

Om Autek AS



Autek AS ble etablert i 1987 og er et selvstendig norsk selskap som arbeider med leveranser, igangkjøring og service av feltinstrumenter til offshore og landbasert industri.

Prosjektavdelingen har opparbeidet seg høy kompetanse i fiskal flowmåling og beregning av flowelementer.

Ved hjelp av lang erfaring med pakkeleveranser offshore har vi gode rutiner og en effektiv prosjektgjennomføring.

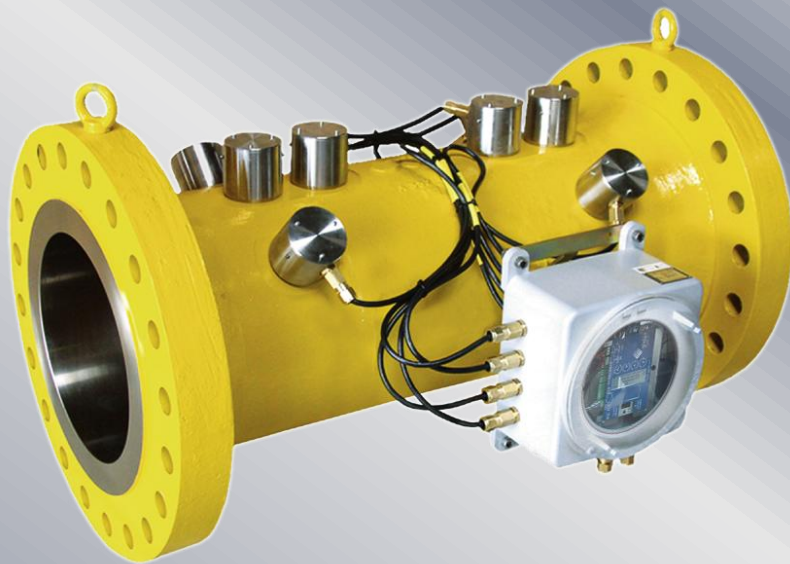
Pyro °Control












Pyro °Control ble en del av Autek AS i 1992. De produsent av temperatursensorer, termolommer og flow elementer.

Typisk kunde er offshore eller de som trenger små volum eller teknisk krevende produkter.

Alle sertifikater og prosedyrer for produktene er i henhold til de krav som stilles i Norsk offshore.



Diagnosesignaler fra en USM

	Performance	
	Ukompensert gasshastighet	RGV
	Lydens hastighet i gass.	VOS
	Forsterkningsnivå	AGC Level
	Forsterkningsgrense	AGC Limit
	Diagnostikkinformasjon	DiagBits
	V-status	V-status
	Puls bilder	Sample View
	Swirl grader	Swirl Angle



Performance

- Aksepterte målinger regnes ut i % fra sendte og mottatte pulser.
- Det kalles "**Performance**" og oppgis i %.
- Det er Uniform som beregner dette.
- Normalt 95-100%, virker ned til 20%



Gasshastighet

Ukompensert gasshastighet:

- Viser hastighet målt per lydbane før de kombineres etter Elster-instrumentet sin vekting og gir ut korrigert gass hastighet.
- For diagnose brukes de til å finne flowprofil og når de overvåkes over tid og sammenligner med profil fra da måleren var ny, kan problemer med flowrettere avsløres.

Korrigert gasshastighet:

- Her vil høy gasshastighet over 28m/s forklare reduksjon i Performance og økning i AGC level, samt minskning av AGC Limit grunnet støy fra flow.
- Nullpunkt – Zero flow er følsom for termisk bevegelse av gassen inni måleren.



Lydens hastighet i gassen

VOS

- Rå VoS måles per lydbane. Der brukes forholdet mellom de forskjellige lydbaner til å etablere et fotavtrykk. Endring i fotavtrykk vil avsløre problemer med transducer og/eller elektronikk.
- Målt VoS brukes sammen med trykk og temperatur i AGA 10, hvor beregnet VoS sammenliknes med målt VoS.
- På Oseberg feltsenter bruker en av måleteknikerne VoS-avviket mellom målt og beregnet VoS som indikasjon på når det er på tide å overhale GC



Forsterkningsnivå

AGC LEVEL

- Forsterkning av målesignalet blir utført av en automatisk reguleringskrets. Den forsterker signalet opp til riktig styrke, er det støy i systemet eller belegg på transdusere økes forsterkningen.
- Dette kalles ”**AGC Level**” og er uten benevning, fra 0 til ca 65000.



Forsterknings grense

AGC LIMIT

- Mellom hver måling vil transducere lytte etter støy, ut i fra styrken på støyen regnes det ut maks tillat forsterkning.
- Dette kalles ”**AGC LIMIT**” og er uten benevning, fra 0 til ca 65000.
- Du kan se retningen på hvor støyen er ved å se forskjellen mellom A og B transducer.



Diagnose bit

- Elektronikken gir fra seg diagnose bit som forteller hvor eventuelle problemer er.

Bit	Value	Description
3	0x0008	AGC Level of transducer A clipped to AGC Limit
7	0x0080	AGC Level of transducer B clipped to AGC Limit
8	0x0100	Speed of Sound out of range
9	0x0200	Gas velocity out of range
11	0x0800	Performance low
12	0x1000	A per-path gas velocity value was calculated by substitution
Other	-	Reserved

Meterstatus

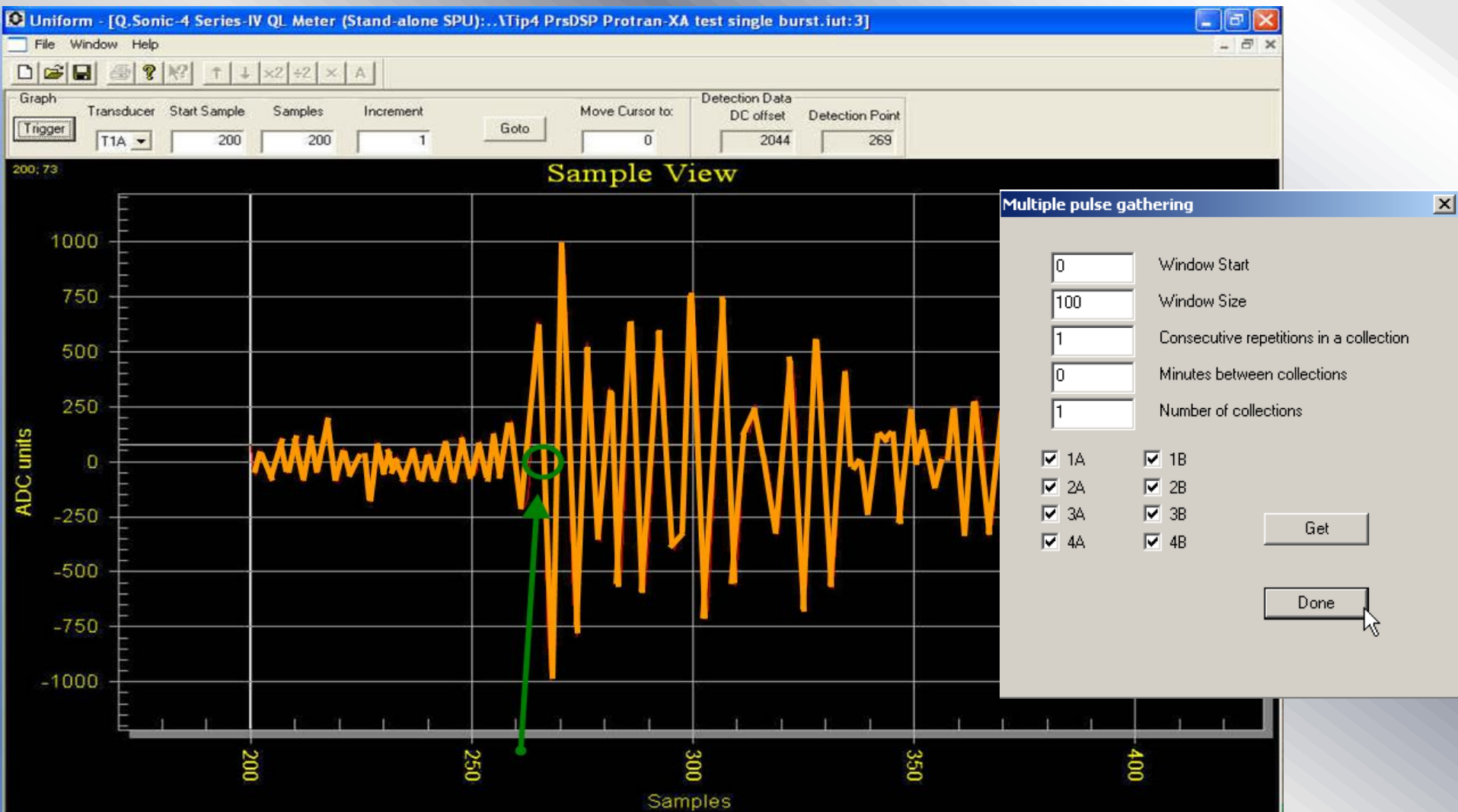
V-status

- Feil koder i elektronikken

Bit	Value	Mnemonic	Name	Description
0	0001h	GF	GENERAL FAILURE	Refer to the other flow meter documentation for detailed information about this type of alarm.
1	0002h	iL	I OUTPUT LOAD ERROR	Improper current output load (probably an open circuit).
2	0004h	iU	I DAC UNDERFLOW	Underflow of the current output DAC.
3	0008h	iO	I DAC OVERFLOW	Overflow of the current output DAC.
4	0010h	fU	F OUTPUT UNDERFLOW	Underflow of the frequency generator.
5	0020h	fO	F OUTPUT OVERFLOW	Overflow of the frequency generator.
6	0040h	A	REDUCED ACCURACY	Reduced accuracy.
7	0080h	S	SECURITY	Protection disabled.
8	0100h	-	COMM ERROR	Device-internal communication error.
9	0200h	-	TIMEOUT ERROR	Device-internal (communication) process timed out.
10	0400h	B	BATTERY FAIL ¹⁾	Back-up battery exhausted.
11	0800h	LF	LOG BUF FULL ¹⁾	Log buffer of embedded data logger (nearly) full.
12	1000h	DE	DSP ERROR ¹⁾	Error (or inconsistency) in internal (DSP) parameters.
13	2000h	SUB	SUBSTITUTION ¹⁾	A per-path gas velocity value was calculated by substitution.
14	4000h	-	-	Reserved.
15	8000h	-	REMOTE UNIT ERROR	If this bit is set, the error in bits 0-14 is flagged by the Remote Unit.

1) Applicable to Series-IV meters only

Puls bilder



Rotasjon i gassen

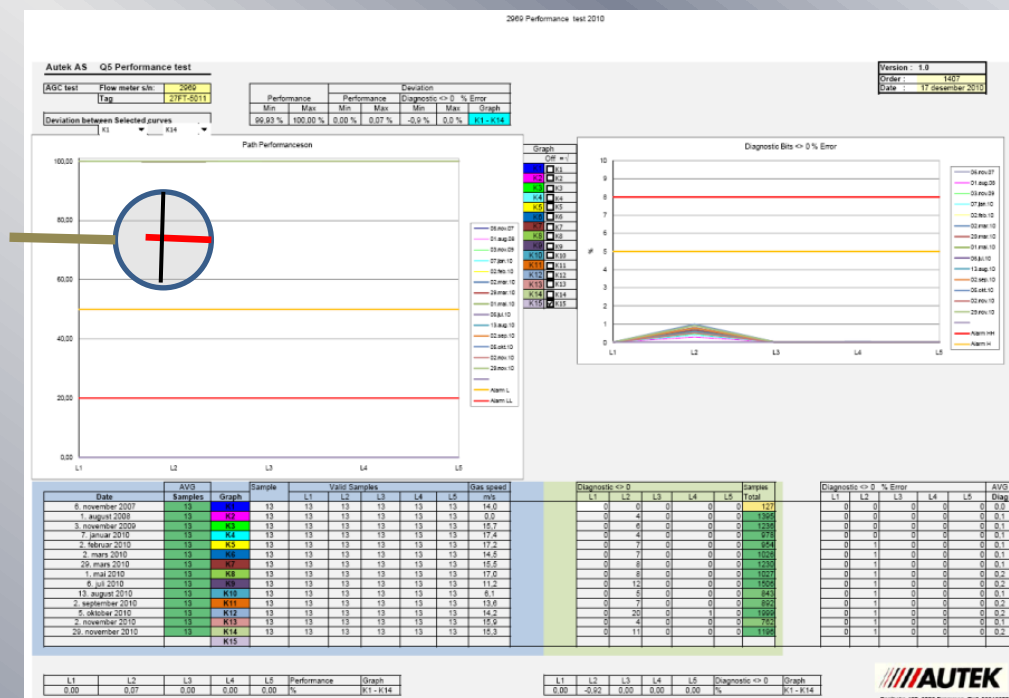
SWIRL

- Den måles i grader og forteller om hvor sterk rotasjonen er.
- For diagnose brukes endring i Swirl til å fortelle om flowprofilendring, som kan komme av delvis tetninger i strømningsretter.

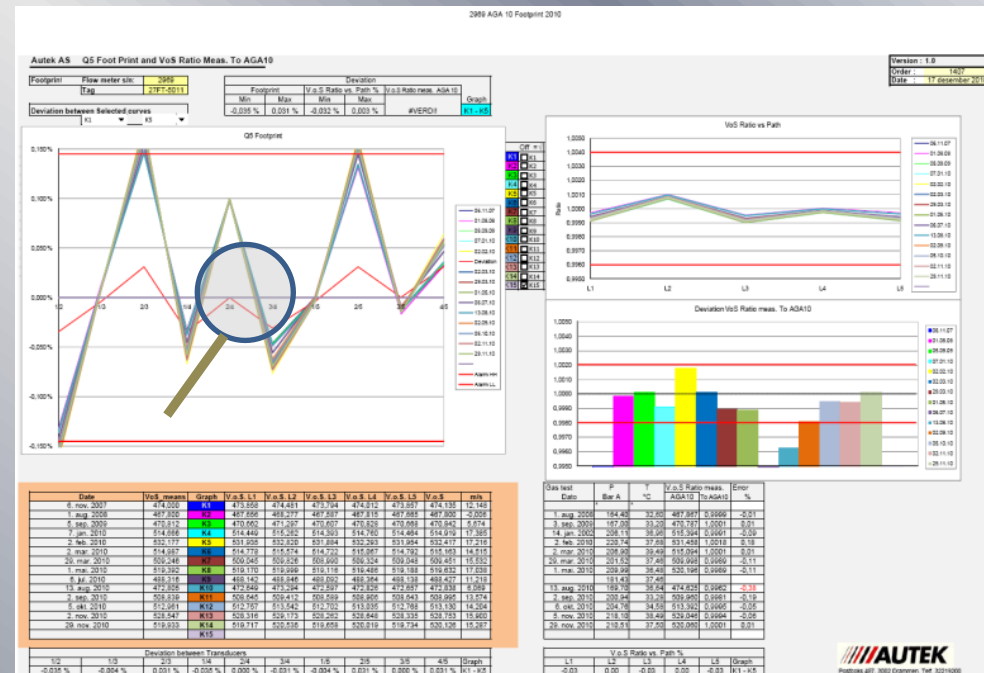


Data samlet fra Uniform brukes til tilstandskontroll

- Performance og diagnostikkdata samles og presenteres i et regneark, hvor data tilbake i tid kan sammenliknes.

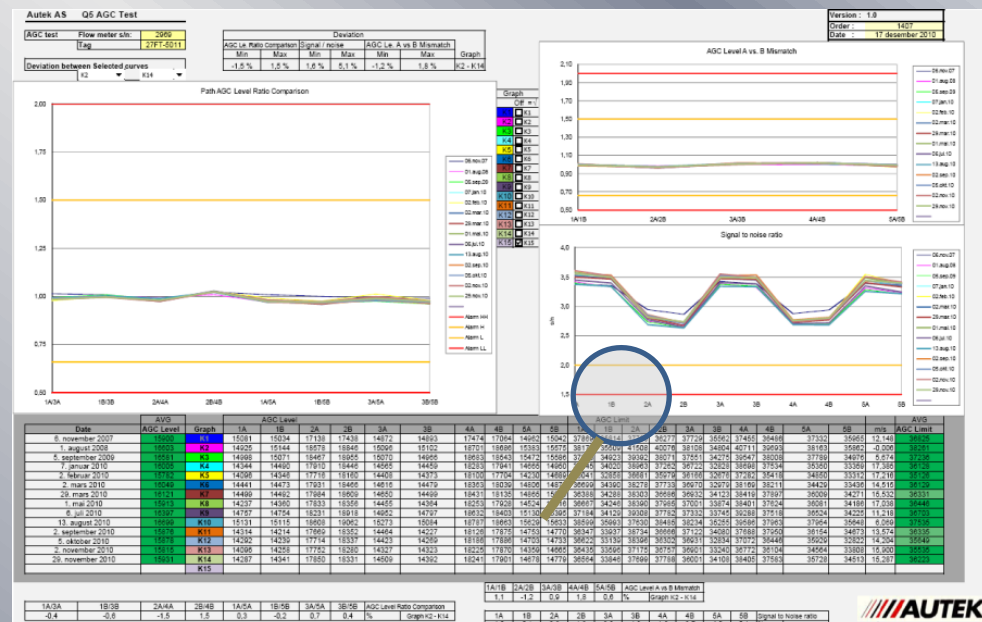


- **AGA10 Footprint** vil kunne indikere feil med transducere, for eksempel ved bytte av transducer. Videre vil problemer med GC, temperatur og trykk indikeres med feil i AGA10 verdiene.
- Her brukes UniGuard til å regne ut V.o.S.
- V.o.S ratio viser om en av lydbanene begynner å avvike fra de andre. Feil i signalbehandling.
- Transducerfeil, belegg.



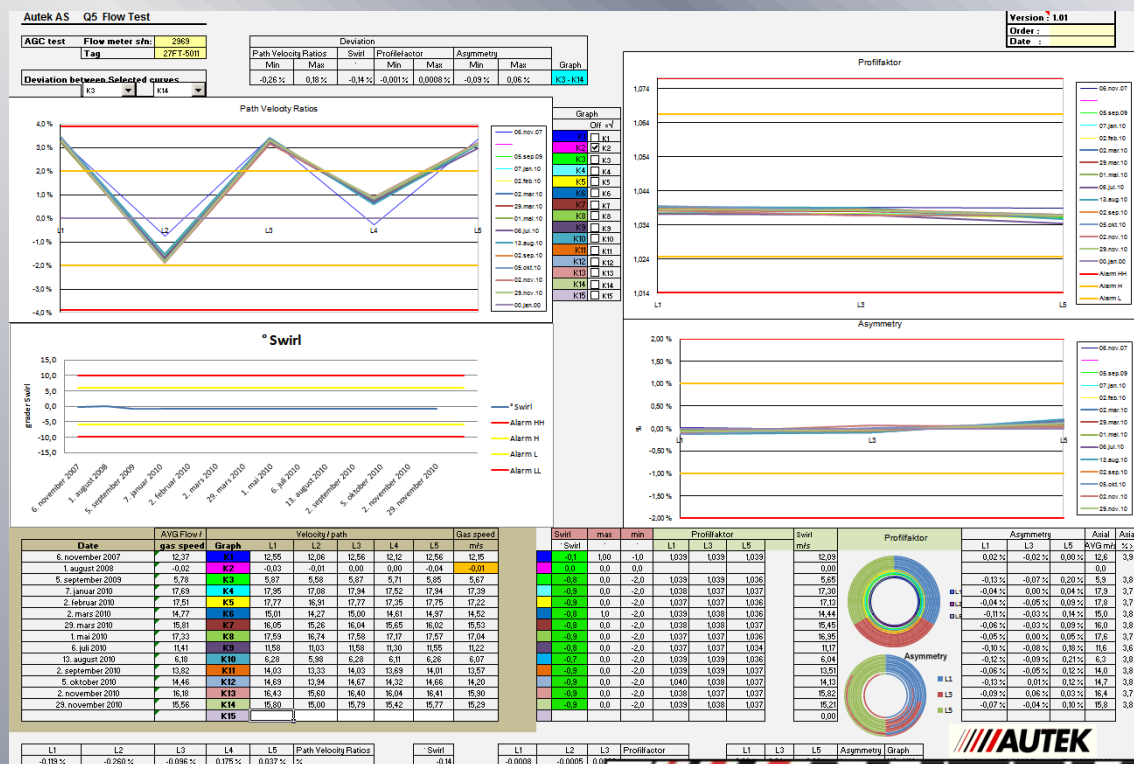
AGC Test

- **AGC Test** tar for seg forsterkning.
- Dokument **AGC Test** vil indikere endring i forsterkning, som kan komme av belegg på transducere, ny støykilde, feil med signalbehandling



Flowtest

Flowtest tar for seg flowprofilendringer.
Kan detektere delvis tette flowrettere.



Diagnoseprogrammet UniGuard

UniGuard [Kompatibilitetsmodus] - Microsoft Excel



v2.10.001

Select Function

Connecting to
meter

Ultrasonic Meter
Online Data

Enter Gas
Composition

Enter Process
Conditions

Analyze Test Data

Generate Report



Perform meter health check

Connect to the meter and read current UltraSonic diagnostic information.



AGA8/10 Calculator

Off-line calculation tool.

Advanced :



Analyze offline data

Retrieve and analyze offline data, recorded during calibration or Uniform tag files.

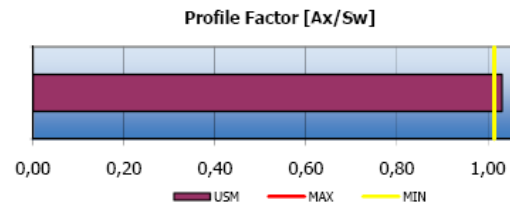
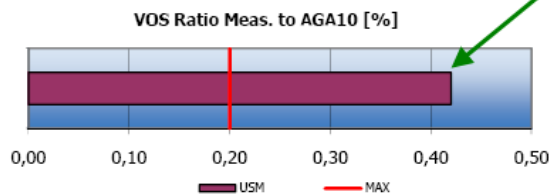
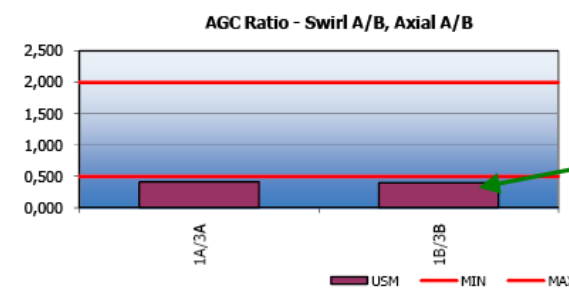
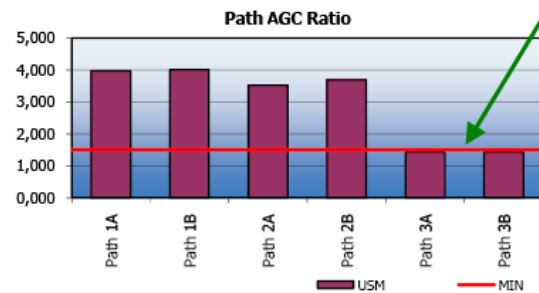
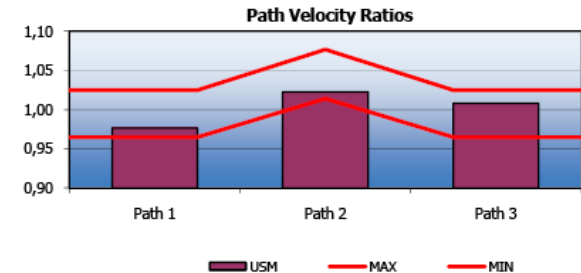
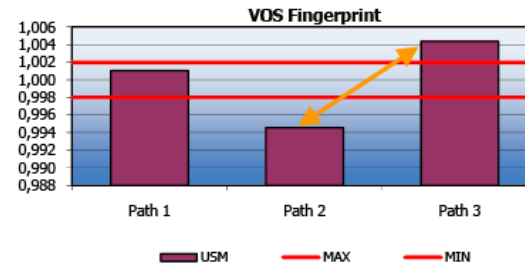
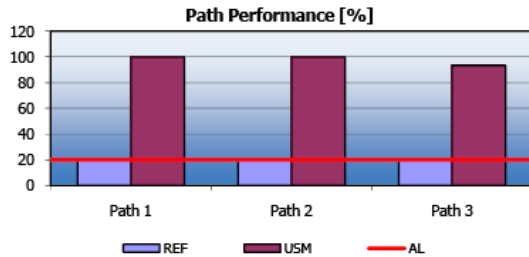


Collect reference data

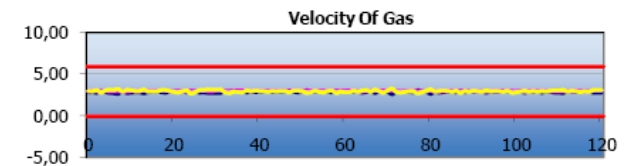
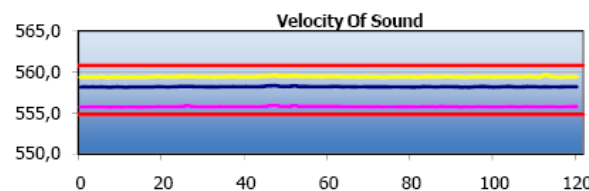
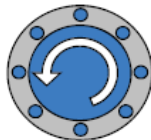
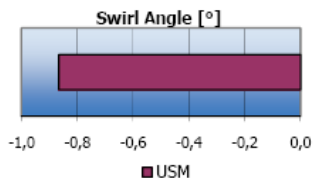
Retrieve and store online measurement data for reference



Siden med grafisk oversikt



Asymmetry N/A for 3 path meters.



Bilde med alarmgrenser og status etter testen



UniGuard

TEST	Limit	Measured	Status
Performance			
Number of acquired samples		15	
Percentage accepted pulses Path 1	20,00	100	PASS
Percentage accepted pulses Path 2	20,00	100	PASS
Percentage accepted pulses Path 3	20,00	93	PASS
Percentage accepted pulses Path 4	N/A	-	N/A
Percentage accepted pulses Path 5	N/A	-	N/A
		4	
Velocity of Sound			
AGA 10 Calculated	557,78 m/s	555,45 m/s	
Deviation VOS Average to Path 1	0,2 %	0,11 %	PASS
Deviation VOS Average to Path 2	0,2 %	0,54 %	ALARM
Deviation VOS Average to Path 3	0,2 %	0,44 %	ALARM
Deviation VOS Average to Path 4	0,2 %	- %	N/A
Deviation VOS Average to Path 5	0,2 %	- %	N/A
Deviation Avg VOS Measured to AGA10	0,2 %	0,42 %	ALARM
Velocity of Gas			
Deviation VOG Average to Path 1	3 %	1,89 %	PASS
Deviation VOG Average to Path 2	3 %	2,19 %	PASS
Deviation VOG Average to Path 3	3 %	-1,31 %	PASS
Deviation VOG Average to Path 4	3 %	- %	N/A
Deviation VOG Average to Path 5	3 %	- %	N/A
Profile Factor (AX/SW)	3 %	1,42 %	PASS
Swirl Angle			
Swirl Angle	± 5 °	-0,9 °	PASS
Assymetry			
Assymetry	0,02	-	N/A

TEST	Limit	Measured	Status
Automatic Gain Control			
Axial Path Level Ratio			
	Min	Max	
-	0,5	2,0	-
-	0,5	2,0	-
-	0,5	2,0	-
-	0,5	2,0	-
-	0,5	2,0	-
-	0,5	2,0	-
Swirl Path Level Ratio			
1A/3A	0,5	2,0	0,41
1B/3B	0,5	2,0	0,40
Elevated Level			
Path 1A	40 000	12601	PASS
Path 1B	40 000	12510	PASS
Path 2A	40 000	14302	PASS
Path 2B	40 000	13635	PASS
Path 3A	40 000	30688	PASS
Path 3B	40 000	31349	PASS
Path 4A	40 000	-	N/A
Path 4B	40 000	-	N/A
Path 5A	40 000	-	N/A
Path 5B	40 000	-	N/A
Limit/Level Ratio			
Path 1A	1,5	3,98	PASS
Path 1B	1,5	4,01	PASS
Path 2A	1,5	3,53	PASS
Path 2B	1,5	3,69	PASS
Path 3A	1,5	1,43	ALARM
Path 3B	1,5	1,43	ALARM
Path 4A	1,5	-	N/A
Path 4B	1,5	-	N/A
Path 5A	1,5	-	N/A
Path 5B	1,5	-	N/A
Level A vs. B Mismatch			
Path 1	0,5	2,0	1,01
Path 2	0,5	2,0	1,05
Path 3	0,5	2,0	0,98
Path 4	0,5	2,0	-
Path 5	0,5	2,0	-

Gassdata og kalkulerede verdier

Gas Composition

		mol %
C1	Methane	70,5200
N2	Nitrogen	2,6500
CO2	Carbon Dioxide	0,5200
C2	Ethane	13,3000
C3	Propane	9,2000
H2O	Water	0,0000
H2S	Hydrogen Sulphide	0,0000
H2	Hydrogen	0,0000
CO	Carbon Monoxide	0,0000
O2	Oxygen	0,0000
iC4	i-Butane	0,7800
nC4	n-Butane	2,1600
iC5	i-Pentane	0,3300
nC5	n-Pentane	0,3500
neoC5	neo-Pentane	0,0000
nC6	n-Hexane	0,1300
nC7	n-Heptane	0,0400
nC8	n-Octane	0,0200
nC9	n-Nonane	0,0000
nC10	n-Decane	0,0000
He	Helium	0,0000
Ar	Argon	0,0000
	Sum	100,0000

Process Conditions

PT	Pressure	298,860 Bar a
TT	Temperature	98,900 °C

Base Conditions

Pb	Base Pressure	1,013 Bar a
Tb	Base Temperature	15,000 °C
Tc	Comb. Temperature	15,556 °C

AGA10

Velocity of Sound	555,452 m/s
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AGA8

Line Compressibility	0,9254
Line Density	237,1433 kg/m ³

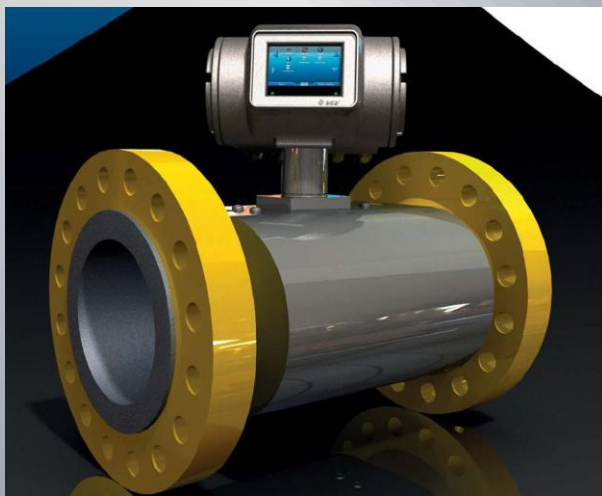
ISO 6976

Superior Calorific Value	49,18 [MJ/m ³]
Real relative density	0,7873
Molecular weight	22,715 [kg/kmol]
Standard density	0,9647 [kg/Sm ³]
Standard Compressibility	0,9958
Superior Calorific Value	50,98 [MJ/kg]
Superior Calorific value	1157,97 [kJ/mol]
Inferior heating value	44,69 [MJ/m ³]

Notes

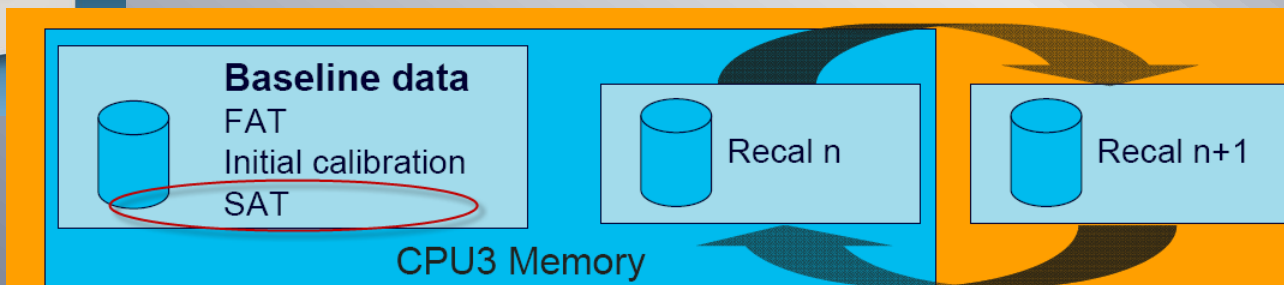
Notes

Qsonic+



Elster Instromet lanserer i disse dager en helt ny ultralydmåler og flowcomputer for gass. Måleren er designet for fiskal måling med lokal elektronikk.

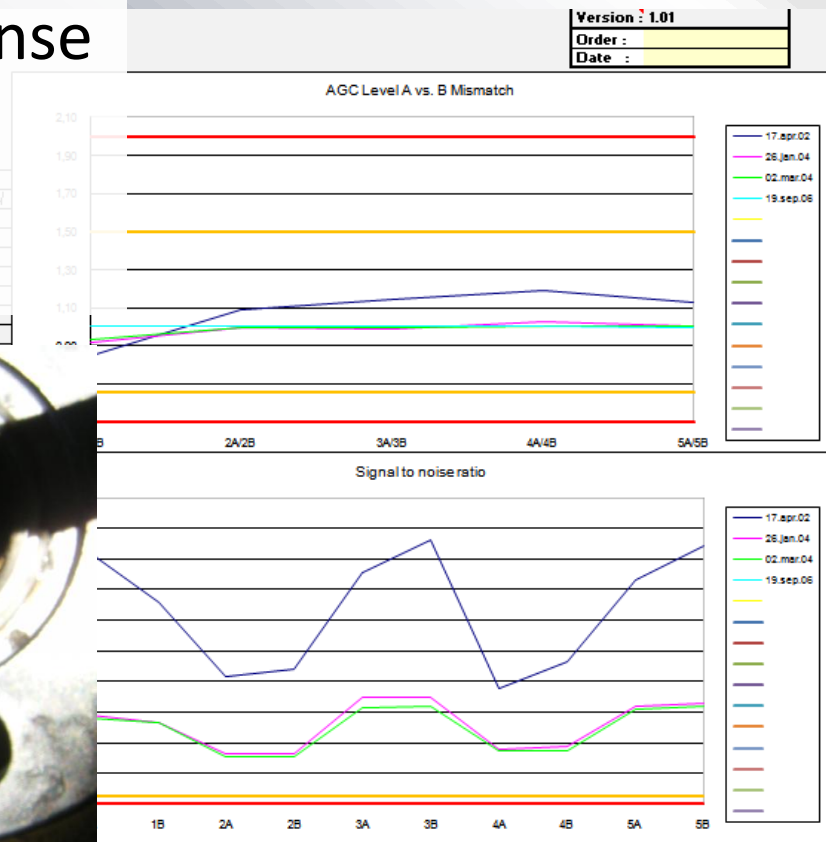
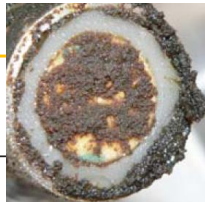
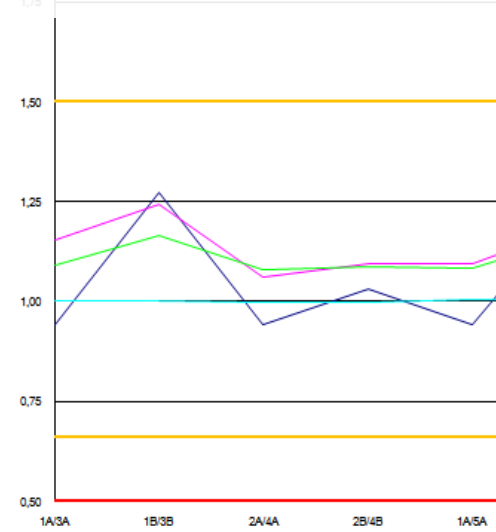
Innebygget on-line diagnose. Sammenlikner måleverdier med fabrikkdata / data fra kalibrering / oppstartsdata



?

AGC Test

- Manglende etablering av referanse ved oppstart i 2002
- Manglende oppfølging mellom 2004 og 2006

[illegible]

1A/3A	1B/3B	2A/4A	2B/4B	1A/5A	1B/5B	3A/5A	3B/5B	AGC Level Ratio Comparison	
22.9	-2.3	12.7	6.2	16.3	-5.3	-5.4	-3.0	%	Graph K1 - K2

1A/1B	2A/2B	3A/3B	4A/4B	5A/5B	AGC Level A vs B Mismatch	
8,8	-8,7	-13,5	-14,0	-11,4	%	Graph K1 - K2

1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	Signal to Noise ratio
-59.3	-53.7	-51.0	-53.8	-48.9	-54.6	-44.0	-51.5	-51.1	-55.7	% Graph K1 - K2

Performance test

2009 Performance test 2010

Autek AS Q5 Performance test

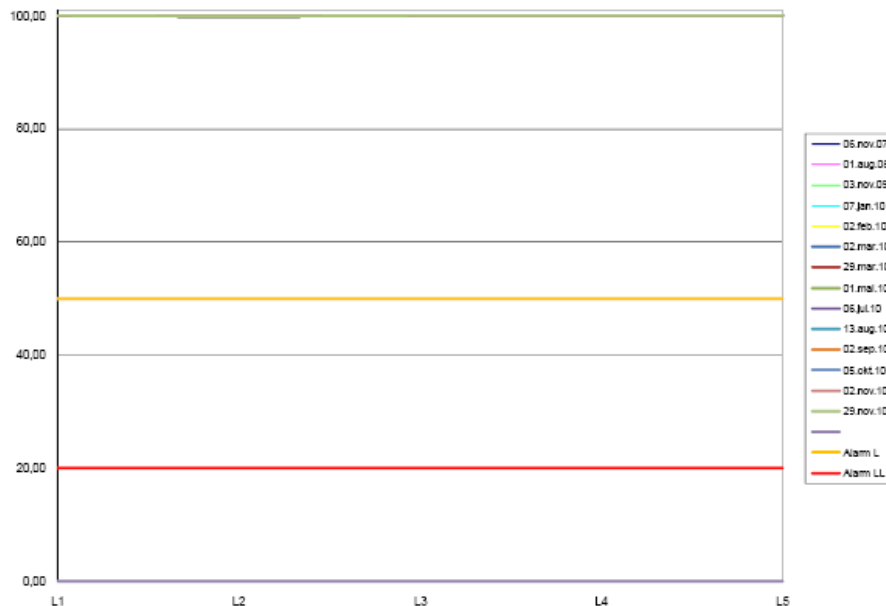
AGC test	Flow meter s/n:	2009
	Tag	27FT-5011

Deviation between Selected curves	K1	K14
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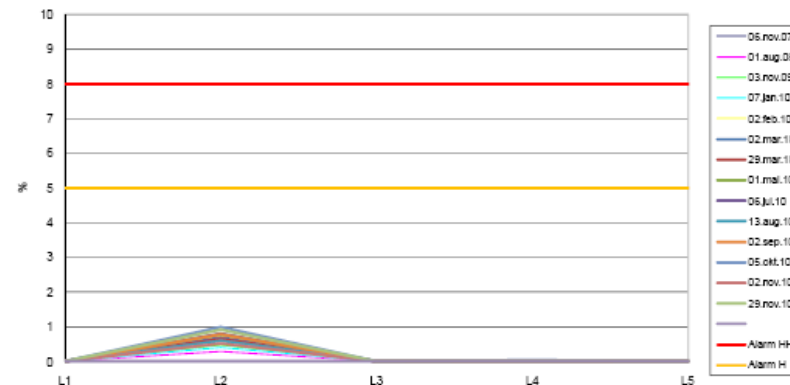
Performance		Performance		Deviation		Graph
Min	Max	Min	Max	Diagnostic <= 0 % Error	Min	
99,93 %	100,00 %	0,00 %	0,07 %	-0,9 %	0,0 %	K1 - K14

Version :	1.0
Order :	1407
Date :	17 desember 2010

Path Performance on



Diagnostic Bits <= 0 % Error



Date	AVG Samples	Graph	Sample	Valid Samples					Gas speed m/s
				L1	L2	L3	L4	L5	
6. november 2007	13	K1	13	13	13	13	13	13	14,0
1. august 2008	13	K2	13	13	13	13	13	13	0,0
3. november 2009	13	K3	13	13	13	13	13	13	15,7
7. januar 2010	13	K4	13	13	13	13	13	13	17,4
2. februar 2010	13	K5	13	13	13	13	13	13	17,2
2. mars 2010	13	K6	13	13	13	13	13	13	14,6
29. mars 2010	13	K7	13	13	13	13	13	13	15,5
1. mai 2010	13	K8	13	13	13	13	13	13	17,0
6. juli 2010	13	K9	13	13	13	13	13	13	11,2
13. august 2010	13	K10	13	13	13	13	13	13	6,1
2. september 2010	13	K11	13	13	13	13	13	13	13,6
5. oktober 2010	13	K12	13	13	13	13	13	13	14,2
2. november 2010	13	K13	13	13	13	13	13	13	15,9
29. november 2010	13	K14	13	13	13	13	13	13	15,3
		K15							

Diagnostic <= 0					Samples Total
L1	L2	L3	L4	L5	
0	0	0	0	0	127
0	4	0	0	0	1395
0	6	0	0	0	1238
0	4	0	0	0	978
0	7	0	0	0	954
0	7	0	0	0	1026
0	8	0	0	0	1230
0	8	0	0	0	1027
0	12	0	0	0	1506
0	5	0	0	0	843
0	7	0	0	0	892
0	20	0	1	0	1999
0	4	0	0	0	762
0	11	0	0	0	1198

Diagnostic <= 0 % Error					AVG Diag
L1	L2	L3	L4	L5	
0	0	0	0	0	0,0
0	0	0	0	0	0,1
0	0	0	0	0	0,1
0	0	0	0	0	0,1
0	1	0	0	0	0,1
0	1	0	0	0	0,1
0	1	0	0	0	0,1
0	1	0	0	0	0,2
0	1	0	0	0	0,2
0	1	0	0	0	0,1
0	1	0	0	0	0,2
0	1	0	0	0	0,1
0	1	0	0	0	0,2

L1	L2	L3	L4	L5	Performance	Graph
0,00	0,07	0,00	0,00	0,00	%	K1 - K14

L1	L2	L3	L4	L5	Diagnostic <= 0	Graph
0,00	-0,92	0,00	0,00	0,00	%	K1 - K14



Postboks 457, 3002 Drammen, Tlf. 32219200

AGA10 foot Print

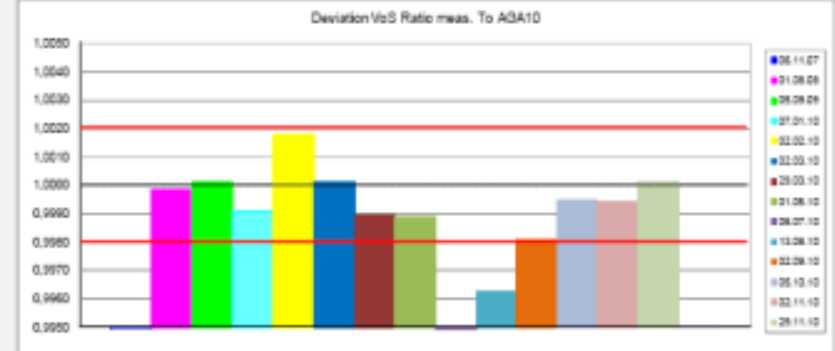
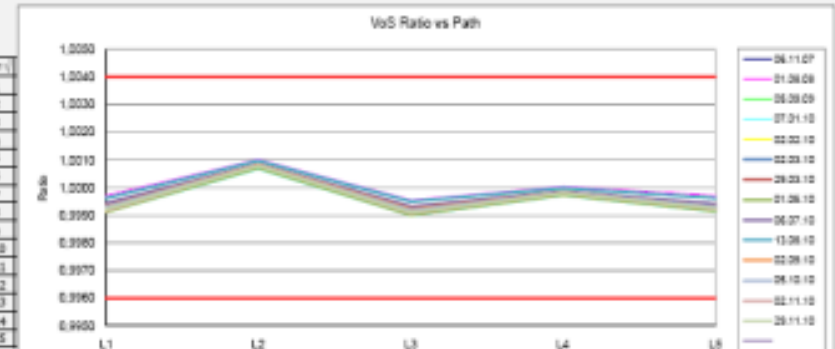
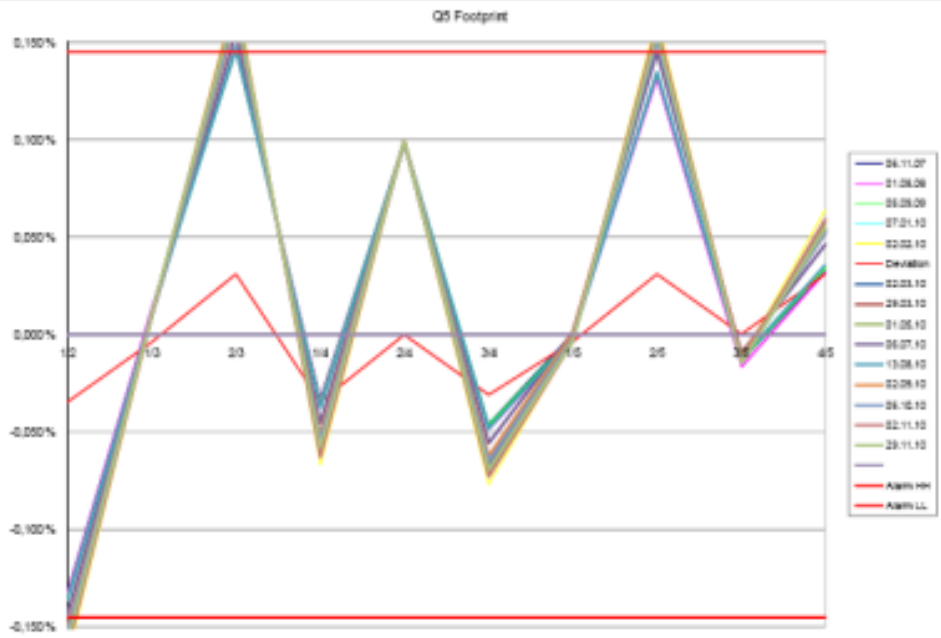
2989 AGA 10 Footprint 2010

Autek AS Q5 Foot Print and VoS Ratio Meas. To AGA10

Version : 1.0
Order : 1407
Date : 17 desember 2010

Footprint	Flow meter sin:	2989
Tag		27FT-5011
Deviation between Selected curves		
K1 K5		

Footprint		Deviation		V.o.S Ratio vs. Path %		V.o.S Ratio meas. AGA10		Graph
Min	Max	Min	Max					
-0.035 %	0.031 %	-0.032 %	0.003 %	#VERDI				K1 - K5



Date	VoS meas.	Graph	V.o.S. L1	V.o.S. L2	V.o.S. L3	V.o.S. L4	V.o.S. L5	V.o.S.	m/s
6. nov. 2007	474.000	K1	473.858	474.461	473.794	474.812	473.857	474.138	12.148
1. aug. 2008	487.800	K3	487.886	488.277	487.587	487.815	487.885	487.800	-0.006
5. sep. 2009	470.312	K3	470.662	471.287	470.607	470.828	470.698	470.842	5.674
7. jan. 2010	514.866	K4	514.449	515.262	514.393	514.760	514.484	514.919	17.385
2. feb. 2010	532.177	K5	531.935	532.820	531.884	532.263	531.954	532.417	17.216
2. mar. 2010	514.887	K6	514.778	515.574	514.722	515.067	514.792	515.163	14.515
20. mar. 2010	509.246	K7	509.045	509.826	508.990	509.324	509.048	509.451	15.532
1. mai. 2010	519.392	K8	519.170	519.969	519.116	519.486	519.188	519.632	17.638
6. jul. 2010	488.316	K9	488.142	488.846	488.092	488.364	488.138	488.427	11.216
13. aug. 2010	472.858	K10	472.649	473.294	472.597	472.826	472.657	472.838	8.089
2. sep. 2010	508.839	K11	508.645	509.412	508.589	508.906	508.643	508.995	13.574
5. okt. 2010	512.961	K12	512.767	513.542	512.702	513.035	512.768	513.130	14.204
2. nov. 2010	528.547	K13	528.316	529.173	528.262	528.646	528.335	528.753	15.960
29. nov. 2010	519.933	K14	519.717	520.535	519.658	520.019	519.734	520.126	15.287
		K15							

Gas test Date	P Bar A	T °C	V.o.S Ratio meas. AGA10	To AGA10	Error %
1. aug. 2008	184.40	32.20	487.887	0.9999	-0.01
3. sep. 2009	187.00	33.20	470.787	1.0001	0.01
14. jan. 2010	206.11	38.90	515.394	0.9997	-0.03
2. feb. 2010	220.74	37.68	531.458	1.0018	0.18
2. mar. 2010	208.90	36.49	515.094	1.0001	0.01
20. mar. 2010	201.52	37.46	509.968	0.9999	-0.11
1. mai. 2010	209.99	38.48	525.198	0.9999	-0.11
6. jul. 2010	181.43	37.45			
13. aug. 2010	189.70	38.24	474.825	0.9982	-0.38
2. sep. 2010	203.94	33.28	509.980	0.9981	-0.19
6. okt. 2010	204.78	34.59	513.392	0.9995	-0.05
5. nov. 2010	218.10	38.49	529.048	0.9994	-0.06
29. nov. 2010	210.51	37.50	520.080	1.0001	0.01

Deviation between Transducers										
1/2	1/3	2/3	3/4	2/4	1/5	2/5	3/5	4/5	Graph	
-0.035 %	-0.064 %	0.031 %	-0.035 %	0.000 %	-0.031 %	-0.034 %	0.031 %	0.000 %	0.031 %	K1 - K5

V o S Ratio vs. Path %					
L1	L2	L3	L4	L5	Graph
-0.03	0.00	-0.03	0.00	-0.03	K1 - K5

AGC Test



Version : 1.0
Order : 1407
Date : 17 desember 2010

Autek AS Q5 AGC Test

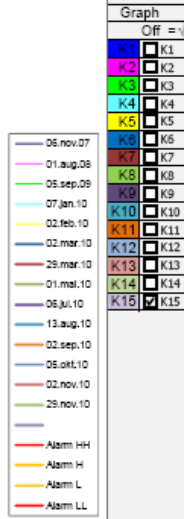
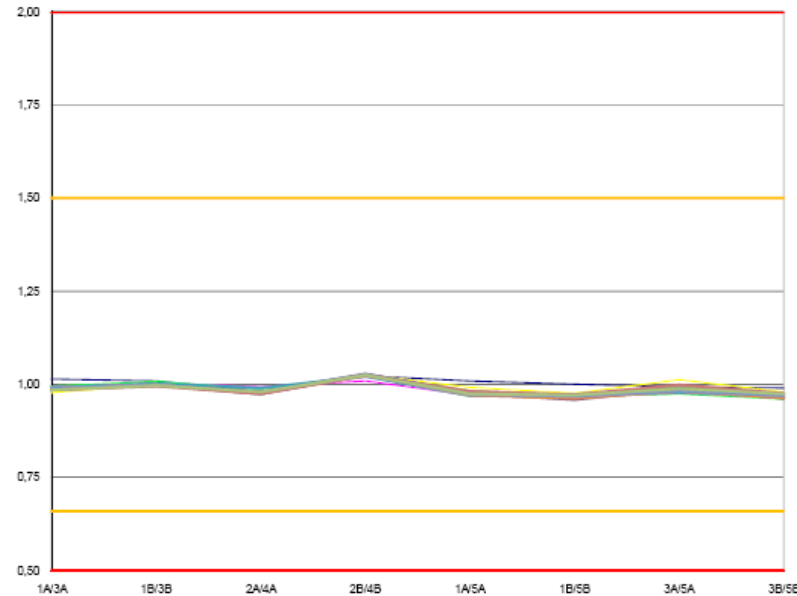
AGC test Flow meter s/n: 2969
Tag 27FT-5011

Deviation between Selected curves
K2 K14

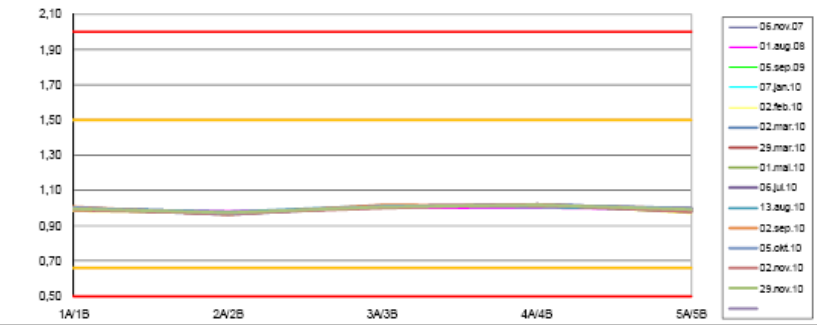
Deviation					
AGC Le. Ratio Comparison		Signal / noise		AGC Le. A vs B Mismatch	
Min	Max	Min	Max	Min	Max
-1,5 %	1,5 %	1,6 %	5,1 %	-1,2 %	1,8 %

Graph K2 - K14

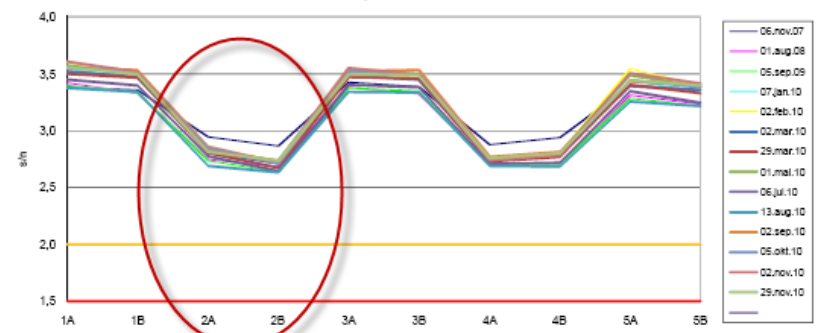
Path AGC Level Ratio Comparison



AGC Level A vs. B Mismatch



Signal to noise ratio



	AVG		AGC Level												AGC Limit													AVG
Date	AGC Level	Graph	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	1A	2A	2B	3A	3B	4A	4B	5A	5B	m/s	AGC Limit					
6. november 2007	15900	K1	15081	15034	17138	17438	14872	14893	17474	17064	14962	15042	37869	35814	37766	36277	37729	35562	37455	36486	37332	35955	12,148	36825				
1. august 2008	16003	K2	14925	15144	18578	18846	16098	15102	18701	18686	15383	15675	38177	35609	41508	40076	38108	34804	40711	39693	38163	35862	-0,006	38261				
5. september 2009	15551	K3	14998	15071	18467	18955	15070	14966	18683	18543	15472	15586	37828	34923	39392	38071	37551	34275	39547	38008	37789	34076	5,874	37236				
7. januar 2010	16006	K4	14344	14490	17910	18446	14565	14459	18283	17941	14665	14650	36545	34020	38963	37262	36722	32828	38698	37534	35350	33359	17,385	36128				
2. februar 2010	15762	K5	14066	14346	17716	18160	14408	14373	18100	17704	14230	14889	36041	32858	36681	35979	36166	32676	37282	35418	34850	33312	17,216	36126				
2. mars 2010	16049	K6	14441	14473	17931	18466	14616	14479	18363	18039	14806	14873	36699	34390	38278	37733	36970	32979	38169	38211	34429	33436	14,515	36129				
29. mars 2010	16121	K7	14499	14492	17984	18609	14650	14499	18431	18135	14865	15049	36388	34288	38303	36686	36932	34123	38419	37897	36009	34271	15,532	36331				
1. mai 2010	15913	K8	14237	14360	17833	18356	14455	14364	18253	17928	14524	14816	36667	34246	38390	37985	37001	33874	38401	37624	36081	34186	17,038	36446				
6. juli 2010	16397	K9	14757	14754	18231	18918	14952	14797	18632	18403	15130	15395	37184	34129	39308	37782	37332	33745	39288	37518	36524	34225	11,218	36703				
13. august 2010	16699	K10	15131	15115	18608	19062	16273	15084	18787	18663	15629	15633	38599	35993	37630	38486	38234	36255	39568	37963	37964	35648	6,069	37535				
2. september 2010	15876	K11	14314	14214	17669	18352	14464	14227	18126	17875	14753	14770	36347	33937	38734	36666	37122	34080	37688	37950	36154	34673	13,574	36335				
5. oktober 2010	15676	K12	14292	14239	17714	18337	14423	14269	18186	17886	14703	14733	36622	33139	38396	36302	36931	32834	37072	36446	35929	32822	14,204	36549				
2. november 2010	15815	K13	14096	14258	17752	18280	14327	14323	18225	17870	14359	14665	36435	33596	37175	36757	36901	33240	36772	36104	34564	33808	15,900	36535				
29. november 2010	15931	K14	14287	14341	17850	18331	14509	14392	18241	17901	14678	14779	36564	33846	37699	37788	36001	34108	38405	37583	35728	34513	15,287	36223				
		K15																										

1A/1B	2A/2B	3A/3B	4A/4B	5A/5B	AGC Level A vs B Mismatch
1,1	-1,2	0,9	1,8	0,6	%

Graph K2 - K14

1A/3A	1B/3B	2A/4A	2B/4B	1A/5A	1B/5B	3A/5A	3B/5B	AGC Level Ratio Comparison
-0,4	-0,6	-1,5	1,5	0,3	-0,2	0,7	0,4	%

Graph K2 - K14

1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	Signal to Noise ratio
4,0	5,1	2,6	1,9	3,3	4,9	1,6	3,7	4,0	5,1	%

Graph K2 - K14

Flowtest

Version: 1.01

Order :

Date :

Autek AS Q5 Flow Test

AGC test Flow meter s/n: 2969
Tag 27FT-5011

Deviation between Selected curves
K3 K14

Deviation							
Path Velocity Ratios		Swirl		Profilefactor		Asymmetry	
Min	Max	Min	Max	Min	Max	Min	Max
-0,26 %	0,18 %	-0,14 %	-0,001 %	0,0008 %	-0,09 %	0,06 %	

Graph

Graph

Off = 1

K1

K2

K3

K4

K5

K6

K7

K8

K9

K10

K11

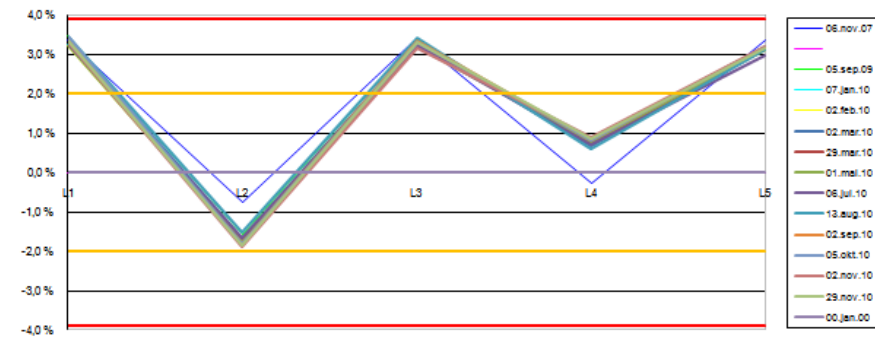
K12

K13

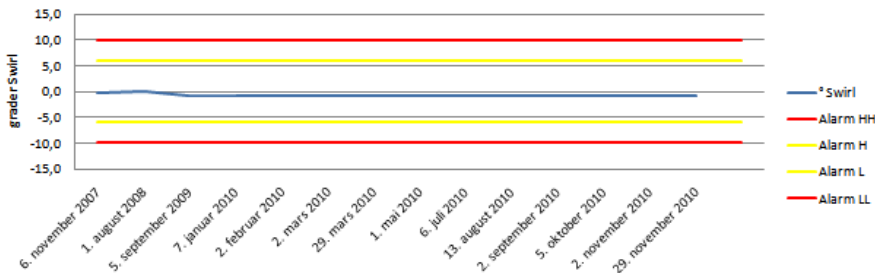
K14

K15

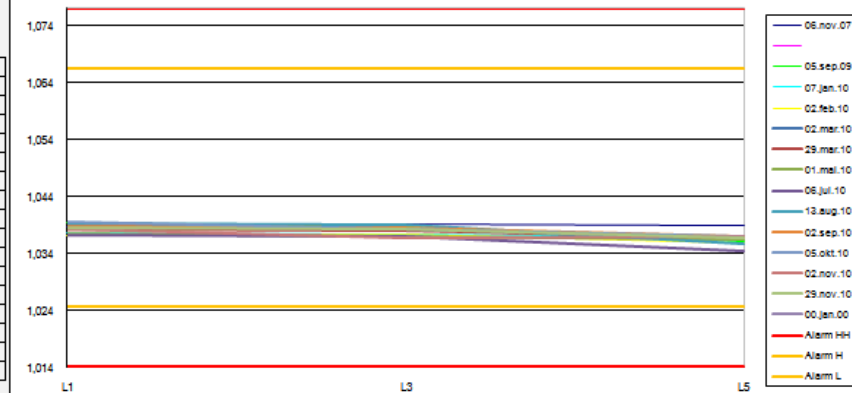
Path Velocity Ratios



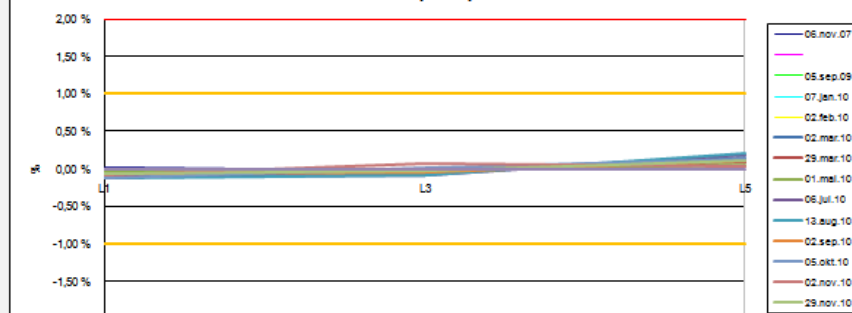
° Swirl



Profilefactor

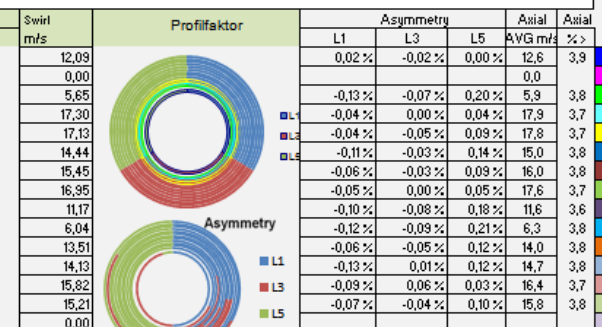


Asymmetry



Date	AVG Flow / gas speed	Graph	Velocity / path	Gas speed
			L1 L2 L3 L4 L5	m/s
6. november 2007	12,37	K1	12,55 12,06 12,56 12,12 12,56	12,15
1. august 2008	-0,02	K2	-0,03 -0,01 0,00 0,00 -0,04	-0,01
5. september 2009	5,78	K3	5,87 5,58 5,87 5,71 5,85	5,67
7. januar 2010	17,69	K4	17,95 17,08 17,94 17,52 17,94	17,39
2. februar 2010	17,51	K5	17,77 16,91 17,77 17,35 17,75	17,22
2. mars 2010	14,77	K6	15,01 14,27 15,00 14,61 14,97	14,52
29. mars 2010	15,81	K7	16,05 15,26 16,04 15,65 16,02	15,53
1. mai 2010	17,33	K8	17,59 16,74 17,58 17,17 17,57	17,04
6. juli 2010	11,41	K9	11,58 11,03 11,58 11,30 11,55	11,22
13. august 2010	6,18	K10	6,28 5,98 6,28 6,11 6,26	6,07
2. september 2010	13,82	K11	14,03 13,33 14,03 13,69 14,01	13,57
5. oktober 2010	14,46	K12	14,69 13,94 14,67 14,32 14,66	14,20
2. november 2010	16,18	K13	16,43 15,60 16,40 16,04 16,41	15,90
29. november 2010	15,56	K14	15,80 15,00 15,79 15,42 15,77	15,29

Swirl	max	min	Profilefactor	Swirl
Swirl			L1 L3 L5	m/s
-0,1	1,00	-1,0	1,039 1,039 1,039	12,09
0,0	0,0	0,0		0,00
-0,8	0,0	-2,0	1,039 1,039 1,036	5,65
-0,9	0,0	-2,0	1,038 1,037 1,037	17,30
-0,9	0,0	-2,0	1,037 1,037 1,036	17,13
-0,8	1,0	-2,0	1,039 1,038 1,036	14,44
-0,8	0,0	-2,0	1,038 1,038 1,037	15,45
-0,9	0,0	-2,0	1,037 1,037 1,036	16,95
-0,8	0,0	-2,0	1,037 1,037 1,034	11,17
-0,7	0,0	-2,0	1,039 1,039 1,036	6,04
-0,9	0,0	-2,0	1,039 1,039 1,037	13,51
-0,9	0,0	-2,0	1,040 1,038 1,037	14,13
-0,9	0,0	-2,0	1,038 1,037 1,037	15,82
-0,9	0,0	-2,0	1,039 1,038 1,037	15,21



L1	L2	L3	L4	L5	Path Velocity Ratios
-0,119 %	-0,260 %	-0,096 %	0,175 %	0,037 %	%

° Swirl
-0,14

L1	L2	L3	Profilefactor
-0,0008	-0,0005	0,0008	%

L1	L3	L5	Asymmetry	Graph
0,06 %	0,04 %	-0,09 %	%	K3 - K14

AUTEK

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