



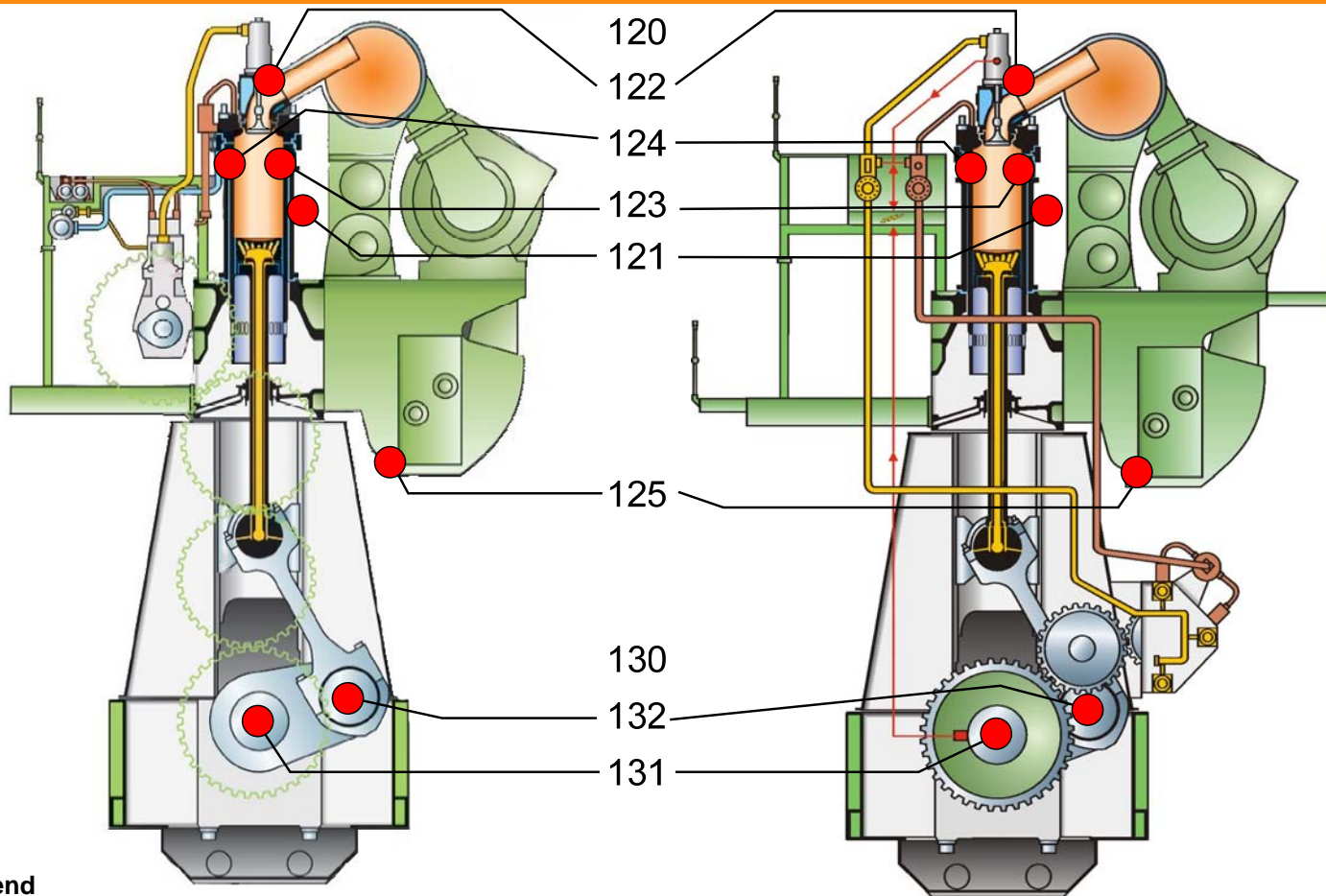
**Welcome to the
MAPEX-PR
Training course**



Monitoring &
mAintenance
Performance
Enhancement with
eXpert knowledge
-
Piston-running
Reliability

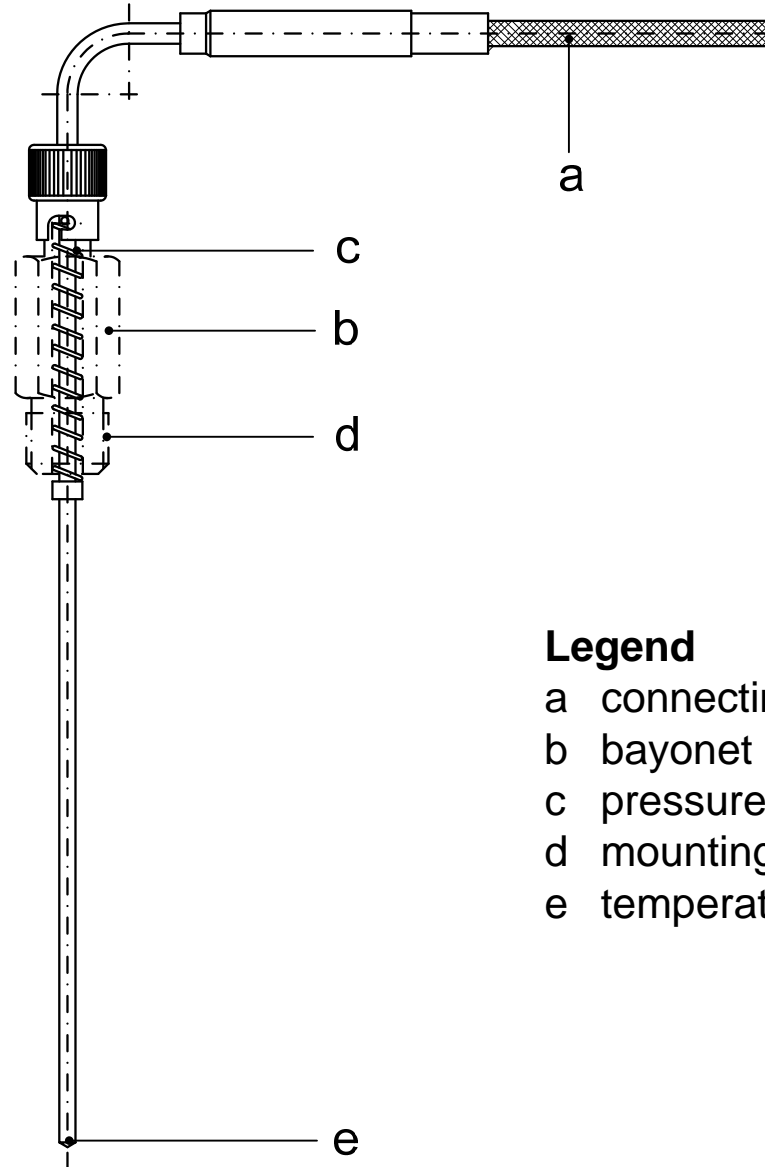
Measurement / monitoring system for ...

- **Liner wall temperatures (LWT: 2 sensors per cylinder)**
- **Cylinder cooling water inlet (CCWIN: common line)**
- **Cylinder cooling water outlet (CCWOUT: common line)**
- **Scavenge air temperatures after each air cooler (SAT)**
- **Load indicator**
- **Speed**



Legend

- 120 MAPEX-PR sensor assembly
- 121 sensor for cooling water input temperature (PT100) at the collective line
- 122 sensor for cooling water output temperature (PT100) at the collective line
- 123 sensor for cylinder liner wall temperature (NiCr-NiAl)
- 124 sensor for cylinder liner wall temperature (NiCr-NiAl)
- 125 sensor for scavenge air temperature after the charge air cooler (PT100)
- 130 engine control
- 131 engine speed measurement
- 132 engine load recording (load indication)

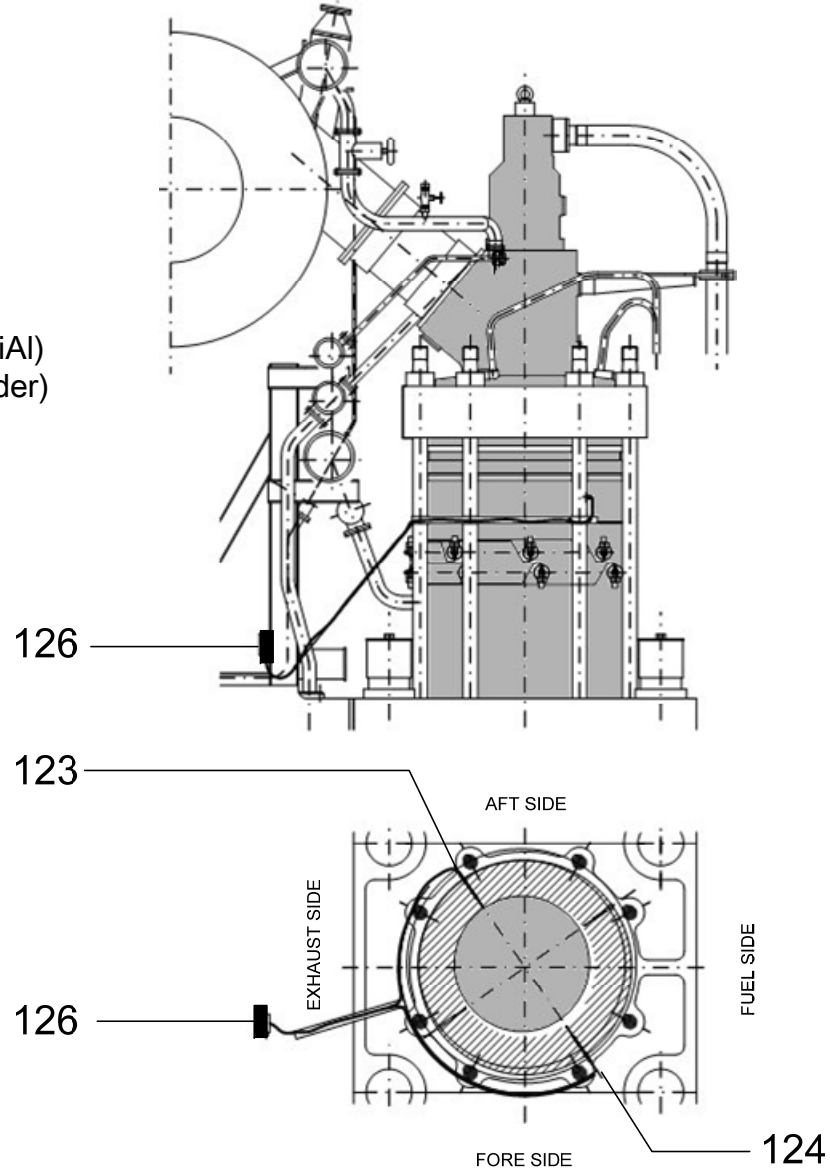


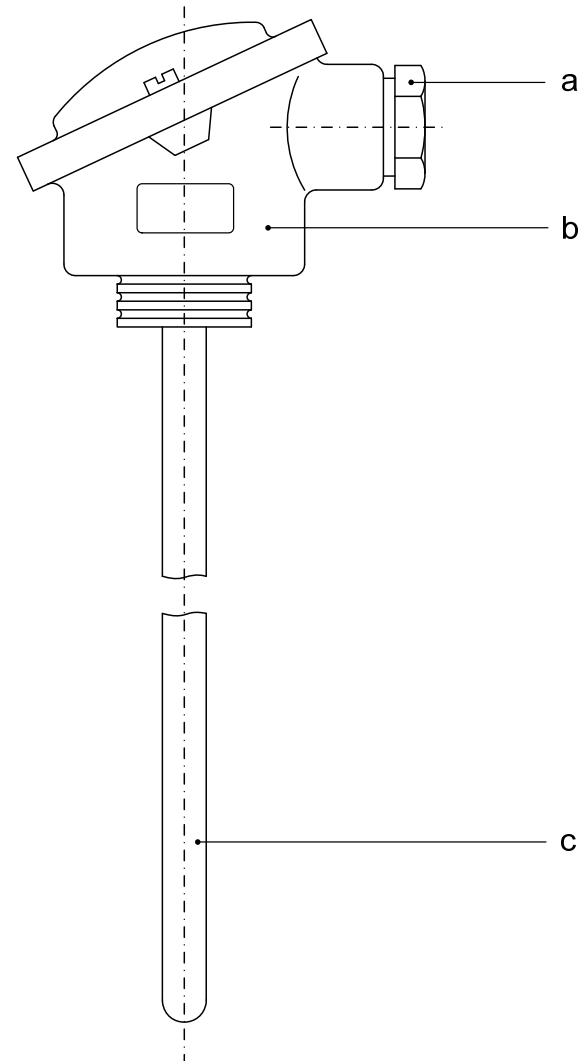
Legend

- a connecting cable
- b bayonet plug (separate part)
- c pressure spring
- d mounting thread
- e temperature sensor

Legend

- 123 sensor for cylinder liner wall temperature AFT (NiCr-NiAl)
- 124 sensor for cylinder liner wall temperature FOREWARD (NiCr-NiAl)
- 126 CANopen converter box (per cylinder)



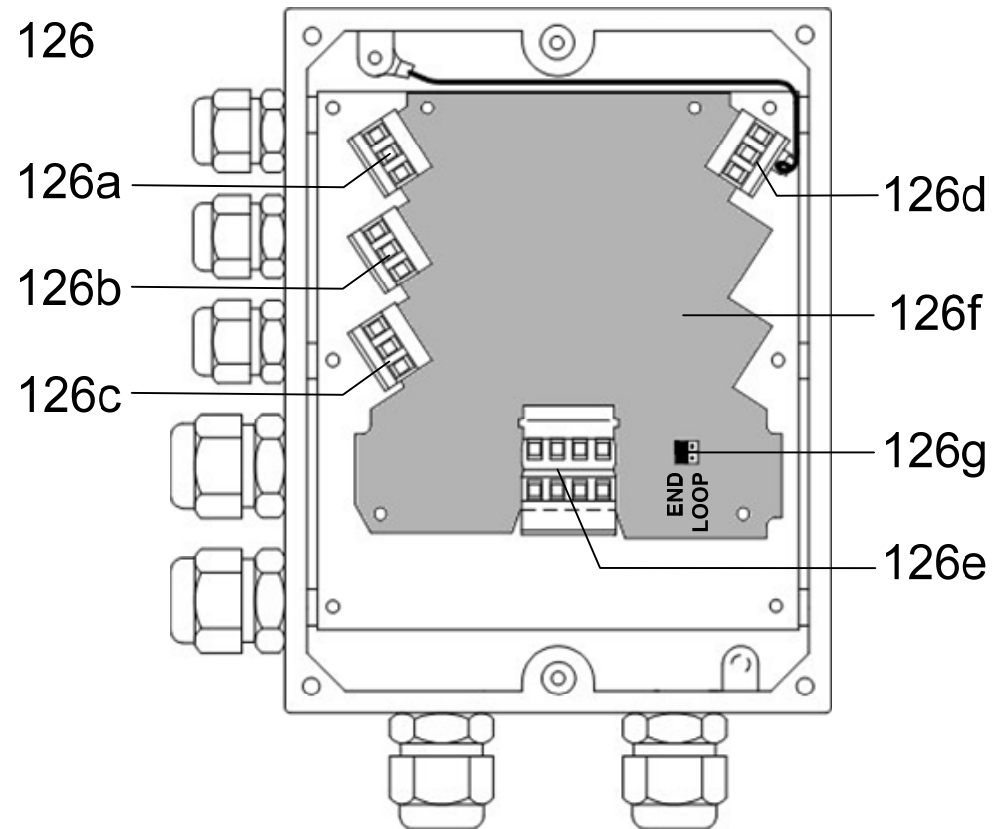


Legend

a cable gland PG16

b sensor housing

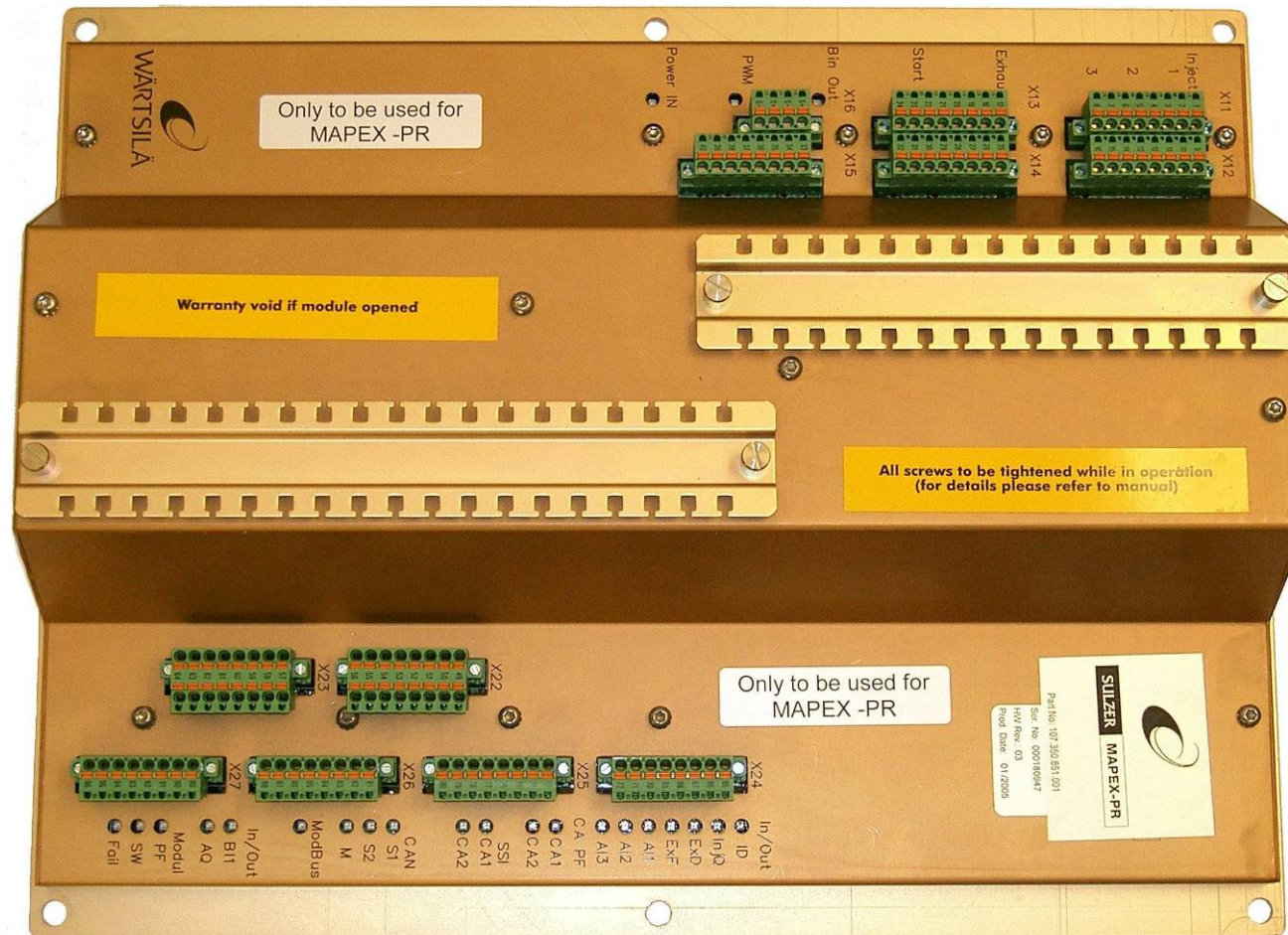
c temperature sensor

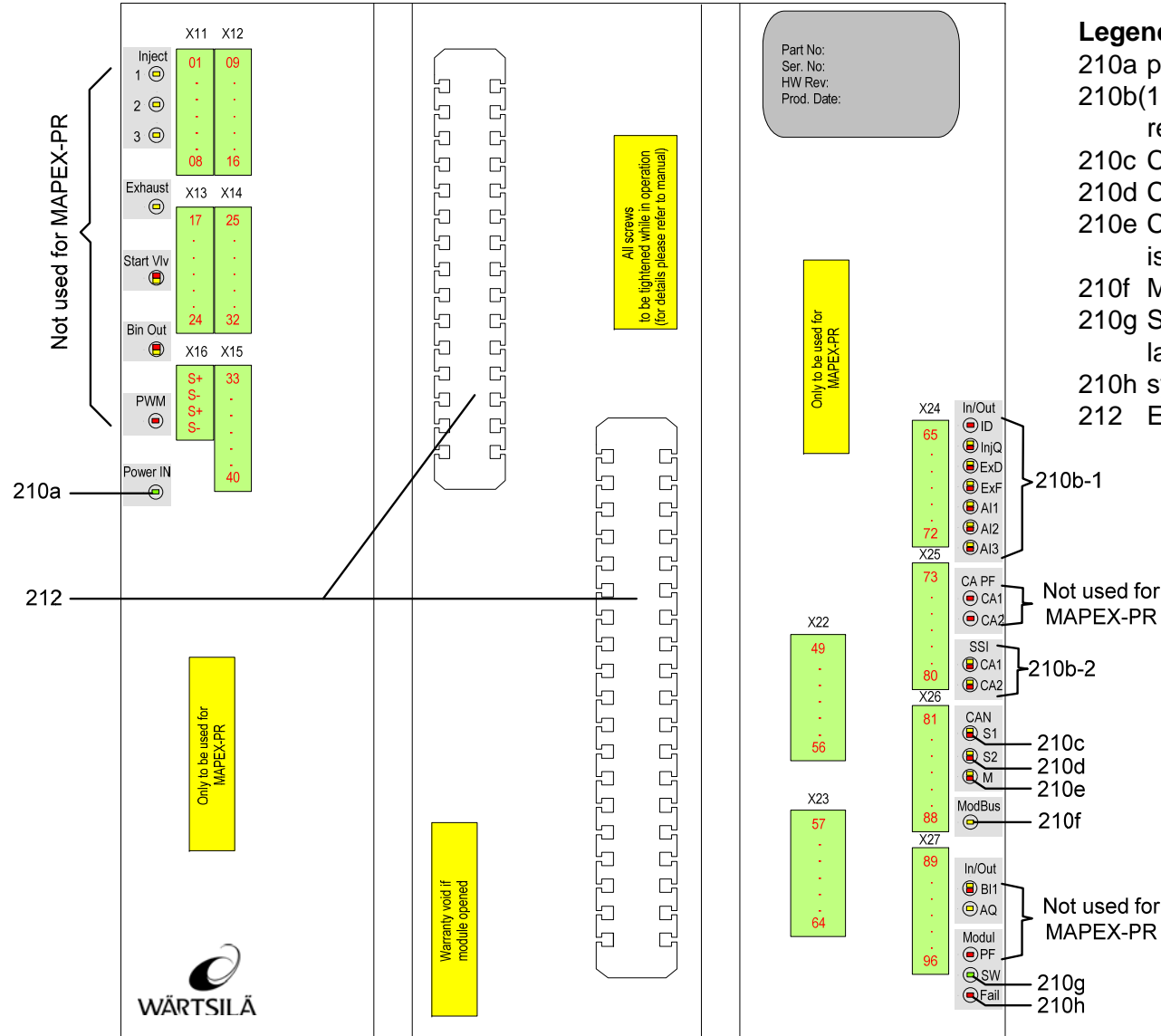


Legend

- 126a cylinder liner wall temperature (NiCr-NiAl)
- 126b cylinder liner wall temperature (NiCr-NiAl)
- 126c one of the cooling water or scavenge air temperatures (PT100)
- 126d CANopen node ID self identification (Box number related resistor)
- 126e power supply and CANopen
- 126f printed circuit part
- 126g CANopen termination jumper selection



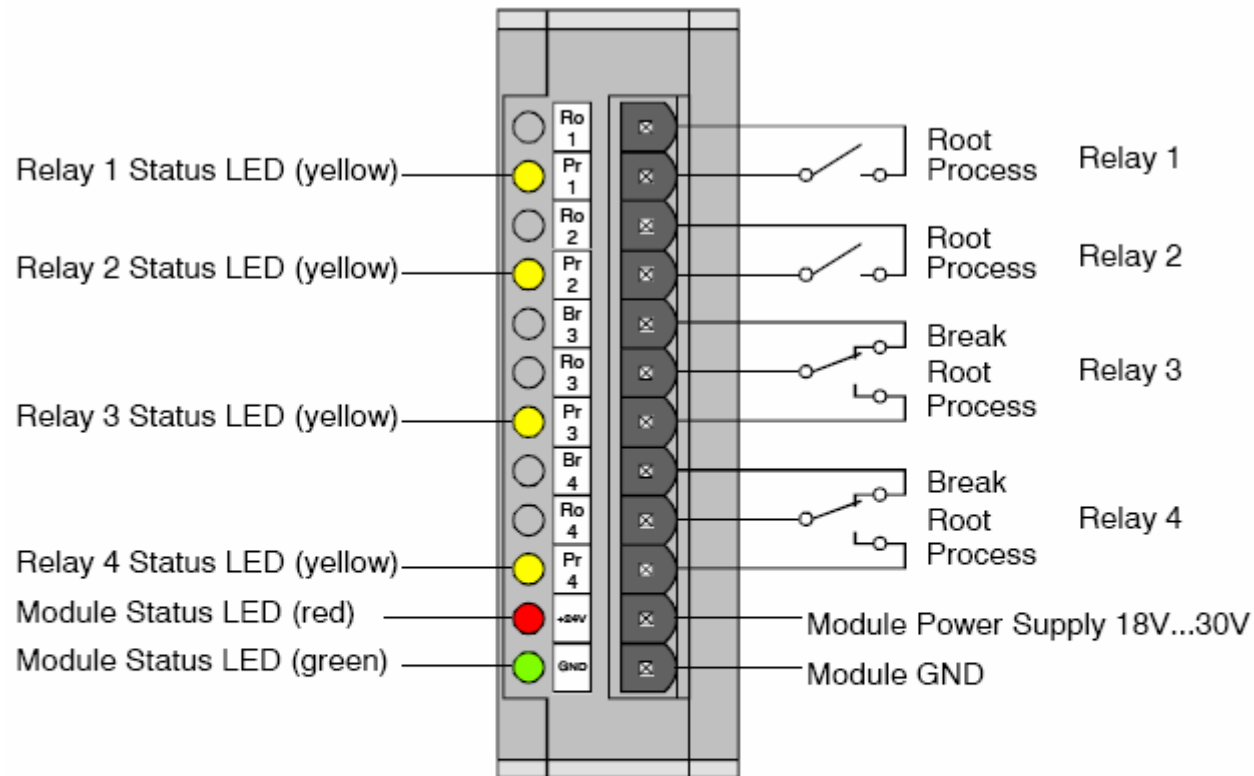




Legend

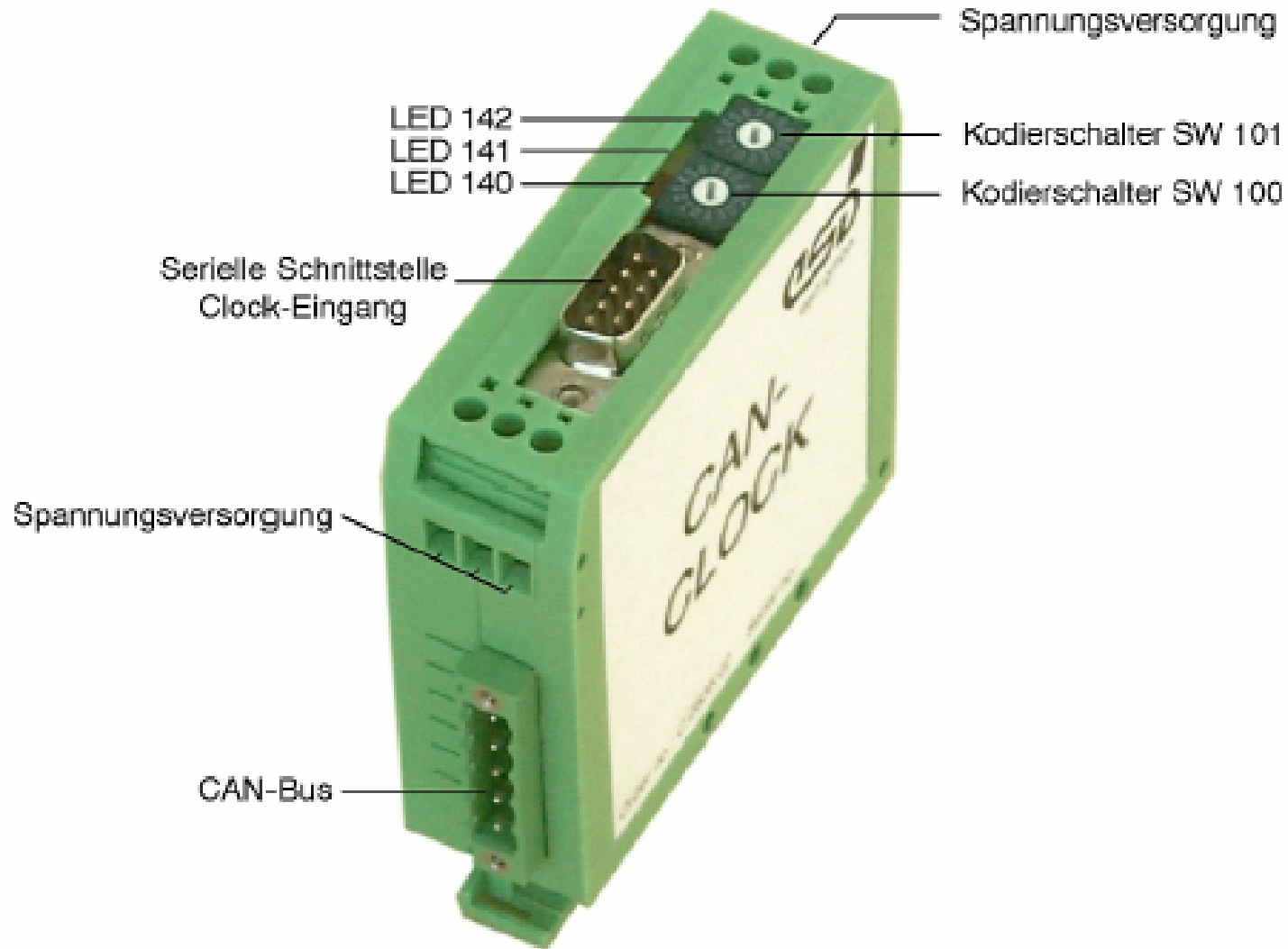
- 210a power supply control lamp (green)
- 210b(1-2) alarm pattern LED group (yellow and red)
- 210c CANopen S1 system bus (yellow/red)
- 210d CANopen S2 system bus (yellow/red)
- 210e CANopen M module bus (galvanic isolated) (yellow/red)
- 210f Modbus (yellow/red)
- 210g SW application and download control lamp (green)
- 210h system error LED (red)
- 212 EMC cable comb



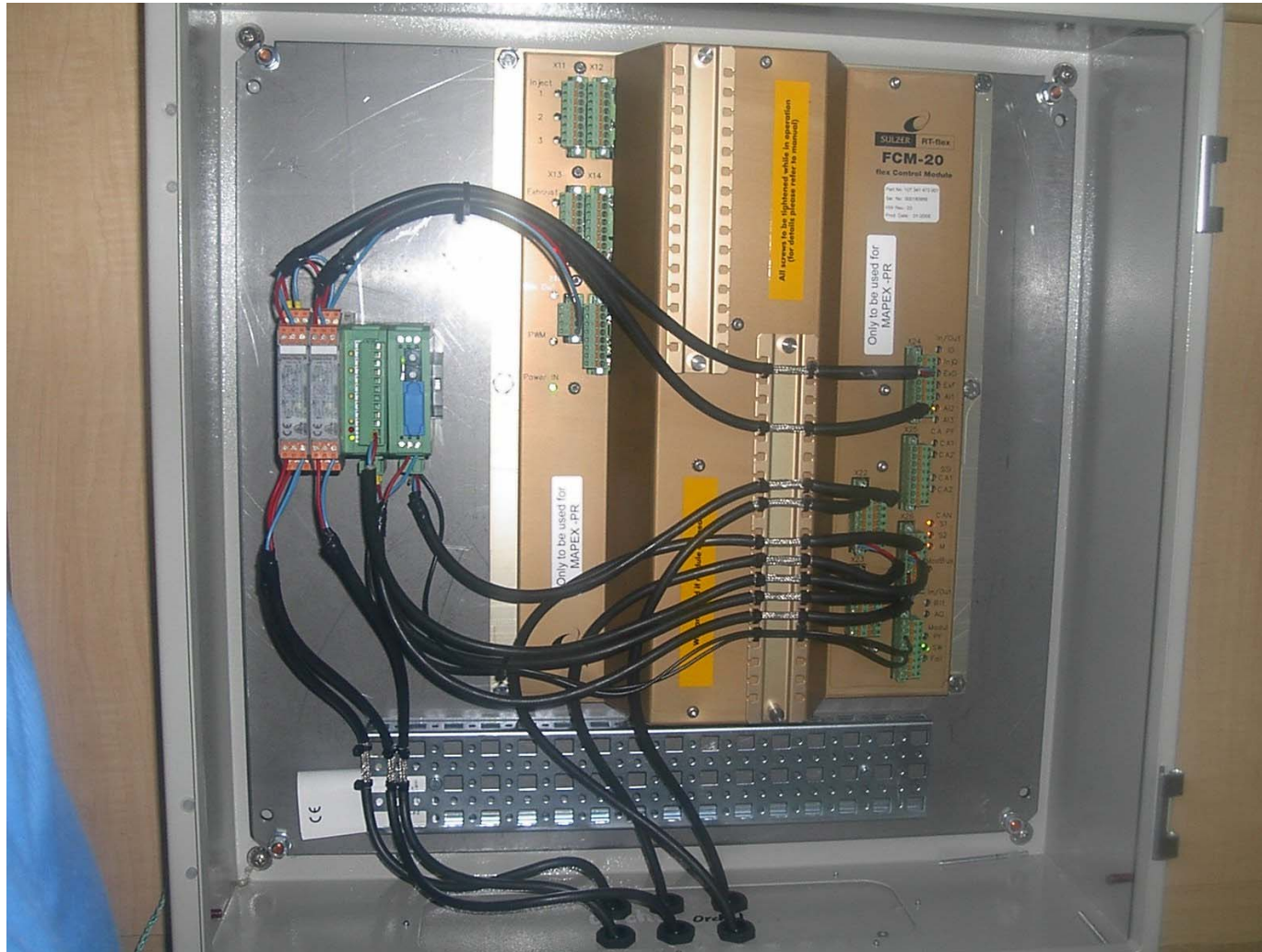


Designation:

Ro...	Root	(COM - common)
Pr...	Process	(N.O. - normally opened)
Br...	Break	(N.C. - normally closed)



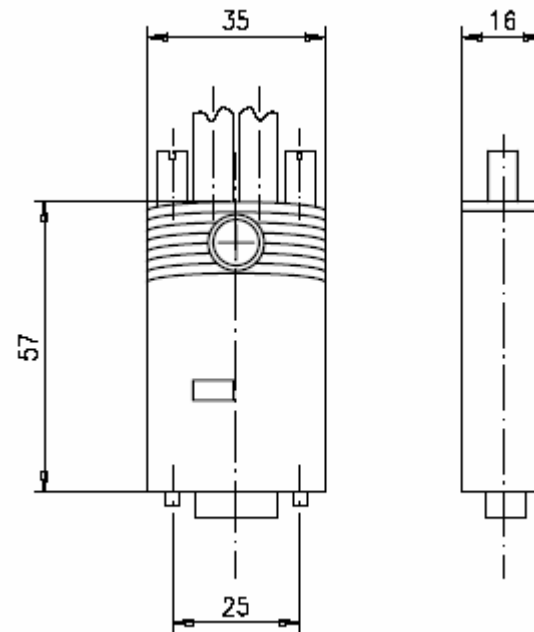
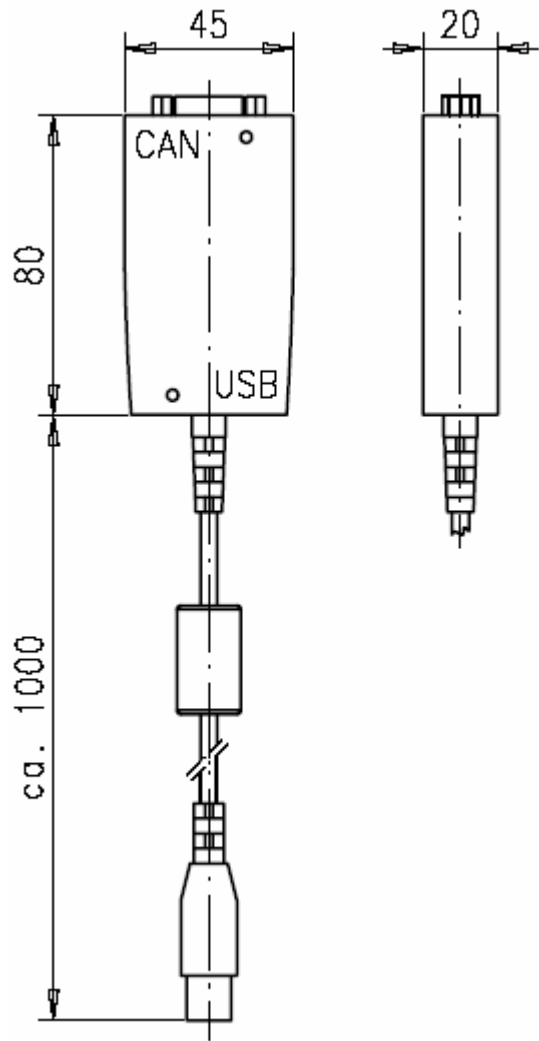


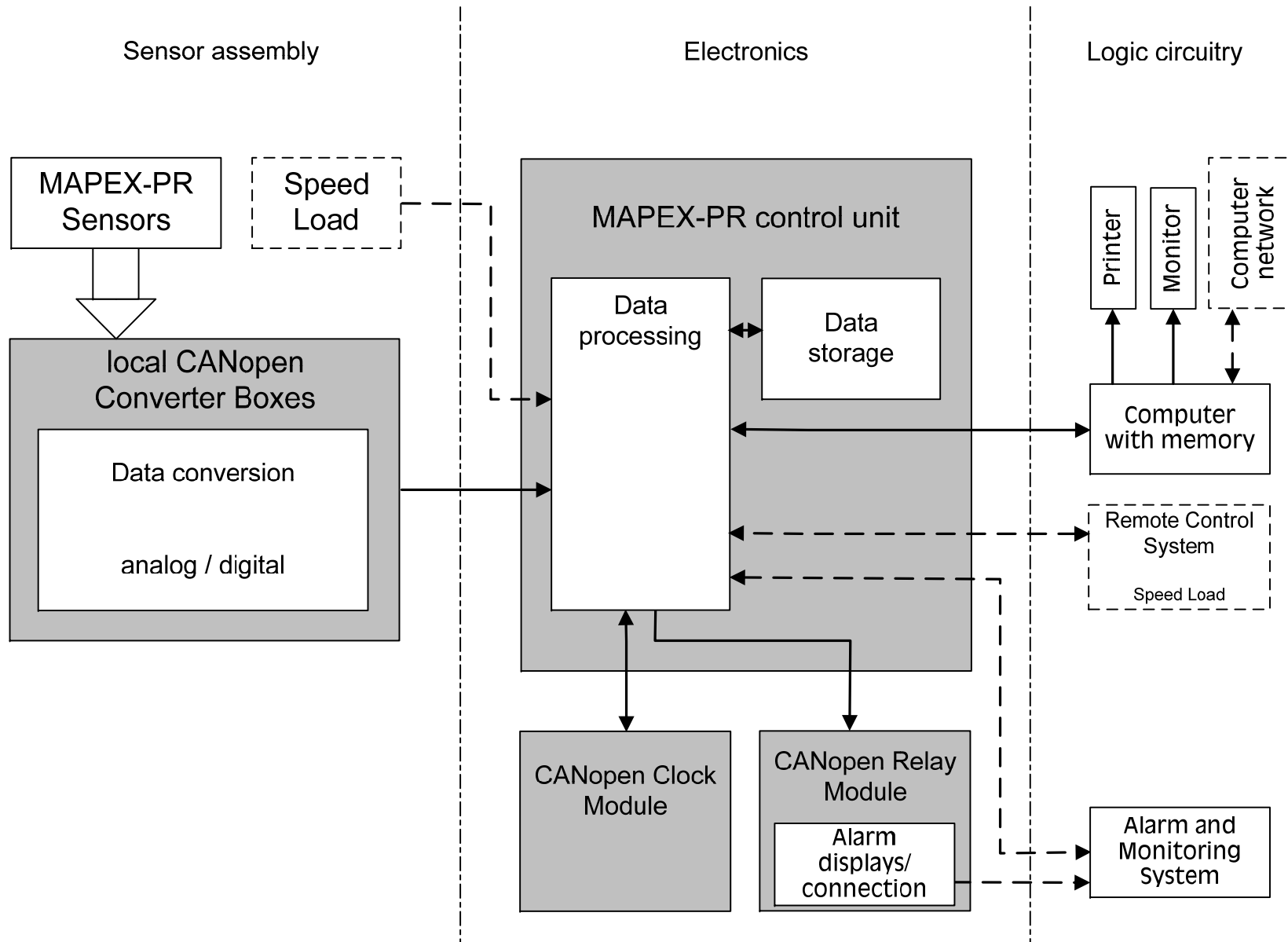


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*USB to CAN adapter
with plug in connector*

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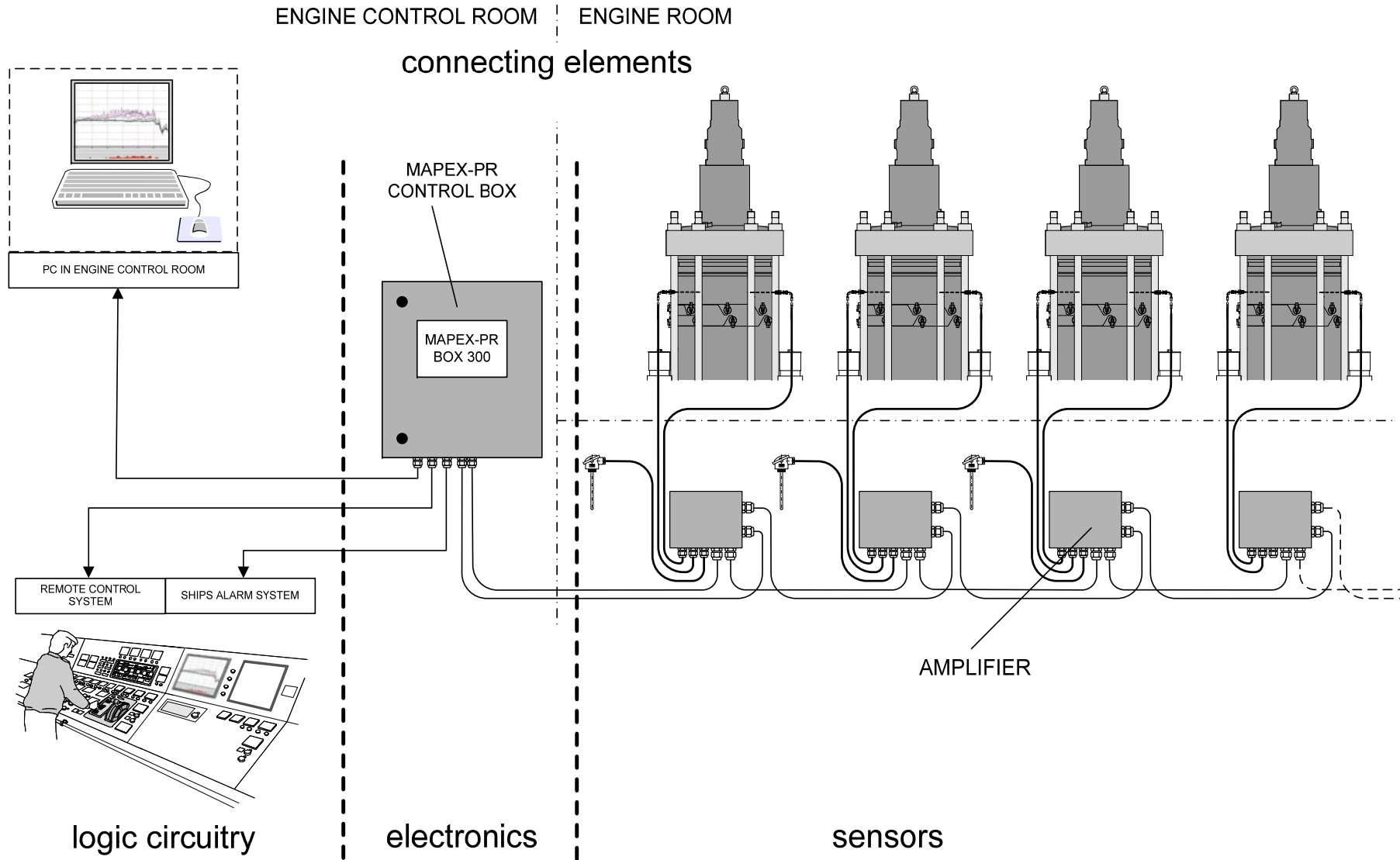




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Block Diagram with CAN/Mod-Bus communication

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Alarm system for ...

- **ALARM 1: HIGH FRICTION SINGLE ALARM**
Appears if on one LWT sensor high friction is indicated
- **ALARM 2: HIGH FRICTION DOUBLE ALARM**
Appears if both LWT sensors indicate abnormal friction
- **ALARM 3: LWT AVERAGE ALARM**
Liner wall temperature average of all cylinders is higher or lower than the given load and speed-dependent alarm curves
- **ALARM 4: LWT DEVIATION SINGLE ALARM**
One liner wall temperature is different from the average of all cylinders

Alarm system for ...

- **ALARM 5: LWT DEVIATION DOUBLE ALARM**
Both liner wall temperature of one cylinder are different from the average of all the other cylinders
- **ALARM 6: CYLINDER COOLING WATER OUTLET ALARM**
The cylinder cooling water outlet temperature fluctuates in an unacceptable manner
- **ALARM 7: SCAVENGE AIR TEMPERATURE ALARM**
The scavenge air temperature after one or more air coolers is too high

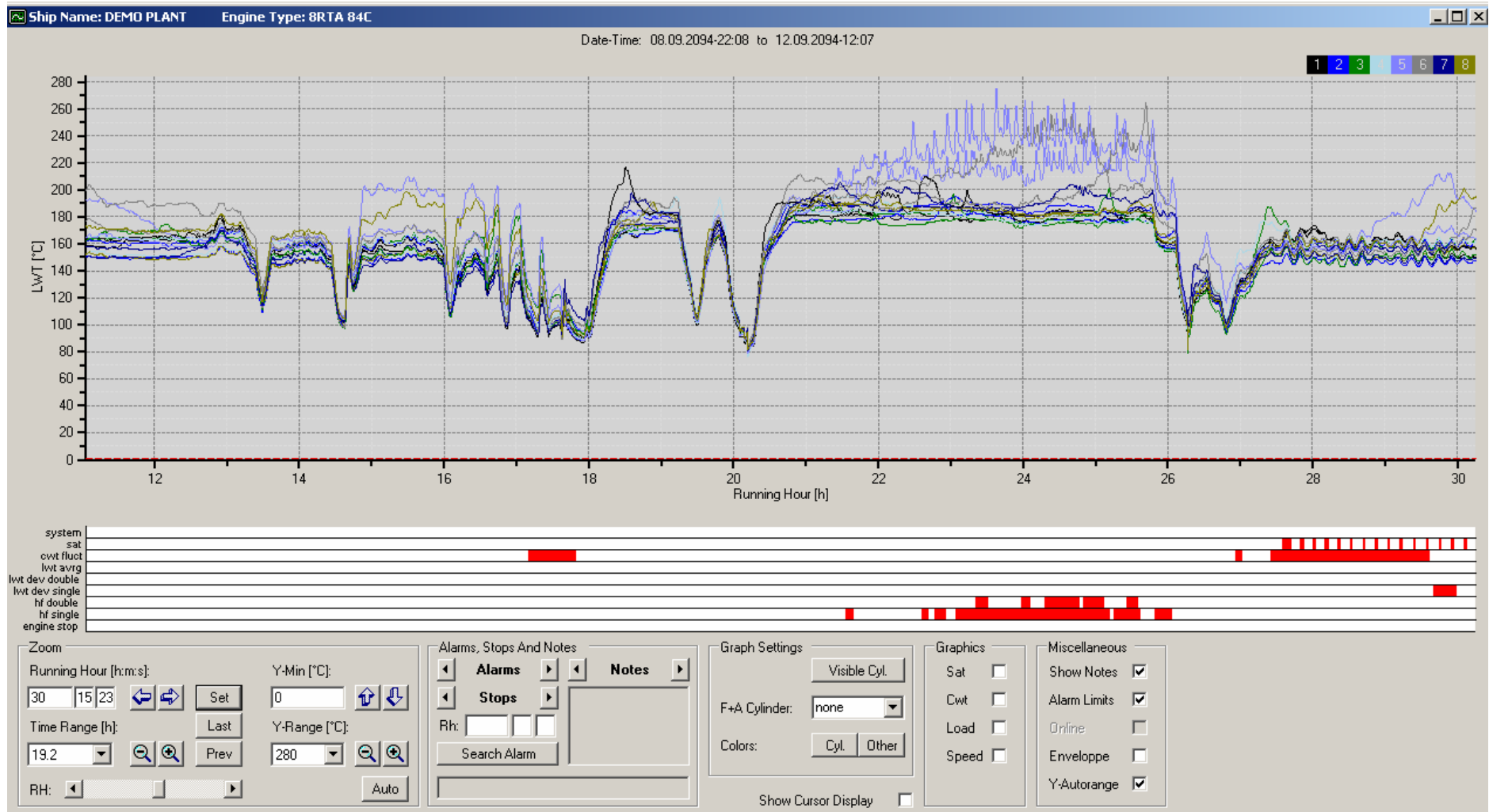
- **Monitoring of the cylinder lube oil film stability on the liner**
- **Alarm activation, if local heat density shows abnormal concentration due to increased piston ring friction or improper ring sealing**
- **To watch the cylinder cooling water stability and release an alarm if necessary**
- **To inform, if a nozzle failure appears**
- **To monitor the scavenge air temperature after each cooler and to actuate an alarm if abnormalities appear**

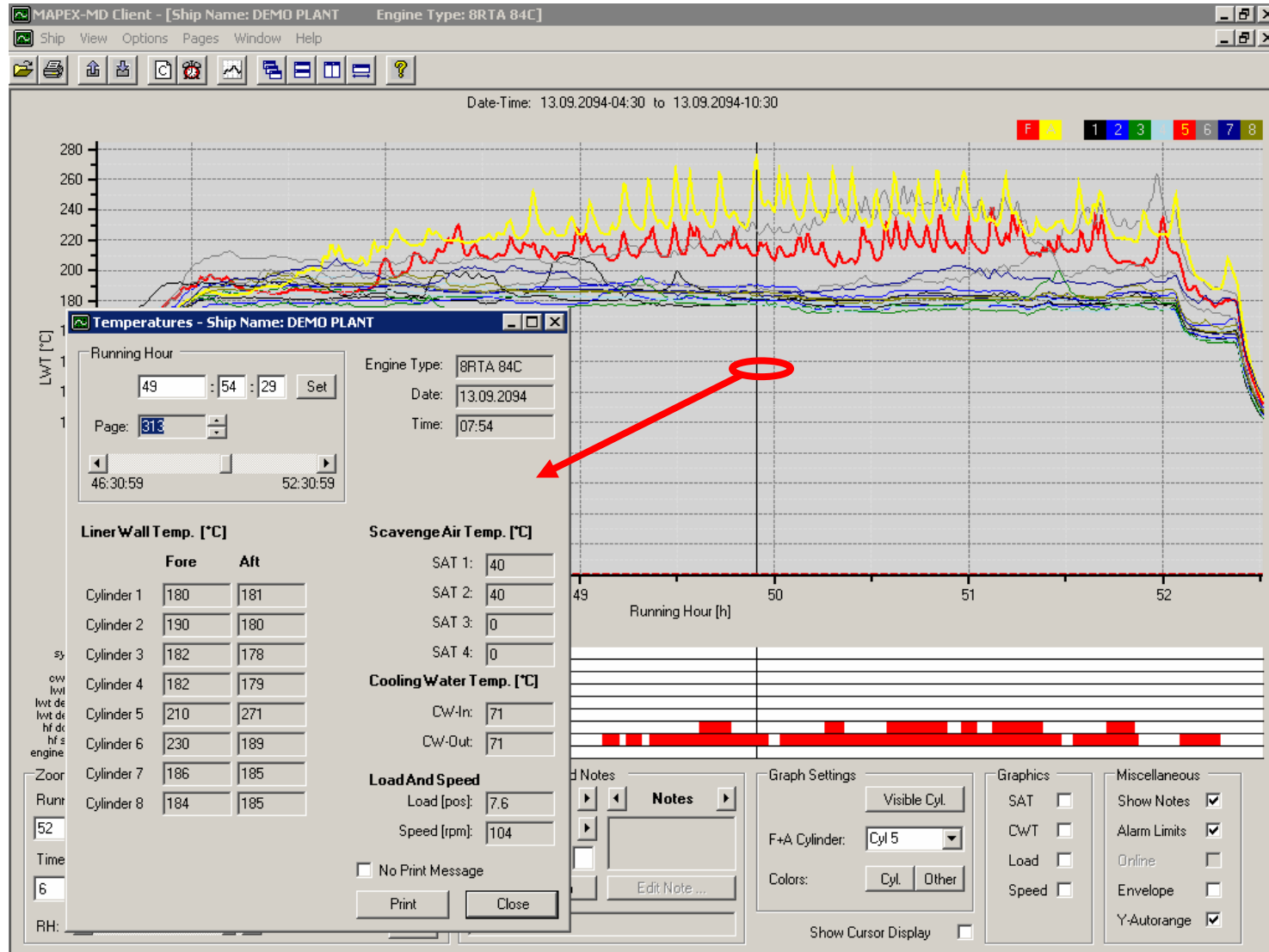
- **To enable monitoring of the piston running performance of each cylinder, 24 hours a day, on line**
- **To be able to optimize the piston running performance**
- **To forecast the sequence and time table for required piston overhauls**
- **To supply the head office with actual data of piston running performance for:**
 - **Transmitting new service or maintenance orders to the ship**
 - **Selecting other fuels and / or lube oil qualities**
 - **To have a cross reference to other ships in the fleet**

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LWT Standard Display with alarm examples

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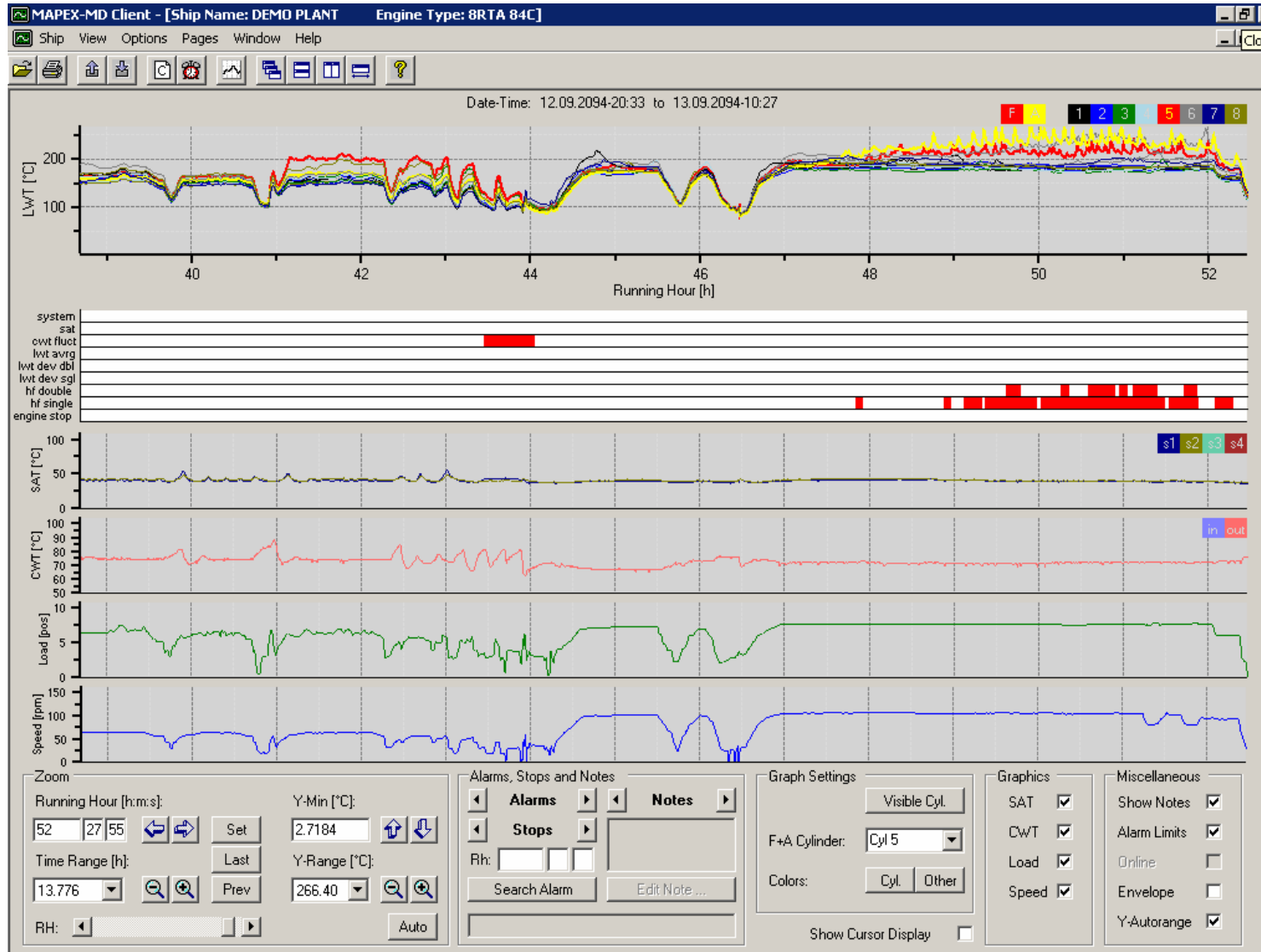


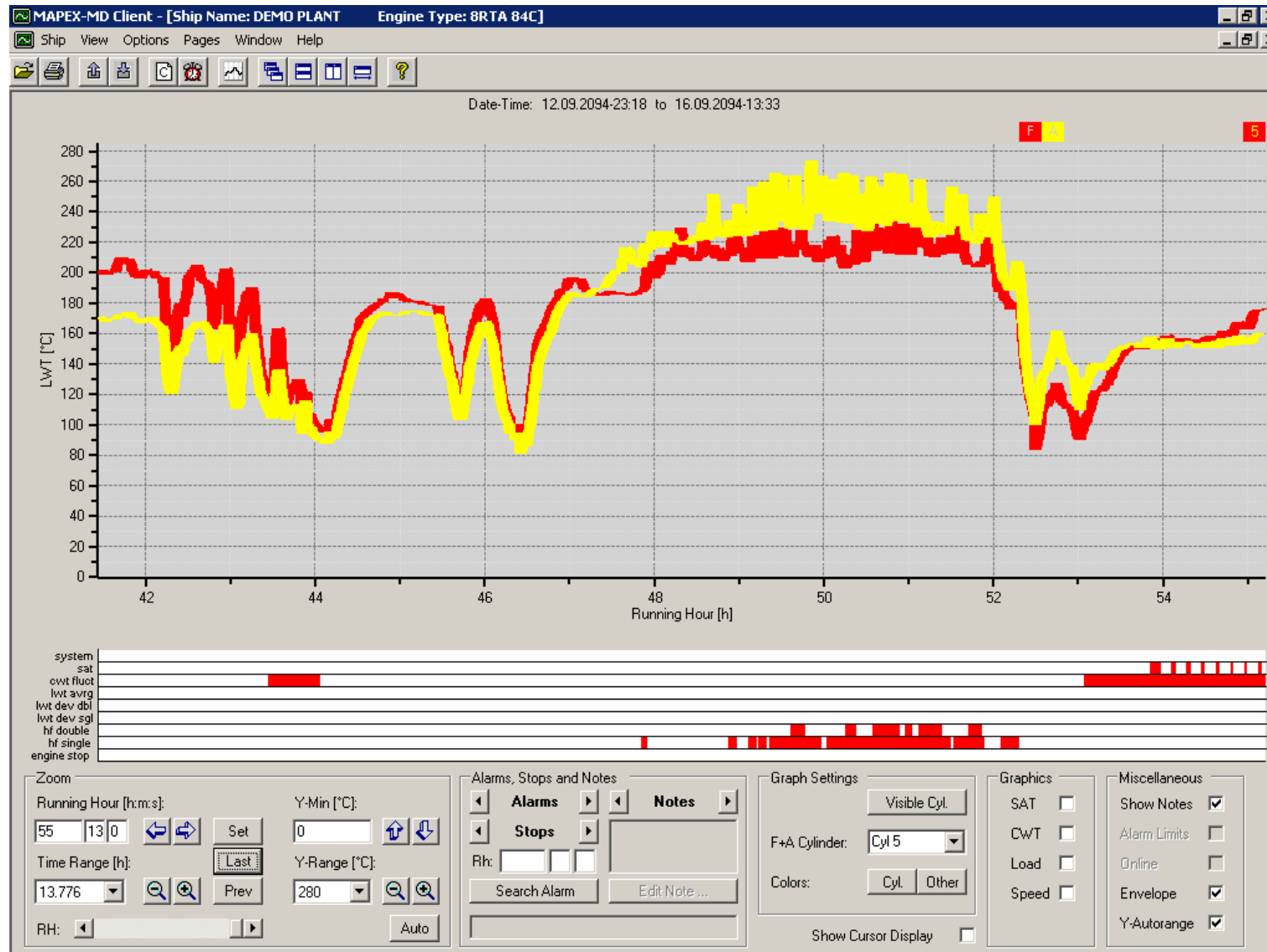


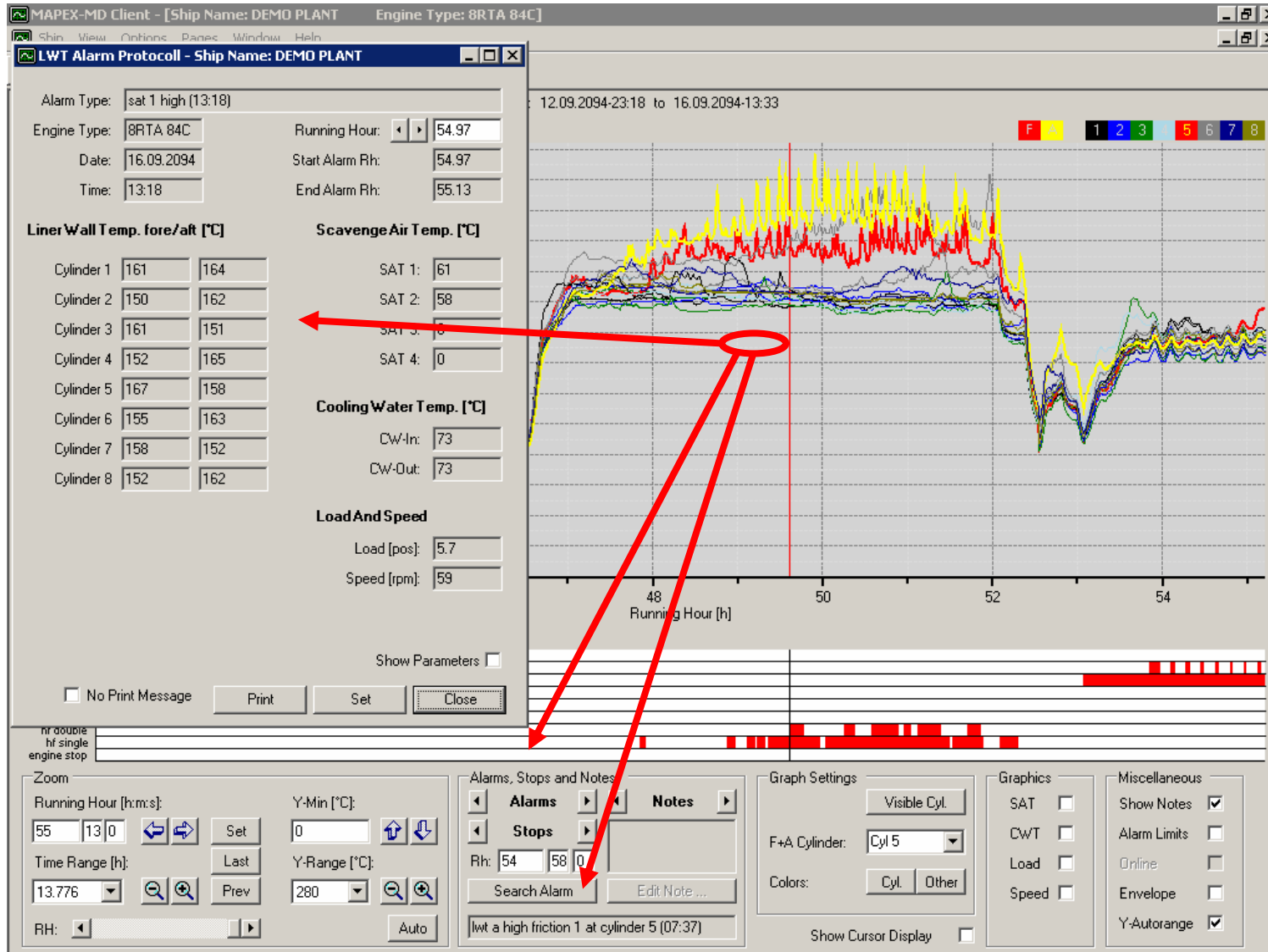
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Display for CCWIN/OUT, SAT, LOAD, SPEED

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File Access Level Settings View Options Tools Print Help

Measured Data

Load, Speed

Engine Speed

Engine Load

CCW

CCW Inlet Temperature

CCW Outlet Temperature

SAT

Scavange Air Temperature 1

Scavange Air Temperature 2

Scavange Air Temperature 3

Scavange Air Temperature 4

Liner Wall Temperature

Cylinder 1	<input type="text" value="213 °C"/>
Cylinder 2	<input type="text" value="189 °C"/>
Cylinder 3	<input type="text" value="170 °C"/>
Cylinder 4	<input type="text" value="206 °C"/>
Cylinder 5	<input type="text" value="184 °C"/>
Cylinder 6	<input type="text" value="235 °C"/>
Cylinder 7	<input type="text" value="191 °C"/>
Cylinder 8	<input type="text" value="201 °C"/>
Cylinder 9	<input type="text" value="196 °C"/>
Cylinder 10	<input type="text" value="0 °C"/>
Cylinder 11	<input type="text" value="0 °C"/>
Cylinder 12	<input type="text" value="0 °C"/>
Cylinder 13	<input type="text" value="0 °C"/>
Cylinder 14	<input type="text" value="0 °C"/>

FWD STB

AFT PSD

Ships Name

Engine Type

Number of Cylinders

Total Running Hours

Total Running Minutes

Date and Time

YY MM DD hh mm

Failures: Failures Log

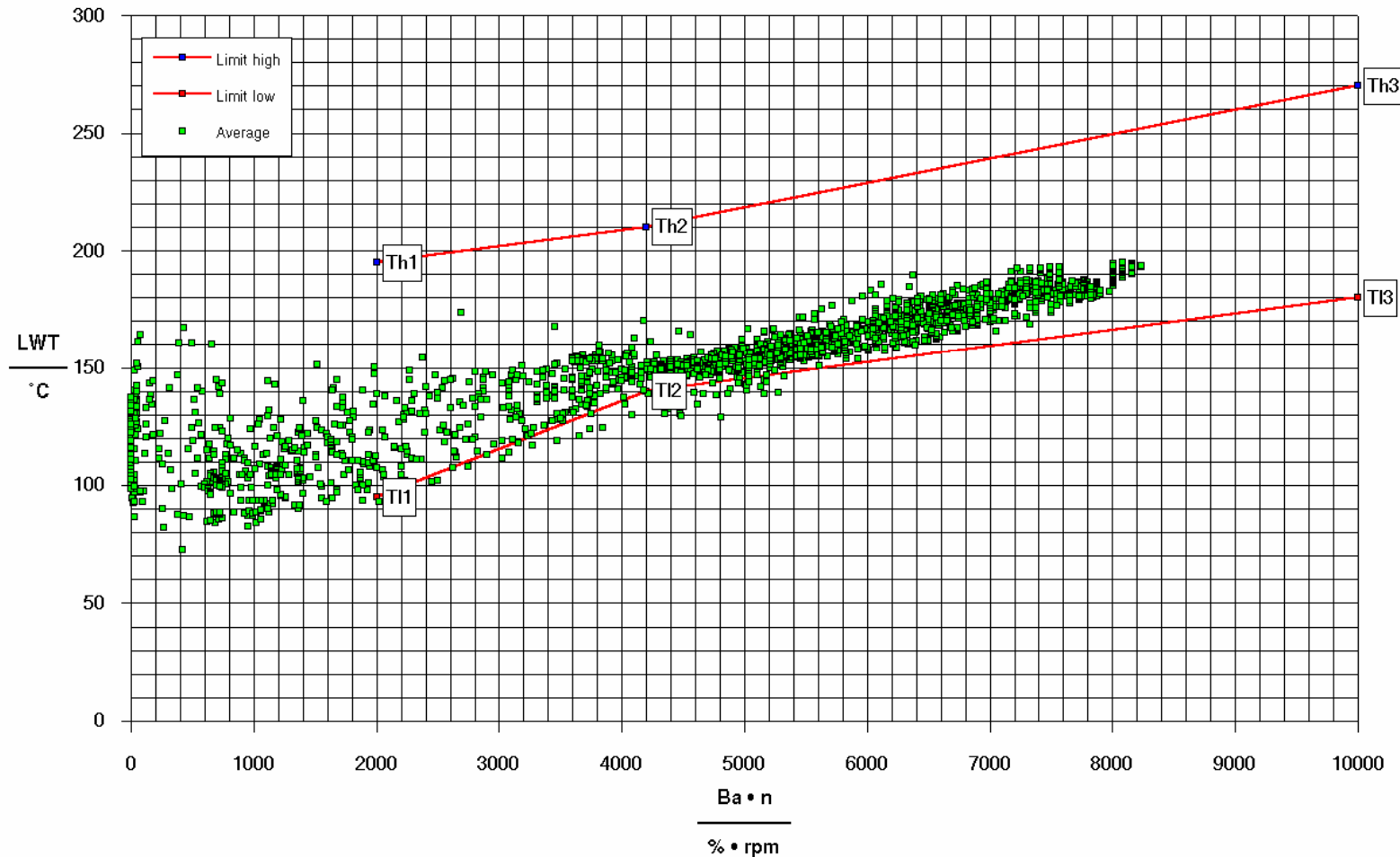
Hide restored logs Hide acknowledged logs Hide flexView logs Hide events

JOURNAL	TYPE	CYL	DESIGNATION	APPEARING TIME	RESTORING TIME
▶	Alarm	0	LWT A High Friction (analytic) Cylinder 6	26.10.2005 11:17:51	
	Alarm	0	LWT A Deviation Low Cylinder 3	26.10.2005 10:53:20	
	Alarm	0	CCWT Fluctuation	26.10.2005 10:28:49	
	Alarm	0	LWT B Deviation High Cylinder 6	26.10.2005 02:18:50	

MV "S/E AFRICAN QUEEN" - RH 380 - 420

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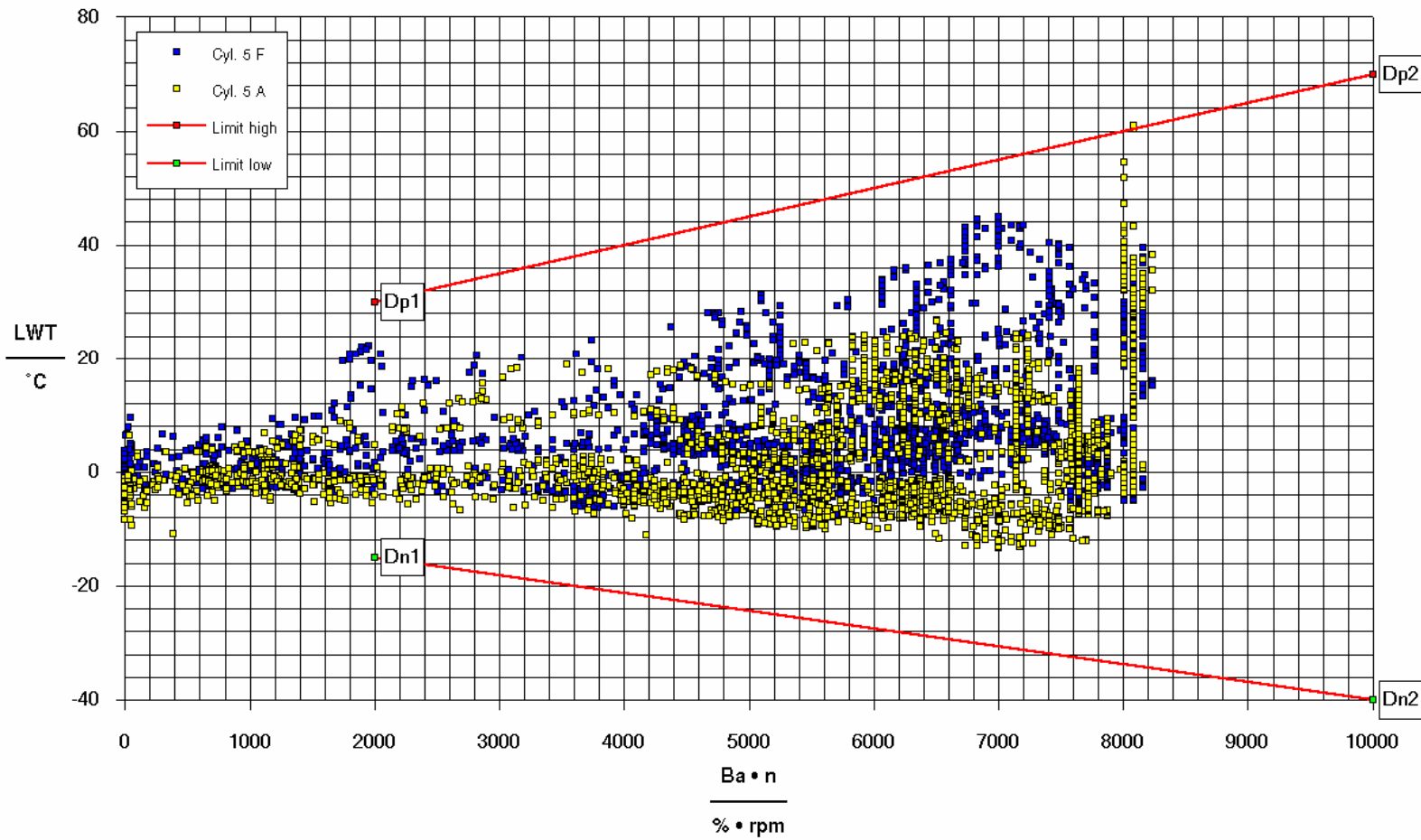
Liner Wall Temperature (LWT) - Average 9RTA84C



MV "S/E AFRICAN QUEEN" - RH 380 - 420

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LWT - Average - Deviation 9RTA84C Cylinder 5 F+A



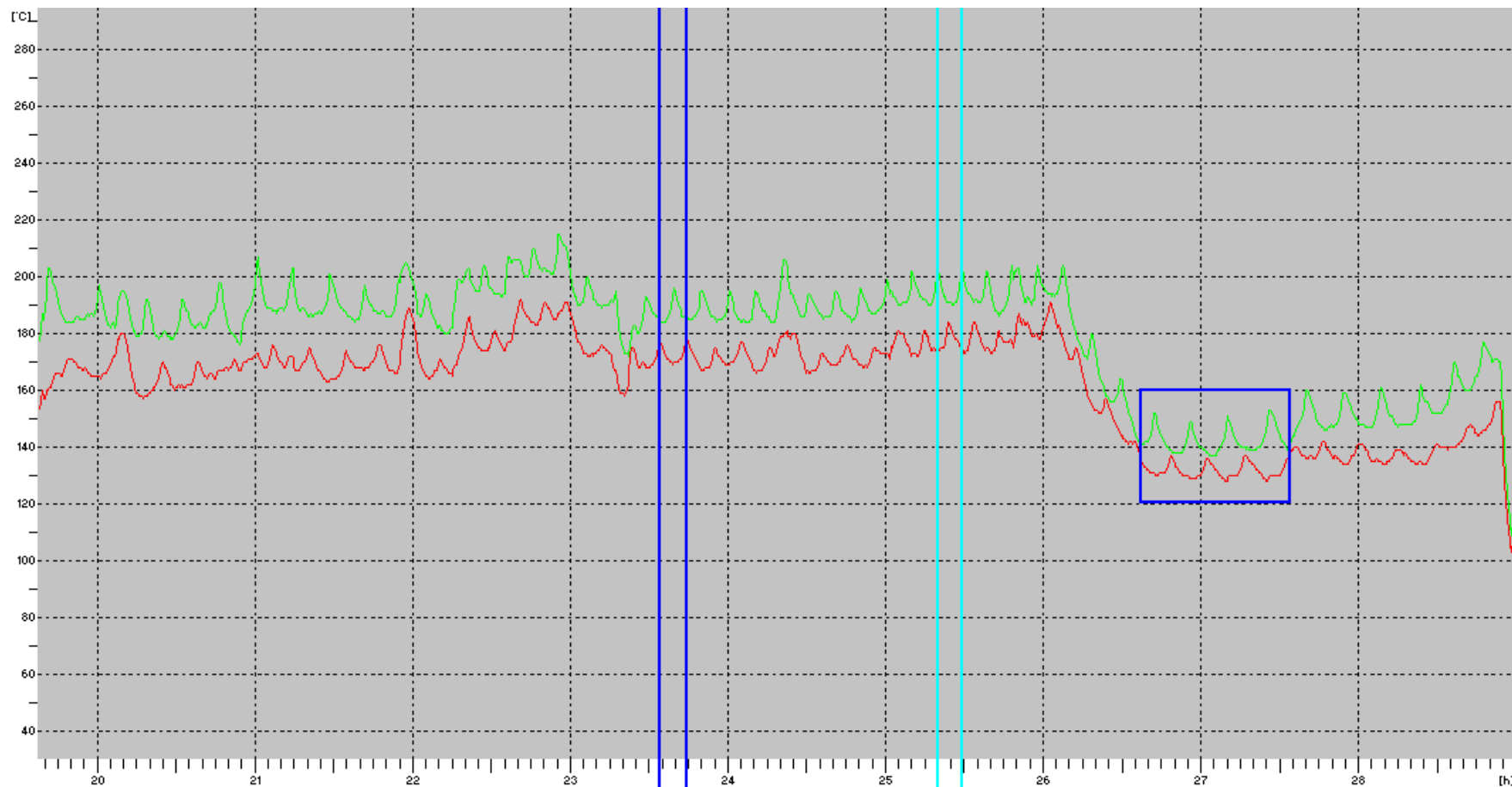


ANALYSIS: **High Friction** **Ring rotation** **Deviation**

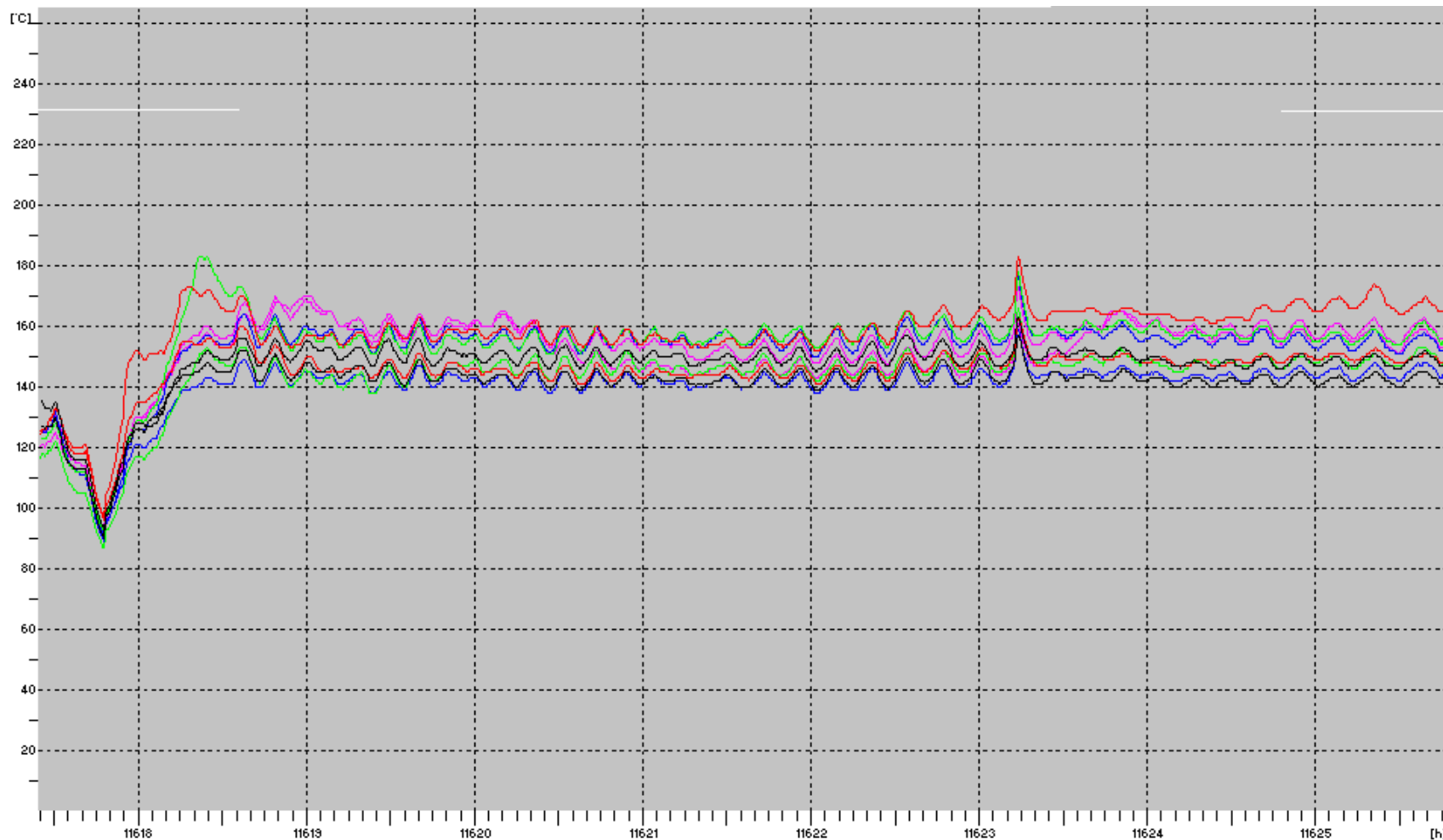
Checkpoints for analysis on High Friction alarms and similar characteristics

- Choose a suitable scale combination (RH: 4.5h : LWT:140°C recommended)
- Display only the requested cylinder (or a second cylinder for reference)
- Search for reasons of unstable liner wall temperatures:
 - (Frequent) load changes
 - Piston ring rotation/movements
(typical characteristic: maximum on one side mostly requires
minimum on the other side ⇒ ring gap)
 - Unstable cylinder cooling water
 - Unstable scavenge air temperature
 - High friction

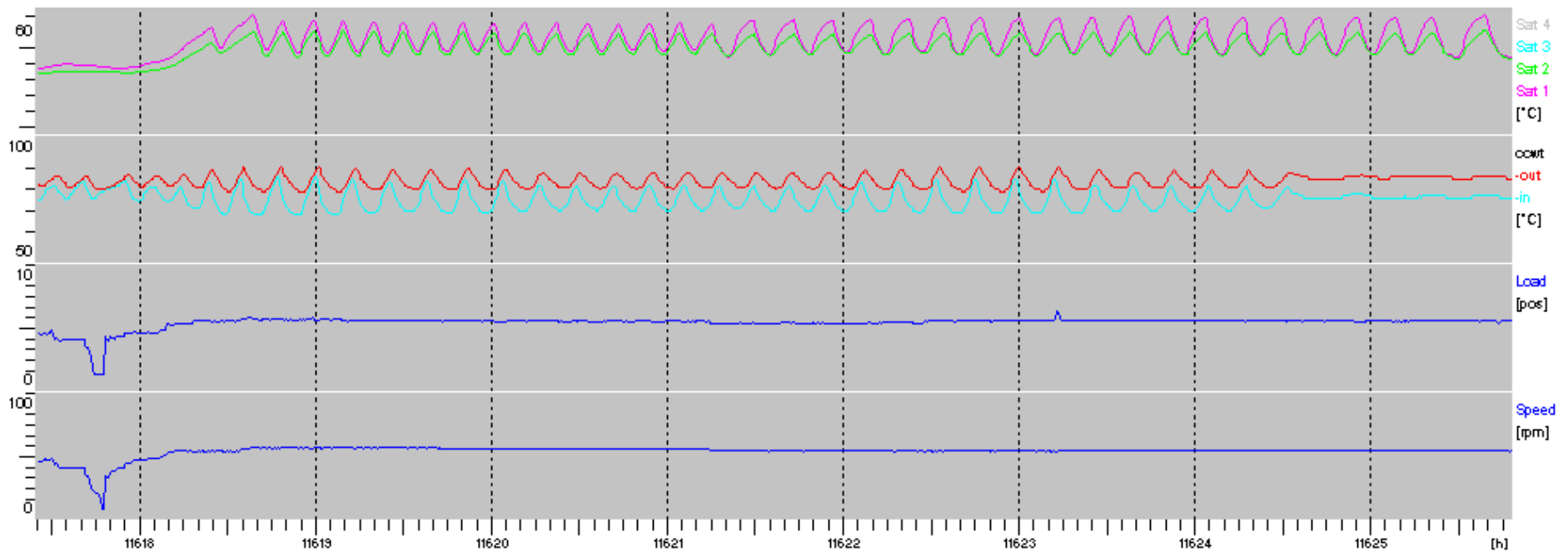
- ANALYSIS: High Friction Ring rotation Deviation



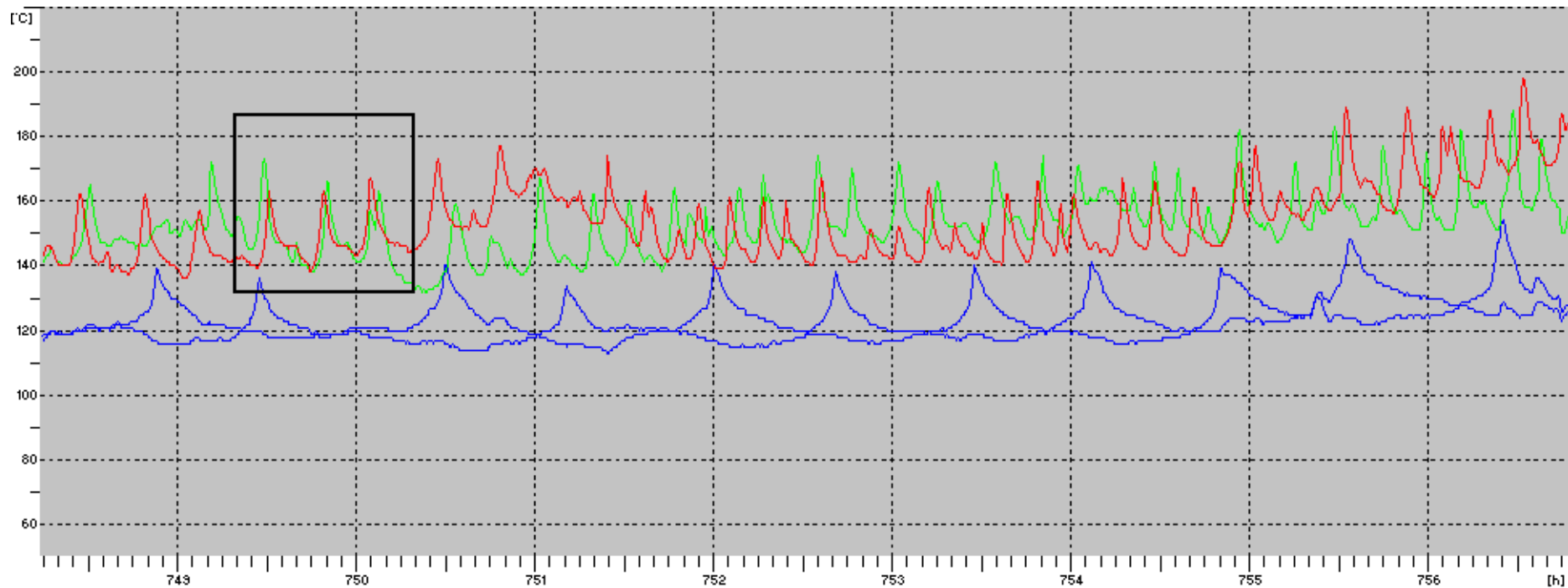
- ANALYSIS: High Friction Ring rotation Deviation



- ANALYSIS: High Friction Ring rotation Deviation



- ANALYSIS: High Friction Ring rotation Deviation



Exercises

- ANALYSIS: High Friction Ring rotation Deviation

