

Contribution to Safe Ship Operation by Main Engine Monitoring Systems e-GICS Advance / CMAXS e-GIC SX

Mitsui E&S Machinery Co., Ltd

Techno Service Division

After-sales Services for Diesel Engines



Challenges to Safe Operation of Vessels

Elements required for marine transport vessels



- ◆ Timely and safe operation
- ◆ Reduction of critical defects leading to off-hire
- ◆ Contribution to Reduction of Environmental Impact

Becoming more and more important

Environment/Climate Change

- Tighter GHG emission regulations (zero emissions, EEXI, CII)
- Marine pollution due to heavy oil spills

COVID19

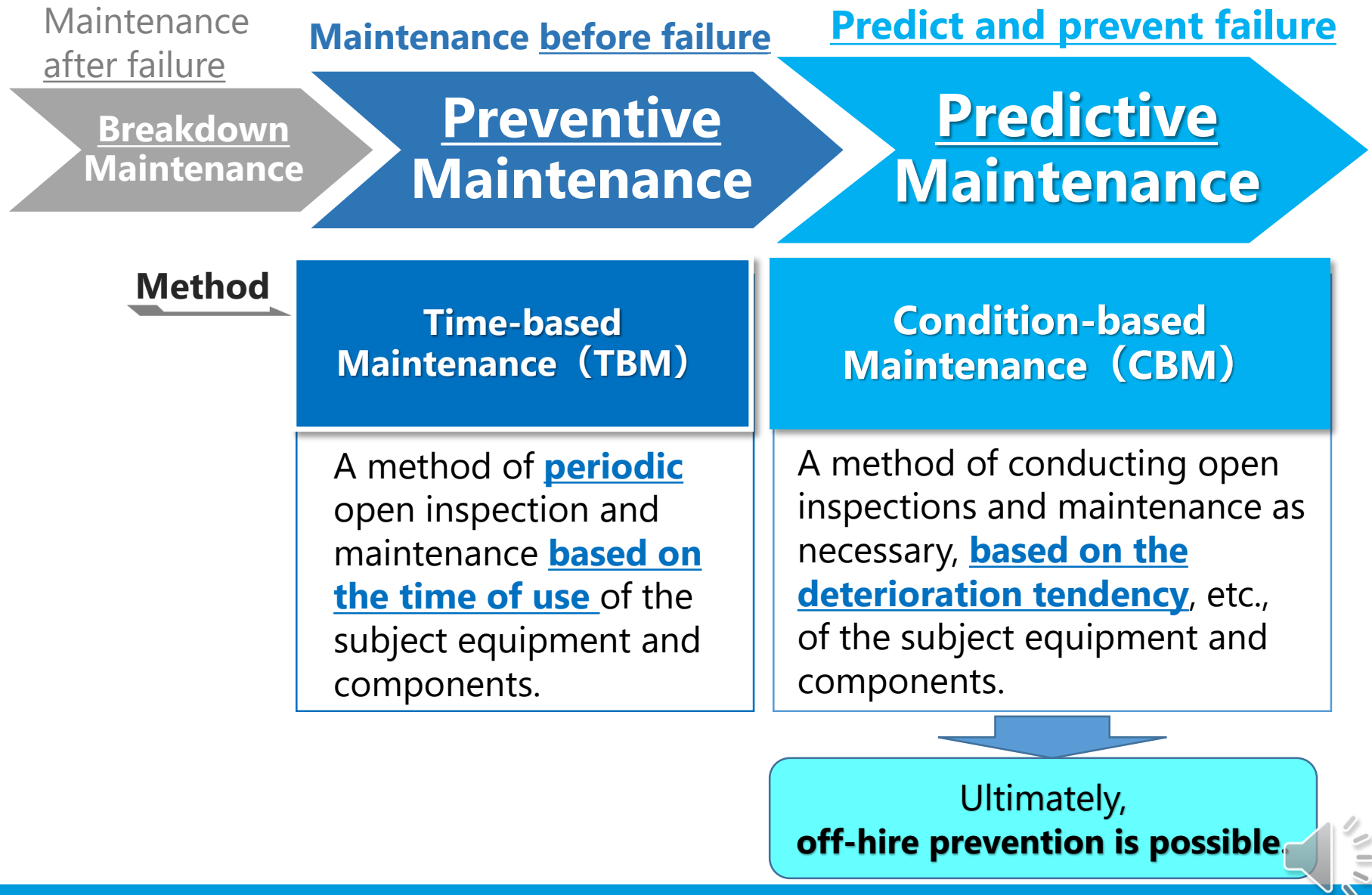
- Decrease in other transport capacity

aging population with declining birthrate

- shortage in human resources



Development of Marine Diesel Engine Maintenance Strategy



PURPOSE



Maintain safe and on-time operation
with the engine running as usual
Prevent off-hire





e-GICS Advance

(electronic Global Internet Customer Support Advance)

Standard spec for reasonable monitoring

Make with Heart.

Mitsui E&S Machinery

CMAXS e-GICSX

(electronic Global Internet Customer Support neXt)

High-end spec with onboard AI abnormality diagnostic function



FEATURE

Condition Diagnosis

- Mechanical Engineering Diagnostics
- Performance and combustion diagnostics
- **AI abnormality diagnosis function**
(e-GICSX standard equipment)

High frequency

- Capable of identifying signs of abnormality in the early stages

Preventive Maintenance Effectiveness

Reduction of major accidents /
reduction of life cycle costs

Automation

- Reduced crew workload
- Elimination of input errors

Only engine manufacturer can do this

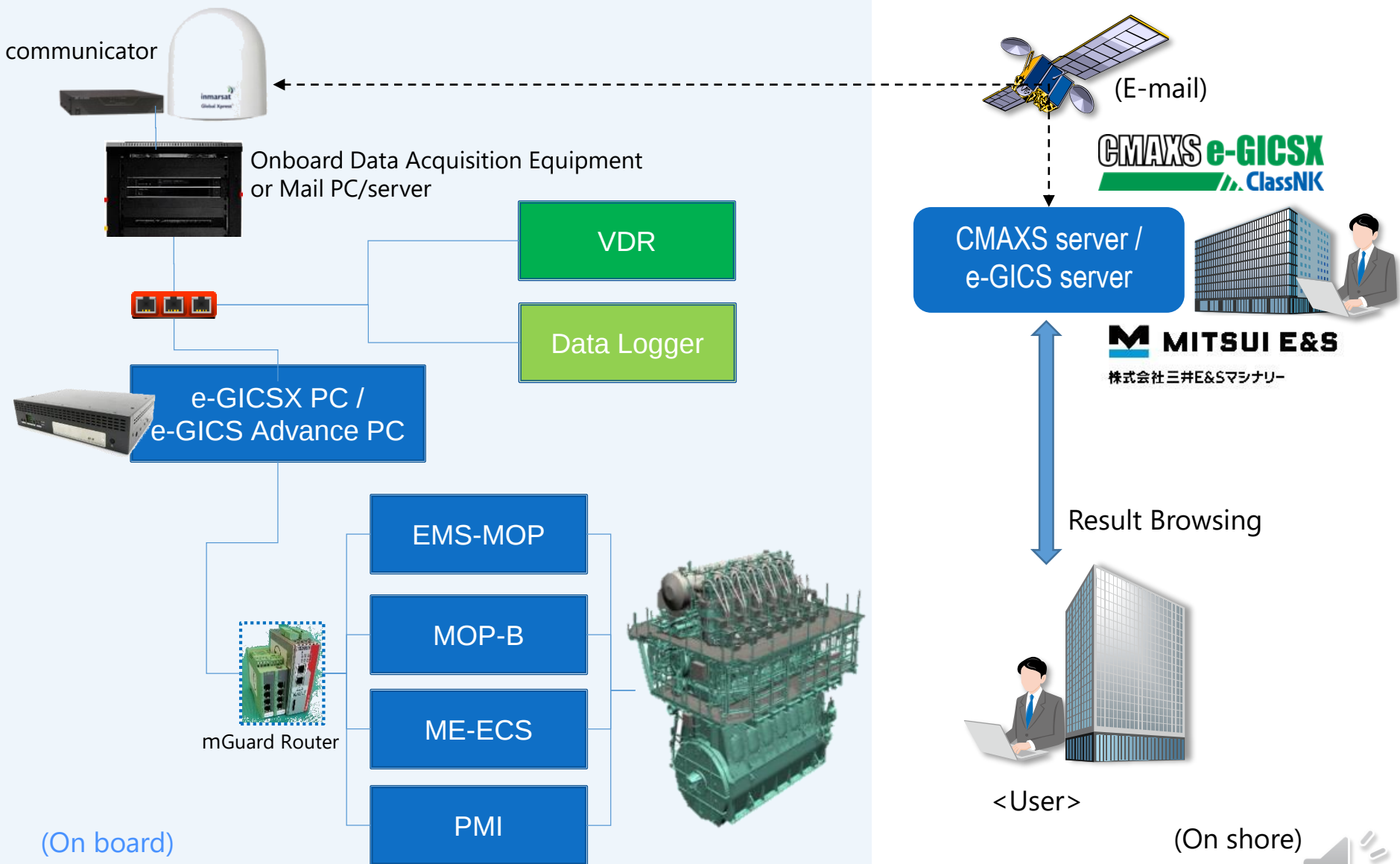
e-GICS Series Function Comparison

	CMAXS e-GICSX	e-GICS Advance	e-GICS
Main engine data acquisition	Automatic (Every 3 minutes)		Manual
Abnormality diagnostic function (onboard)	YES	No	
Performance diagnostic function (land-based)	YES		
	1 time/day*)	1 time/week*)	When collecting data manually
Combustion Diagnostics (Onshore)	YES		NO
	1 time/day	1 time/week	
Dashboard function	YES		NO
Contracting Office	ClassNK Consulting Services	Mitsui E&S Machinery	

*) Additional diagnosis can be requested by selecting any data.

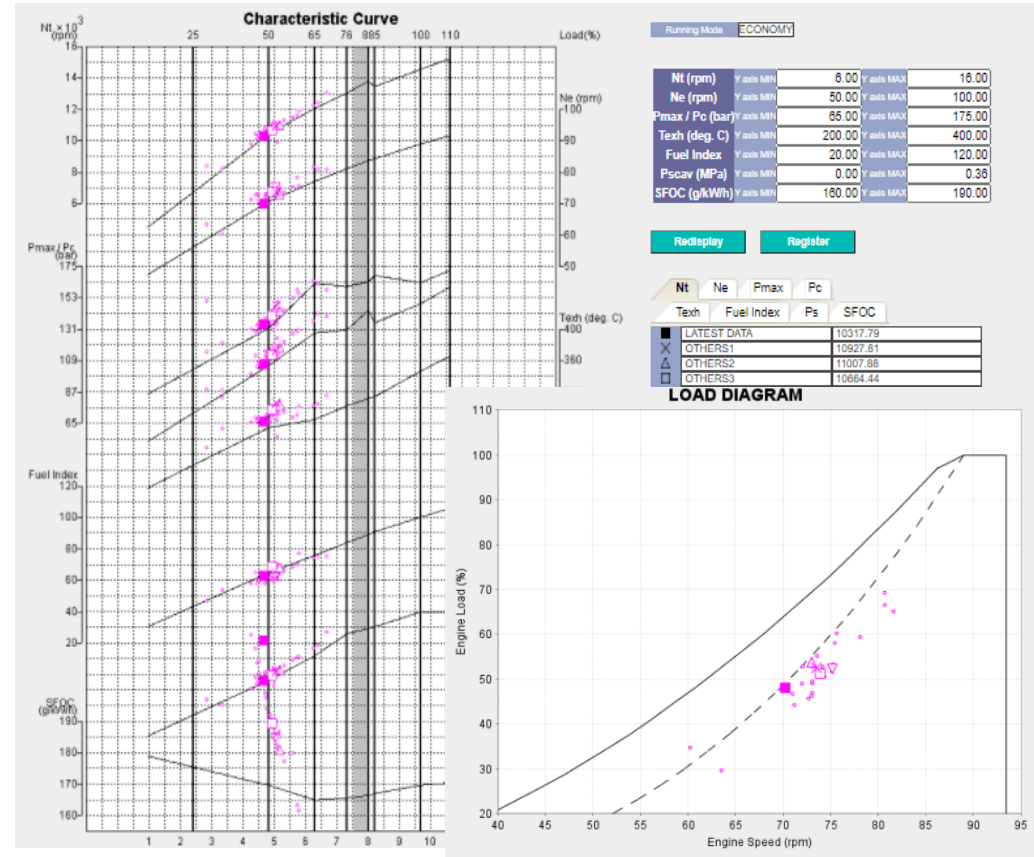


e-GICSX / Advance Device Configuration



Performance Diagnostic Function

NOTIFICATION OF PERFORMANCE DETERIORATION!



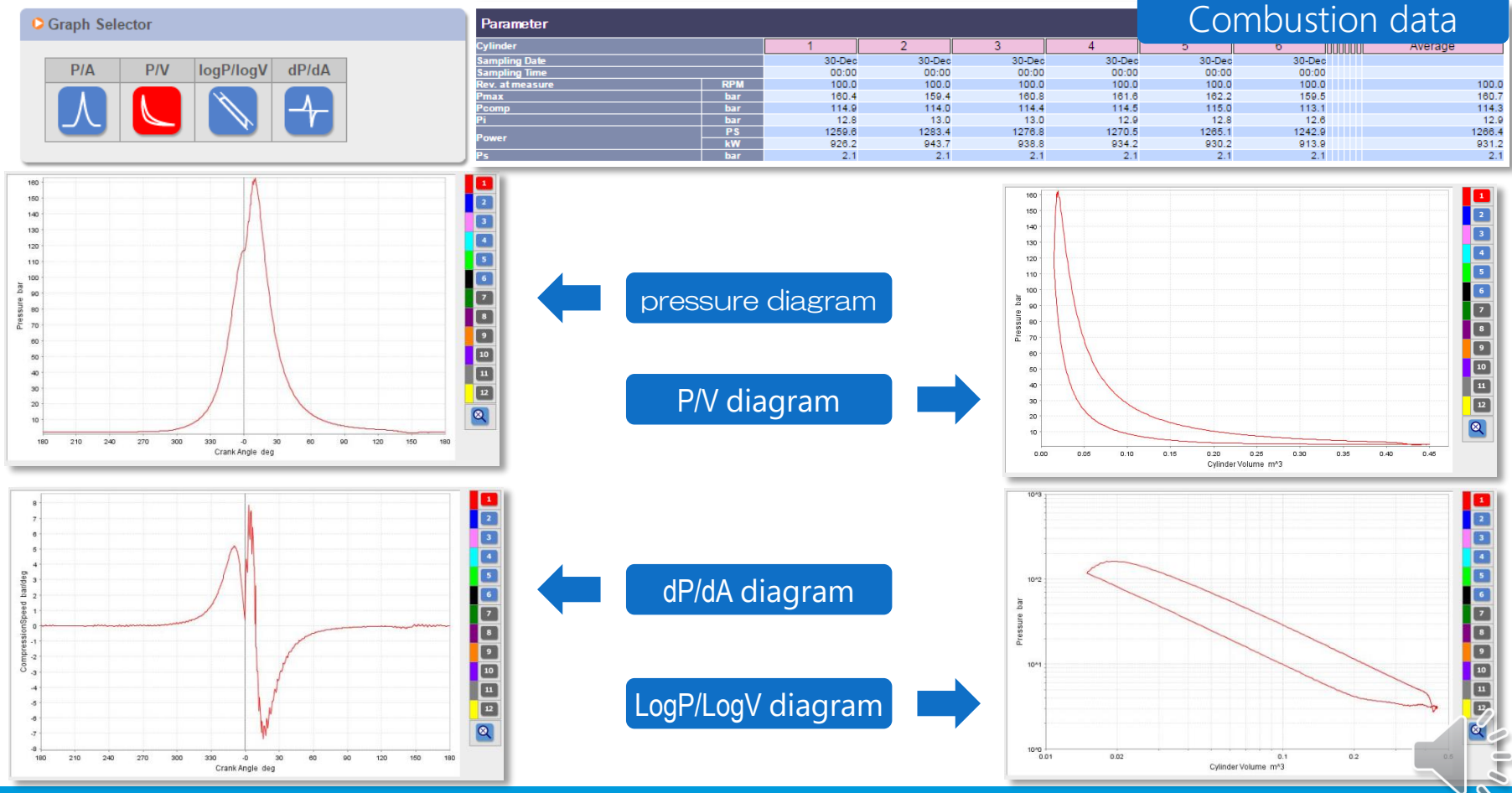
Data can be plotted on each characteristic curve.
Performance diagnosis results and comments can be output

Normal conditions are automatically reported,
Abnormal conditions are answered by our engineers.



Combustion Diagnostic Function

- ◆ Pressure diagrams for each cylinder can be viewed on the web screen to assist in detailed studies during monitoring and troubleshooting.
- ◆ Combustibility of fuel oils can be compared and evaluated based on ignition delay, combustion time, Pmax, etc., and minimize problems caused by fuel combustibility.



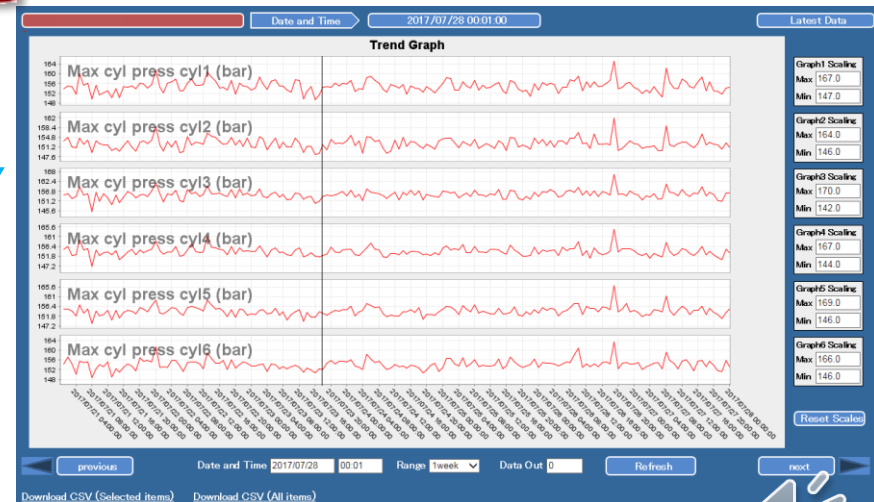
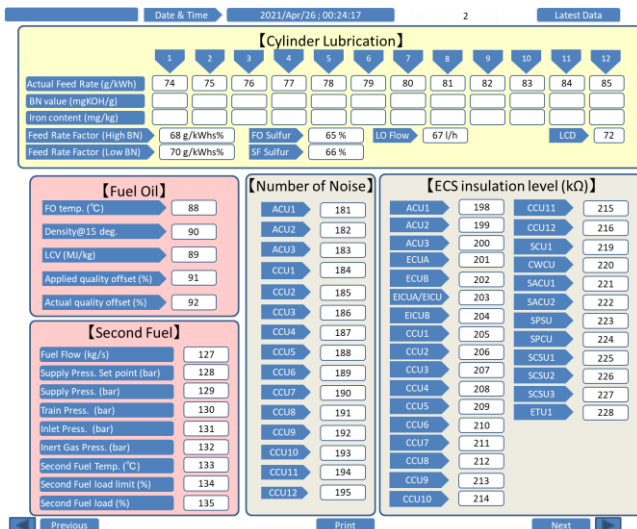
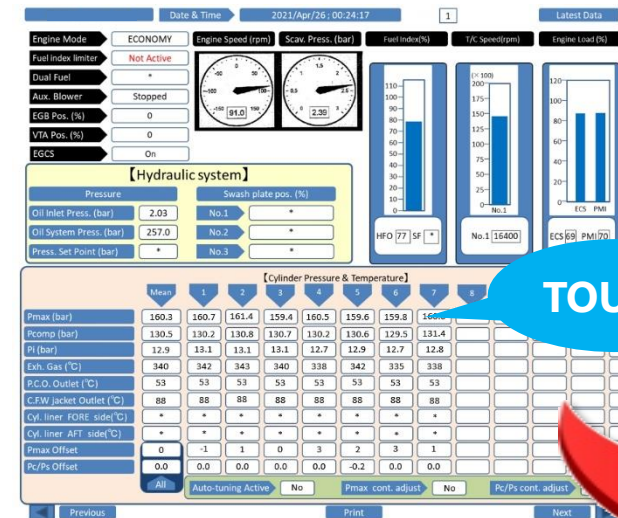
Dashboard (MOP display)

Data acquisition
every 3 minutes

Data can be sent
to land every hour

TOUCH

TRENDS
DISPLAY



Sensor Data Trend Display

◆ All sensor data can be freely selected and displayed.

[NK000] CMAXS EGICXS DD



e-GICS Advance: Functions (Video)

e-GICSA

IMO9090999

MES-M E-GICSA DEMO

TOP

Condition

Select

Upload

Results

TrendGraph

Combustion

Oil

Maintenance

Q&A

Report

Document

Dashboard

Album

Troubleshooting

Options

MITSUI E&S

CONDITION SELECT

BACK

HISTORY DATA SELECT

2021/01/17

UTC Time (RPM)

January 2021

Su	Mo	Tu	We	Th	Fr	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

03:27:02 (95 rpm)
03:24:02 (95 rpm)
03:21:02 (95 rpm)
03:18:02 (95 rpm)
03:15:02 (95 rpm)
03:12:02 (95 rpm)
03:09:01 (95 rpm)
03:06:02 (95 rpm)
03:03:01 (95 rpm)
03:00:01 (95 rpm)
02:57:01 (95 rpm)
02:54:01 (95 rpm)
02:51:01 (95 rpm)
02:48:01 (95 rpm)
02:45:01 (95 rpm)
02:42:01 (95 rpm)
02:39:01 (95 rpm)

Gray: No Data
Yellow: No Running
Green: Now Select
SF: Second Fuel

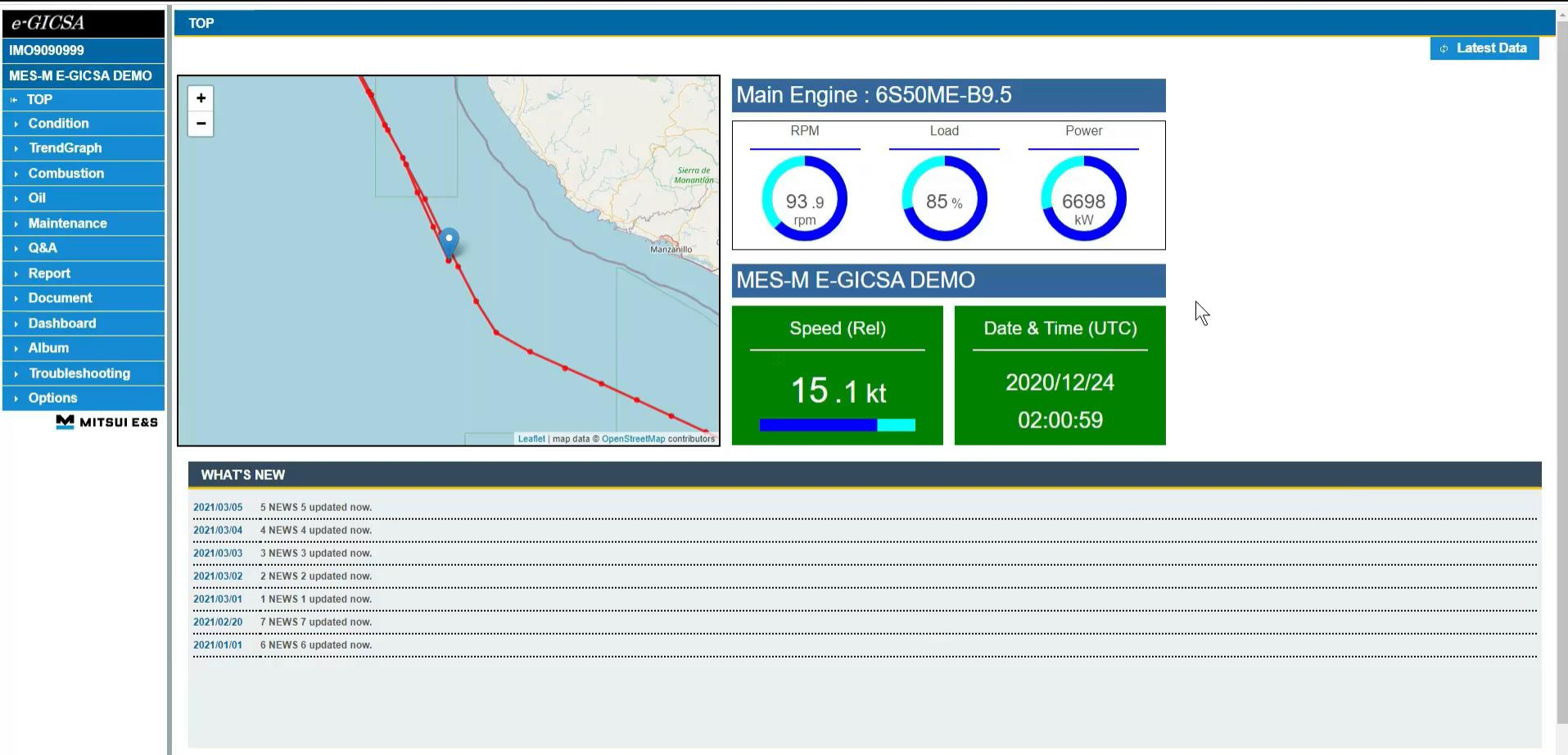
Red: Condition Judgement
Underline: Manual Data Regist
SF: Second Fuel

MEASUREMENT MANUAL INPUT

TOP > CONDITION SELECT

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e-GICS Advance: Functions (Video)



e-GICS Advance: New Functions

◆ Album(photo upload)Function

Image data can be extracted / saved, managed, and shared on shore

MES-M E-GICSA DEMO

TOP

Condition

TrendGraph

Combustion

Oil

Maintenance

Q&A

Document

Data Registration

Album

Album

Report

Album Parts Mainte

CBM

Options

MITSUBI E&S

ALBUM SEARCH

PARTS NAME

DATE

FROM : 2021/08/30

TO : 2021/09/29

DISPLAY LEVEL

DAY

PARTS

SEARCH

ALBUM

Add Today



Oil pan
Main Engine1



Metal detachment
Main Engine1
MAIN BEARING SHELL



A/C Fin
Main Engine1
ARR. OF SCAV. AIR CONNECTING...



Chain
Main Engine1
CHAIN ARRANGEMENT

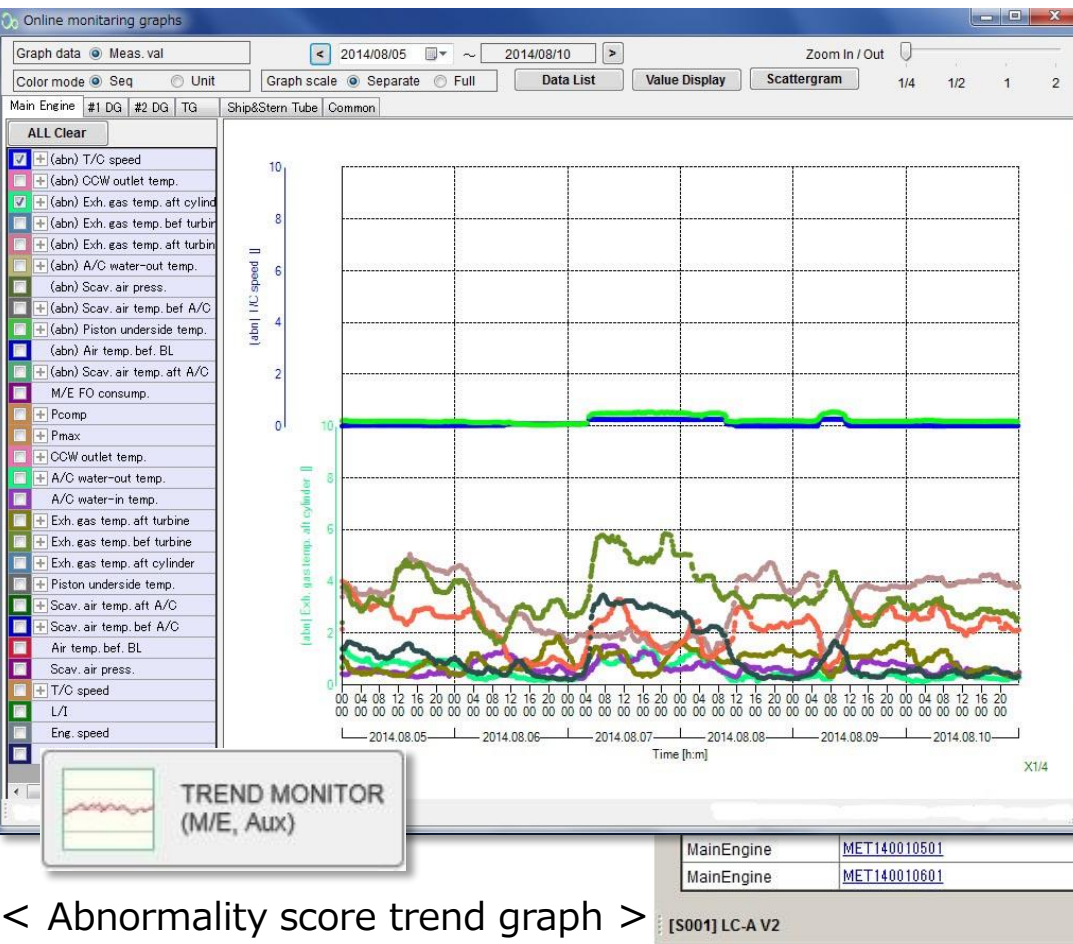


Cylinder liner
Main Engine1
CYLINDER LINER

Onboard abnormality diagnosis (Abnormality judgment by AI)

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- ◆ Correlation check of measurement points by AI is performed, and the degree of deviation from the normal model is calculated as the degree of abnormality.
- ◆ An alarm will notify you of an anomaly and display the anomaly score



Abnormalities can be narrowed down.

Abnormality.val | Abnormality Moving-Avg. val

item name	ormality-Reg	Abnormality-Mat	Ranking
M/E SCAV AIR P	0.6	0.6	
M/E REV	0.5	0.5	
M/E T/C REV #01	0.4	0.4	
M/E NO.# JACKET CFW OUT T #01	6.1	6.1	1
M/E NO.# JACKET CFW OUT T #02	2.7	2.7	2
M/E NO.# JACKET CFW OUT T #03	1.9	1.9	5
M/E NO.# JACKET CFW OUT T #04	2.3	2.3	3
M/E NO.# JACKET CFW OUT T #05	0.2	0.2	
M/E NO.# JACKET CFW OUT T #06	1.7	1.7	6
M/E NO.# JACKET CFW OUT T #07	2.3	2.3	4
M/E NO# PISTON C O OUT T #01	0.5	0.5	
M/E NO# PISTON C O OUT T #02	0.7	0.7	
M/E NO# PISTON C O OUT T #03	0.1	0.1	
M/E NO# PISTON C O OUT T #04	1.1	1.1	7
M/E NO# PISTON C O OUT T #05	0.7	0.7	
M/E NO# PISTON C O OUT T #06	0.9	0.9	
M/E NO# PISTON C O OUT T #07	0.3	0.3	
M/E NO# CYL EXH GAS OUT T #01	0.5	0.5	
M/E NO# CYL EXH GAS OUT T #02	0.3	0.3	
M/E NO# CYL EXH GAS OUT T #03	0.3	0.3	
M/E NO# CYL EXH GAS OUT T #04	0.1	0.1	
M/E NO# CYL EXH GAS OUT T #05	0	0	
M/E NO# CYL EXH GAS OUT T #06	0	0	

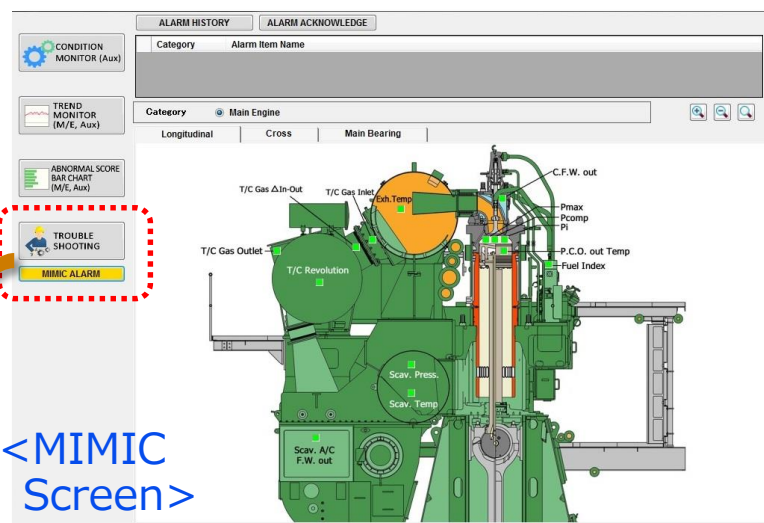
ABNORMAL SCORE BAR CHART (M/E, Aux)

< Abnormality score trend graph >

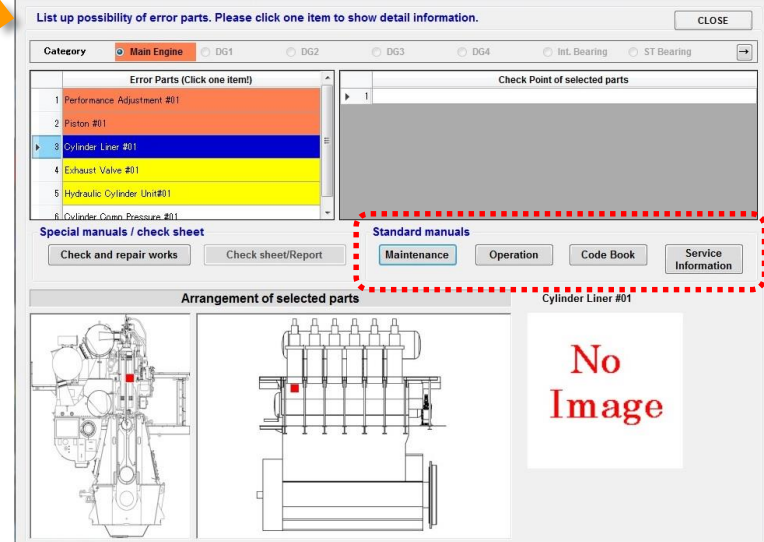
< Abnormality score bar graph >

Onboard abnormality diagnosis (Troubleshooting Function)

e-GICSX Limited



- ◆ The anomaly detection sensor visually informs the change of the pointer on the MIMIC screen (green-> red) and blinking.
- ◆ On the troubleshooting screen, inspection items arranged in order of inspection priority are displayed.
- ◆ When you press the inspection item name button, related procedures, drawings, etc. (lower right figure) are displayed.

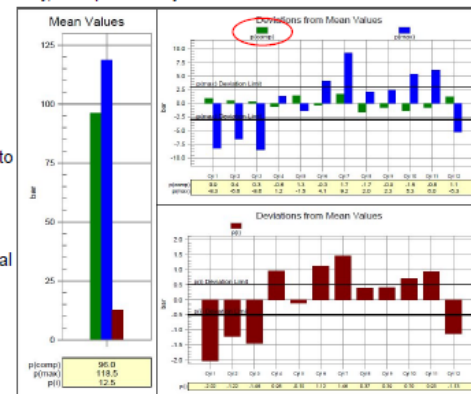


Pcomp Adjustment

Step 4. After the evaluation, if necessary, Pcomp can be adjusted.

- Please check the Pcomp balanced within the tolerance(3 bar)
- Usually, it is not necessary to adjust Pcomp.
- If Pcomp is not balanced, please check the mechanical defect first before adjustment. See next slide.

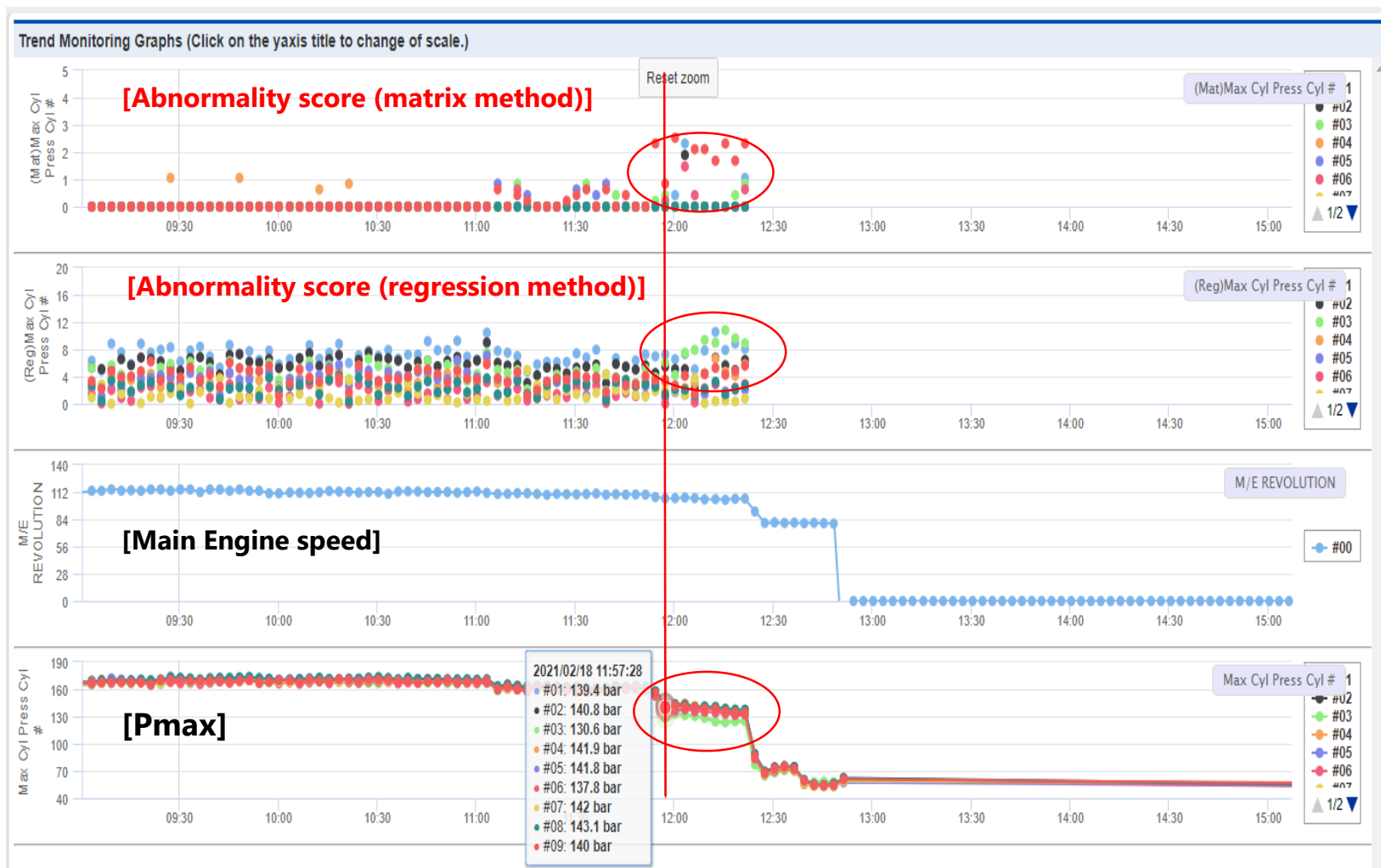
■ 12K98ME-C, 49% load, 18000 RH



< Adjustment manual >

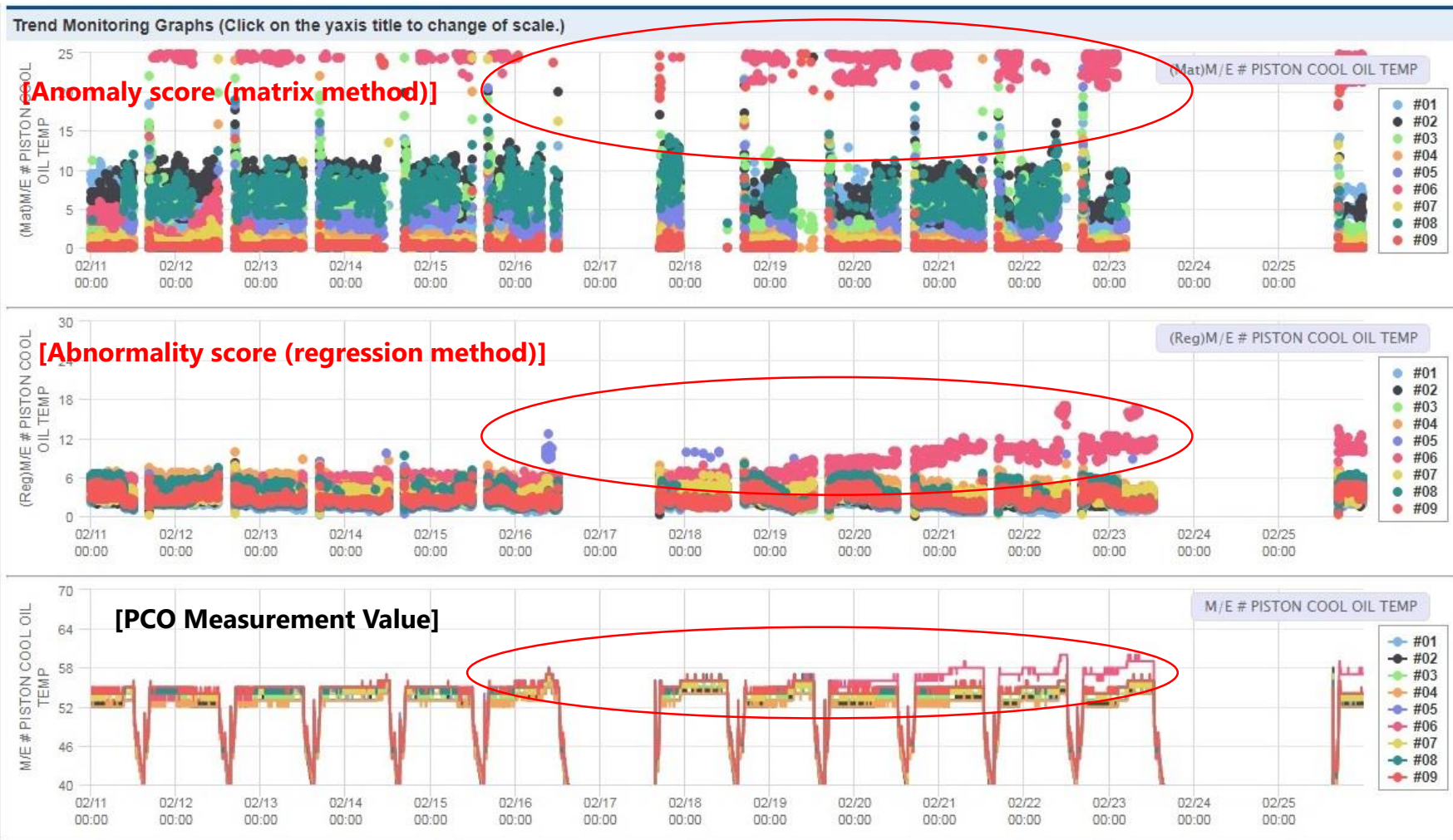
Abnormality detection (CMAXS e-GICSX)

Quick detection of a slight decrease in Pmax in multiple cylinders → Fuel valve malfunction



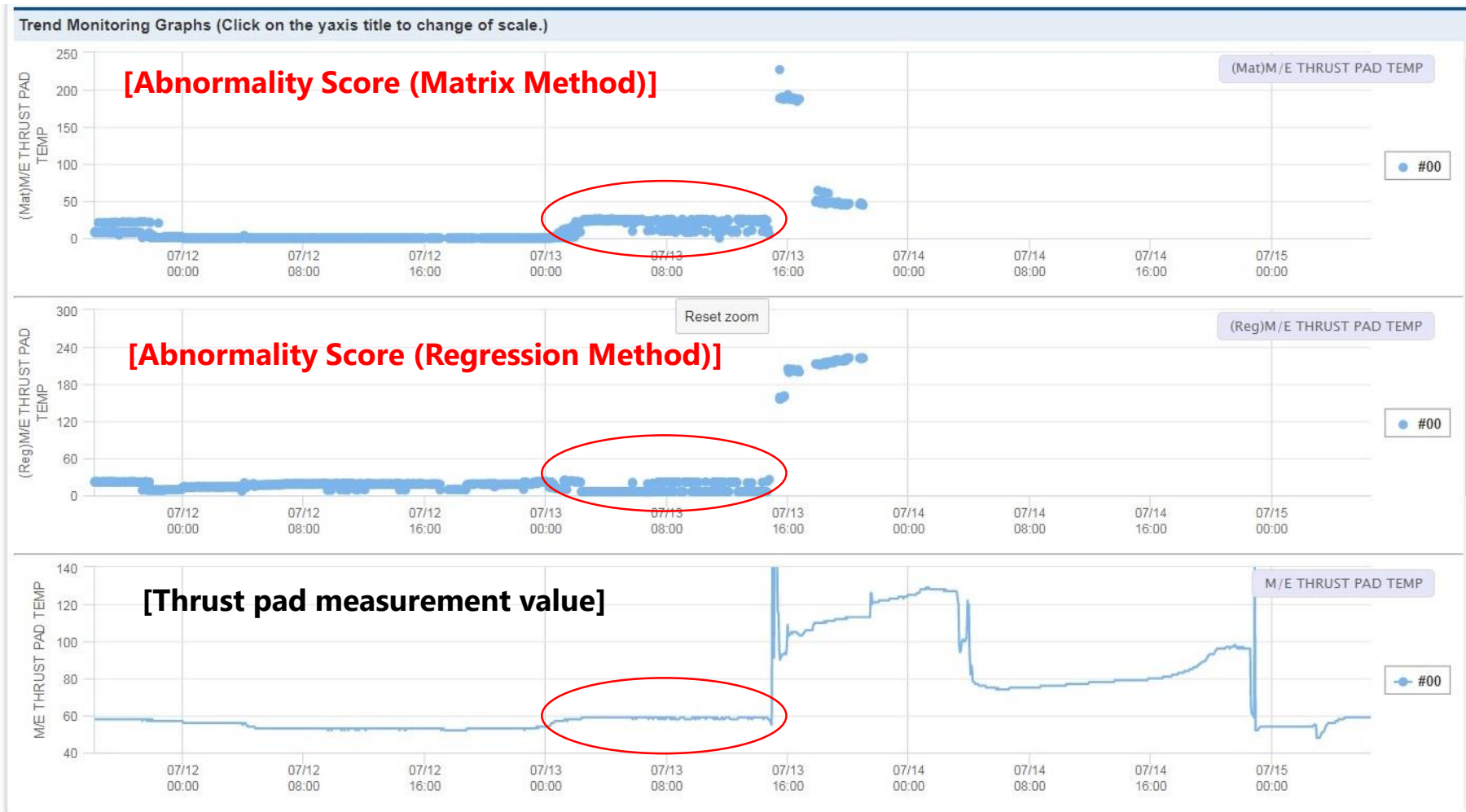
Abnormality Detection(CMAXS e-GICSX)

Quickly detects PCO temperature rise in specific cylinders → Cracks in PCO channel



Abnormality Detection(CMAXS e-GICSX)

Quickly detects thrust pad temperature rise → Foreign object (?)



異常検知事例 (e-GICS Advance + MADOCS)

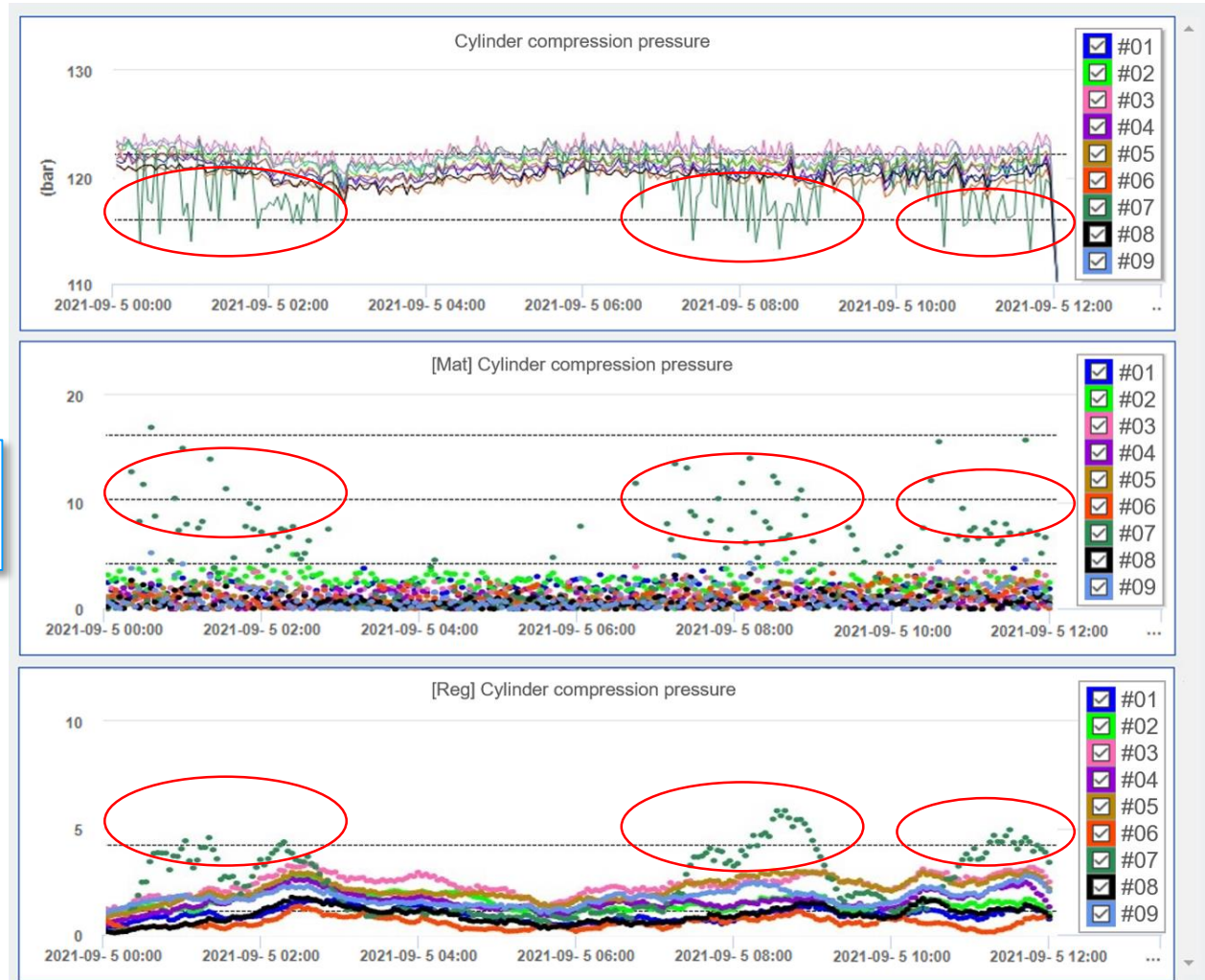
**Detects slight Pcomp
drops quickly and
accurately**



**Troubleshoot before
critical failures and off-hires**



Safe Operation



*) Mitsui Abnormal Detecting system for On-site Collected Sensor data



e-GICS Advance
(electronic Global Internet Customer Support Advance)

CMAXS e-GICSX
(electronic Global Internet Customer Support neXt)

Make with Heart.

Mitsui E&S Machinery

**Our contribution to ship safety and
on-time performance
is continuously evolving**



Mitsui E&S Machinery Co., Ltd.

~ Make with Heart ~

Thank you for your attention !

<Contact>

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