

# Ship Performance Monitoring system



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# 1) General description

SPECS Ship Performance Monitoring System (SPM) are designed to help ship owners and operators to measure and log the actual condition of vessels fuel consumption and display the related data on screen from the ship's system.

Actually, SPECSVISION SPM provides real time trend to guide operators to save the fuel oil, finally operational costs.

That also is efficiently available 'performance trial' during sea trial or on voyage.

And we provide monitor based on window O/S, dual core CPU is available to store raw data in every 30 sec, and send those data to on shore site by Inmarsat.

We provide user-friendly GUI (Graphic User Interface) with 'user edit function' easily add parameters or modify those. i.e. comparing accumulated data, report, real time voyage data.

LAN interface is available to use between VDR, ECDIS and AMS to save the cost, time and space.

And available to apply the various type i.e. Serial, TCP, UTP etc.

Also if unstable signal received from other equipment, SPM filters to check this signal or makes alarm.

Those has variable communication ports for receiving data from TPM, DAQ(if necessary), AMS, VDR, Loading computer etc.

It provides protocol analyzing function to communicate other device (NMEA0183, MODBUS, etc.)

It indicates actual value from other devices and accumulated values.

All receiving data is stored every 30 seconds, user can analyses data trend by stored data.

### VDR (yard scope)

- Position
- Ship Speed by LOG, GPS
- Wind speed, Direction
- etc.



LAN (UTP)

### AMS (option/yard scope)

- Draft
- Temp.
- Pressure
- etc.



RS485 (2C x 1)

### Flow meter x 3

- M/E F.O.
- G/E F.O.
- Boiler F.O.



PULSE & PT100 (8C x 3)

### Temp. sensor x 3

- M/E F.O.
- G/E F.O.
- Boiler F.O.

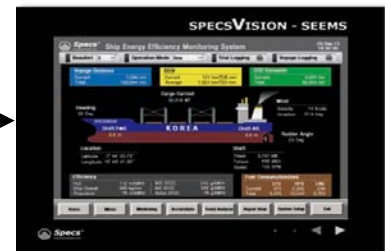


### TPM on the intermediate shaft

- Torque
- RPM
- Power

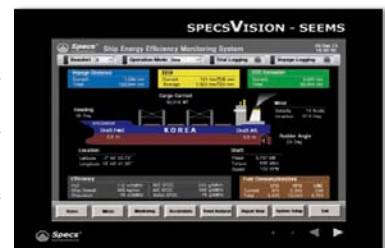
### Local Indicator in ECR

- Shaft Torque, RPM, Power
- Ave. and total power
- Accumulated values
- Total power, total revolution
- Fuel Flow, Ship speed by LOG
- SFOC, SOE (actual, corrected)
- propulsion efficiency



### SPM workstation in W/H

- All data from TPM indicator
- Other data from AMS
- Environment data from VDR
- Reference curve with actual data
- Data trend
- Reporting
- Data storage and transfer to shore



### SPM workstation in ECR

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Fig. 1 System configuration

## 2) Scope of supply

### A. TPM (Shaft Power Meter) 1 set per ship-set

TPM provides the shaft torque, RPM and power on the indicator.

TPM installed at intermediate shaft and measures shaft torque using by strain gauge. (Shaft Size : 370mm)

TPM consists of rotor module, stator module and indicator module.

- i. Rotor module is installed on shaft, it rotates with shaft. inside coil supplies electric power to strain gauge and measured strain value is transmitted to stator module by wireless communication.
- ii. Stator module is installed near rotor module, it supplies induction power to rotor coil and receiving strain data from rotor module by wireless communication. Stator module sends strain data to indicator module every second.
- iii. Indicator module: typically installed engine control room console. It received data from stator module and displays Shaft Torque, RPM and Power. And the indicator provides RS422 serial output and 4~20mA analog output to communicate with other device.
- iv. Spare part

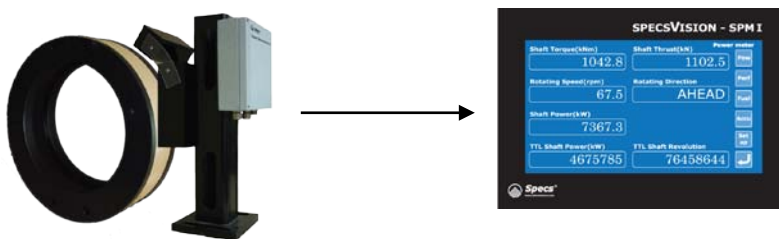


Fig. 2 TPM configuration

### B. SPM (Ship Performance Monitor) 2sets per ship-set

SPM consists of 15" touch screen base workstation, keyboard & mouse, inkjet printer, network hub

- i. Master SPM workstation installed on ECR console or ECR desk, If SPM installed on ECR desk, we will provide mounting bracket.
- ii. Slave SPM workstation will be installed on wheel house desk.
- ii. Inkjet printer, mouse and key board installed with Master SPM workstation.

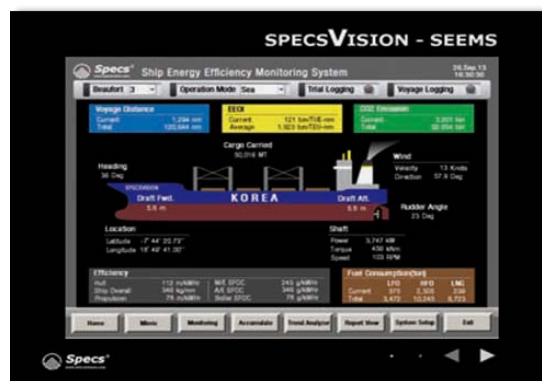


Fig. 3 SPM configuration

### C. 4ch. Serial to Ethernet Converter 1set per ship-set

To receive serial communication data (NMEA protocol format and Modbus protocol format)

- GPS, Speed log, Anemometer, Depth meter

**D. Network Hub                      2 sets per ship-set**

Network hub will be installed in ECR and Wheel house to communicate between Master SPM workstation and Slave workstation.

**3) Technical specification**

**A. Shaft Specification**

Measurable Shaft Diameter range: 370 mm

**B. Equipment Specification**

- i.     Sensing Element
  - Torque: Strain Gauge
  - Shaft Revolution: 2 of Proximity Sensors
- ii.   Remote Indicator:
  - Display: Shaft Torque, RPM, Power, Total revolution, Total Shaft Power
  - Dimension: W200 X H170 X D90 mm
  - Mounting type: Flush mounting, wall mounting or using stand
  - Communication: Serial output (RS-422) , Analog output (4~20mA)
- iii.   Work station
  - Size : 15" (1024, 768)
  - CPU : Dual Atom core 1.8 GHz
  - Storage : 256GB SSD
  - Touch screen : 5 wires Analog resistive
  - I/O interface : 1 of VGA, 2 of Serial port(1 of RS 232, 1 of RS 485/422), 4 of USB

**C. Accuracy**

- i.     Instrumentation Accuracy
  - Shaft torque     $\pm 0.5\%$
  - Shaft RPM        $\pm 0.5\%$
  - Shaft Power      $\pm 0.5\%$
- ii.    System Accuracy
  - Shaft Torque     $\pm 0.5\% + ke^1$
  - Shaft RPM        $\pm 0.5\% + ke$
  - Shaft Power      $\pm 0.5\% + ke$
- iii.   Environmental
 

|                       |                       |
|-----------------------|-----------------------|
| Operating Temperature | -15°C to +55°C        |
| Storage Temperature   | -25°C to +70°C        |
| Rotor Stator Air Gap  | Radial 5-12mm         |
| Supply Voltage        | 110-230VAC, or DC 24V |

ke<sup>1)</sup> Total error in shaft modulus constant and shaft Diameter measurement

## 4) Input / Output Data

### A. Input Data

|                       |  |
|-----------------------|--|
| Power meter data      | From TPM (RS-422)  |
| GPS data              | From GPS (RS-485/422)                                      |
| Wind Speed, Direction | From Anemometer (RS-485/422)                               |
| Water Depth           | From Echo sounder (RS-485/422)                             |
| Ship Speed by Log     | From Speed LOG ( 200 pulse / 1 mile or RS-422 NMEA format) |
| Generator Power       | From AMS (RS-485/422 NMEA format)                          |
| Fuel oil flow         | From Each Flow meter ( 1 pulse / 1 liter )                 |
| Fuel Temperature      | From Each Flow temperature sensor ( PT 100 ohm )           |
| Displacement          | Keyboard Input   |
| Fuel factor           | Keyboard Input   |

\* If VDR output will be available, SPM can receive voyage data from VDR via LAN cable,

\* SPM can interface with AMS / IAS via serial communication cable (Modbus protocol)

### B. Output Data

|               |   |
|---------------|---|
| Serial output | RS-422 , All display data are available (SPM workstation) |
| LAN           | TCP, UDP All display data are available (SPM workstation) |
| Analog output | 4-20mA , Torque, power, rpm (TPM indicator)               |

## 5) Display Data

Shaft Torque, RPM, Power  
 Fuel consumption (M/E , A/E , Boiler)  
 Generator Power  
 Specific Fuel Oil Rate  
 Propulsion Efficiency  
 Ship Overall Efficiency  
 Ship Speed by LOG  
 Ship Speed by GPS  
 Wind Speed and Direction  
 Water depth  
 Distance  
 Displacement  
 CO2 emission  
 EEOI  
 Accumulated data

## 6) Data Logging and Reporting

Data storage in every approx. 30sec interval for all data

Logging files are made available as CSV file. Created daily file size is lower than 1MB. User can transmit to shore side.

Notepad or MS-excel can read the files.

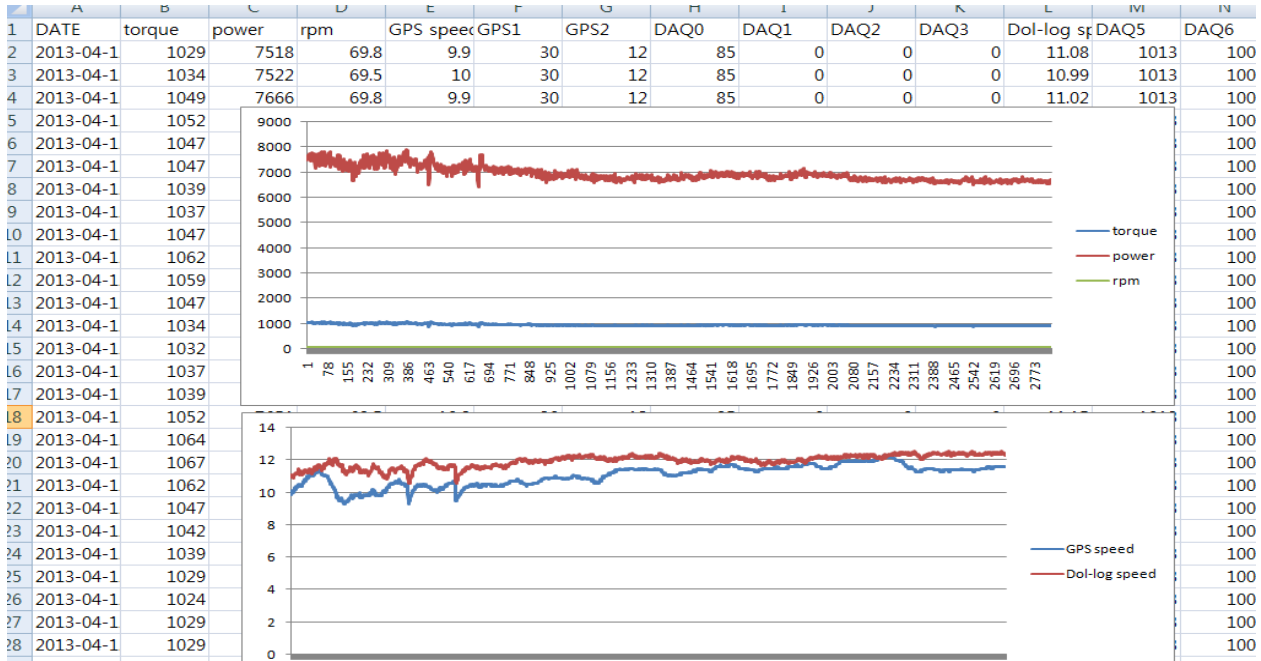


Fig. 4 Trend Analysis

SPM provides 3 kinds of Reports

- Daily Report - is generated every noon
- Performance Report - Operator
- Voyage Report - when operator clicks voyage start button, new voyage will be start, previous voyage report generated automatically

## 7) SPM Software

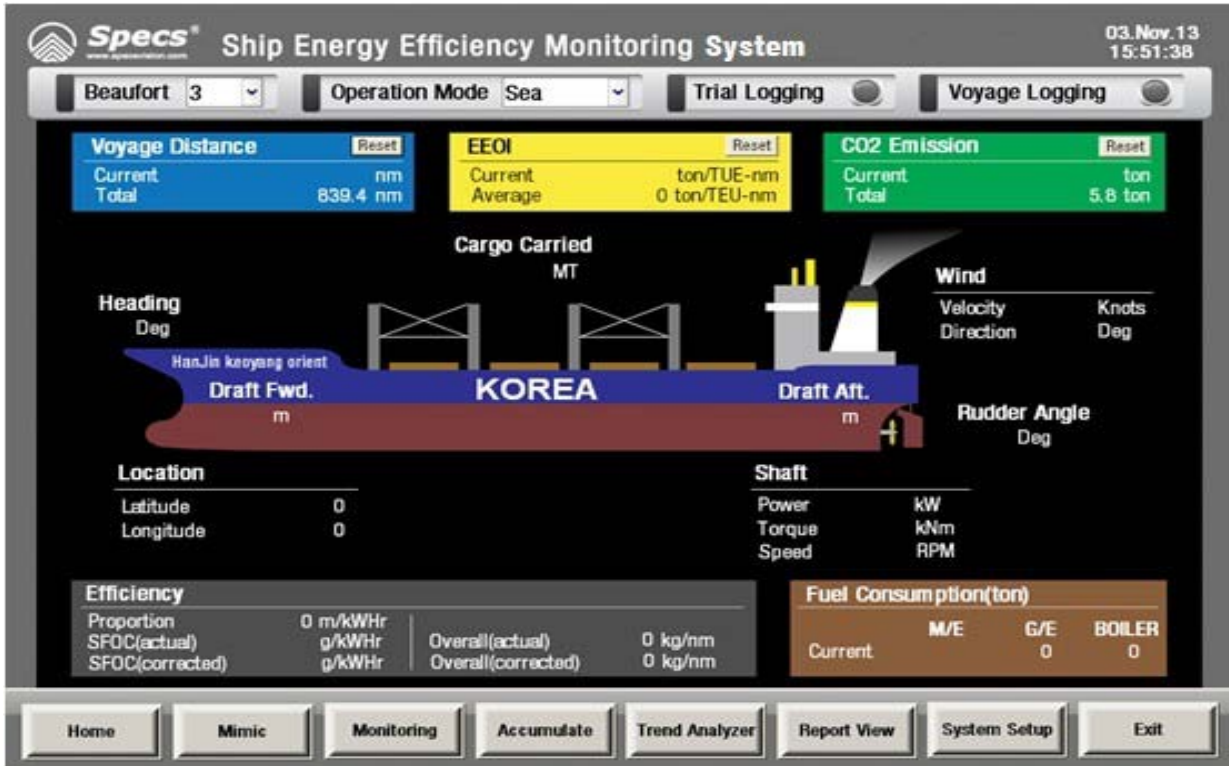


Fig. 5 Mimic page

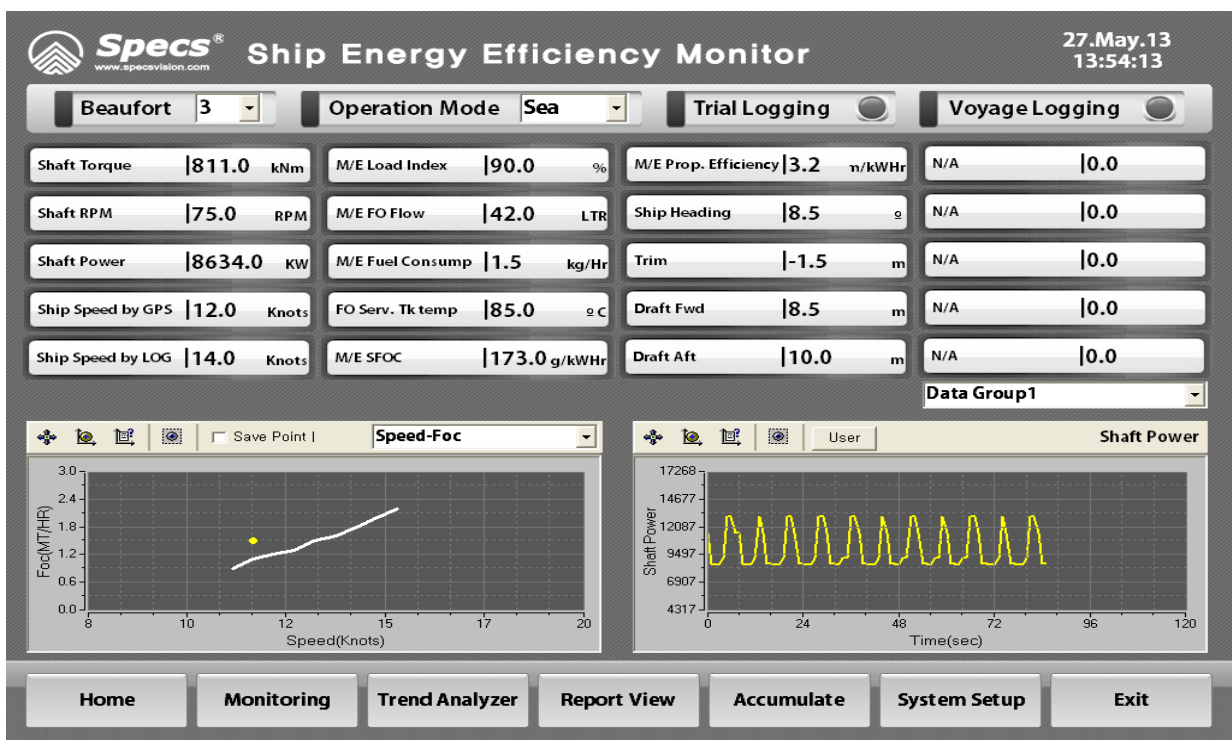
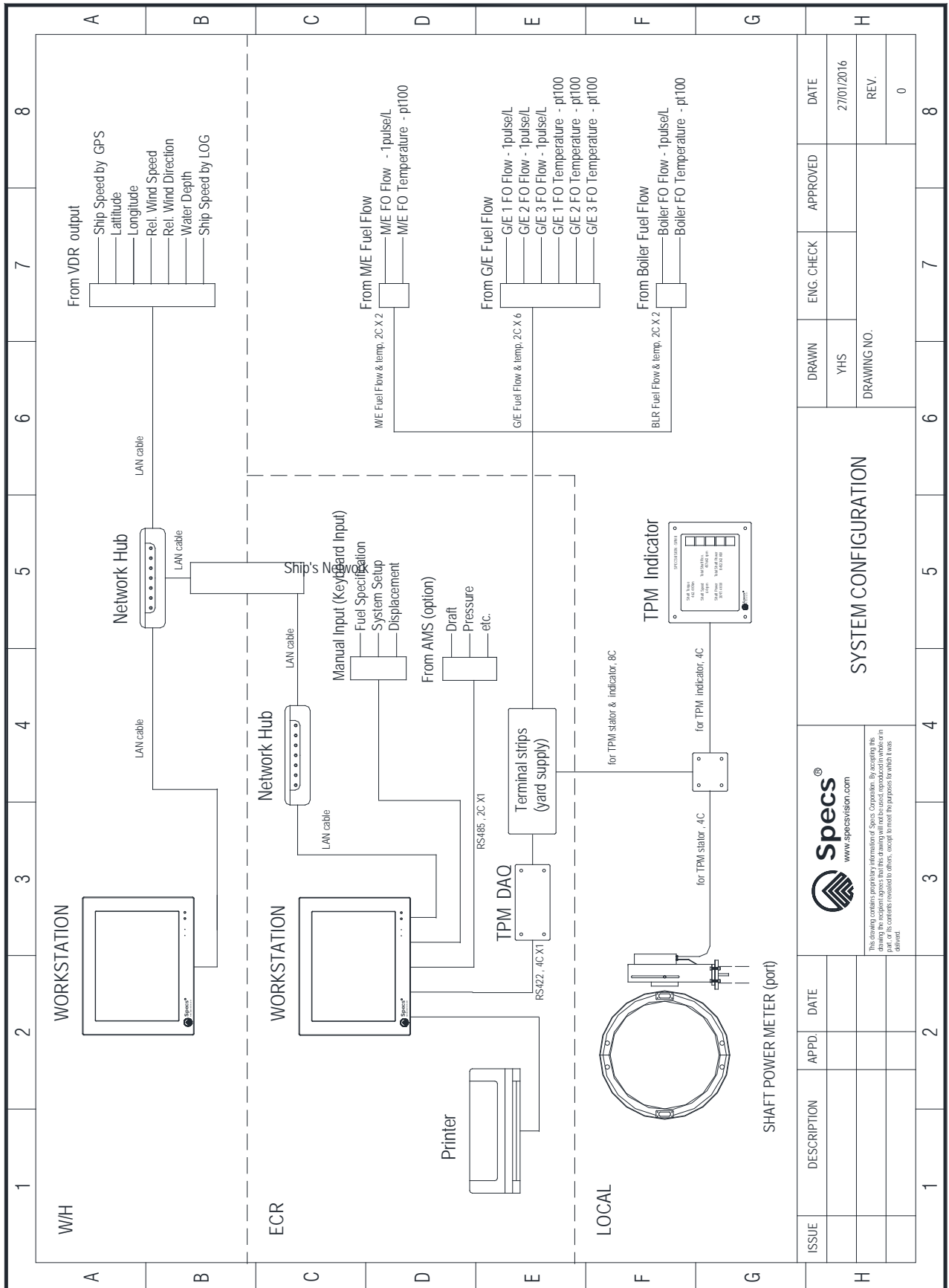


Fig. 6 Monitoring page

## 8) Drawings

### A. System configuration



SYSTEM CONFIGURATION

| ISSUE | DESCRIPTION | APPD | DATE |
|-------|-------------|------|------|
|       |             |      |      |
|       |             |      |      |

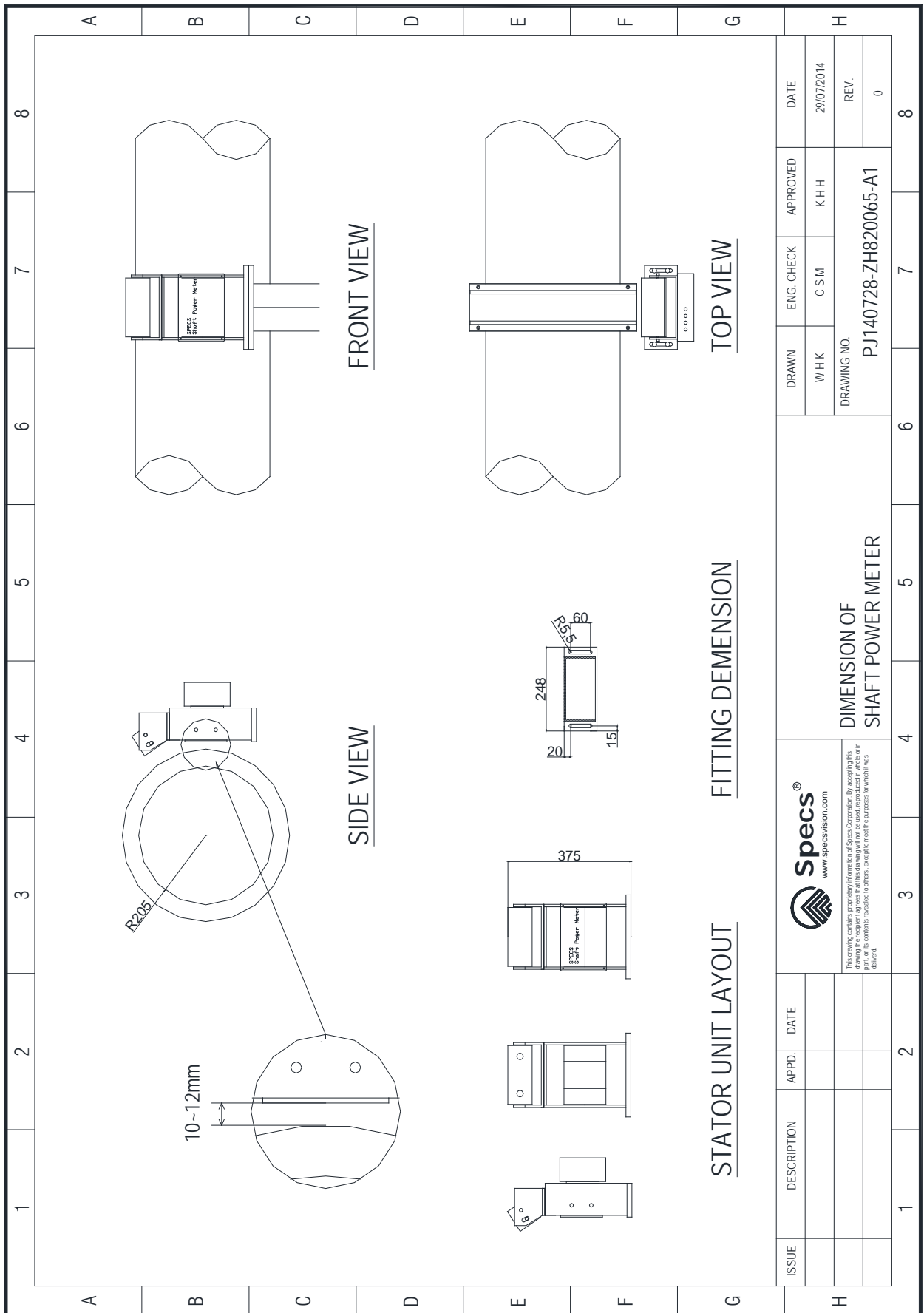
| DRAWN       | ENG. CHECK | APPROVED | DATE       |
|-------------|------------|----------|------------|
| YHS         |            |          | 27/01/2016 |
| DRAWING NO. |            |          | REV.       |
|             |            |          | 0          |



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## B. Shaft Power Meter



| ISSUE | DESCRIPTION | APPD. | DATE | DIMENSION OF SHAFT POWER METER |   |   |   | DRAWING NO.          | APPROVED | DATE       |
|-------|-------------|-------|------|--------------------------------|---|---|---|----------------------|----------|------------|
|       |             |       |      |                                |   |   |   | PJ140728-ZH820065-A1 | KHH      | 29/07/2014 |
|       |             |       |      |                                |   |   |   |                      |          | REV.       |
|       |             |       |      |                                |   |   |   |                      |          | 0          |
| 1     |             |       | 2    | 3                              | 4 | 5 | 6 | 7                    |          | 8          |

### C. Workstation

