



TECHNICAL LIBRARY

AS A SERVICE TO THE
HYDROCARBON MEASUREMENT
INDUSTRY, CRT-SERVICES
CURATES THIS COLLECTION OF
DIGITAL RESOURCES.

eXLerate[®] - software platform

Spirit 
Innovative Technologies



Spirit IT, the Netherlands

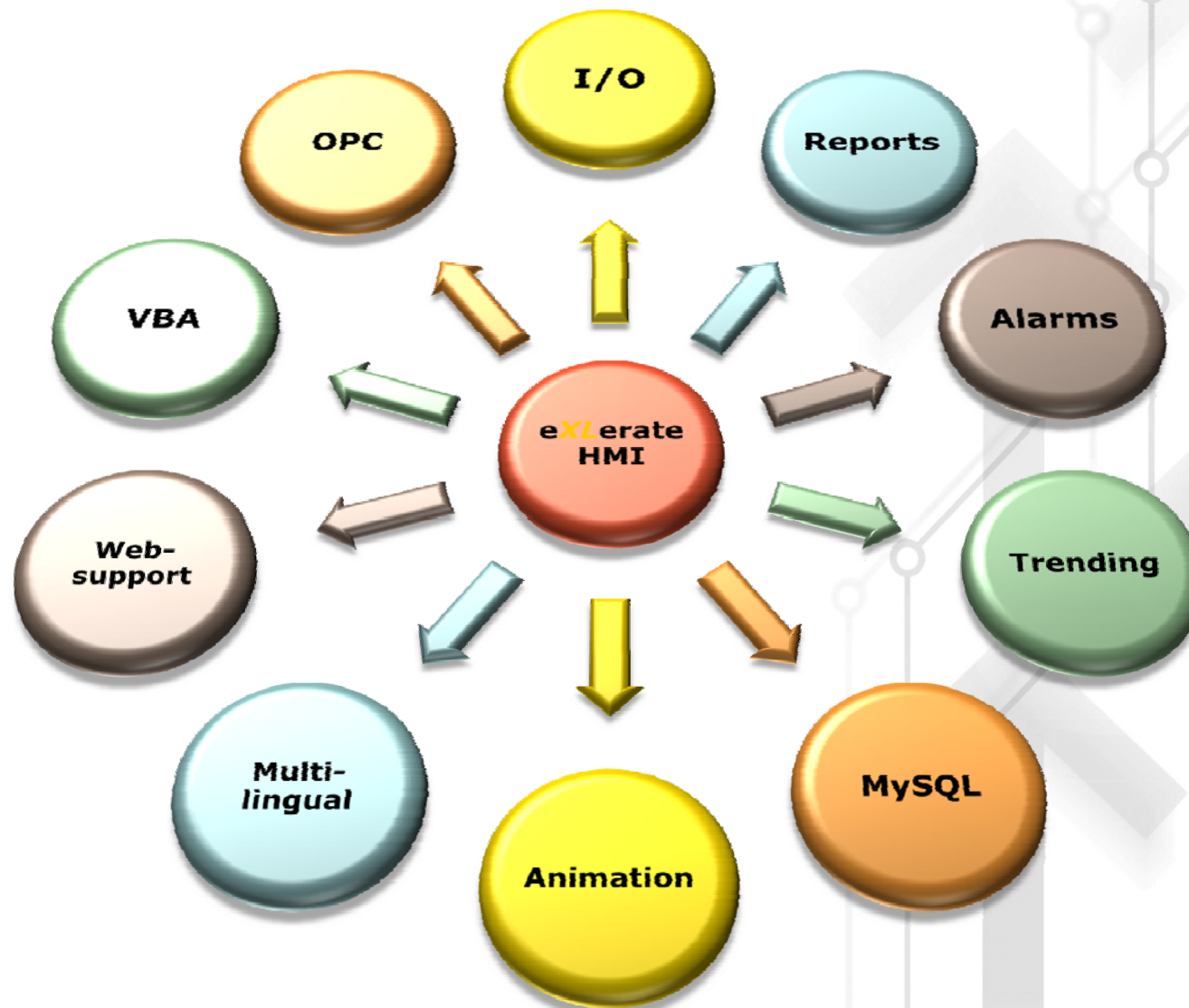
Spirit IT, Inc., USA

Market segments oil & gas

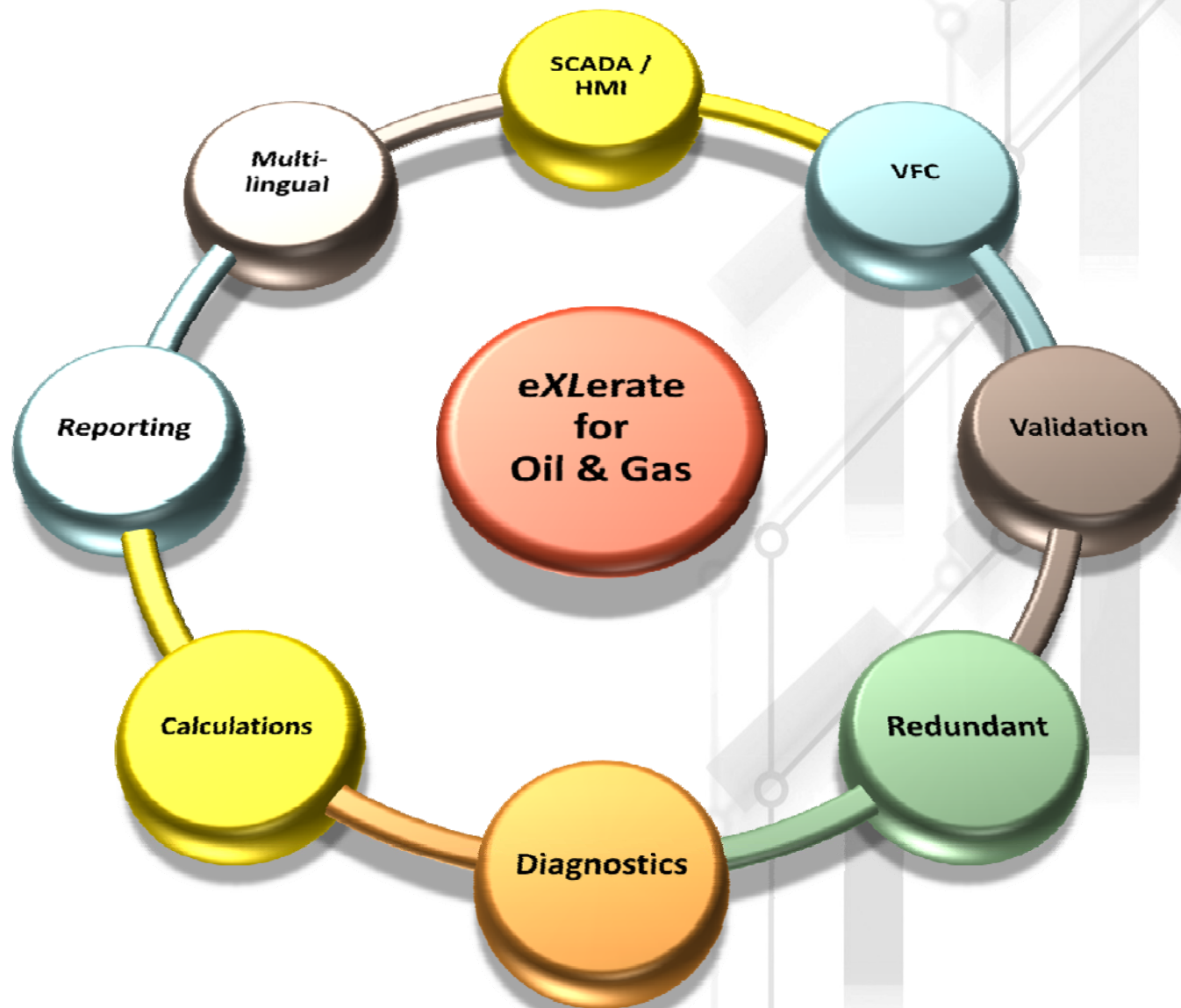
eXLerate[®]



Visualization & Control functions



Functionality needed for oil & gas



The usual approach

- **Standard SCADA/HMI packages:**
 - Citect, InTouch, iFix, Cimplicity, Wizcon, ...
- **... is general purpose software...**
- **... frequently used, but not made for oil & gas**
 - Metering = Computational for Financial purposes. NOT a control system!
 - Introducing complex solutions with many special challenges
 - Where is the technical support when you have a problem ?
- **Challenges for oil & gas:**
 - Obtain a maintainable & yet flexible & powerful software environment
 - Synchronized redundancy on clients + servers
 - Integrated HMI, combined with full fiscal reporting
 - Embedded flow equations, time series, weighted averages...
 - High precision 64-bit calculation accuracy
 - Real-time embedded diagnostics & performance monitoring
 - Integrated validation & calibration facilities for instrumentation
 - Multi-lingual interface
 - Etc.etc.



Our solution makes the difference!

eXLerate is ...

- ➔ Especially developed for the oil & gas market
- ➔ A stable and mature product, used in many large control systems

A simple solution for a demanding industry

- ➔ Popular interface integrated/combined with all SCADA/HMI functions
- ➔ Powerful & flexible, and yet simple toolbox
- ➔ Only 1 developer required - even for complex projects

HMI / SCADA with advanced oil & gas functions & knowledge

- ➔ High precision embedded gas and liquid flow calculations
- ➔ Super report generator, trending, alarming etc.
- ➔ Validation procedures 100% integratable with SCADA/HMI

Supporting many architectures

- ➔ from...laptop to... redundant client-/server systems

A product with a rapidly growing install base

- ➔ Many (>300 aug 08) installed systems, running 24/7

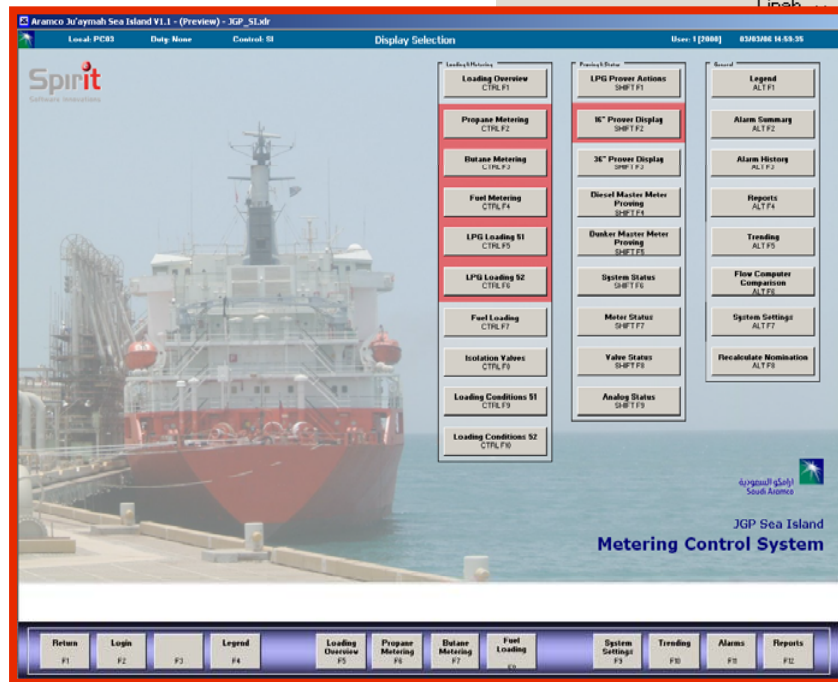
A product in front of a great support team

- ➔ Your problem is OUR problem and we solve it!
- ➔ From starters training sessions to expert level project knowledge

Example: Tanker Loading system, Persian Gulf



Fiscal Metering with TAS



Saudi Aramco, Ju'aymah Gas Plant

Project systems description

- Compliant with Saudi Aramco specifications **SAES-Y-102** and **SAES-Y-103** for Royalty Metering of Hydrocarbon Liquids
- Sea Island Ship Loading System +
- product Feed & Surge system

System Hardware

- 46 Multistream Flow computers
- 140 liquid flow meters & proving
- Redundant PLC system
- 2 Client-/Server systems with 8 PC's
- Fully dual redundant

Software functions

- Redundant SCADA
- Fiscal Metering
- Terminal Automation
- 24/7 Continuous Operation & Control
- Proving (16" & 36" ball provers)
- Reporting



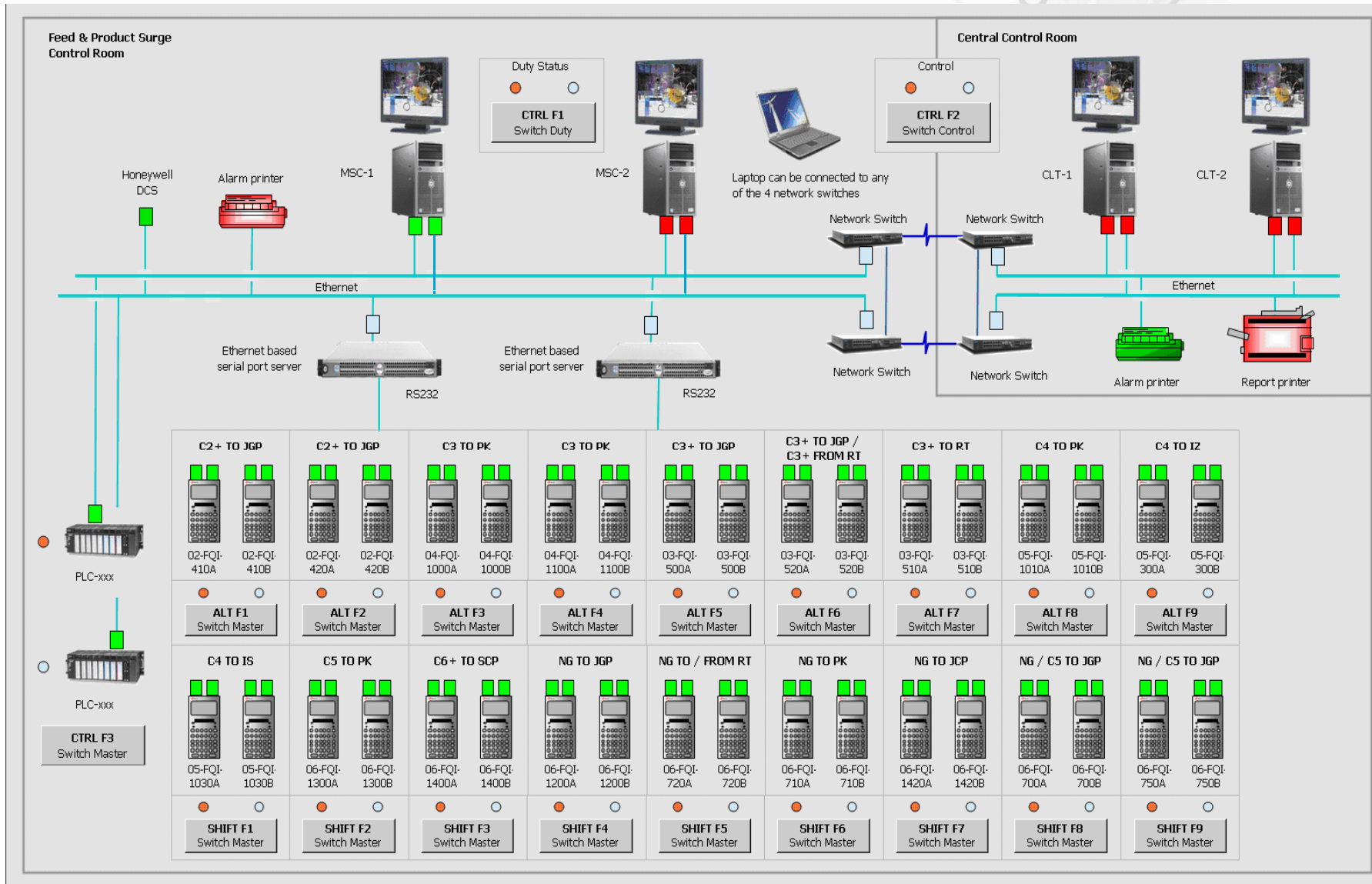
eXLerate 2003 - Industrial Office for oil & gas

Quality in System Integration

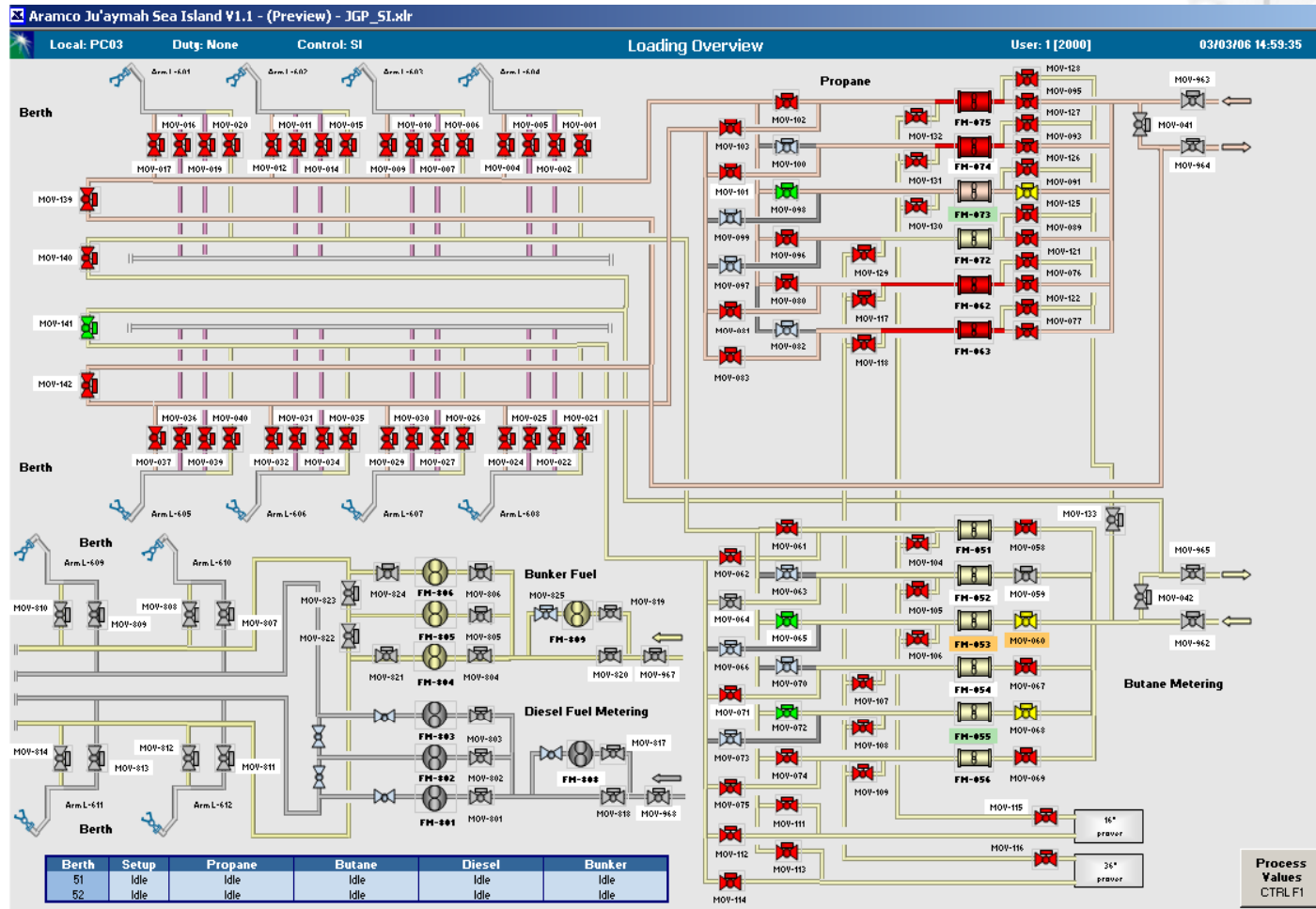
Spirit it
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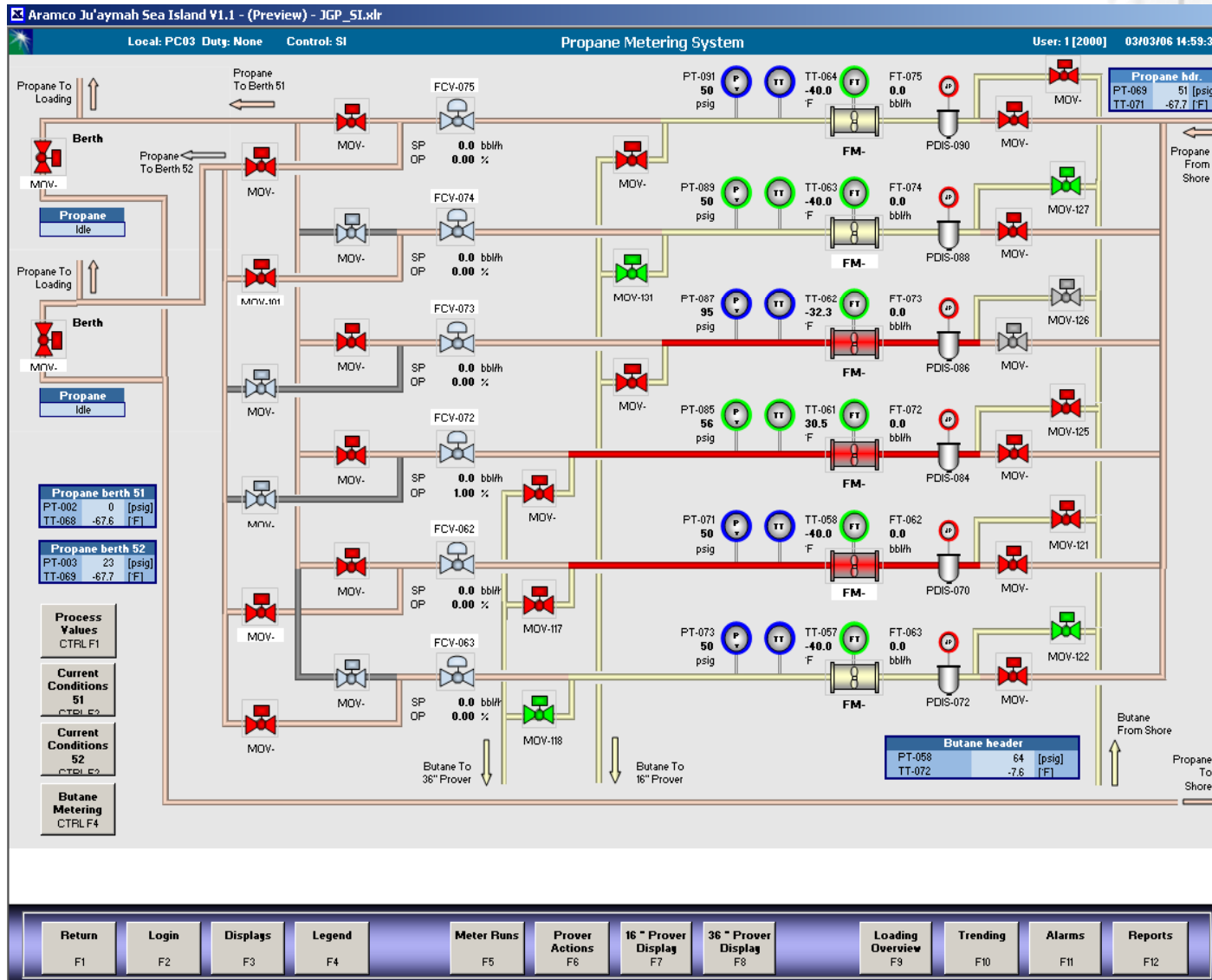
System architecture



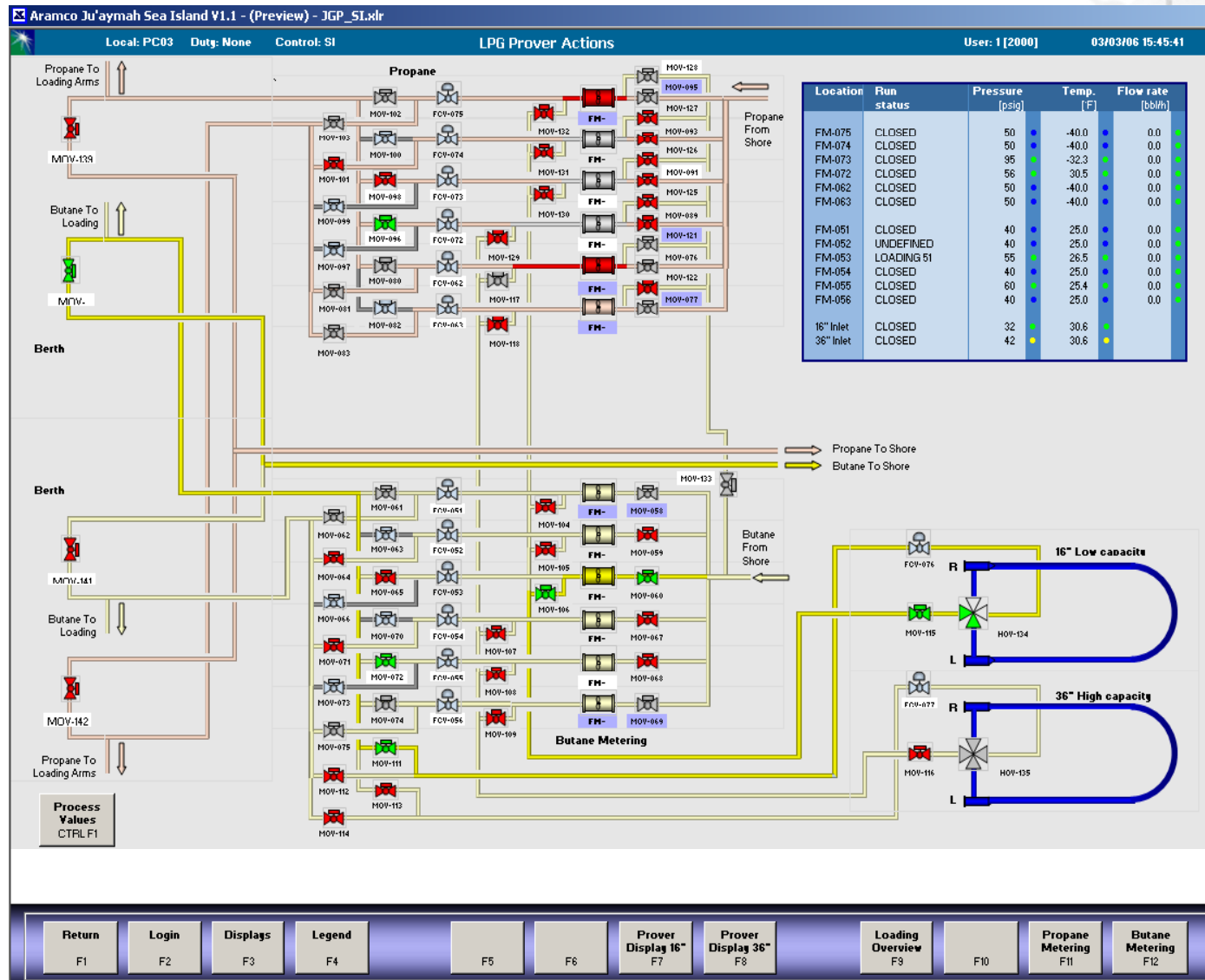
Automated loading



Metering – Propane/Butane/Fuel



Integrated Meter Proving - LPG



METER TAG NUMBER:	MT-420
METER SERIAL NUMBER:	77-T-776
PRODUCT:	C2+
METER SYSTEM FACTOR:	1036.70
BASE FLOW RATE [bbl/h]	300.2
METER FACTOR @ BASE F.R.	1.0003

POINT	FLOW RATE (bph)	METER FACTOR
1	289	1.0010
2	359	1.0009
3	430	1.0008
4	508	1.0010
5	572	1.0012
6	626	1.0013
7	684	1.0005
8	0	0.0000
9	0	0.0000
10	0	0.0000
11	0	0.0000
12	0	0.0000

Flow Rate (bph)	Value
280	1.0008
350	1.0008
430	1.0006
510	1.0008
580	1.0010
630	1.0011
680	1.0005
700	1.0000
720	0.9998
750	0.9998

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JU'AYMAH GAS PLANT									
STATION SUMMARY REPORT									
SAUDI ARABIAN OIL COMPANY (Saudi Aramco)									
PRINT TIME: MM/DD/YY HH:MM:SS MEASURING STATION: C2+ TO JOD SPECIFIC GRAVITY (SG @ 60 °F): 0.8500					DELIVERY START TIME: MM/DD/YY HH:MM:SS DELIVERY STOP TIME: MM/DD/YY HH:MM:SS				
WATER TAG ID	METER TAG ID	FINA DISPENSING RATE (GPM)	FINA DISPENSING RATE (GPM)	AOO DISPENSING RATE (GPM)	INDICATED RATE (GPM)	NET RATE (GPM)			
WTR-001	1	0.000	0.000	0.000	0.000	0.000			
WTR-002	2	0.000	0.000	0.000	0.000	0.000			
WTR-003	3	0.000	0.000	0.000	0.000	0.000			
WTR-004	4	0.000	0.000	0.000	0.000	0.000			
WTR-005	5	0.000	0.000	0.000	0.000	0.000			
WTR-006	6	0.000	0.000	0.000	0.000	0.000			
WTR-007	7	0.000	0.000	0.000	0.000	0.000			
WTR-008	8	0.000	0.000	0.000	0.000	0.000			
WTR-009	9	0.000	0.000	0.000	0.000	0.000			
WTR-010	10	0.000	0.000	0.000	0.000	0.000			
WTR-011	11	0.000	0.000	0.000	0.000	0.000			
WTR-012	12	0.000	0.000	0.000	0.000	0.000			
WTR-013	13	0.000	0.000	0.000	0.000	0.000			
WTR-014	14	0.000	0.000	0.000	0.000	0.000			
WTR-015	15	0.000	0.000	0.000	0.000	0.000			
WTR-016	16	0.000	0.000	0.000	0.000	0.000			
WTR-017	17	0.000	0.000	0.000	0.000	0.000			
WTR-018	18	0.000	0.000	0.000	0.000	0.000			
WTR-019	19	0.000	0.000	0.000	0.000	0.000			
WTR-020	20	0.000	0.000	0.000	0.000	0.000			
WTR-021	21	0.000	0.000	0.000	0.000	0.000			
WTR-022	22	0.000	0.000	0.000	0.000	0.000			
WTR-023	23	0.000	0.000	0.000	0.000	0.000			
WTR-024	24	0.000	0.000	0.000	0.000	0.000			
WTR-025	25	0.000	0.000	0.000	0.000	0.000			
WTR-026	26	0.000	0.000	0.000	0.000	0.000			
WTR-027	27	0.000	0.000	0.000	0.000	0.000			
WTR-028	28	0.000	0.000	0.000	0.000	0.000			
WTR-029	29	0.000	0.000	0.000	0.000	0.000			
WTR-030	30	0.000	0.000	0.000	0.000	0.000			
WTR-031	31	0.000	0.000	0.000	0.000	0.000			
WTR-032	32	0.000	0.000	0.000	0.000	0.000			
WTR-033	33	0.000	0.000	0.000	0.000	0.000			
WTR-034	34	0.000	0.000	0.000	0.000	0.000			
WTR-035	35	0.000	0.000	0.000	0.000	0.000			
WTR-036	36	0.000	0.000	0.000	0.000	0.000			
WTR-037	37	0.000	0.000	0.000	0.000	0.000			
WTR-038	38	0.000	0.000	0.000	0.000	0.000			
WTR-039	39	0.000	0.000	0.000	0.000	0.000			
WTR-040	40	0.000	0.000	0.000	0.000	0.000			
WTR-041	41	0.000	0.000	0.000	0.000	0.000			
WTR-042	42	0.000	0.000	0.000	0.000	0.000			
WTR-043	43	0.000	0.000	0.000	0.000	0.000			
WTR-044	44	0.000	0.000	0.000	0.000	0.000			
WTR-045	45	0.000	0.000	0.000	0.000	0.000			
WTR-046	46	0.000	0.000						

 JU'AYMAH GAS PLANT HOURLY REPORT SAUDI ARABIAN OIL COMPANY (Saudi Aramco)					
METERING STATION:		C3-70-SEP	PRINT TIME:		MM/DD/YY HH:MM:SS
SPECIFIC GRAVITY (GAS %):		3.0000	DELIVERY START TIME:		MM/DD/YY HH:MM:SS
			HOURLY STOP TIME:		MM/DD/YY HH:MM:SS

ITEM	Flow ID	Flow	Flow	Units	Uncalculated	Net
		TEMPERATURE	THROUGH	PER HOUR	VOLUME	VOLUME
		(°C)	(MM3)			
100-101	100-101	22.00	0.0000	0.0000	0.0000	0.0000
100-102	100-102	22.00	0.0000	0.0000	0.0000	0.0000
100-103	100-103	22.00	0.0000	0.0000	0.0000	0.0000
100-104	100-104	22.00	0.0000	0.0000	0.0000	0.0000
100-105	100-105	22.00	0.0000	0.0000	0.0000	0.0000
100-106	100-106	22.00	0.0000	0.0000	0.0000	0.0000
TOTALS					0.0000	0.0000

[illegible]

JU'AYMAH GAS PLANT			
METAM TICKET			
SAUDI ARABIAN OIL COMPANY (Saudi Aramco)			
NGL TICKET 3			
(X) DELIVERY		() RECEIPT	
(X) OFFICIAL		() UNOFFICIAL	
LOCATION: Ju'aymah Gas Plant		PRINT DATE/TIME: 10/26/05 09:18	
DELIVERED TO / RECEIVED FROM Customer		MASTER FC: FQI-005A	
METER MANUFACTURER: DOHLHOFF		METER SIZE (in): 3"	
METER MODEL: Turbine		NOMINAL R.F. FACTOR: 1026.70	
METER SERIAL NUMBER: 771-1776		METER TAG NUMBER: FM-051	
1. BATCH NUMBER		12310601	
2. TYPE OF LIQUID		Butane	
3. METER CLOSING READING (DATE/TIME)		10/25/05 10:15:53	
4. METER OPENING READING (DATE/TIME)		10/25/05 10:15:19	
5. NET DELIVERY TIME		0.039 hours	
6. NET CLOSING READING		1014.83 bbl	
7. METER OPENING READING		1014.32 bbl	
8. GROSSED VOLUME		11 bbl	
9. AVERAGE FLOW RATE		298.4 bbl/hr	
10. INDICATED VOLUME		11.01 bbl	
11. AVERAGE METER FACTOR		1.0010	
12. OBSERVED RELATIVE DENSITY		0.9000	
13. WEIGHTED AVERAGE TEMPERATURE		20.0 °C	
14. RELATIVE DENSITY AT 60°F		0.5770	
15. TEMPERATURE CORRECTION FACTOR (CTFm)		1.0428	
16. WEIGHTED AVERAGE PRESSURE		1000.0 psig	
18. PRESSURE CORRECTION FACTOR (CPLm)		1.0014	
19. CORRECTED CORRECTION FACTOR (CCFm)		1.0443	
20. NET STD VOL AT 50°F & 14.696 kpa (0 psig)		11.50 Mbls	
21. NET STD VOL AT 15°C & 101.325 kpa (0 kPa (gag))		1.827 m³	
22. NET WEIGHT		1.04 long tons	
23. NET WEIGHT		1.06 metric tons	
NON-NEGOTIABLE, NON-TRANSFERABLE			
SAUDI ARABIAN OIL COMPANY			
CHECKED FOR Saudi Aramco:			
BY: _____		DATE: _____	
WITNESSED BY: _____			
BT _____			
COPY: _____			

eXLerate 2003

Advantages for the developer

- 👤 Superb support from Spirit IT
- 👤 Well-known development environment
- 👤 Simple, very Flexible & extremely Powerful
- 👤 Runs on simple laptop & large client-/server systems
- 👤 Open Architecture
- 👤 Highly re-usable library of applications/sections/objects
- 👤 Conclusion: **Low cost on development work**

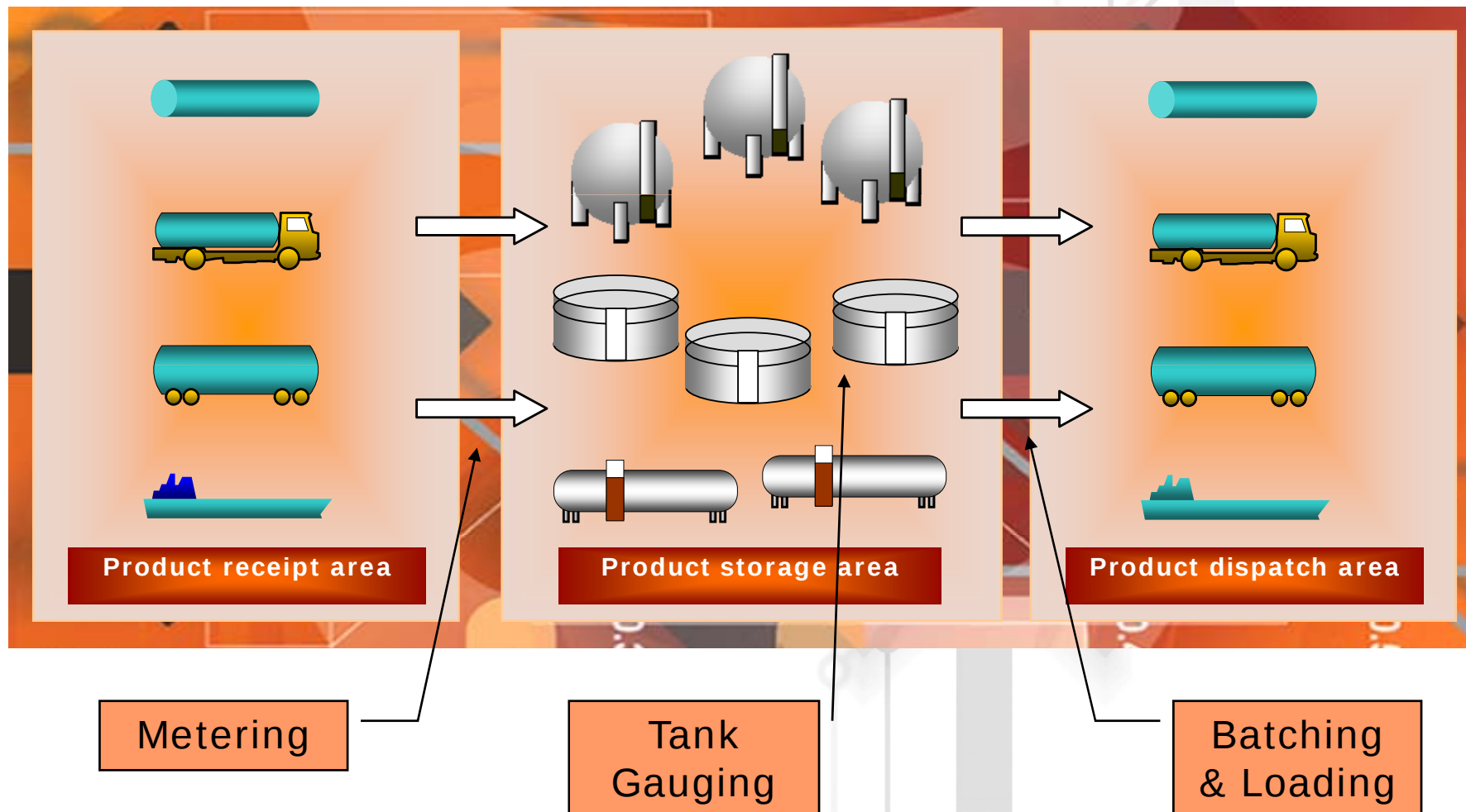


Advantages for the end-user

- 👤 Proven working solution for your project
- 👤 Suitable for a wide range of applications, from small to large
- 👤 Maintenance, extensions, modifications etc. in Excel
- 👤 Open Architecture
- 👤 Conclusion: **Low Cost Of Operation**

Terminal Automation Solutions

Horizontal Integration



Terminal Automation applications

Installed systems:

- Ship loading
- Truck loading
- Railcar loading
- Tank farm management

eXLerate® based solutions

- + Allows you to integrate all equipment
- + SCADA/HMI integrated
- + Product based tank inventory
- + Fiscal flow metering
- + Valve control
- + Fully automated product loading
- + Document generation & storage
- + Database support available in a tailor-made solution
- + Independent of hardware suppliers.



Product loading

Loading order management

- Scheduled orders, direct orders
- Compartment based loading orders
- Aggregate loading orders
- Interface with host (ERP) system
- Multiple loading stations, multiple compartments
- Loading sequences

Vehicle management

- Vehicles, forwarding agencies
- Railcar, truck, trailer
- Access to facilities
- Authorization

Control of field devices

- Loading field information
- Product data to devices
- Storage of audit trails
- Meter proving



Product receipt & dispatch

Product receipt & dispatch

- Batch scheduling
- Batch controlling
- Flow metering
- Meter proving
- Custody transfer reporting
- Audit trail for Weights & Measures
- Vehicle loading scheduling and controlling
- Loading order processing and management
- Bill of lading & delivery documents
- Vehicle and driver entry validations
- Managing Identification Systems
- Managing vehicle weighing systems

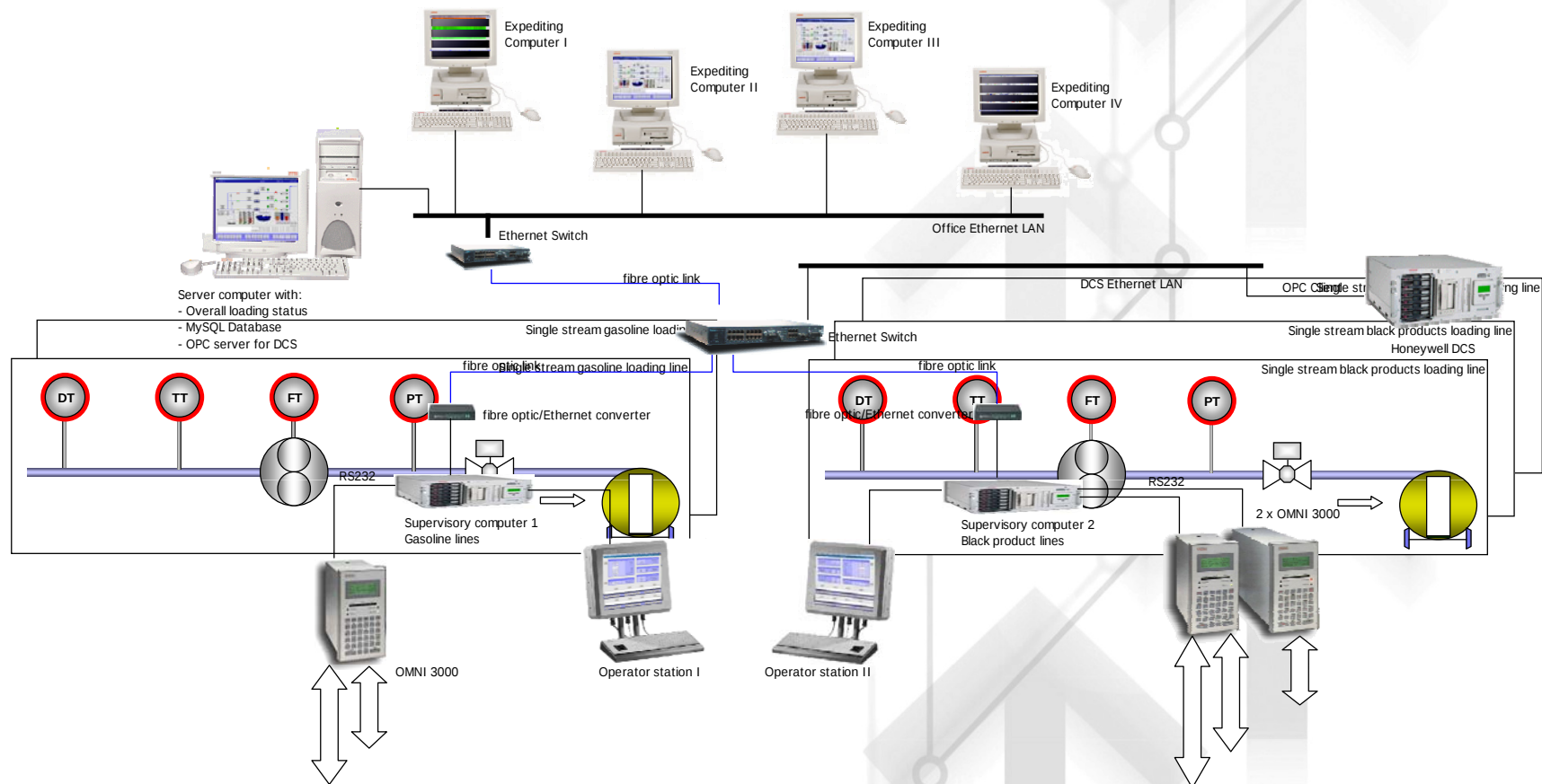


Railcar loading system example





Railcar loading system architecture



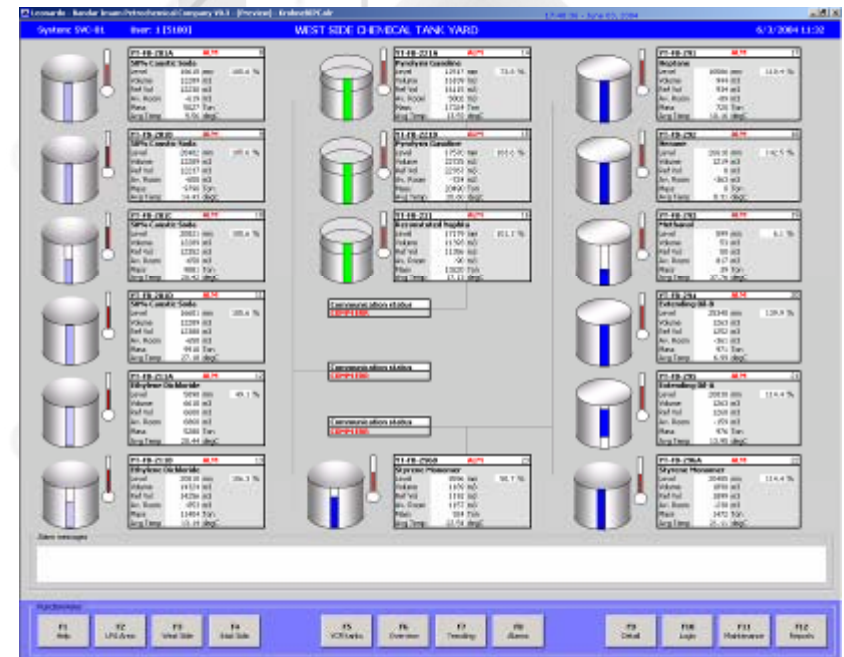
Tank farm management

Hardware independent

- Integration of tank gauging equipment of various vendors through versatile communication drivers

Tank shape, volume corrections & density calculations etc. built in

Combine SCADA with metering & tank gauging in one platform



Tank inventory functionality

Volume corrections

- API 2540 (ASTM)
- TP-25 (LPG)
- Others
- Strapping tables

Tank shape corrections

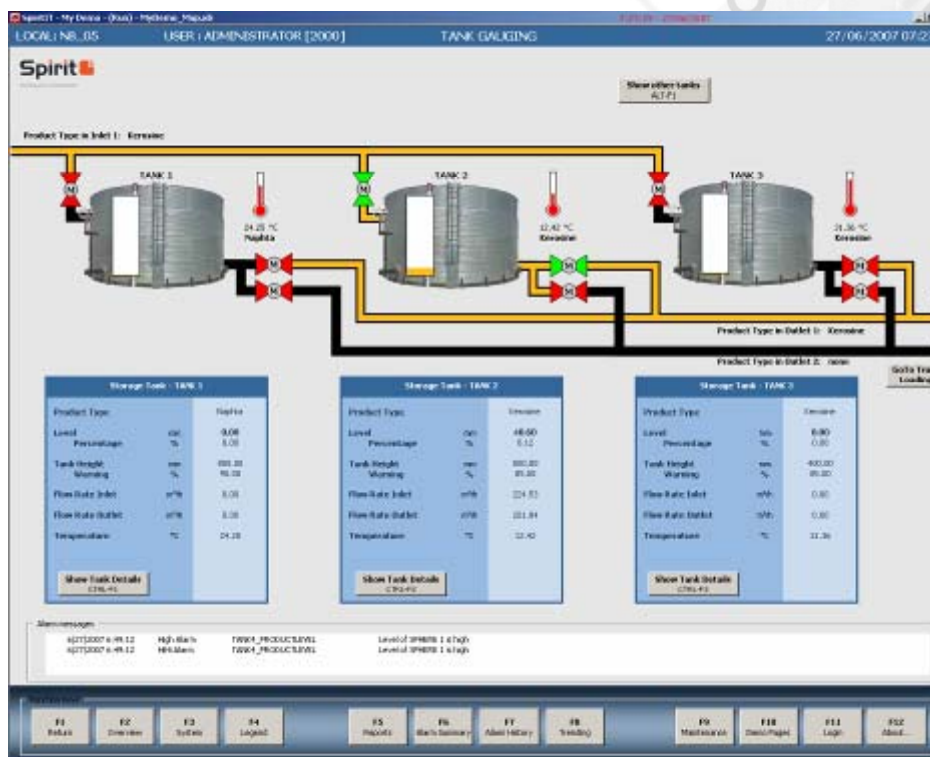
- Spherical
- Dome
- Floating roof
- Conical

Integrated reporting

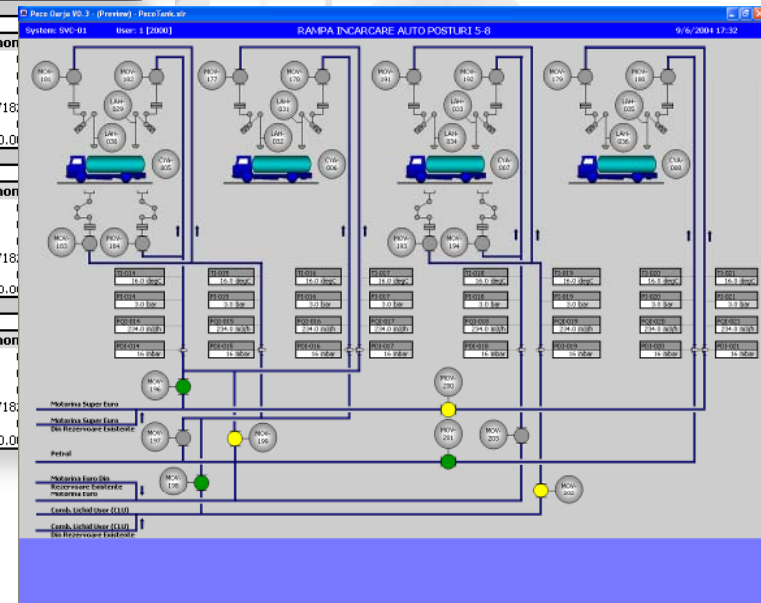
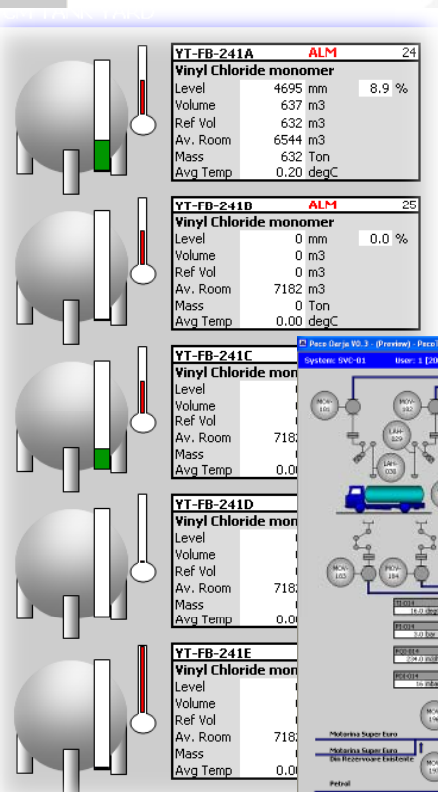
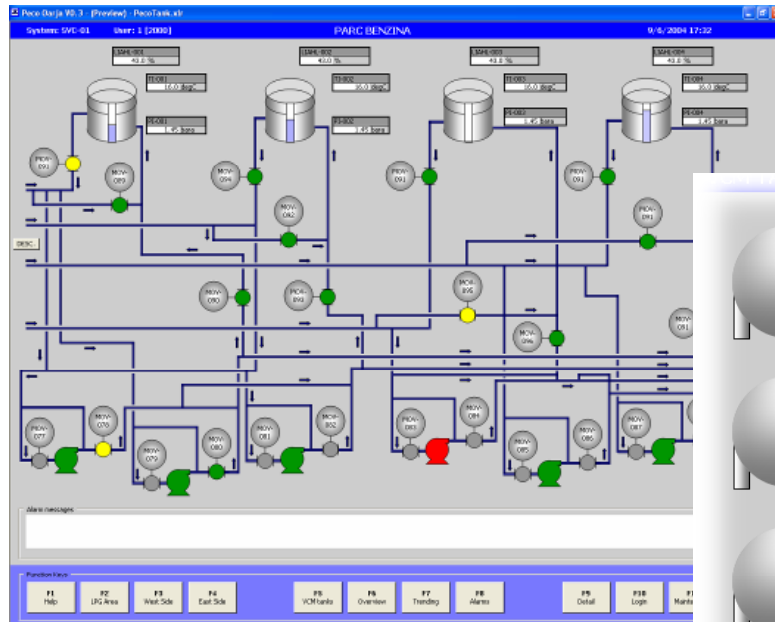
- Shift reports
- Daily reports
- Monthly reports

Graphical tank displays

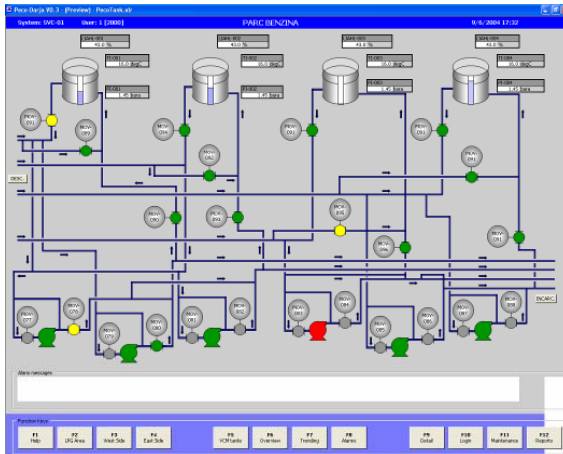
- Tank farm overview
- Tank group display
- Tank detail display
- Tank maintenance



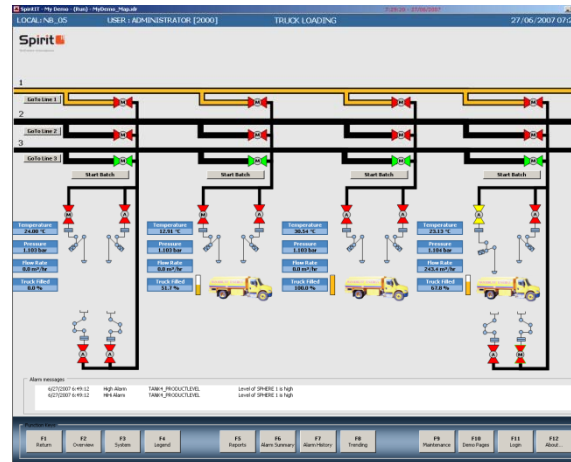
Integrated tank farm operation



Tank farm – volume balancing



+



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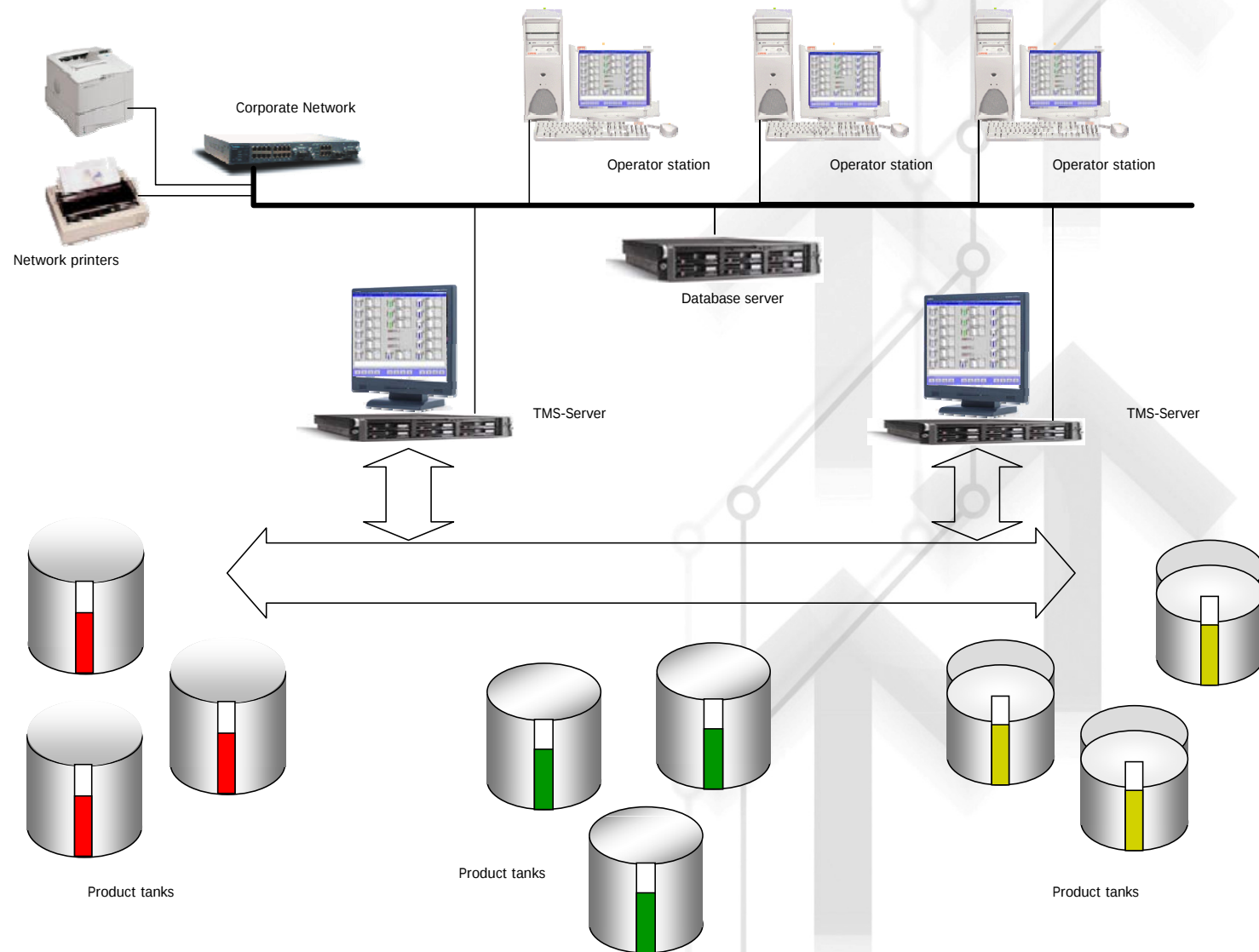


Compare Metering data with Tank data

Minimize product give-away

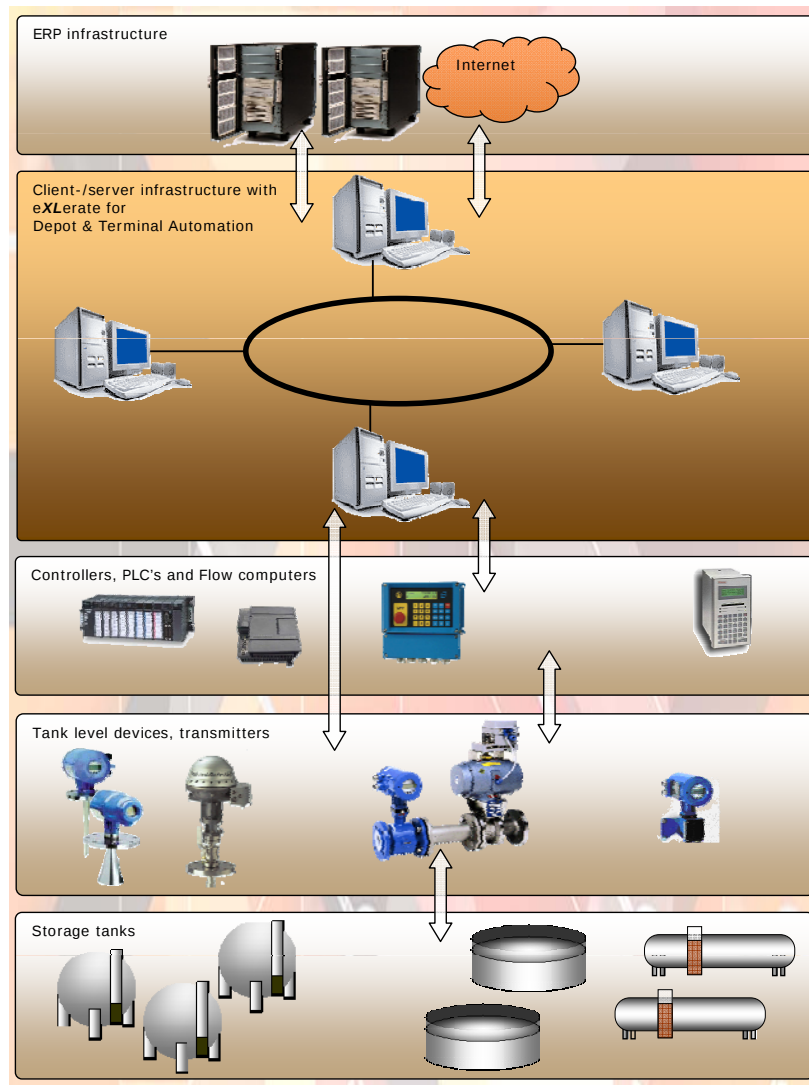


Tank farm management systems

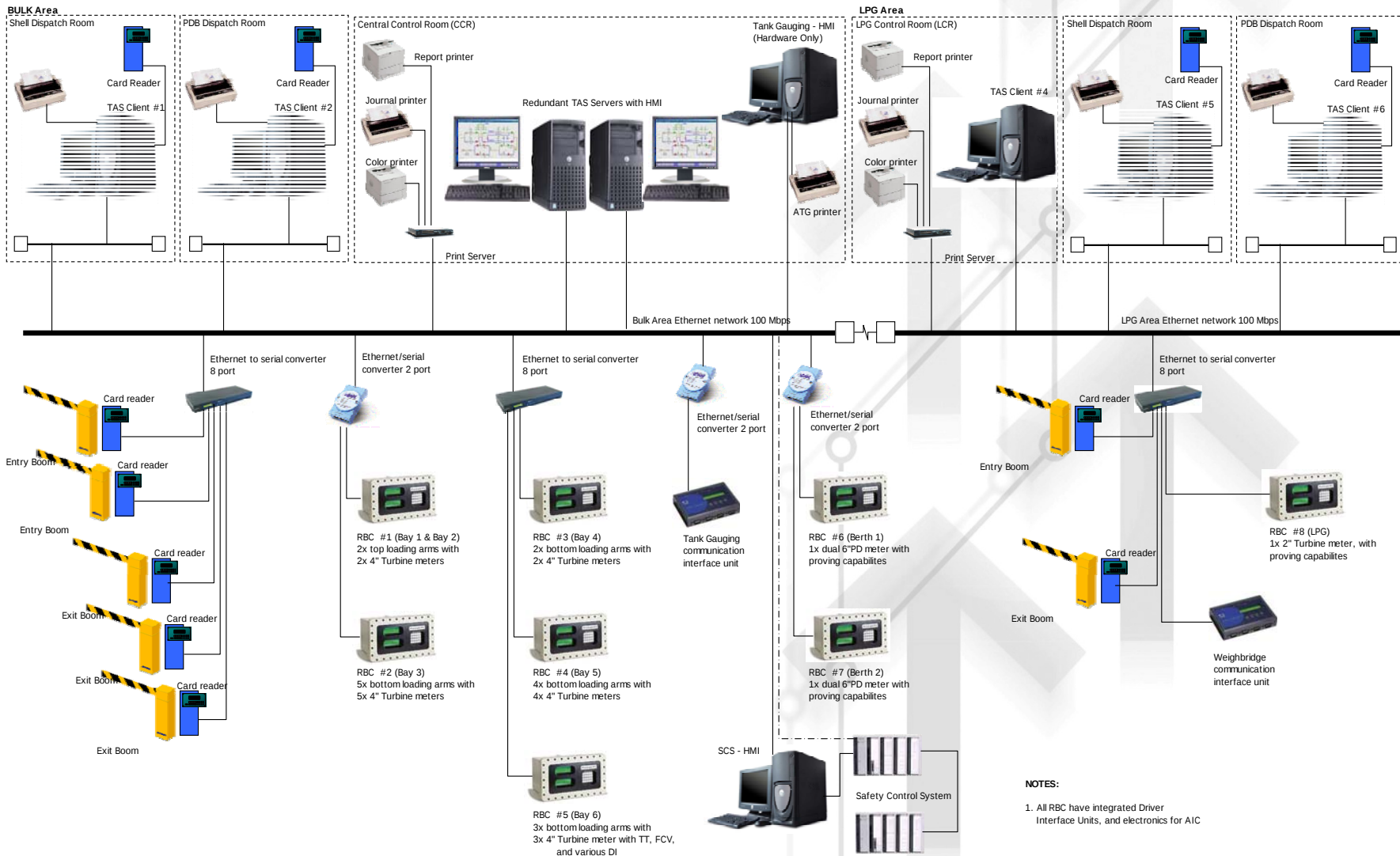




Vertical integration



Advanced system architectures



Gas Metering



Virtual Flow Computer calculations

- Period totalizers, high precision (64-bits)
- ISO-5167, ISO-6976, ISO-12213
- AGA-3, AGA-5, AGA-NX19, AGA-8, AGA-10
- Precision counters, accumulative totals, retentive data
- dynamic viscosity, isochoric heat capacity, isobaric heat capacity, isentropic exponent, energy, entropy, enthalpy, many other



Metering

- Time series
- Weighted averages
- Integrated fiscal reporting



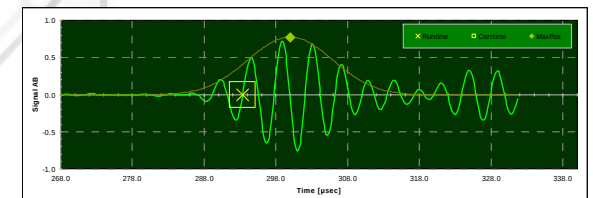
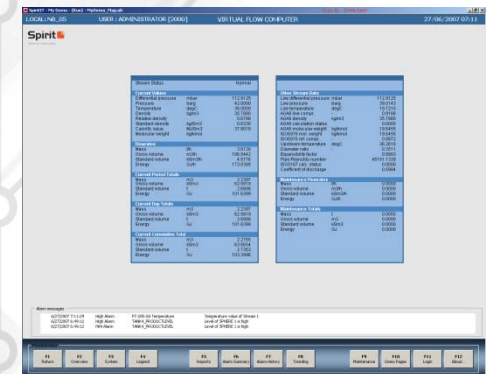
Performance monitoring & diagnostics

- VOS comparison within 0.1% typically
- Online meter fingerprint verification
- CUSUM-based drift analysis on signals
- Historical trending with advanced trouble-shooting features

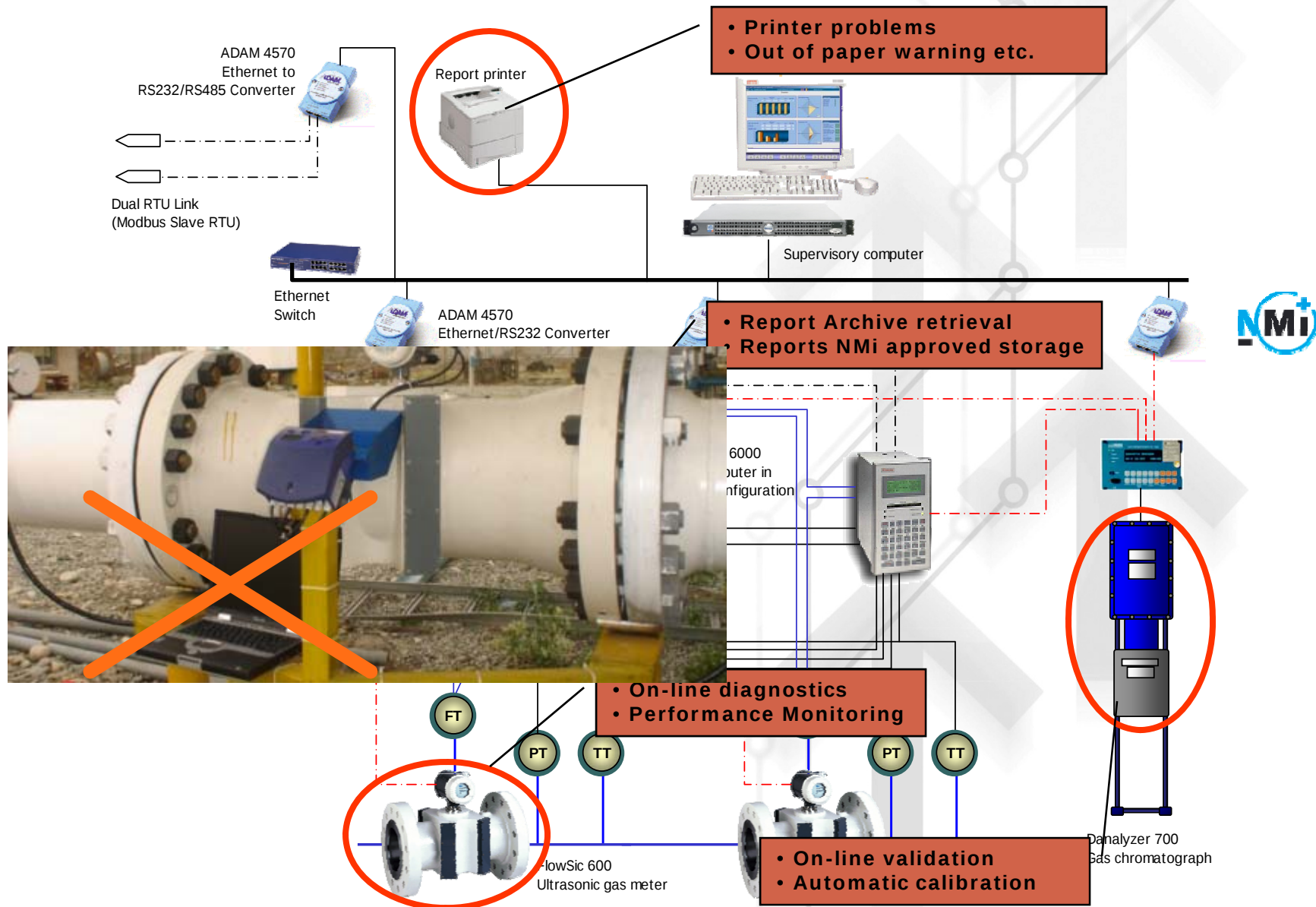


On-line Validation & Calibration

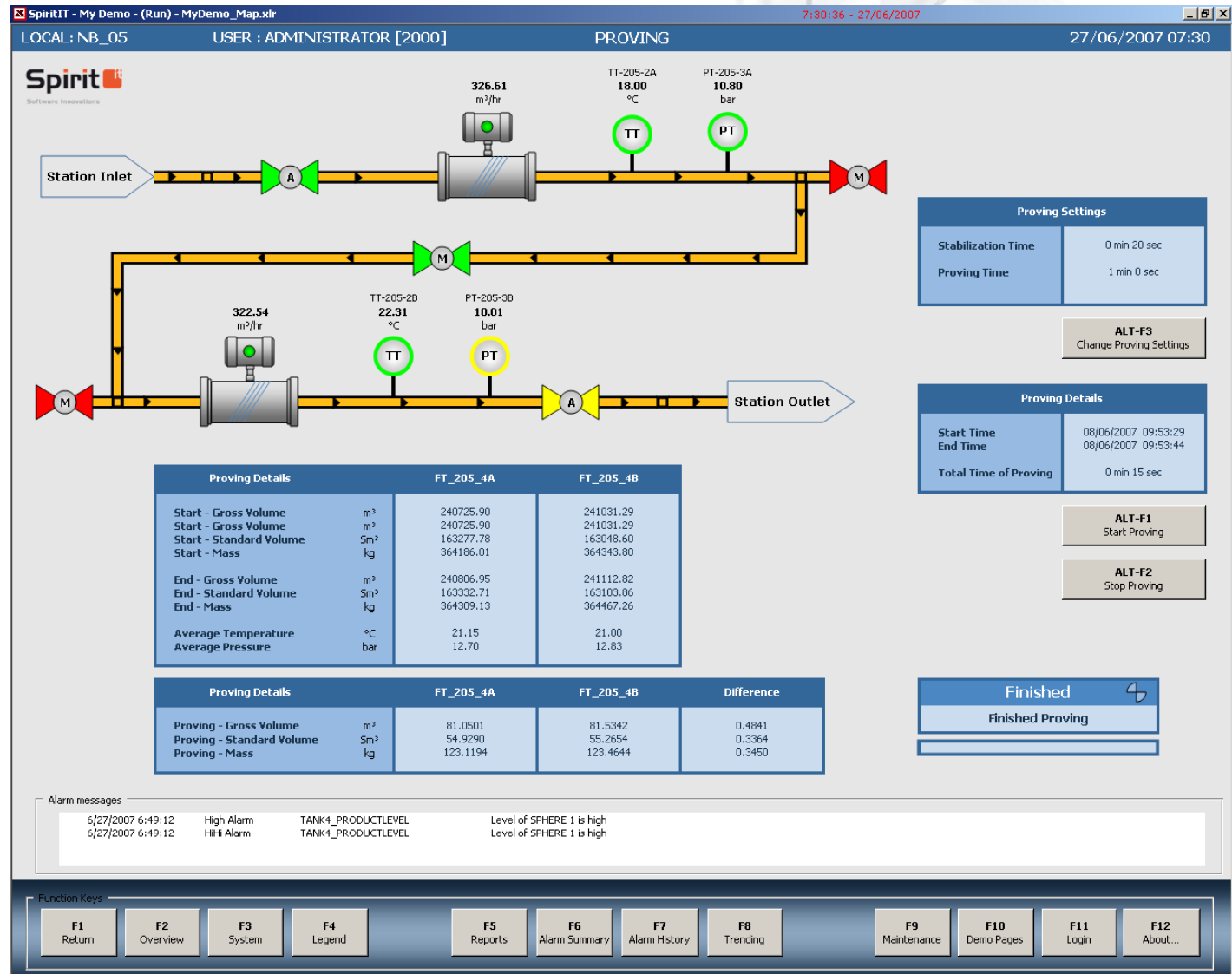
- Temperature & Pressure transmitters
- Density, Relative density analyzers
- Gas chromatographs
- Ultrasonic meters



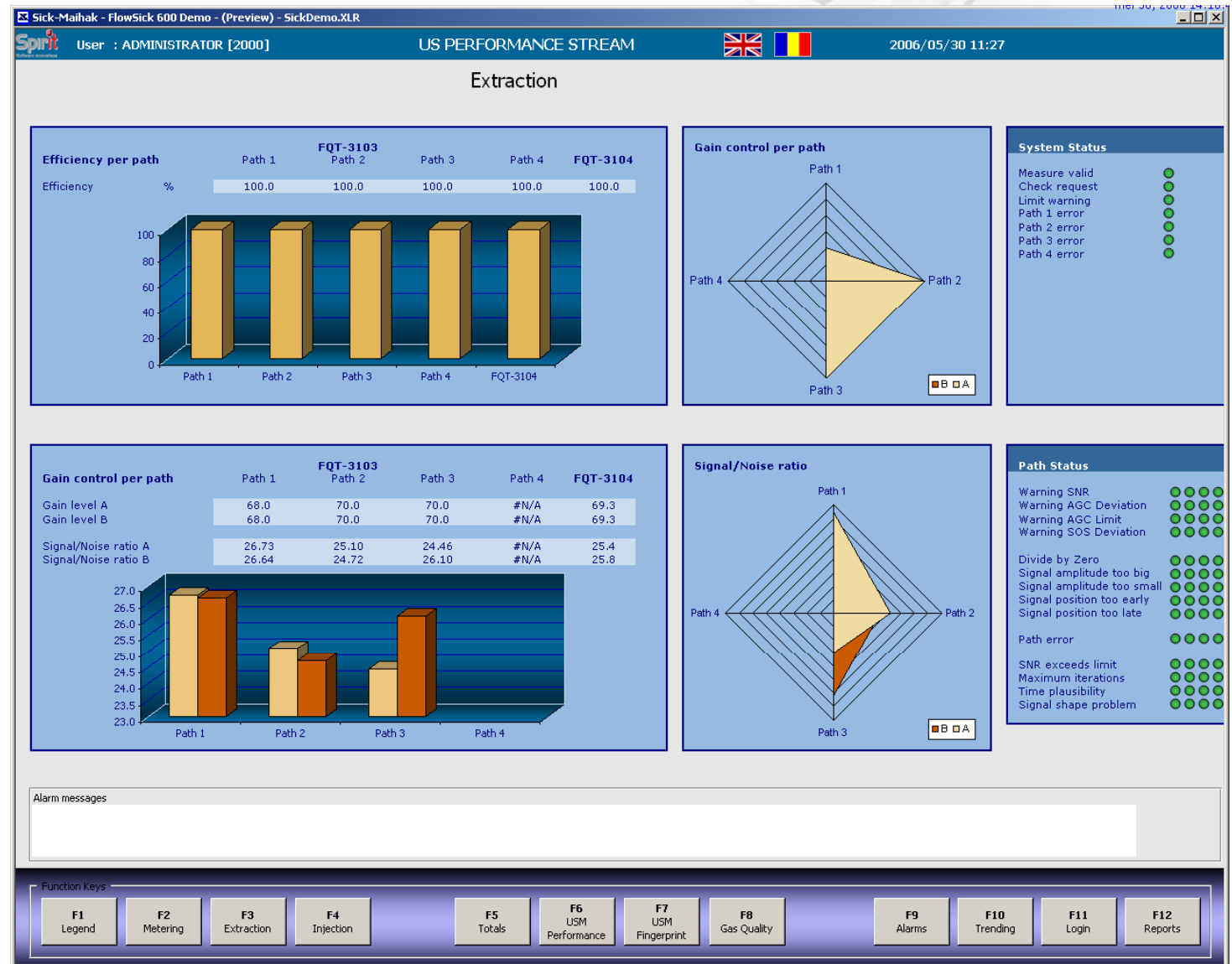
Performance Monitor & Diagnostics



Master meter proving



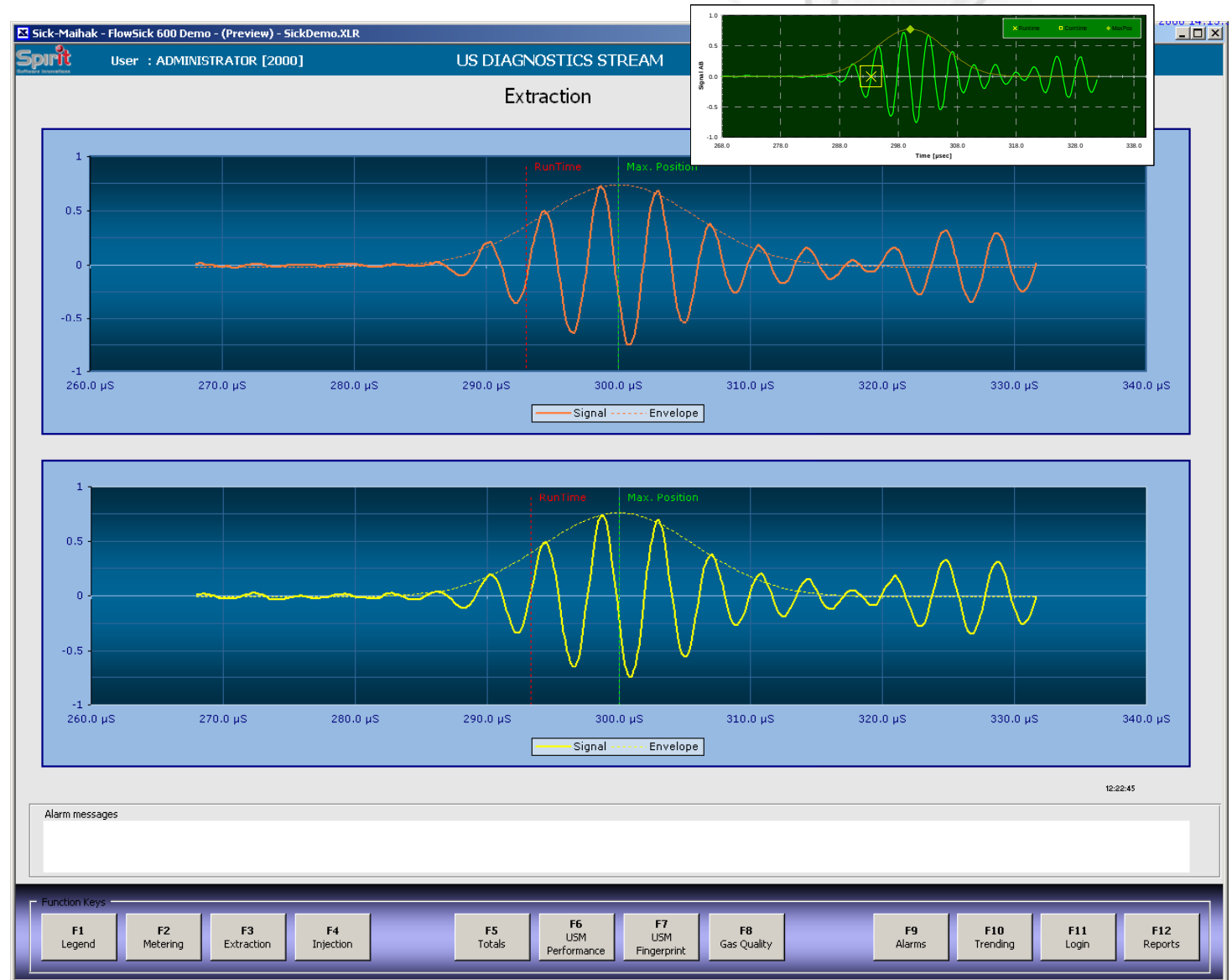
USM Performance monitoring



Real-time meter fingerprints



Integrated meter diagnostics



Flow equipment verification

Compressibility

- All used international standards
- Comparison with FC

Speed of Sound

- Advanced methodology
- AGA10

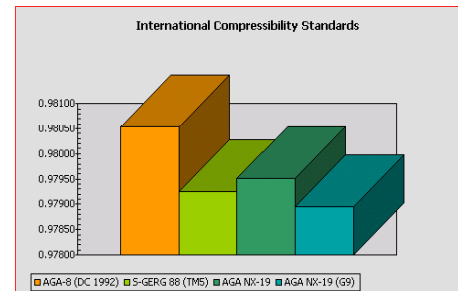
CUSUM

- Drift analysis
- Long-term drift detection

Deviation checks

- Peak detection
- Delayed deviation
- Definable band-width

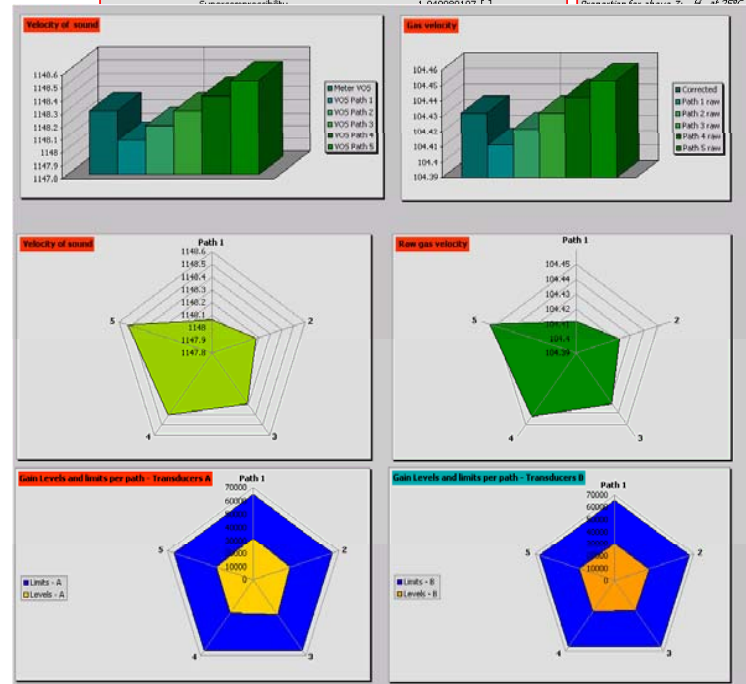
Compressibility and other thermodynamical properties



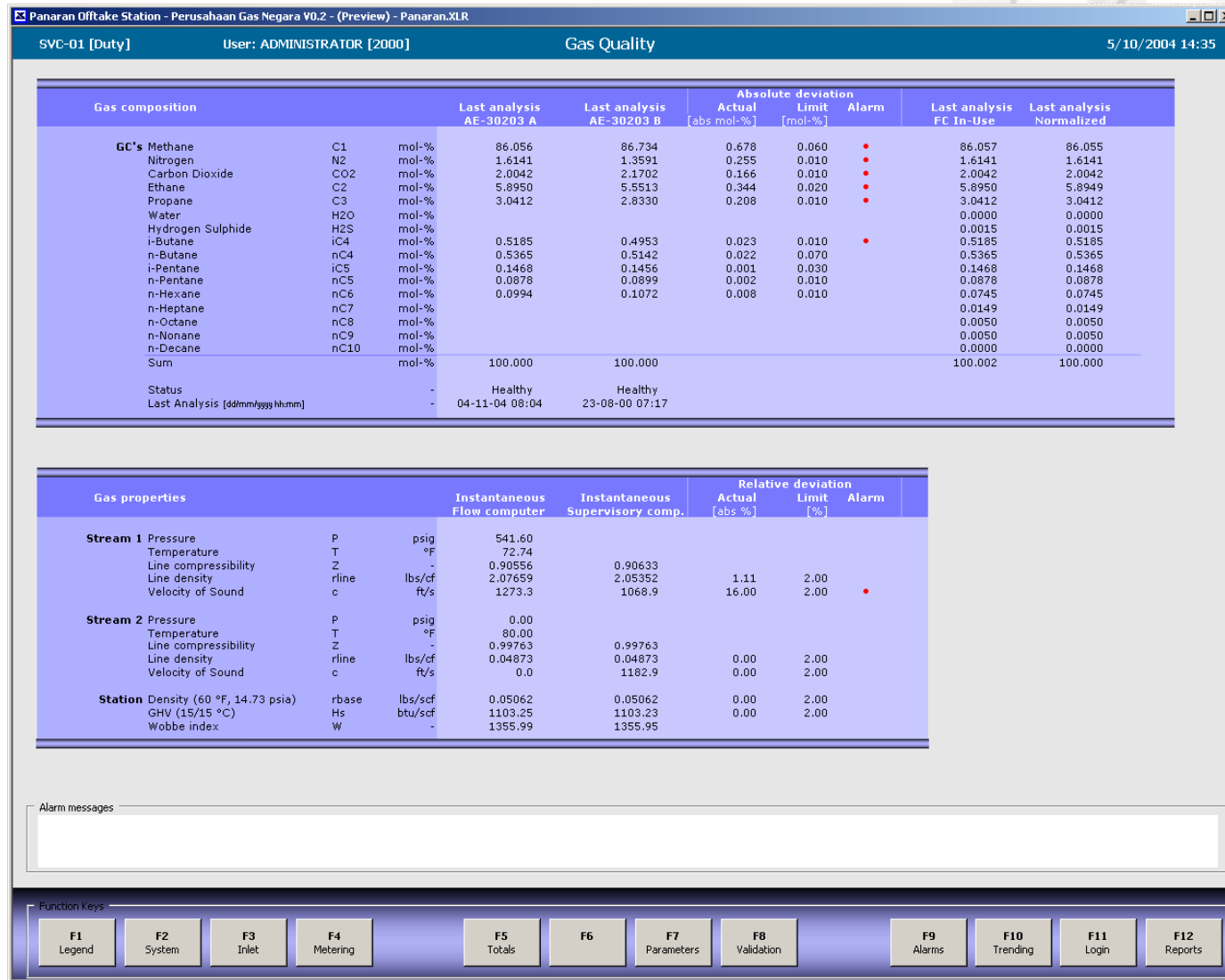
Selected gas composition: Amarillo gas		
Methane	C1	90.6724% [mol-%]
Nitrogen	N2	3.1284% [mol-%]
Carbon Dioxide	CO2	0.4676% [mol-%]
Ethane	C2	4.5279% [mol-%]
Propane	C3	0.8280% [mol-%]
Water	H2O	0.0000% [mol-%]
Hydrogen Sulphide	H2S	0.0000% [mol-%]
Hydrogen	H2	0.0000% [mol-%]
Carbon Monoxide	CO	0.0000% [mol-%]
Oxygen	O2	0.0000% [mol-%]
i-Butane	iC4	0.1037% [mol-%]
n-Butane	nC4	0.1563% [mol-%]
i-Pentane	iC5	0.0321% [mol-%]
n-Pentane	nC5	0.0443% [mol-%]
n-Hexane	nC6	0.0393% [mol-%]
n-Heptane	nC7	0.0000% [mol-%]
n-Octane	nC8	0.0000% [mol-%]
n-Nonane	nC9	0.0000% [mol-%]
n-Decane	nC10	0.0000% [mol-%]
Helium	He	0.0000% [mol-%]
Argon	Ar	0.0000% [mol-%]

Miscellaneous properties at 145.037743897283 [psi(a)] and 20 [°C]		
Herrington-Zipperer	Dynamic viscosity μ	7.31195E-06 [lb/(ft.s)]
	Velocity of sound ω	425.21793 [m/s]
	Real gas isobaric heat capacity C_p	37.75070166 [J/(mol.K)]
	Real gas isochoric heat capacity C_v	28.50646813 [J/(mol.K)]
AGA-8	Gas density ρ	0.000266329 [lb/m3]

Common properties at 145.037743897283 [psi(a)] and 20 [°C] [psi(a) 14.69594940]		
AGA-8 (DC92)	Compressibility	Z 0.980538628 Z_R 0.9973081
S-GERG-88 (TMS)	Compressibility	Z 0.97925346 Z_R 0.9973148
AGA NX19	Compressibility	Z 0.979504579 Z_R 0.9973734
AGA NX19 (G9)	Compressibility	Z 0.979952367 Z_R 0.9973035



Flow computer verification



On-line integrated validation software

Validations

-  Turbine master meter proving
-  Pressure / Differential Pressure
-  Temperature transmitters & elements
-  Density transducers
-  Relative density analyzers
-  Ultrasonic meters
-  Gas chromatographs

as-found, as-left methods

-  Validations
-  Calibrations

Functionality

-  Extensive reporting
-  MySQL database storage
-  Visual interface
-  Instructions for operator
-  Fully integrated with HMI

eXLerate 2003 - (Run) - Validations.XLR 7/34/31 - 27/06/2007

Instructions for Pressure transmitter validation

Use the scroll bar to the right to navigate

Version 1.0

Powered by



Parameter	Value
Active Step	8 Calculating validation result
Current line pressure	44.88 bara
Current record	3
Number of records	11
Lower range value	0 bara
Upper range value	50 bara
Tolerance	0.15 bara

Equipment used:
Dead weight tester
Dead-weight Tester Lagrange et Huot DWT 310 S/N LH 323-445-1

Weight certificate
Weights Lagrange et Huot WT S/N 00031

Witnesses

Sellgas inc.	Buygas corp.
N. Armstrong	L. Minelli
R. Reagan	D. Day
G. Bush	L. Taylor

Actual	PT-101	PT-102	PT-103	PT-104	PT-105										
% [bara]	Reading [bara]	Dev. [bara]	Error [rel %]	Reading [bara]	Dev. [bara]	Error [rel %]	Reading [bara]	Dev. [bara]	Error [rel %]	Reading [bara]	Dev. [bara]	Error [rel %]	Reading [bara]	Dev. [bara]	Error [rel %]
0%	11.26	2.14	2.14	14.19	14.19	17.85	17.85	13.37	13.37	4.46	4.46	4.46	26.41	13.91	111.3%
25%	17.64	5.14	41.1%	46.39	33.89	31.77	19.27	154.2%	0.38	12.12	-97.0%	26.41	13.91	111.3%	
50%															
75%															
100%															
110%															
100%															
75%															
50%															
25%															
0%															

Procedure: Validation

Click here to (re)start

```

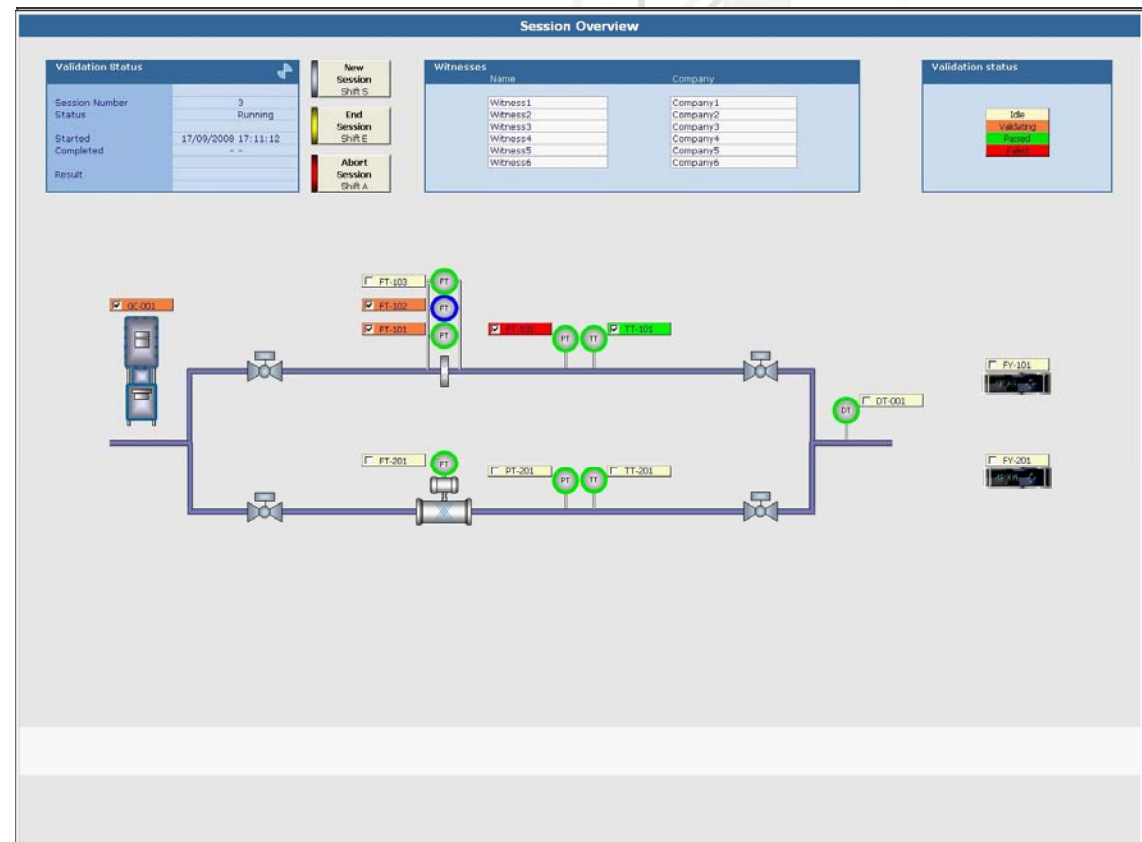
graph TD
    Start([Start]) --> Init[Initialization  
n := 1]
    Init --> Prep[Step n  
preparation]
    Prep --> Measure[Measure value of  
step n]
    Measure --> Stable{Stable  
reading?}
    Stable -- F --> Error{Error?}
    Error -- F --> Stable
    Error -- T --> Reject[Reject step]
    Stable -- T --> Process[Process step]
    Process --> Next[n := n+1]
    Next --> Complete{Completed?}
    Complete -- F --> Measure
    Complete -- T --> Finalize[Finalize validation]
    Finalize --> End([Completed])
    
```

Function Keys

F1	F2	F3	F4	F5	F6	F7 Print	F8	F9	F10 Login	F11 Alarms	F12 Trending
----	----	----	----	----	----	-------------	----	----	--------------	---------------	-----------------

Session Manager

- Graphical Overview of station showing transmitters for validation
- Shows results of running / last Validation Session
- <New Session>:
The Operator selects the equipment to be validated
Validations are performed with the individual validation procedures
- Session is active:
Session Overview shows the running validation status



Single Transmitter Validation

- Shows the running / last validation.
- Start Validation : previous results are removed.
- results for the running step are calculated and displayed.
- With the radio buttons, the operator selects the next step.
- Supports storing results into database for Control Charts.

Pressure Transmitter Validation

Validation Status

Session	3	As Found
Status	Step 5	
Started	17/09/2008 17:13	
Completed	-	
Progress	3.75%	
Result	-	

Witnesses

Name	Company	Comments
Witness1	Company1	
Witness2	Company2	
Witness3	Company3	
Witness4	Company4	
Witness5	Company5	
Witness6	Company6	

Calibration equipment

Make	Calibration
Type	DWT
Serial no.	34567890
Calibration date	01/02/2007
Calibration due	31/12/2008

PT-101

Make	Rosemount
Type	3051
Serial no.	23456789
Lower range	bar 0.0
Upper range	bar 60.0
Tolerance	% 0.75

Step No.	Step %	Value bar	Ref. Value bar
1	0%	0.0	0.00
2	25%	15.0	15.00
3	50%	30.0	30.00
4	75%	45.0	45.00
5	100%	60.0	60.00
6	110%	66.0	66.00
7	100%	60.0	60.00
8	75%	45.0	45.00
9	50%	30.0	30.00
10	25%	15.0	15.00
11	0%	0.0	0.00

Reading bar	Deviation bar	Error % Ref	Error % Span
0.1	0.1	-	0.13
15.1	0.1	0.40	0.10
29.9	-0.1	-0.37	-0.18
45.1	0.1	0.27	0.20
63.0	-7.0	-11.66	-11.66
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
Overall	7.0	11.66	11.66

Instructions

Preparation
 Before starting a validation, isolate the corresponding stream.
 Close the valves of the stream to the transmitter.
 Vent the pressure lines.
 Open the valves to the calibration equipment.

Select the calibration equipment.
 Enter the Witnesses.

Press the <Start Validation> button.

Steps 1 - 11
 Set up the calibration equipment to be close to the indicated value for the running step.
 Enter the reference value for the running step.
 Wait for the reading to stabilize.
 Select the next step.

End validation
 When all steps are completed, press <End Validation>.
 The validation values and results are stored and a report is generated.

Abort
 When the validation is aborted, the results are not stored, no report is being generated.

Finish
 If you are finished, close the valves to the calibration equipment.
 Open the valves of the stream to the transmitter.

Multiple Transmitter Validation

- ➡ Validation of Multiple Transmitters with the same calibration equipment at the same time;
e.g. orifice plate with differential pressure transmitters.
- ➡ Same as Single Transmitter Validation.
- ➡ Supports storing results into database for Control Charts.

Differential Pressure Transmitter Validation

Validation Status	
Session Status	3 As Found Step 5
Started	17/09/2008
Completed Progress	100%
Result	

Witnesses	
Name	Company
Witness1	Company1
Witness2	Company2
Witness3	Company3
Witness4	Company4
Witness5	Company5
Witness6	Company6

Comments	

Calibration equipment	
Make	Calibration
Type	DWT
Serial no.	34567890
Calibration date	01/02/2007
Calibration due	31/12/2008

DPT-101	
Make	Rosemount
Type	3051
Serial no.	12345678
Lower range	mbar 0.0
Upper range	mbar 150.0
Tolerance	% 0.75

DPT-102	
Make	Rosemount
Type	3051
Serial no.	23456789
Lower range	mbar 0.0
Upper range	mbar 150.0
Tolerance	% 0.75

DPT-103	
Make	Rosemount
Type	3051
Serial no.	98765432
Lower range	mbar 0.0
Upper range	mbar 150.0
Tolerance	% 0.75

Step No.	Step %	Value mbar	Ref. Value mbar	
1	0%	0.0	0.00	C
2	25%	37.5	37.50	C
3	50%	75.0	75.00	C
4	75%	112.5	112.50	C
5	100%	150.0	150.00	C
6	110%	165.0	165.00	C
7	100%	150.0	150.00	C
8	75%	112.5	112.50	C
9	50%	75.0	75.00	C
10	25%	37.5	37.50	C
11	0%	0.0	0.00	C

Reading mbar	Deviation mbar	Error % Ref	Error % Span	
-0.1	-0.1	-	-0.03	✓
37.5	0.0	-0.08	-0.01	✓
74.9	-0.1	-0.15	-0.07	✓
112.0	-0.5	-0.44	-0.33	✓
146.7	-3.3	-2.22	-2.22	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
Overall	3.3	2.22	2.22	✗

Reading mbar	Deviation mbar	Error % Ref	Error % Span	
0.1	0.1	-	0.07	✓
37.6	0.1	0.27	0.07	✓
75.1	0.1	0.08	0.04	✓
112.6	0.1	0.09	0.07	✓
37.5	-112.5	-74.99	-74.99	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
Overall	112.5	74.99	74.99	✗

Reading mbar	Deviation mbar	Error % Ref	Error % Span	
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
-	-	-	-	✗
Overall	0.0	0.00	0.00	✗

Instructions		
Preparation Before starting a validation, isolate the corresponding stream. Close the stream valves to the transmitter and vent the pressure lines. Open the valves to the calibration equipment. Select the calibration equipment. Enter the Witnesses. Press the <Start Validation> button.	Steps 1 - 11 For each step, set up the calibration equipment close to the indicated value. Enter the reference value for the running step. Wait for the reading to stabilize. Select the next step.	End validation When all steps are completed, press <End Validation>. The validation values and results are stored and a report is generated. Abort When the validation is aborted, the results are not stored. Finish If you are finished, close the valves to the calibration equipment. Open the stream valves to the transmitter.

GC Validation

- Shows the running / last validation.
- Start Validation : previous results are removed.
- results for the running step are calculated and displayed after each new GC Analysis.
- Supports storing results into database for Control Charts.

Gas Chromatograph Validation

Validation Status

Session	3	As Found
Status	Waiting for run 3	
Started	17/09/2008 17:13	
Completed	-	
Progress		
Result		

Start Validation
Shift V
End Validation
Shift E
Abort Validation
Shift A

Instructions

Witnesses

Name	Company	Comments
Witness1	Company1	-
Witness2	Company2	-
Witness3	Company3	-
Witness4	Company4	-
Witness5	Company5	-
Witness6	Company6	-

Calibration gas

Make	Hochloos
Type	CalGas
Serial no.	Bottle
Calibration date	01/02/2007
Calibration due	31/12/2008

GC-001

Make	Siemens
Type	Maxum II
Serial no.	GC1234

Gas composition		Calibration gas	Analysis Run 1	Analysis Run 2	Analysis Run 3	Analysis Run 4	Average Result	Deviation	Limit
Methane	[mol-%]	86.00	86.0	85.5	-	-	85.8	-0.25	0.20
Ethane	[mol-%]	8.00	8.0	8.0	-	-	8.0	0.00	0.20
Propane	[mol-%]	2.00	2.0	2.0	-	-	2.0	0.00	0.10
i-Butane	[mol-%]	1.50	1.5	1.5	-	-	1.5	0.00	0.10
n-Butane	[mol-%]	1.00	1.0	1.0	-	-	1.0	0.00	0.10
i-Pentane	[mol-%]	0.50	0.5	0.5	-	-	0.5	0.00	0.10
n-Pentane	[mol-%]	0.30	0.3	0.3	-	-	0.3	0.00	0.10
neo-Pentane	[mol-%]	0.20	0.2	0.2	-	-	0.2	0.00	0.10
n-Hexane	[mol-%]	0.10	0.1	0.1	-	-	0.1	0.00	0.10
Nitrogen	[mol-%]	0.15	0.2	0.2	-	-	0.2	0.00	0.10
Carbon Dioxide	[mol-%]	0.25	0.3	0.3	-	-	0.3	0.00	0.10
Caloric value	[MJ/Nm3]	40.50	40.5	40.5	-	-	40.5	0.00	-
Relative density	[-]	0.65	0.7	0.7	-	-	0.7	0.00	-
Wobbe index	[MJ/Nm3]	50.00	50.0	50.0	-	-	50.0	0.00	-

Transmitter validation report

Pressure & temperature validation

Start time: 18/06/2007 12:27
End time: 18/06/2007 12:27

Result pressure: OK
Result temperature: OK

Witnessed by: Company 1
 person 1
 person 2
 person 3

Pressure:
Make: Rosemount
Serial numbers: 12345
Lower range value: 0.00
Upper range value: 80.00
Tolerance: 1.00

Calibration equipment:
PT: make 123
TT: make 356

Temperature:
Make: Rosemount
Serial numbers: 12345
Lower range value: 0.00
Upper range value: 80.00
Tolerance: 1.00

Readings

(Snapshot)

Measurement		Pressure transmitter		
	Ref. value	Readings	Deviation	Error
	[barg]	[barg]	[barg]	[%]
1	64.2		-	-
2	2		-	-
3	3		-	-
4	4		-	-
5	5		-	-
6	6		-	-
7	55		-	-
8	8		-	-
9	9		-	-
10	10		-	-
11	55		-	-

Measurement		Temperature transmitter		
	Ref. value	Readings	Deviation	Error
	[°C]	[°C]	[°C]	[%]
1	27.78		-	-
2	21		-	-
3	50		-	-
4	75		-	-
5	21		-	-
6	110		-	-
7	100		-	-
8	30		-	-
9	50		-	-
10	25		-	-
11	30		-	-

Turbine validation display

User: ADMINISTRATOR [2000] This PC: PC14 Duty: None **Turbine validation FYI-8803** 07/06/2007 12:15

validation can be done only on duty SVC

Turbine validation	Flow computer	Turbine meter
Measurement 1 Pressure Temp. Step mM Step mM Base Dens Line Dens Step mM Step mM	Start Start Start time 13:50:54 Start total 100 Nm3 Stop Stop End time 13:51:49 End total 200 Nm3 Normal volume flow rate 6545.45 Nm3/hr	Start time 13:50:49 Start total 0 m3 End time 13:51:44 End total 1.5 m3 55 sec Time 55 sec 13:51:44 Pressure 65 bara 55 sec Temperature 25 °C Gross volume flow rate m3/hr 98.14 Normal volume flow rate Nm3/hr 6407.05 6507.16 Deviation FC / Field % 2.16 0.59
Measurement 2 Pressure Temp. Step mM Step mM Base Dens Line Dens Step mM Step mM	Start Start Start time 13:53:04 Start total 100 Nm3 Stop Stop End time 13:53:34 End total 300 Nm3 Normal volume flow rate 24000.00 Nm3/hr	Start time 13:52:58 Start total 0 m3 End time 13:53:28 End total 3 m3 30 sec Time 30 sec 13:53:28 Pressure 65 bara 30 sec Temperature 25 °C Gross volume flow rate m3/hr 360.23 Normal volume flow rate Nm3/hr 23517.17 23884.63 Deviation % 2.05 0.48
Measurement 3 Pressure Temp. Step mM Step mM Base Dens Line Dens Step mM Step mM	Start Start Start time 13:54:09 Start total 300 Nm3 Stop Stop End time 13:54:39 End total 500 Nm3 Normal volume flow rate 24000.00 Nm3/hr	Start time 13:54:03 Start total 0 m3 End time 13:54:34 End total 3 m3 30 sec Time 30 sec 13:54:34 Pressure 65 bara 31 sec Temperature 25 °C Gross volume flow rate m3/hr 360.23 Normal volume flow rate Nm3/hr 23517.17 23884.63 Deviation % 2.05 0.48
Measurement 4 Pressure Temp. Step mM Step mM Base Dens Line Dens Step mM Step mM	Start Start Start time 14:05:19 Start total 700 Nm3 Stop Stop End time 14:05:44 End total 900 Nm3 Normal volume flow rate 28800.00 Nm3/hr	Start time 14:05:13 Start total 0 m3 End time 14:05:43 End total 3 m3 25 sec Time 25 sec 14:05:43 Pressure 64 bara 30 sec Temperature 25 °C Gross volume flow rate m3/hr 432.32 Normal volume flow rate Nm3/hr 28223.66 28223.66 Deviation % 2.04 2.04
Measurement 5 Pressure Temp. Step mM Step mM Base Dens Line Dens Step mM Step mM	Start Start Start time 14:07:14 Start total 900 Nm3 Stop Stop End time 14:07:44 End total 1100 Nm3 Normal volume flow rate 24000.00 Nm3/hr	Start time 14:07:13 Start total 0 m3 End time 14:07:43 End total 3 m3 30 sec Time 30 sec 14:07:43 Pressure 64 bara 30 sec Temperature 25 °C Gross volume flow rate m3/hr 360.23 Normal volume flow rate Nm3/hr 23517.17 23517.17 Deviation % 2.05 2.05
Measurement 6 Pressure Temp. Step mM Step mM Base Dens Line Dens Step mM Step mM	Start Start Start time 15:17:54 Start total 1500 Nm3 Stop Stop End time 15:18:24 End total 1700 Nm3 Normal volume flow rate 24000.00 Nm3/hr	Start time 15:17:48 Start total 0 m3 End time 15:18:19 End total 3 m3 30 sec Time 30 sec 15:18:19 Pressure 65 bara 31 sec Temperature 25 °C Gross volume flow rate m3/hr 360.23 Normal volume flow rate Nm3/hr 23517.17 23884.63 Deviation % 2.05 0.48

Function Keys

F1 Return	F2 Overview	F3	F4	F5	F6	F7	F8 Generate report	F9	F10	F11 Login	F12 Reports
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 Validation in principle:

- Integrated reporting
- Integrated SCADA/HMI
- Simple to verify: Excel based
- Fully user-definable
- Highly flexible, yet secured
- Redundant on all levels
- Significant installed base



Turbine Validation Report

Print date: 18-06-2017
Print time: 12:05

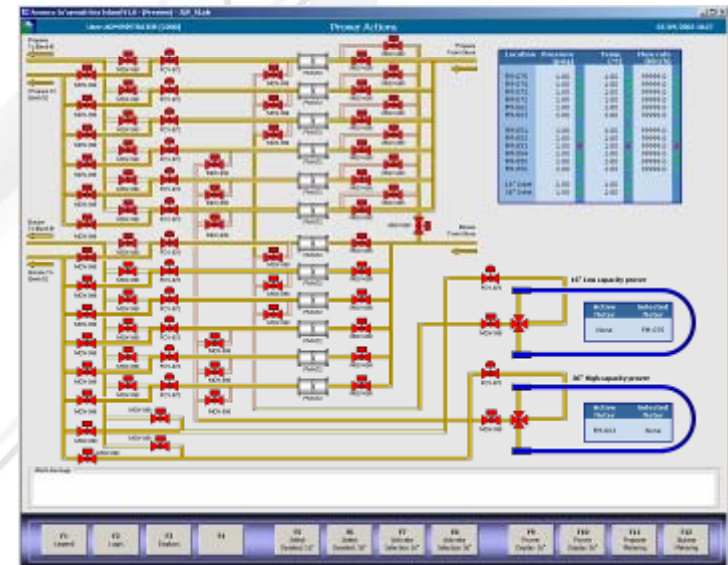
Validator: Turbine meter FYT-8032

	Measurement 1	Measurement 2	Measurement 3	Measurement 4	Measurement 5	Measurement 6
Meter						
Start flow: [m3]	0	1	3	3	4	5
End flow: [m3]	3	4	5	6	7	8
Turn: [sec]	30.2	30	30	30	30	30
Pressure [bara] FC	64.00	64.00	64.00	64.00	64.00	64.00
Temperature [°C] FC	25.00	25.00	25.00	25.00	25.00	25.00
N. flow rate: Nm3/hr	23361	23517	23517	23517	23517	24329
Correction factor	65.2837	65.2837	65.2837	65.2837	65.2837	65.2837
RECALC						
Pressure [bara] FIELD	65.00	65.00	65.00	64.00	66.00	65.00
Temperature [°C] FIELD	25.00	25.00	25.00	24.00	25.00	25.00
Flow rate: m3/hr	353	360	360	360	360	373
N. flow rate: Nm3/hr	23726	23865	23150	23396	24252	24799
Correction factor	66.3037	66.3037	64.2636	65.5034	67.3238	66.3037
Frequency [Hz]	112.53	113.33	113.33	113.33	113.33	117.24
Frequency k-factor	11.42-100000	11.42-100000	11.42-100000	11.42-100000	11.42-100000	11.42-100000
Base density	0.7780	0.7780	0.7780	0.7780	0.7780	0.7780
Line density	50.7919	50.7919	50.7919	50.7919	50.7919	50.7919
FC						
Start time:	14:44:44	14:47:14	15:03:06	15:04:29	15:06:44	15:15:00
End time:	14:45:14	14:47:44	15:03:30	15:05:29	15:07:14	15:15:29
Start flow: [Nm3]	100	500	500	700	900	1300
End flow: [Nm3]	300	500	700	900	1100	1500
Flow rate: Nm3/hr	24000	24000	24000	24000	24000	24000
Pressure [bara]	64.00	64.00	64.00	64.00	64.00	64.00
Temperature [°C]	25.00	25.00	25.00	25.00	25.00	25.00
Ref. dens. [-]	0.60175	0.60175	0.60175	0.60175	0.60175	0.60175
GHV [MJ/Nm3]	40.24375	40.24375	40.24375	40.24375	40.24375	40.24375
NO [mol-%]	2.59375	2.59375	2.59375	2.59375	2.59375	2.59375
CO2 [mol-%]	1.11111	1.11111	1.11111	1.11111	1.11111	1.11111
K-factor [-]	1133.31995	1133.31995	1133.31995	1133.31995	1133.31995	1133.31995
Base density	0.7780	0.7780	0.7780	0.7780	0.7780	0.7780
Line density	51.8679	51.8679	51.8679	51.8679	51.8679	51.8679
FYT-8032						
Deviation [%]	2.73	2.05	2.05	2.05	2.05	2.05
Status	OK	OK	OK	OK	OK	OK
Deviation [%] RECALC	1.15	6.40	3.67	1.71	1.04	6.40
Status	OK	OK	OK	OK	OK	OK

Signed:

Liquid Metering

- **Virtual Flow Computer calculations**
 - Period totalizers, high precision (64-bits)
 - ISO-5167
 - Liquid density calculations
 - API-2540
 - TP-25
 - Other products
- **Special calculations**
 - Double precision floating point data
 - Retentive flow totalizers
 - Time series
 - Flow weighted averages etc.
- **Linearization curves for meters**
 - Master meter applications supported straight in application
- **Proving**
 - Master-meter proving
 - Compact proving
 - Ball-proving
- **Batching**
- **Validations & Instrument diagnostics**
- **Audit trails**



Automated fiscal recalculations

Avanco Alkyd Feed & Product Stage V1.0 - (Run) - JGP_FSA6

Local: MSC-1 Duty: MSC-1 Control: FMP6 CR C2+ TO JGP User: ADMINISTRATOR [2000] 11/24/2005 01:41

Station - Recalculation

Station: C2+ to JGP
Recalculation status: Idle

Batch Number:
Batch to be recalculated: 112105

Specific Gravity:
New SG value [-]: 0.6011

Meter tickets

Meter	Ticket	Start Time	Stop Time	SG [-]	Remark
FM-418	34	10:36	10:40	0.6004	
FM-418	35	10:40	10:41	0.6004	
FM-418	36	10:41	13:28	0.6004	

Recalc. selected

Recalc. all

Abort all

Reprint Station Rpt

PT-427 TT-402 FT-418 FM-418 PDES-437

PT-403 TT-403 FT-419 FM-419 PDES-438

PT-404 TT-404 FT-420 FM-420 PDES-439

PT-416 TT-416 FT-421 FM-421 PDES-451

PT-422 TT-422 FT-422 FM-422 PDES-422

C2+

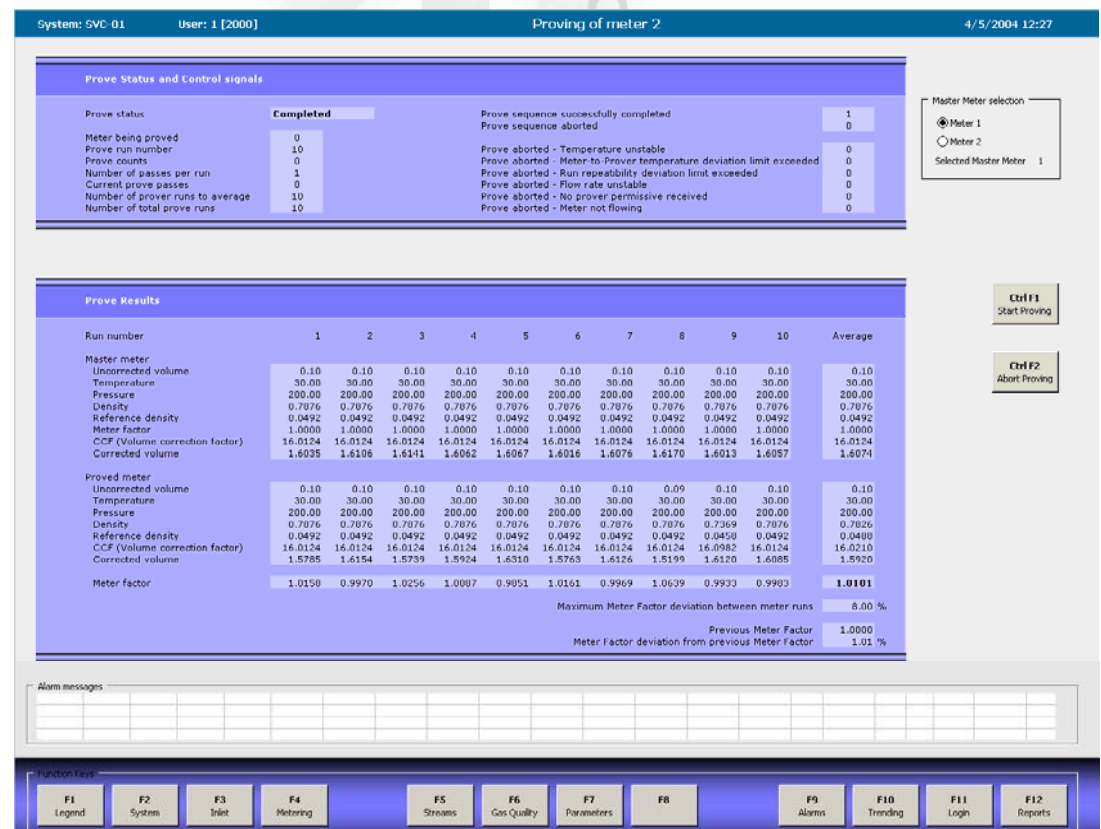
Header
12 [psig]
12.00 [°F]

SG
0.6000 [-]

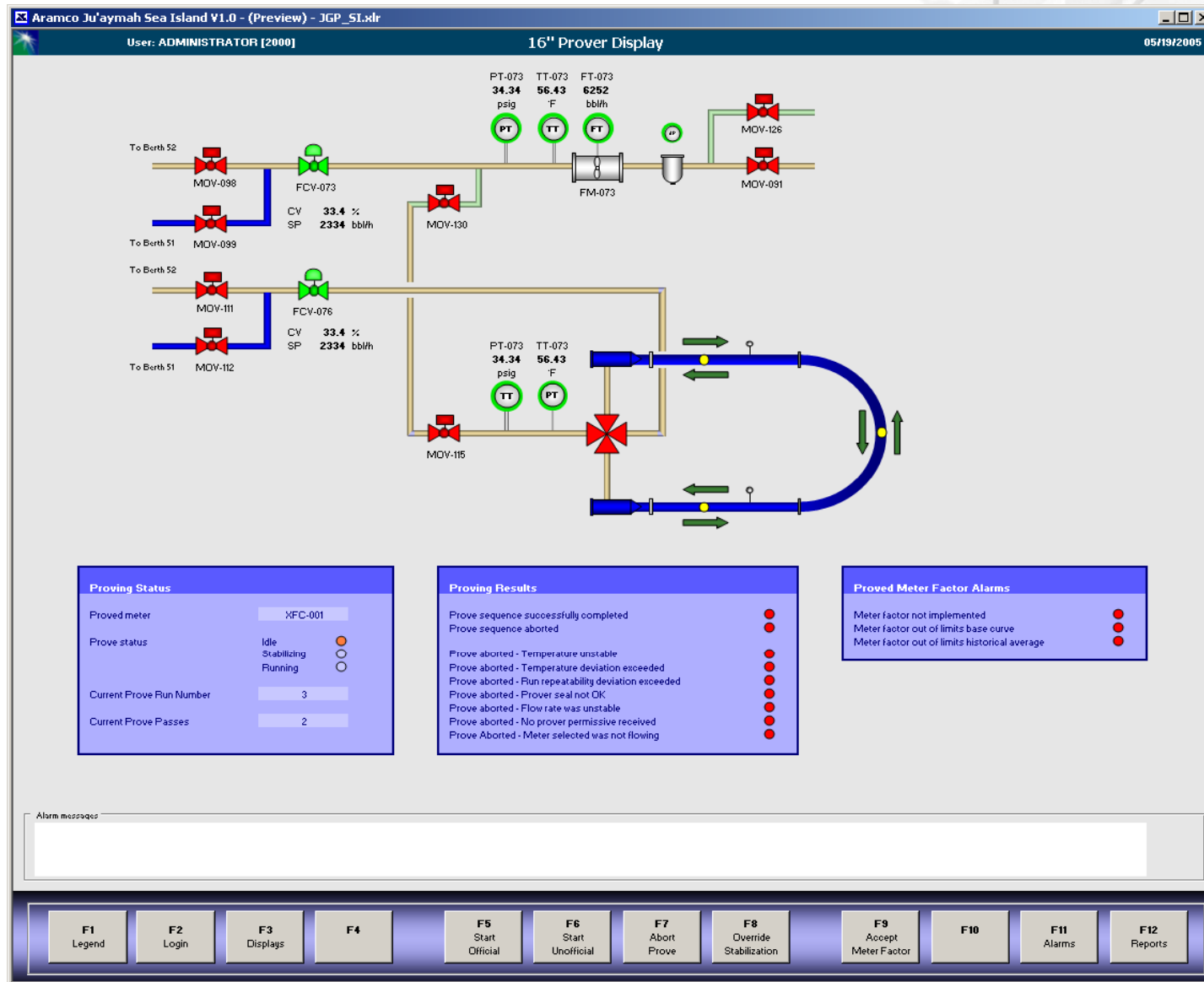
CTRL F1
Edit SG

CTRL F2
Recalculate

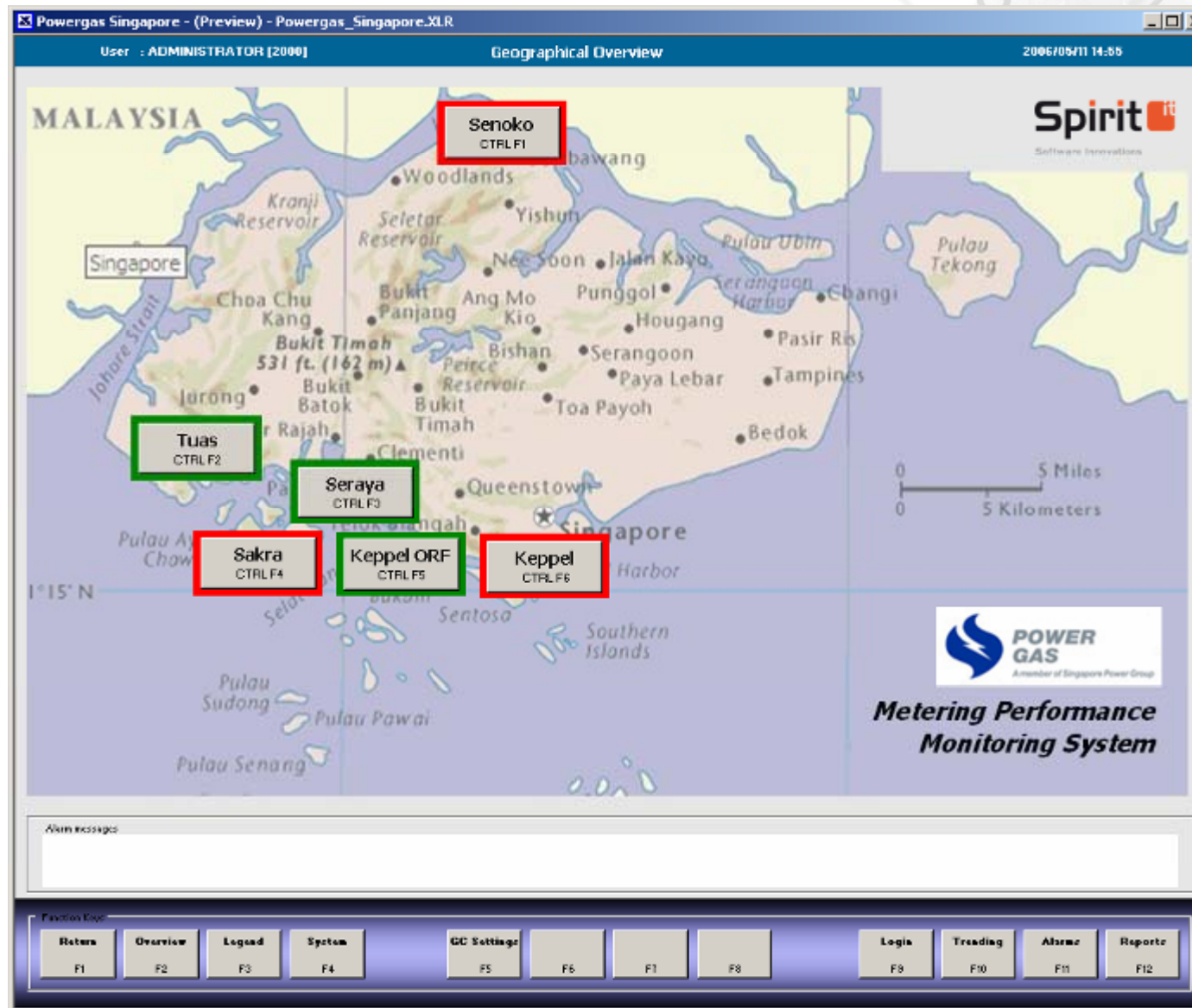
F1 Return F2 Login F3 Displays F4 Legend F5 Current Conditions F6 F7 Prover Actions F8 Prover Display F9 Meter Runs F10 Trending F11 Alarms F12 Reports



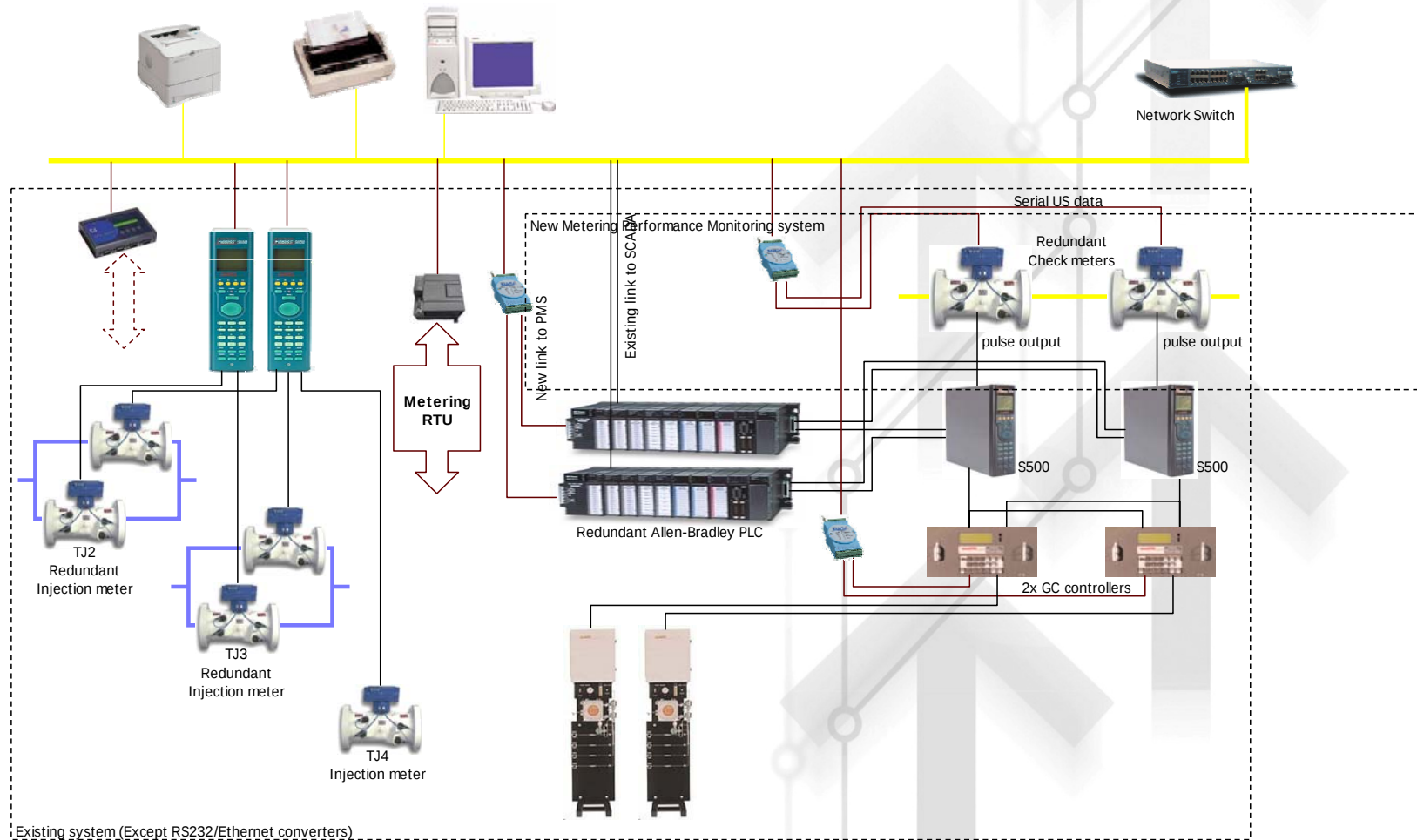
Liquid proving with ball prover



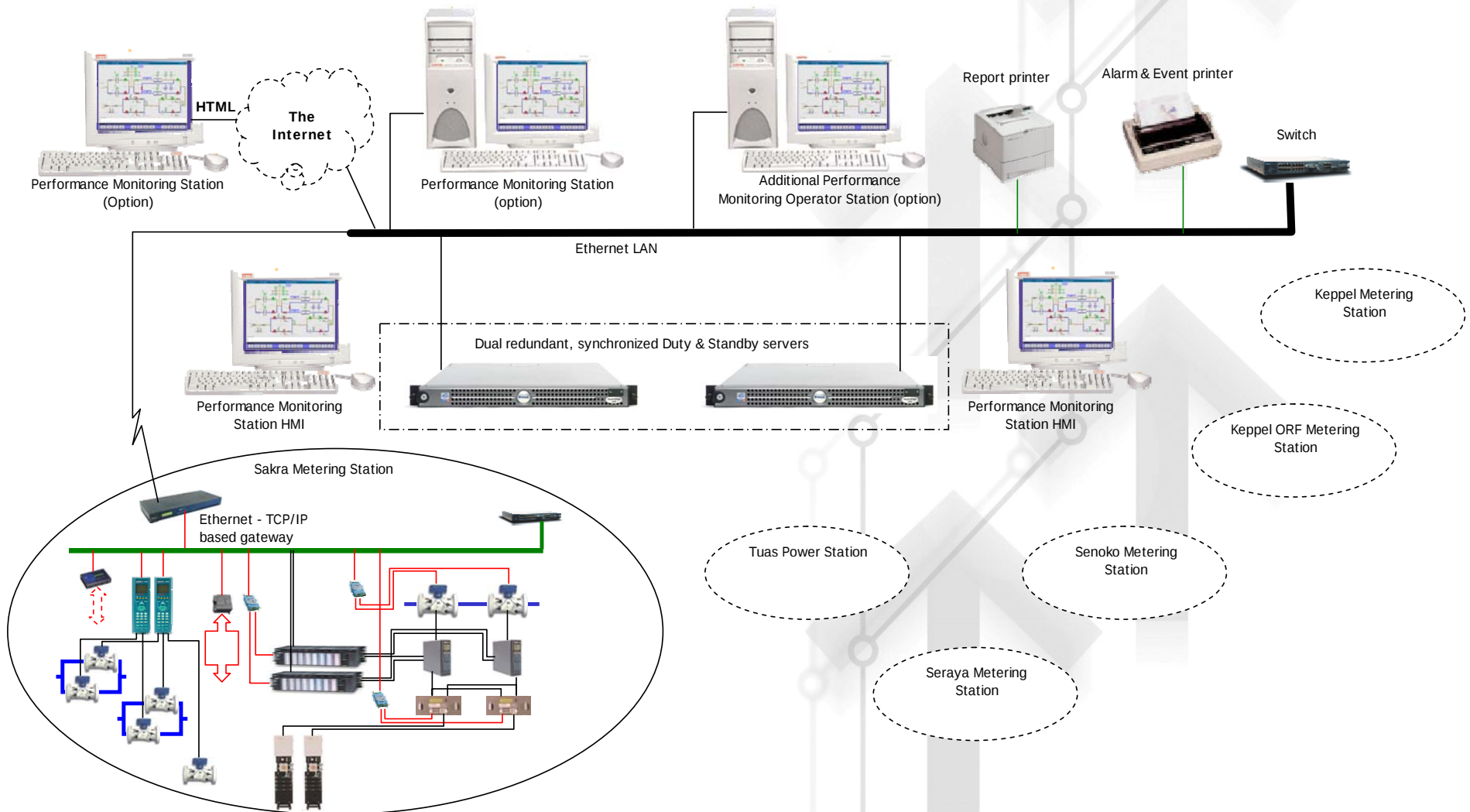
Performance Monitoring SCADA



Station oriented architectures



Station based Performance Monitoring



Performance Monitoring functions





Questions?
Thank you!
Please feel free to ask!