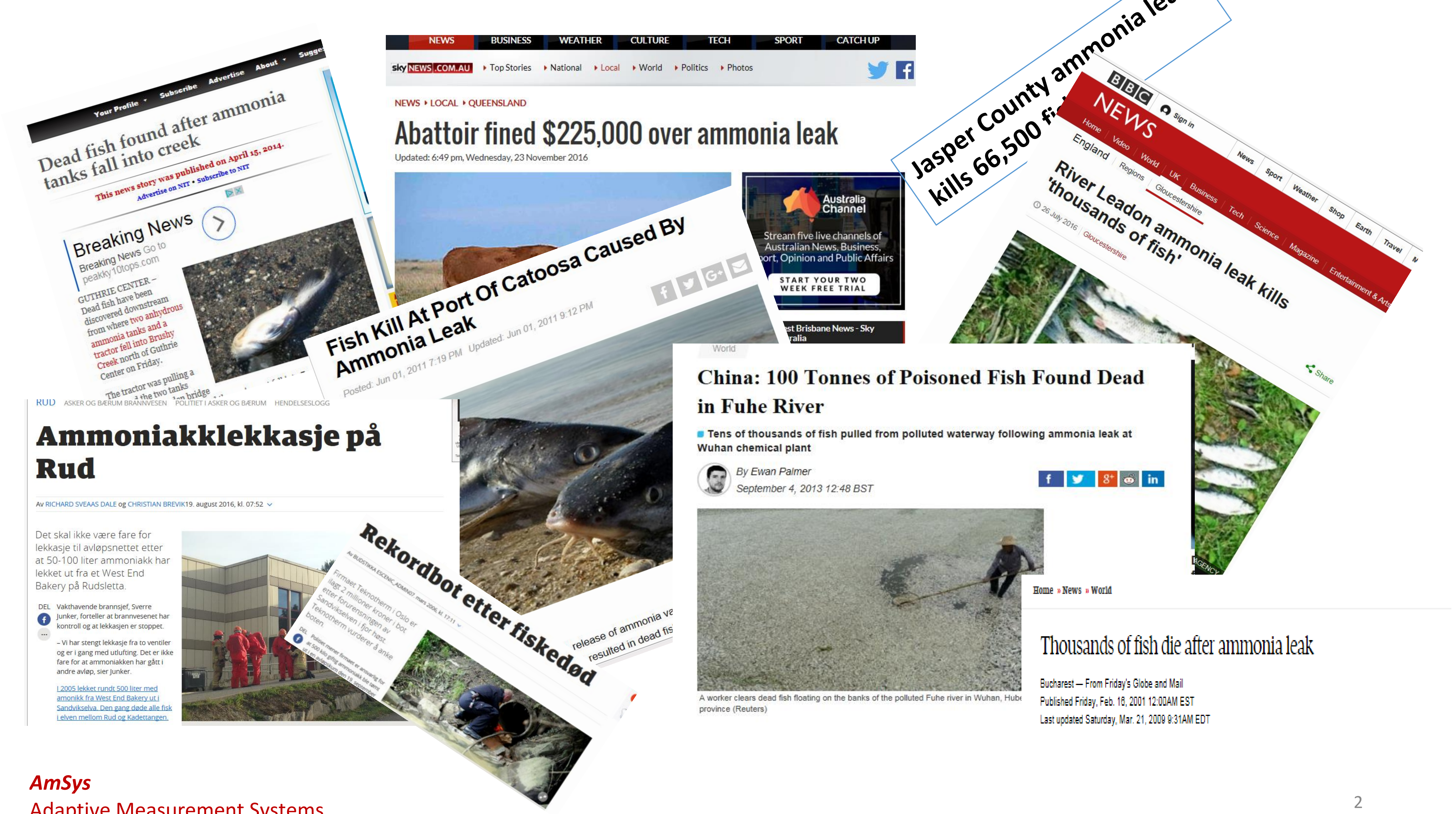
AmSys Leak Detection Unit (*amsys.no*)

Main features


Dead fish found after ammonia tanks fall into creek
This news story was published on April 15, 2014.
Breaking News
GUTHRIE CENTER – Dead fish have been discovered downstream from where two anhydrous ammonia tanks and a tractor fell into Brushy Creek north of Guthrie Center on Friday.
NEWS BUSINESS WEATHER CULTURE TECH SPORT CATCH UP
NEWS › LOCAL › QUEENSLAND
Abattoir fined $225,000 over ammonia leak
Updated: 6:49 pm, Wednesday, 23 November 2016
Australia Channel
Stream five live channels of Australian News, Business, Sport, Opinion and Public Affairs
START YOUR TWO WEEK FREE TRIAL
Fish Kill At Port Of Catoosa Caused By Ammonia Leak
Posted: Jun 01, 2011 7:19 PM Updated: Jun 01, 2011 9:12 PM
Jasper County ammonia leak kills 66,500 fish
BBC NEWS
River Leadon ammonia leak kills 'thousands of fish'
26 July 2016 Gloucestershire
Ammoniakklekkasje på Rud
Av RICHARD SVEAAS DALE og CHRISTIAN BREVIK 19. august 2016, kl. 07:52
Det skal ikke være fare for lekkasje til avløpsnettet etter at 50-100 liter ammoniakk har lekket ut fra et West End Bakery på Rudsletta.
Vakthavende brannsjef, Sverre Junker, forteller at brannvesenet har kontroll og at lekkasjen er stoppet.
– Vi har stengt lekkasje fra to ventiler og er i gang med utlufting. Det er ikke fare for at ammoniakken har gått i andre avløp, sier Junker.
I 2005 lekket rundt 500 liter med amonikk fra West End Bakery ut i Sandvikselva. Den gang døde alle fisk i elven mellom Rud og Kadettangen.
Rekordbot etter fiskedød
China: 100 Tonnes of Poisoned Fish Found Dead in Fuhe River
Tens of thousands of fish pulled from polluted waterway following ammonia leak at Wuhan chemical plant
By Ewan Palmer
September 4, 2013 12:48 BST
A worker clears dead fish floating on the banks of the polluted Fuhe river in Wuhan, Hubei province (Reuters)
Home » News » World
Thousands of fish die after ammonia leak
Bucharest — From Friday's Globe and Mail
Published Friday, Feb. 16, 2001 12:00AM EST
Last updated Saturday, Mar. 21, 2009 9:31AM EDT

The *AmSys* solution for leak detection:

- Can be used in all systems where heat exchanger leakage may be detected as change in conductivity. Typical examples are:
- ammonia into freshwater, seawater, spillwater etc.
- ammonia into cooling and heating circuits
- Seawater into freshwater

Detecting devices and warning systems are required according to EN 378-3.

- According to EN 378-3 section 8, heating/cooling systems with more than 500 kg ammonia (R717) ammonia, detection must be installed the cooling / heating secondary circuits.

AmSys background:

- Based on experience from a heat exchanger leakage in 2012 into a district heating system in Norway (5MW heat pump).

Deres prøvenavn	Varmepumpesentral Fjernvarmevann					
Labnummer	N00140665					
Analyse	**Resultater**	**Usikkerhet (±)**	**Enhet**	**Metode**	**Utført**	**Sign**
Ammonium (NH4)	**78.7**	15.7	mg/l	1	1	MOSA
pH	**10.1**	0.08		2	1	MOSA

- Installed detector (electrolytic) did not give any warnings/alarms of the leakage.
- After this incidence, a lot of effort and money were spent on finding better and more reliable solutions.
- The *AmSys* solution is the result from this experience and 5 years of further development.

Unmatched sensitivity and stability!

- High accuracy process model increase sensitivity typically by factor 20-100 compared to alternative systems.
- Virtually no need for sensor maintenance.
- Adaptive functionality compensates for sensor fouling, water quality drift etc. and ensures «lifetime» sensitivity in most fluids with virtually no maintenance or additional cost.
- Preliminary tests on ammonia in seawater indicates 5-20 ppm as practical detection limit, depending on seawater salinity. This is well below usual recommended limits!

Water type:	Normal conductivity	Typical sensitivity to NH3, ammonia	Practical detection limit (alarm limit)
«Scandinavian» tap water (surface)	50-100 micS/cm @ 25 °C	0.1-0.2 ppm	0.5-1 ppm
«European» tap water (ground water)	200-300 micS/cm @ 25 °C	0.4-0.8 ppm	2-4 ppm
District Heating systems (according to recomendations)	50-80 micS/cm @ 25 °C	0.1-0.2 ppm	0.5-1 ppm
Demineralized boiler feed water steam condensate	0.5-1 micS/cm @ 25 °C	<0.01 ppm	<0.1 ppm

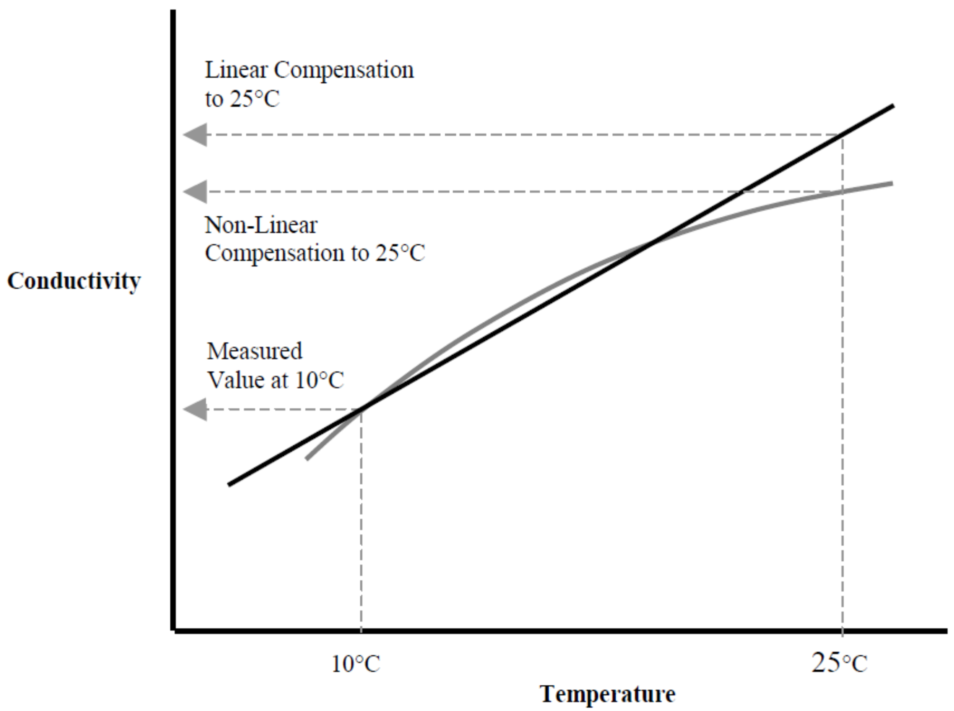
Strong improvement in sensitivity to any substance that gives conductivity change, like seawater, oil, etc.

Advantages with the *AmSys* solution:

- Early detection of defective heat exchangers saves environment and money spent on downtime and troubleshooting.
- Virtually maintenance free. Currently available systems (electrolytic, PH) require a lot of maintenance and have a number of limitations in terms of sensitivity and response time (limited by sampling interval) as well as pressure and temperature limitations.
- Advanced adaptive process model based on statistical and Kalman filter techniques gives unmatched performance and sensitivity that is maintained over time.

Temperature compensation is important!

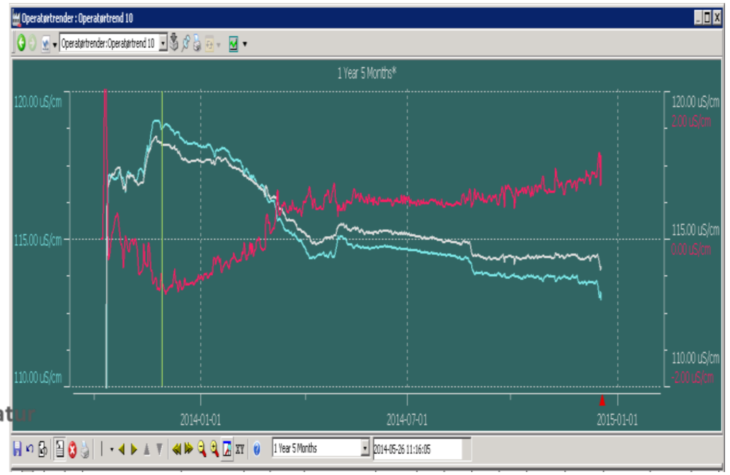
- **Traditionally a 2% fixed value is used for compensation**
- **BUT: Temperature compensation factor varies with fluid and sensor characteristics.**
- **Nonlinear compensation optimal at temperature variation > 10-15 ^{o}C.**
- **Typical cause for change:**
  - **Water; seasonal changes og chemical treatment**
  - **Sensor; fouling or wear**
- **One of the features in the AmSys system is automatic/adaptive determination of linear and nonlinear compensation factors.**
- **Factors are automatically updated if fluid or sensor changes (eg. by fouling)**



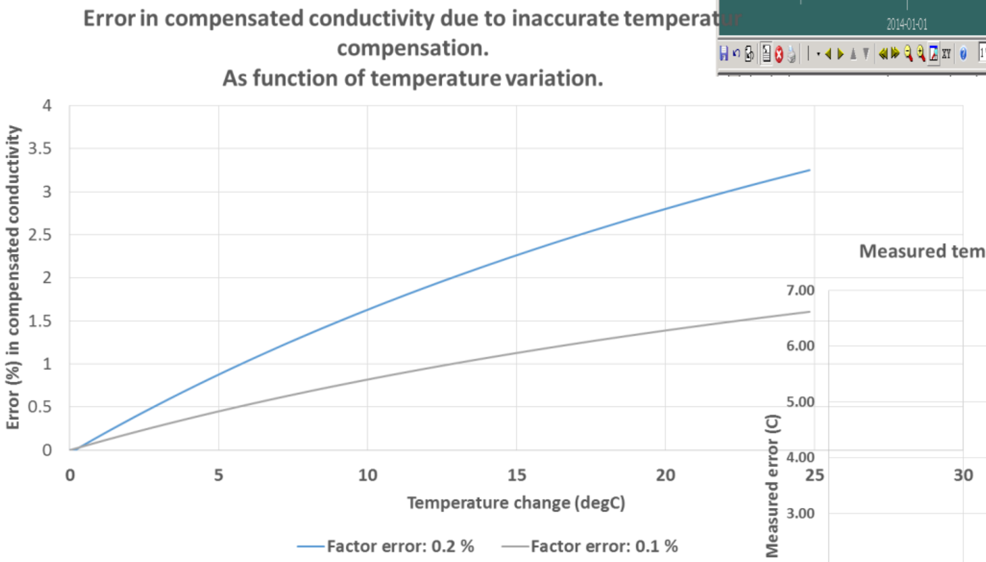
Graph 2: Representation of Linear Compensation & Non-Linear Compensation

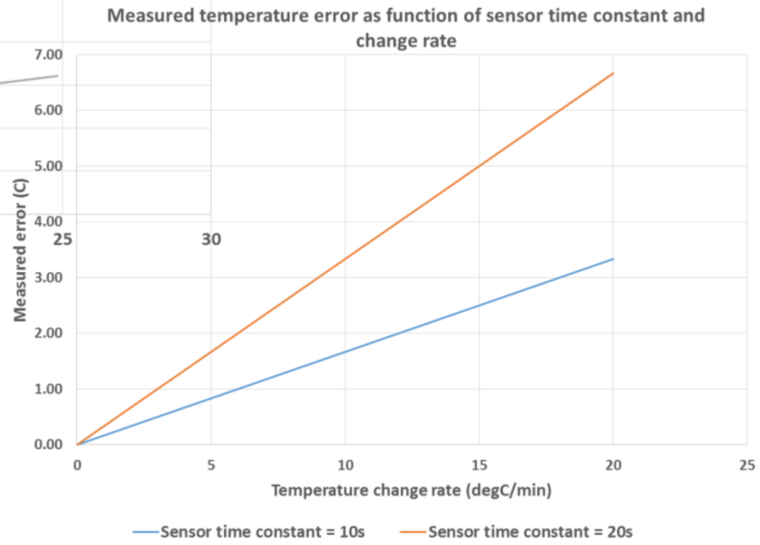
From Reagecon

Adaptive function gives unmatched signal to ”noise” (error) ratio by:

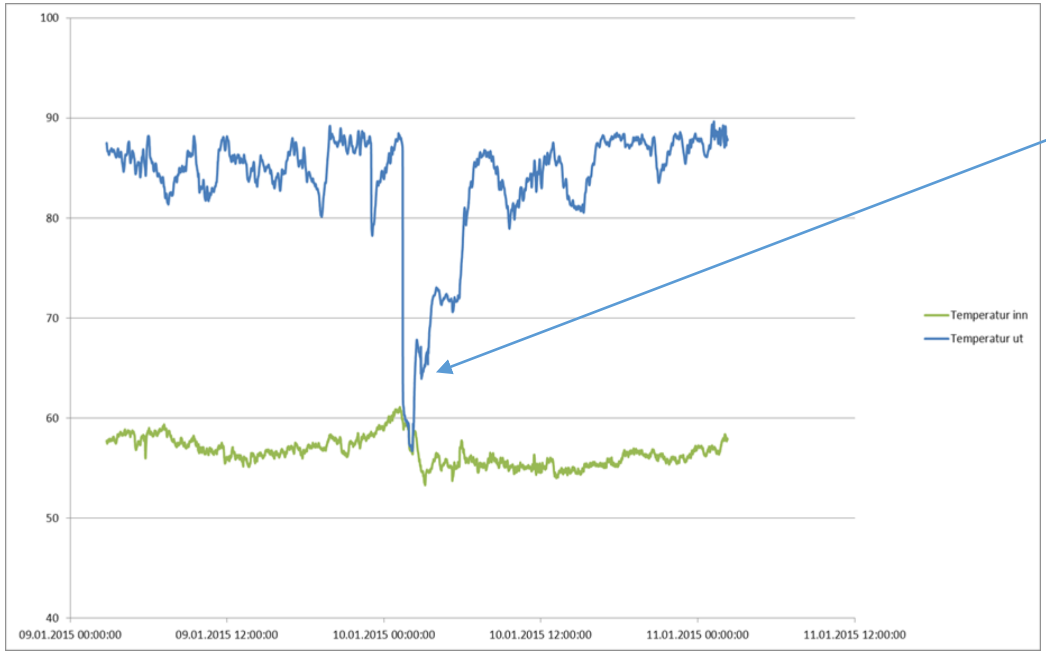


- *Compensation of deviation and drift* due to sensor difference and slow changes in water quality, sensor wear, sensor position, fouling etc.
- *Optimal linear/nonlinear temperature compensation*
- *Transport time error is minimized/eliminated.*
- *Dynamic errors due to heat transfer, dead time etc. minimized/eliminated.*
- *Compensation of conductivity changes.*



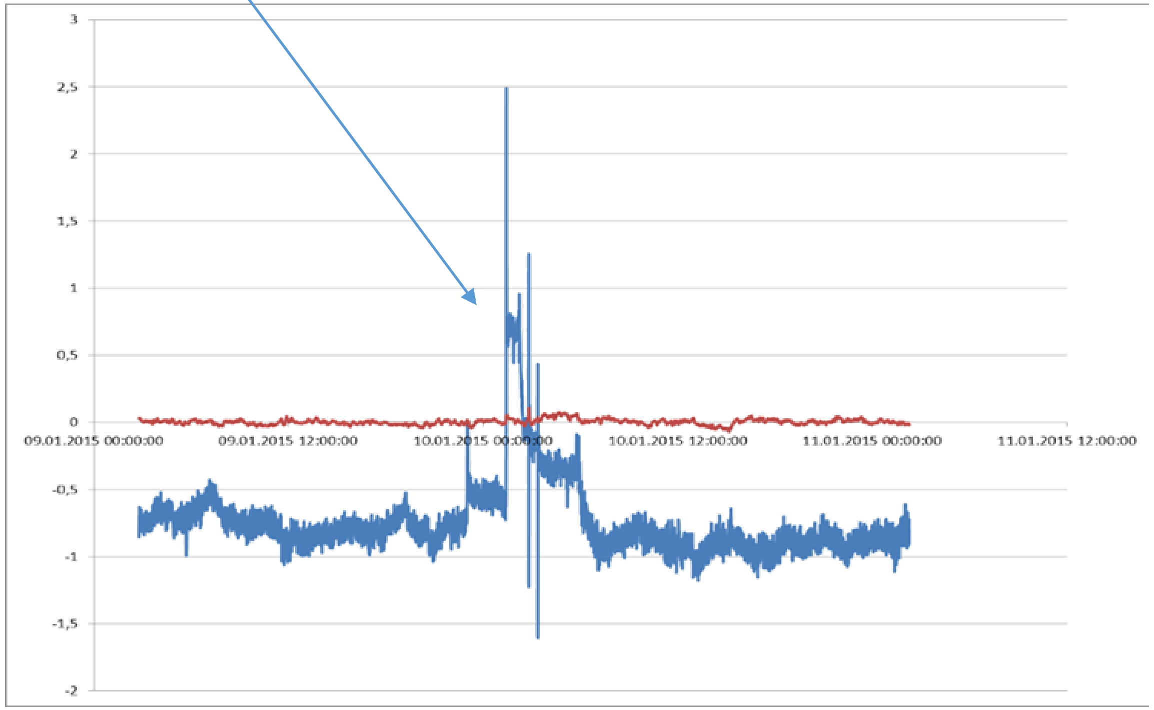


Alarm limits may be significantly reduced :



Short stop of heat pump

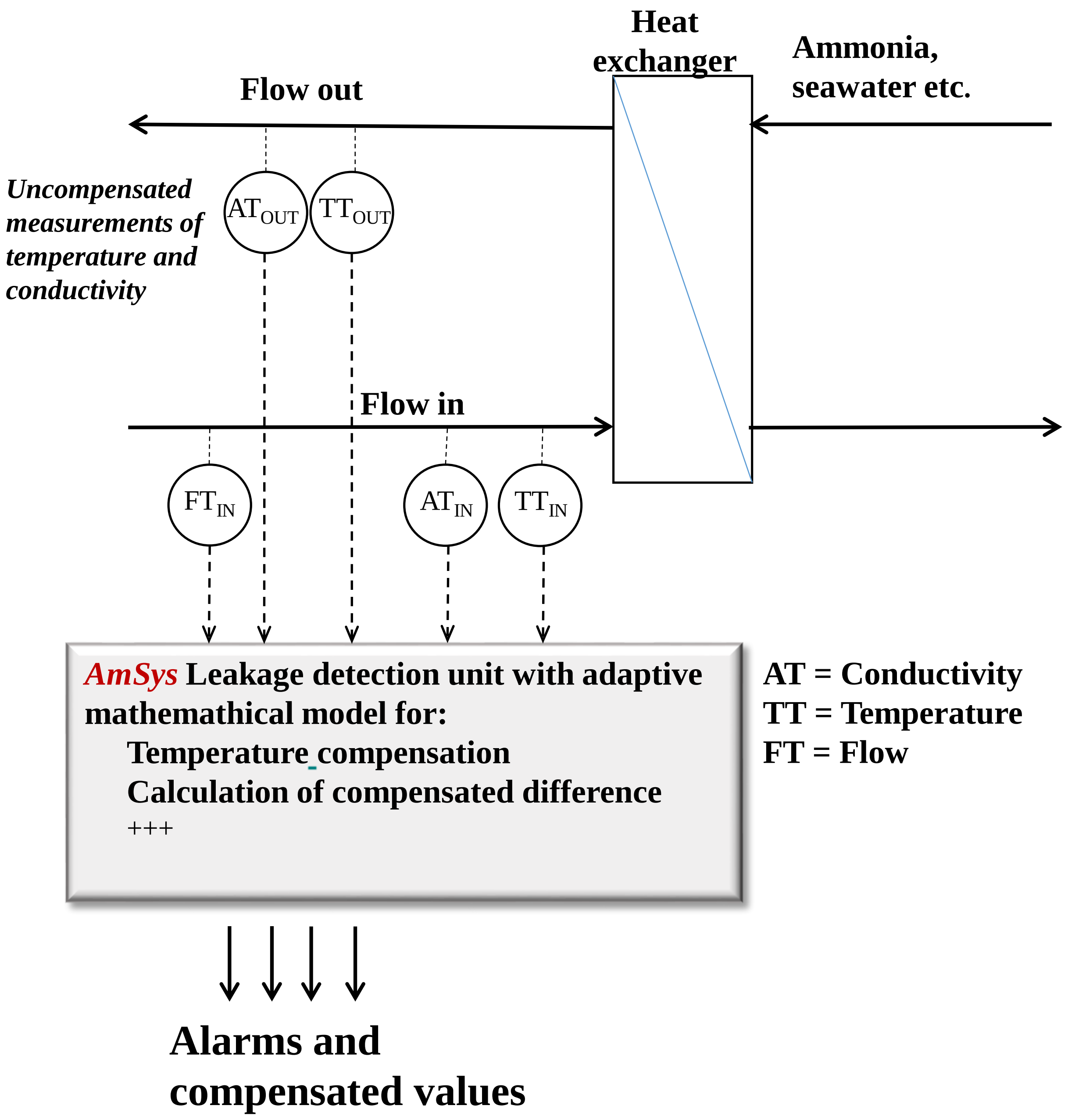
Temperature IN/OUT during stop and restart



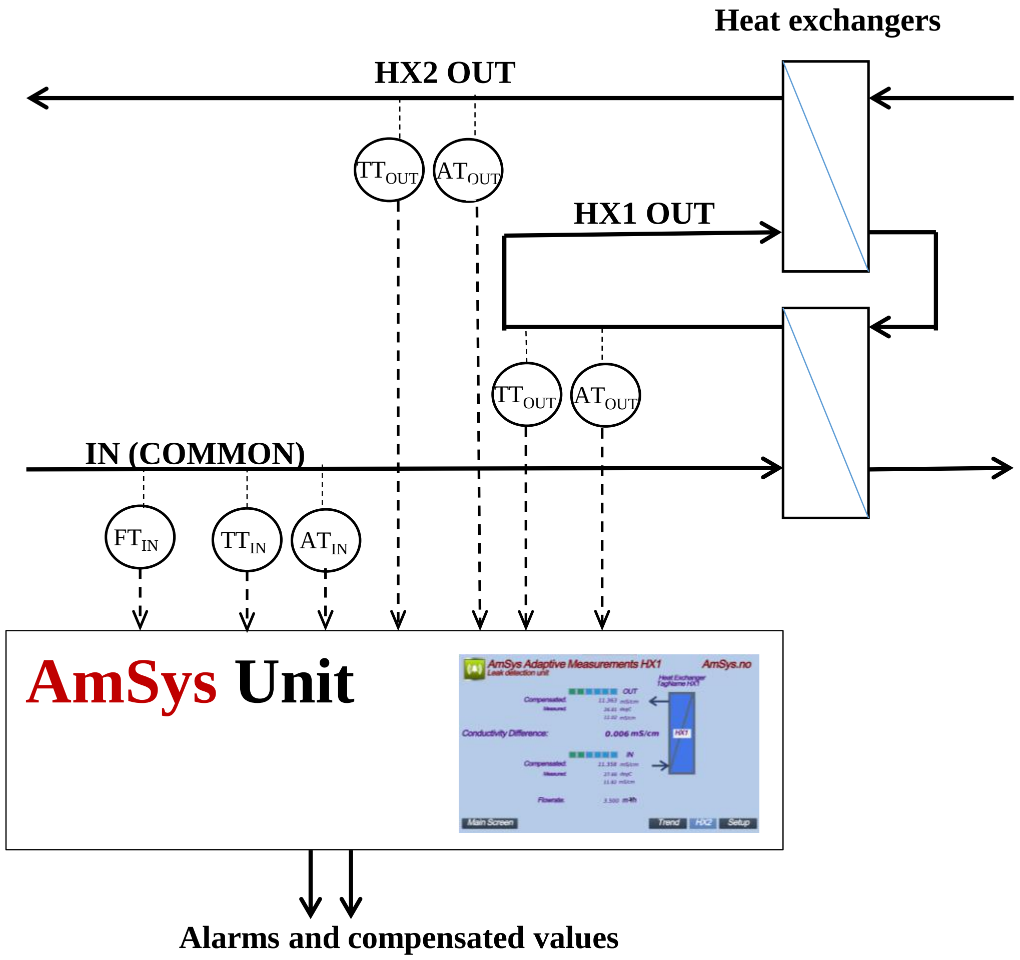
*Measured conductivity difference: **AmSys (red)** vs. traditionally compensated conductivity measurements (blue)*

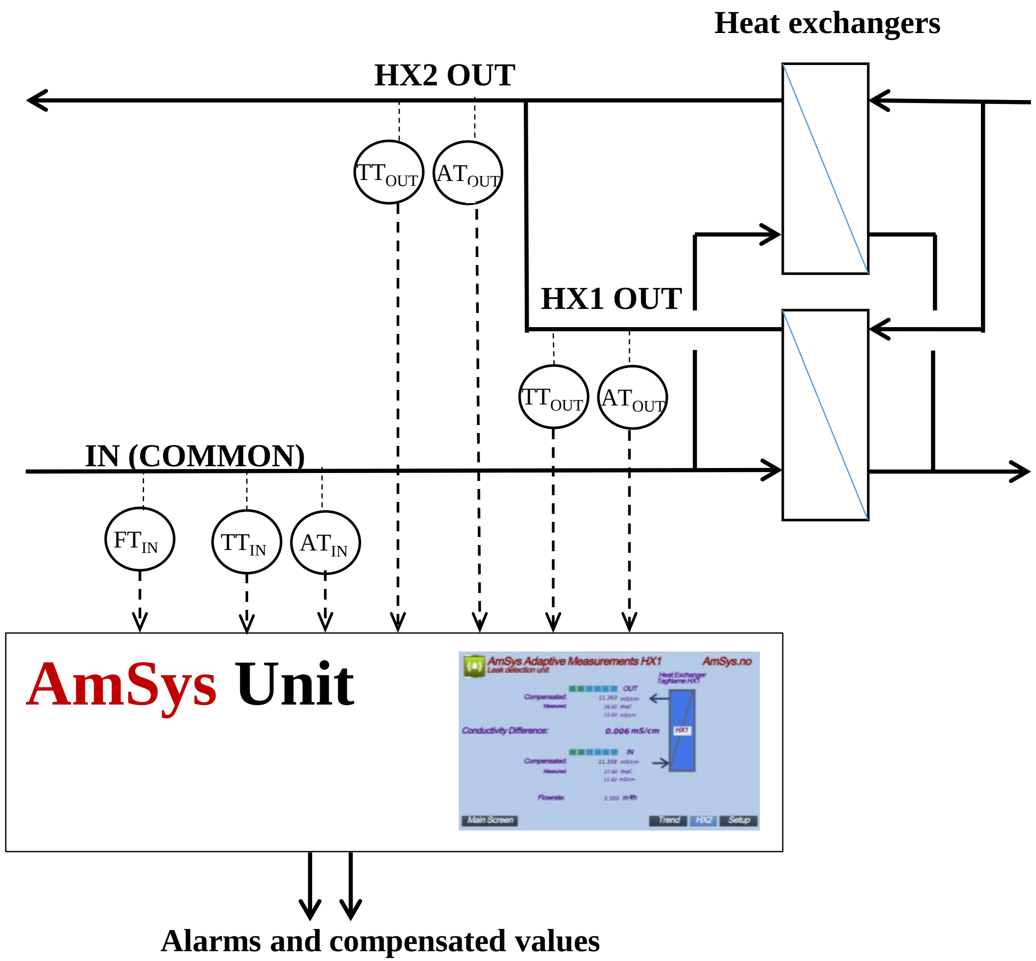
AmSys
Adaptive Measurement Systems

System drawing:



Series and parallell systems



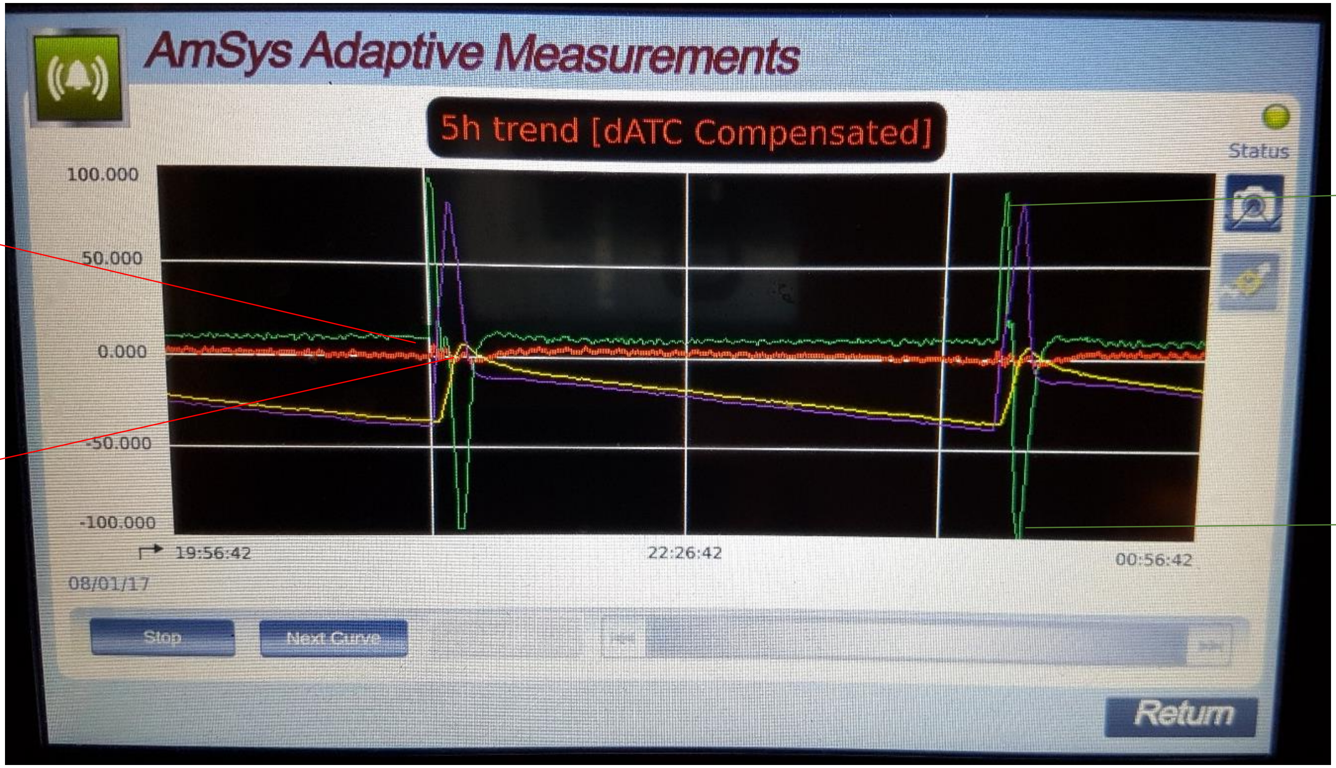


Amsys vs standard temperature compensation (2.2% linear)

4.5 µS/cm

Amsys model (red) (difference= 8.2 µS/cm)

-3.7 µS/cm



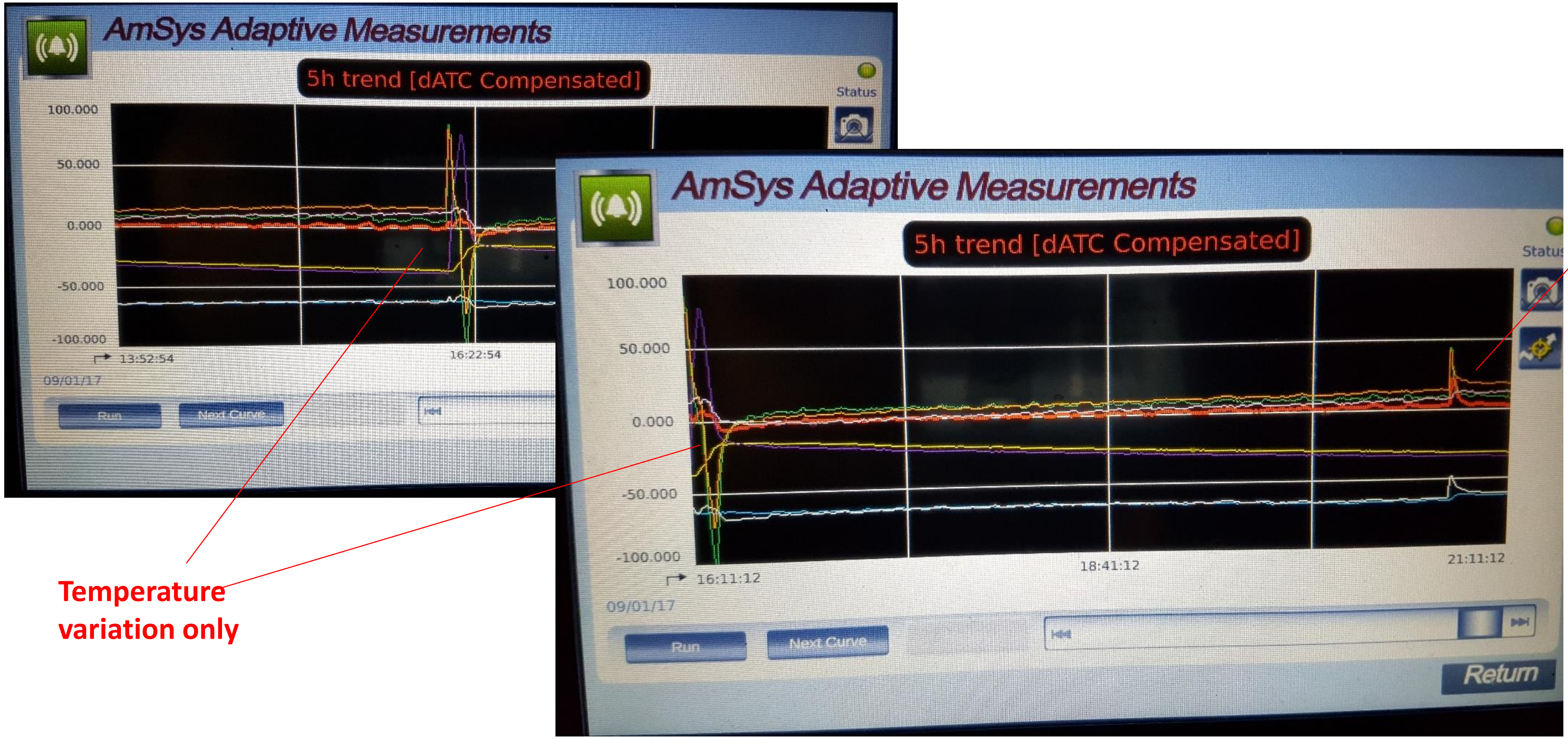
90 µS/cm

«Standard» difference calculation (green) (difference= 197 µS/cm)

-107 µS/cm

Value	Trend scale	Unit
Temperature IN	0-20	ºC
Temperature OUT	0-20	ºC
Standard compensated contuctivity (2.2% linear compensation)	(-100) – 100	µS/cm
Compensated conductivity from **Amsys** model (red)	(-100) – 100	µS/cm

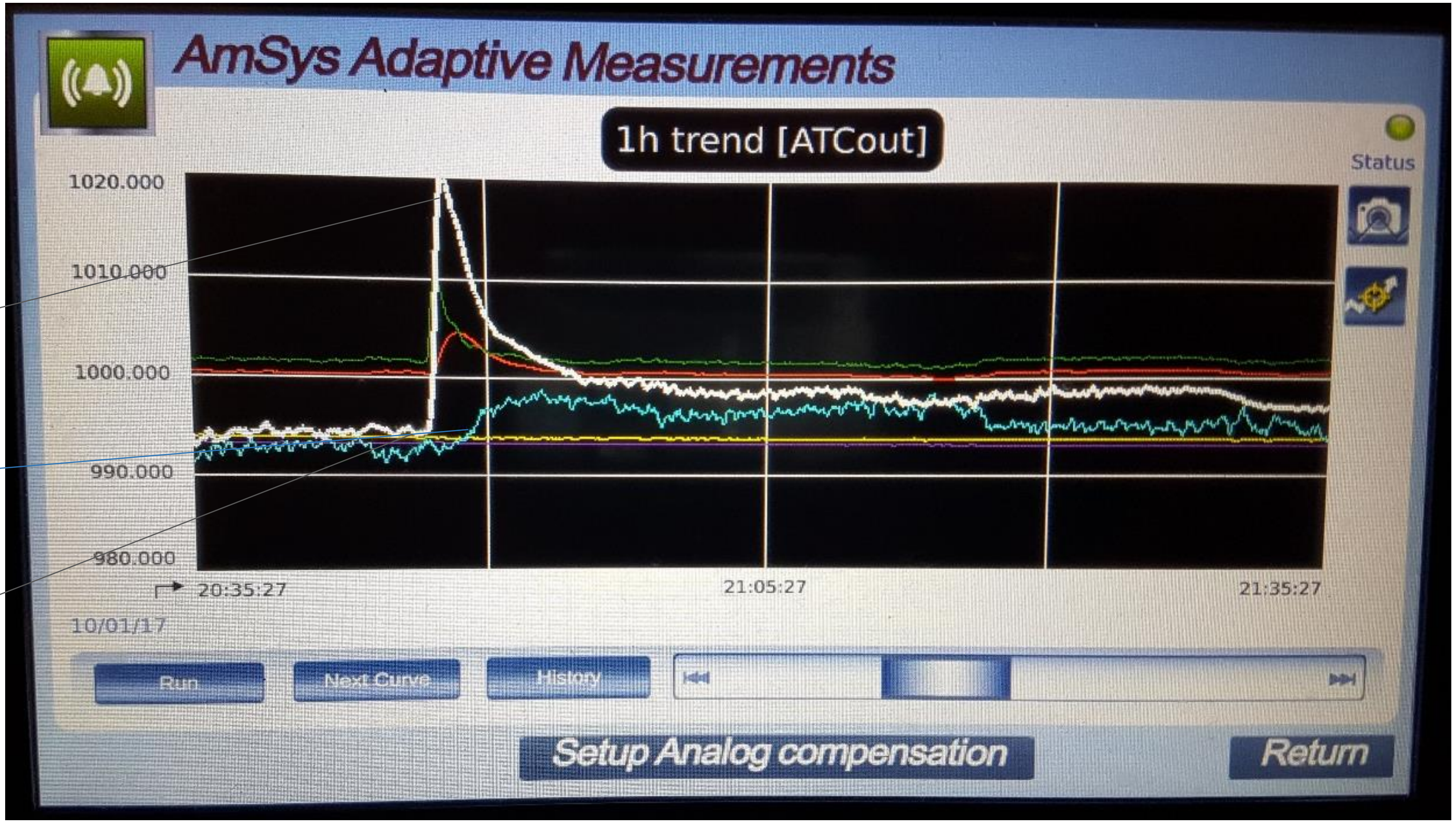
Ammonia: 2.9ppm into 1000 µS/cm water, 0.9ppm when dilluted into total system (small test system)



ammonia added

Temperature variation only

1h trend



«OUT» sensor
2.9ppm
1020 µS/cm

«IN» sensor reacts after some time due to recirculating water in small system

994 µS/cm

Value	Trend scale	Unit
«OUT sensor» compensated conductivity from Amsys model (white)	980-1020	µS/cm
«IN sensor» compensated conductivity from Amsys model	980-1020	µS/cm
Standard compensated contuctivity (2.2% linear compensation)	(-100) – 100	µS/cm
Compensated conductivity from **Amsys** model (red)	(-100) – 100	µS/cm

AmSys model vs simple difference calculation

Temperature variations only:

Simple difference calculalation: *197 μS/cm*

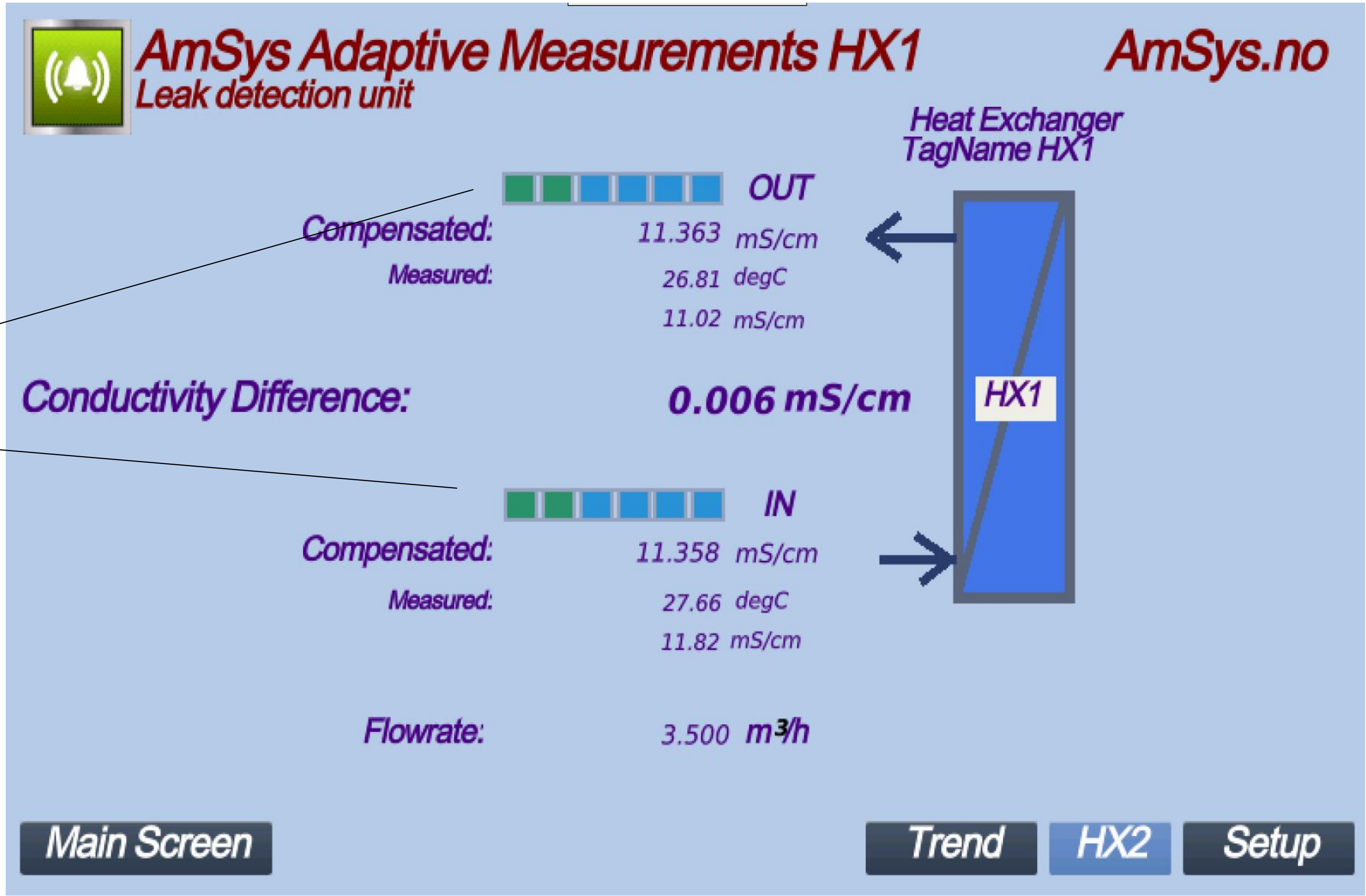
***AmSys* model:** *8.2 μS/cm*

Adding ammonia:

Adding 2.9ppm ammonia into same water (1000 μS/cm) : *24 μS/cm*

AmSys main screen

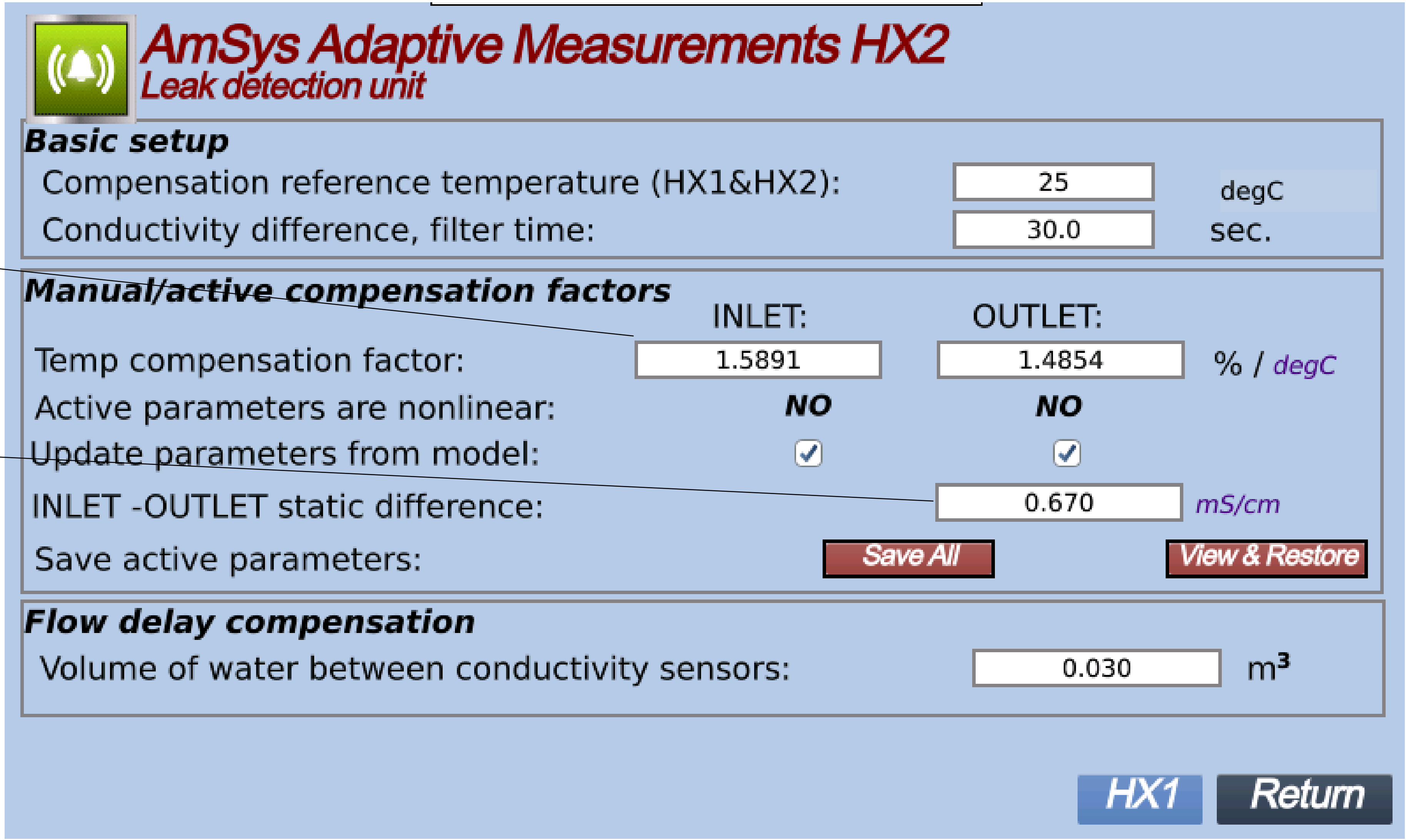
Model quality indicators



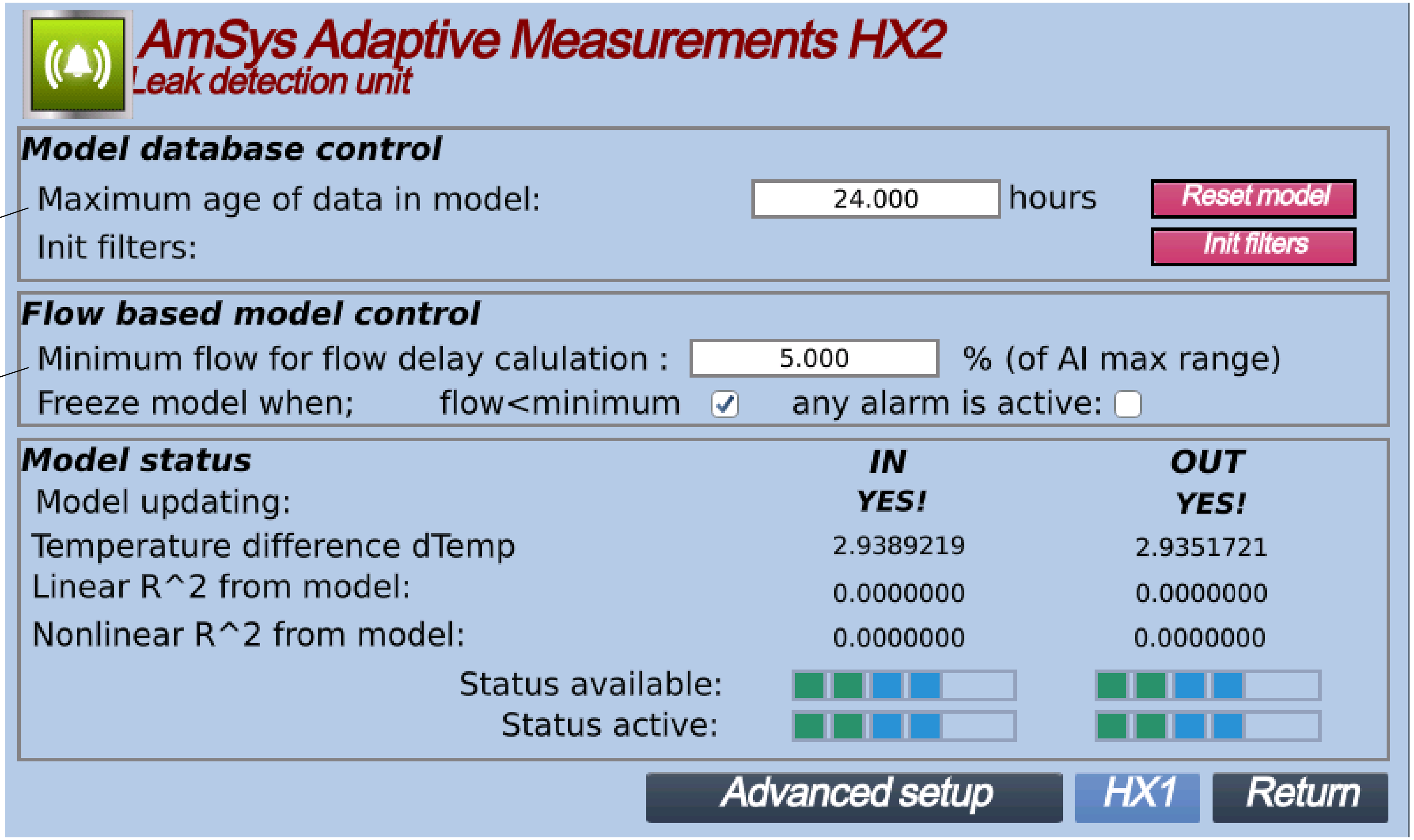
Basic setup:

Active temperature compensation values from model

Static error/difference between sensors from model



Model setup



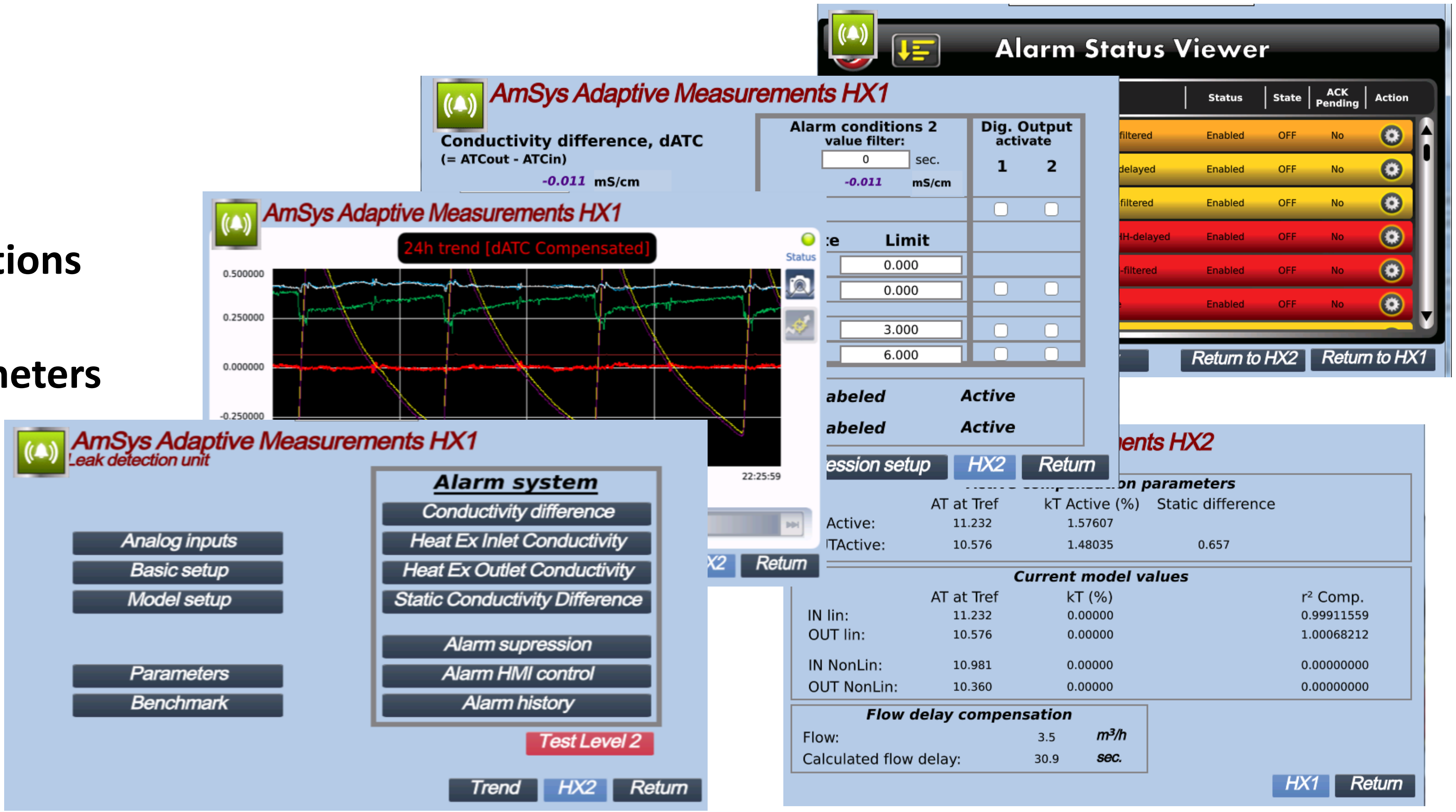
Time horizion. Maximum age of values used for adaptiv functionality.

Parameters to control model quality and use

Model status

Other features in the *AmSys* system:

- **Trend tool**
- **Alarm system**
- **Benchmark calculations**
- **Save/restore parameters**
- **Modbus TCP/RTU**
- **+++**

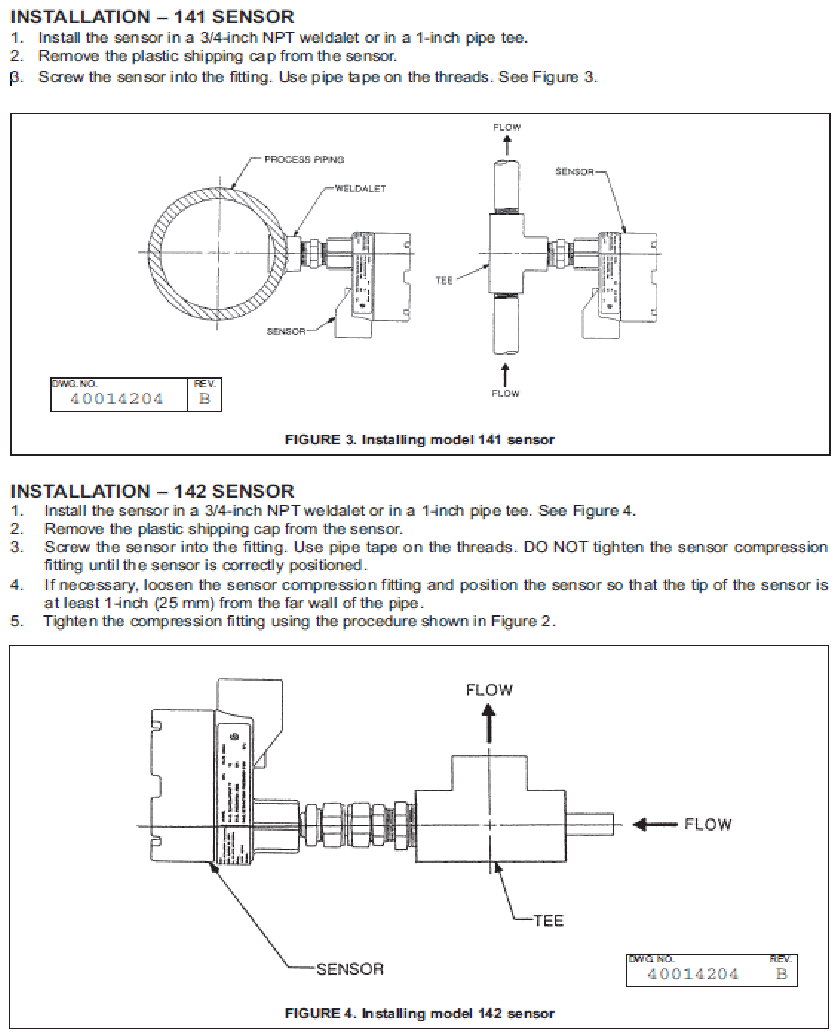


Sensor mounting on pipe

- **Mount on side of horizontal pipe to avoid trapped air and sludge**

- **Sensor mounting through ball valve possible.**

- **Option: Retractable sensor allow changing sensor directly mounted on pipe with up to 3-4 bar pressure. (PN16 when in operation)**



INSTALLATION – 141 SENSOR

1. Install the sensor in a 3/4-inch NPT weldalet or in a 1-inch pipe tee.
2. Remove the plastic shipping cap from the sensor.
3. Screw the sensor into the fitting. Use pipe tape on the threads. See Figure 3.

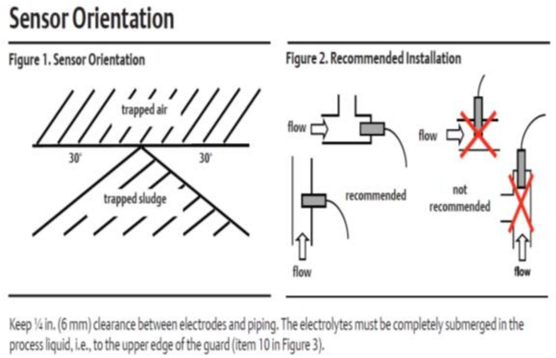
FIGURE 3. Installing model 141 sensor

INSTALLATION – 142 SENSOR

1. Install the sensor in a 3/4-inch NPT weldalet or in a 1-inch pipe tee. See Figure 4.
2. Remove the plastic shipping cap from the sensor.
3. Screw the sensor into the fitting. Use pipe tape on the threads. DO NOT tighten the sensor compression fitting until the sensor is correctly positioned.
4. If necessary, loosen the sensor compression fitting and position the sensor so that the tip of the sensor is at least 1-inch (25 mm) from the far wall of the pipe.
5. Tighten the compression fitting using the procedure shown in Figure 2.

FIGURE 4. Installing model 142 sensor

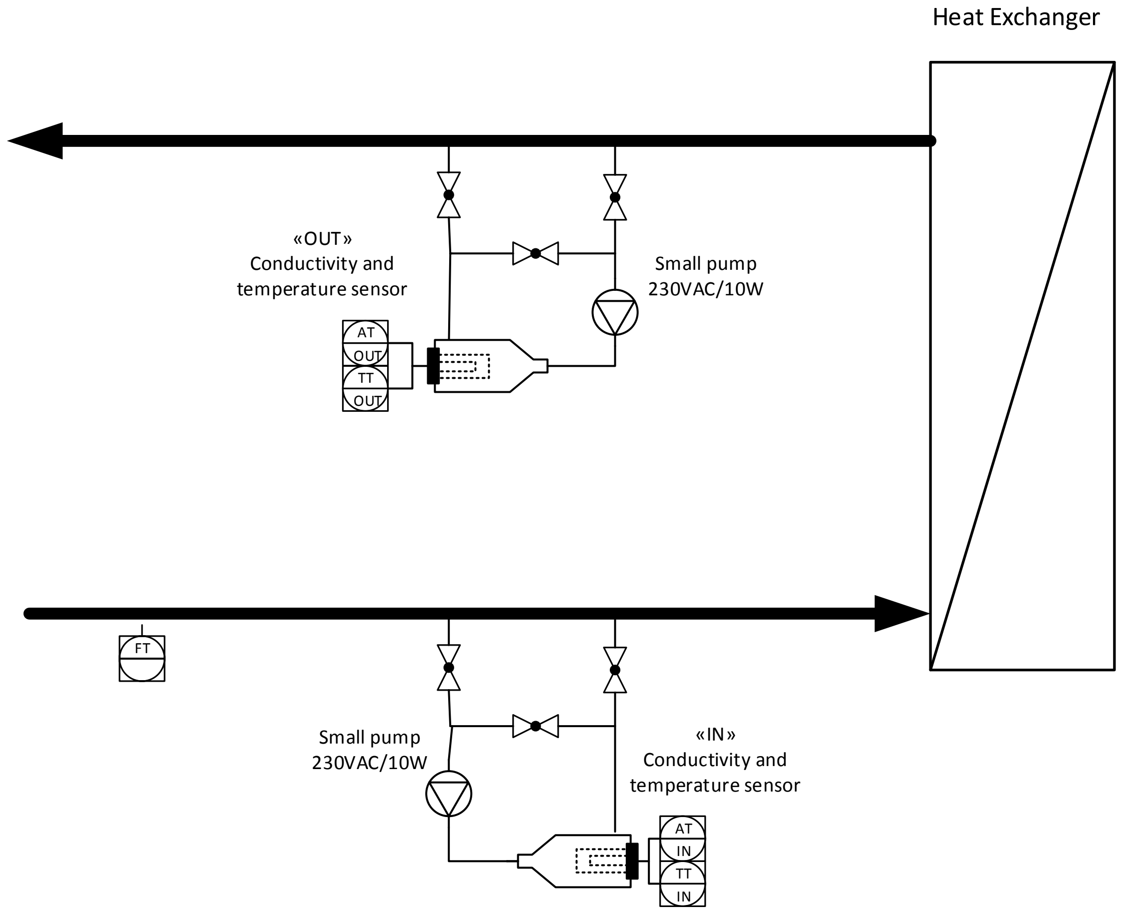
Typical conductivity sensor with «built in» temperature sensor



All ilustrations are from Emerson

System with instrument-pump

- **Option (normally not needed).**
- **Small pump, approx. 10W in sensor circuit.**
- **Simple and safe inspection/ cleaning/service of sensors.**
- **Reduced error at low flow (low heat transfer -> variable time constant, high influence from ambient temperature)**
- **Continuously varying conductivity may be stabilized for a period in order to update sensor model.**



Other applications for the *AmSys* solution:

- **Heat exchanger leakage detection is a typical application, but the technology is general and may be used to increase accuracy in all conductivity measurement applications to improve measurement stability and accuracy.**
- **Sensitivity and measurement accuracy is often improved by a factor 20-100 compared to traditional conductivity measurements. Early alarm from small contaminations provides optimal protection of environment and equipment.**