+/- 0.528%			
2%	2.0	-0.0049	-0.049%	-0.247%	+/- 0.0315	+/- 0.315%	+/- 1.575%	+/- 0.0423	+/- 0.423%	+/- 2.117%	+/- 0.0530	+/- 0.530%	+/- 2.650%		+/- 0.025%
4%	4.0	-0.0046	-0.046%	-0.114%	+/- 0.0315	+/- 0.315%	+/- 0.788%	+/- 0.0423	+/- 0.423%	+/- 1.058%	+/- 0.0530	+/- 0.530%	+/- 1.324%		+/- 0.025%
6%	6.0	0.0075	0.075%	0.125%	+/- 0.0315	+/- 0.315%	+/- 0.525%	+/- 0.0423	+/- 0.423%	+/- 0.706%	+/- 0.0533	+/- 0.533%	+/- 0.888%		+/- 0.025%
8%	8.0	-0.0139	-0.139%	-0.174%	+/- 0.0315	+/- 0.315%	+/- 0.394%	+/- 0.0423	+/- 0.423%	+/- 0.529%	+/- 0.0546	+/- 0.546%	+/- 0.682%		+/- 0.025%
10%	10.0	0.0092	0.092%	0.092%	+/- 0.0315	+/- 0.315%	+/- 0.315%	+/- 0.0423	+/- 0.423%	+/- 0.423%	+/- 0.0536	+/- 0.536%	+/- 0.536%		+/- 0.025%
20%	20.0	-0.0063	-0.063%	-0.031%	+/- 0.0315	+/- 0.315%	+/- 0.158%	+/- 0.0423	+/- 0.423%	+/- 0.212%	+/- 0.0531	+/- 0.531%	+/- 0.266%		+/- 0.025%
40%	40.0	-0.0171	-0.171%	-0.043%	+/- 0.0315	+/- 0.315%	+/- 0.079%	+/- 0.0423	+/- 0.423%	+/- 0.106%	+/- 0.0555	+/- 0.555%	+/- 0.139%		+/- 0.025%
60%	60.0	0.0083	0.083%	0.014%	+/- 0.0315	+/- 0.315%	+/- 0.053%	+/- 0.0423	+/- 0.423%	+/- 0.071%	+/- 0.0534	+/- 0.534%	+/- 0.089%		+/- 0.025%
80%	80.0	-0.0008	-0.008%	-0.001%	+/- 0.0315	+/- 0.315%	+/- 0.039%	+/- 0.0423	+/- 0.423%	+/- 0.053%	+/- 0.0528	+/- 0.528%	+/- 0.066%		+/- 0.025%
100%	10.0	0.0028	0.028%	0.028%	+/- 0.0315	+/- 0.315%	+/- 0.315%	+/- 0.0423	+/- 0.423%	+/- 0.423%	+/- 0.0528	+/- 0.528%	+/- 0.528%		+/- 0.025%
Maximum - Minimum Linearity				0.372%											

Summary Calculations																		
Test Point		Linearity			Repeatability			Hysteresis			API 22.4 Baseline Accuracy				Ref. Std.
	Ref. Value	UOM	% MTV	% Reading	UOM	% MTV	% Reading	UOM	% MTV	% Reading	UOM	% MTV	% Reading		% Reading
0%	0.0	0.0040	0.004%		0.0308	0.031%					+/- 0.0311	+/- 0.031%			
2%	2.0	-0.0014	-0.001%	-0.072%	0.0308	0.031%	1.542%	0.0582	0.058%	2.910%	+/- 0.0659	+/- 0.066%	+/- 3.294%		+/- 0.025%
4%	4.0	0.0015	0.002%	0.038%	0.0308	0.031%	0.771%	0.0427	0.043%	1.068%	+/- 0.0527	+/- 0.053%	+/- 1.318%		+/- 0.025%
6%	6.0	-0.0056	-0.006%	-0.094%	0.0308	0.031%	0.514%	0.0657	0.066%	1.095%	+/- 0.0728	+/- 0.073%	+/- 1.213%		+/- 0.025%
8%	8.0	-0.0107	-0.011%	-0.134%	0.0308	0.031%	0.386%	0.0264	0.026%	0.330%	+/- 0.0420	+/- 0.042%	+/- 0.525%		+/- 0.025%
10%	10.0	-0.0070	-0.007%	-0.070%	0.0308	0.031%	0.308%	0.0460	0.046%	0.460%	+/- 0.0558	+/- 0.056%	+/- 0.558%		+/- 0.025%
20%	20.0	-0.0127	-0.013%	-0.063%	0.0308	0.031%	0.154%	0.0466	0.047%	0.233%	+/- 0.0573	+/- 0.057%	+/- 0.287%		+/- 0.025%
40%	40.0	0.0027	0.003%	0.007%	0.0308	0.031%	0.077%	0.0321	0.032%	0.080%	+/- 0.0446	+/- 0.045%	+/- 0.112%		+/- 0.025%
60%	60.0	-0.0050	-0.005%	-0.008%	0.0308	0.031%	0.051%	0.0597	0.060%	0.099%	+/- 0.0674	+/- 0.067%	+/- 0.112%		+/- 0.025%
80%	80.0	-0.0074	-0.007%	-0.009%	0.0308	0.031%	0.039%	0.0510	0.051%	0.064%	+/- 0.0601	+/- 0.060%	+/- 0.075%		+/- 0.025%
100%	100.0	0.0053	0.005%	0.005%	0.0308	0.031%	0.031%				+/- 0.0313	+/- 0.031%	+/- 0.031%		+/- 0.025%

Figure B.6—Example Calculations Based on Test Results in Figure B.5