Automation System

The history

1970-1982 DataChief I, II and III
- Centralised Alarm, Monitoring and Control system
- Deliveries to 100 vessels
- Pioneers

1982-1999 DataChief 7, 1000 and 2000
- Distributed Alarm, Monitoring and Control system
- Microprocessor, colour graphics
- Deliveries to 2000 vessels

1999-2006 DataChief C20
- Highly Distributed Alarm Monitoring and Control system
- No central computer
- High speed redundant field bus
- Deliveries to 1500 vessels

2007 -> K-Chief 500
- Updated presentation SW
- New Operator Control Panel
The K-Chief automation concept

- Alarm monitoring
- Machinery control
- Power management
- Propulsion control
- Cargo & ballast monitoring and control
- Information management
- Ship-shore communication
- Remote diagnostics
The K-Chief automation concept

A distributed automation concept build on common hardware and software modules providing in operation quality and efficiency

- **High reliability**
  - Fully redundant and segregated network
  - Redundancy available at all levels – from operators stations to power supplies
  - Real time processing provides quick response for optimum operation

- **Ease of operation**
  - Intuitive user interface provides efficient and safe operation

- **Easy maintenance**
  - Common hardware technology allows for easy maintenance and repair

- **Cost optimisation**
  - High maintainability, reduced needs for spare, yields low life-cycle costs
  - Reduced installation costs
The K-Chief automation – scaleable to your needs

- Individual systems
- One solution
Automation System

The K-Chief 500

- Modular Functionality
  - Modular hardware and software
  - Software independent of hardware
  - “LEGO” hardware by flexible DPU’s
  - “LEGO” software by function modules

- Modern technology
  - Commercial “off-the-shelf” (COTS) technology
  - Type approved computer (Intel Pentium)
  - Windows XP operating system
  - Distributed process control and signal processing
  - Single board DPU’s “Intelligent junction boxes”
  - Redundant Control Area Network (field bus; CAN)
K-Chief 500 – key features

- **Individual systems & one solution**
  - From small alarm systems to highly integrated alarm, monitoring and control systems
  - Configurable from 16 to 20,000 I/O channels

- **Local processing provides a responsive system**
  - Time stamp of alarms and events > 10msec
  - Advanced control functions provides improved operational economy

- **Redundancy available at all levels**
  - Fully redundant and segregated network
  - Operators stations
  - Distributed process units
  - Power supply

- **Built-in safety features**
  - Earth fault monitoring
  - Built in self test (BIST)
K-Chief 500 – Building blocks

- Operator stations (OS)
  - Multipurpose, self contained and process independent
  - Alarm presentations
  - Command control and transfer
  - Trend systems and reports
  - System configurations
  - Standard and customised graphics

- Operator control panel
  - 8,4” LCD screen with Touch with function keys, one key button for each function
  - Integrated engineers watch call status indication
  - Group alarm indication, standard and customised
  - Tracker ball for control of in mimic pictures
  - Remote sound off
  - Internal self check with alarm

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K-Chief 500 – Building blocks

- **Midi operator stations (MOS-33)**
  - Local monitoring
  - Local maintenance & troubleshooting
  - Back-up for ROS

- **Extended alarm system**
  - Watch Bridge Unit (WBU) for engine room alarms and watch responsibility to and from the bridge;
    - LED version
    - LCD version
  - Watch Cabin Unit (WCU) for engine room alarms in the engineer on duty's cabin and in public quarters;
    - LED version
    - LCD version
Distributed process units (DPU)

- Intelligent junction box, interface to sensors and actuators
- Alarm detection and process control
- Time stamp of alarms and events
- Installed directly on engines and compressors

AD- 0282  DPU RDi-32 / RDi-32a
AD- 0283  DPU RDo-16
AD- 0281  DPU Rai-16
AD- 0289  DPU RAo-08
AD- 0294  DPU Rai-10tc
AD- 0327  Process Segment Star coupler PSS
AD- 0296  dual Process Segment Controller dPSC
Automation System
Integrated Alarm Monitoring & Control

- Applications:
  - Alarm and Monitoring
  - Auxiliary Control
  - Power Management
  - Cargo Monitoring
  - Cargo and Ballast Control
  - HVAC Automation (Air Condition)
  - Management Support
Alarm & monitoring system

Functions & Features
- Alarm monitoring with colour graphic presentation.
- Alarm groups, summary & history.
- Logging of alarms, events and rotating hours & counters.
- Exhaust Gas temperature monitoring.
- Performance monitoring.
- Trend monitoring.
- Extension Alarm System for bridge & cabins for UMS operation.
- Engineer safety system.
K-Chief 500 – System architecture

Alarm, monitoring and control system

Features
- Pump control incl. standby start
- Valve control
- PID controllers
- Compressor control
- Purifier control
- Boiler control
- Heeling control
- Sequential start/stop
- Restart sequence after black-out
- Power Management
- Cargo and Ballast Control
K-Chief 500 – Supports vessels’ redundancy

- **Redundancy**
  - Fully redundant controller area network (CAN); fast, robust and reliable
  - Scaleable redundancy tailored to vessels’ design
  - dPSC provides full segmentation with logical and galvanic isolation
  - PSS provides star topology with galvanic isolation
  - A truly scaleable hierarchical and segregated network
  - Event based, local time stamp, immediate transfer of data
  - Instant and up to date information available at any time

*Extract of redundant propulsion*
Mimic on Site

- Possible to modify mimic picture when the system is running by commissioning eng.
- Mimic editor installed on OS
- Automatic update to all computers
- The view is displaying mimic editor
List view
- Shaded lines
- Possible to sort on all columns
K-Chief 500

- **Short trend**
  - 24 hours history
  - Log all changes for all tags (I/O and SW) the last 24 hours
  - Possible to store 10 individual hours with data
  - Save screen dump
  - No need for selecting tags
**Long trend**

- Maximum 100 days history
- Maximum 100 tags to select for history
- Sample the data E.g 20min sample intervall = 100 days history
K-Chief 500

- **Pdf viewer**
  - Instruction manual following SP
  - Possible to add pdf files to document folder
  - Not possible to access file system
  - Easy search and zoom
  - Printout facility if suitable printer
- **Pop up dialogs for control**

- All control objects have popup dialogs for control
- If more un-normal operation shall be activated, the dialog will expand to a larger dialog when pressing expand button
- **Pop up dialogs for displays**

- New dialogs for user HMI

- Example beside is for “System information display”
K-Chief 500

- **TFT- LCD panel**
  - 8,4” with touch. An option to the CRP panel
  - Easy way of changing mimic picture and views
  - Overview of alarm groups

- **Control Room Panel (CRP)**
  - Control Room Panel to be used in ECR and CCR, no backlight
  - Roller ball and numeric keypad
  - Alarm Ack and sound off
  - Command transfer
Operator panel to be used on Bridge

- Panels with backlight that can be used where it is required (i.e. Bridge)
- A combination of two modules
- The two panels have exact the same buttons and I/O together as the Control Room Panel
- **Two Screen solution**
  - Possible to have 2 screen on one OS
K-Chief 500

- New Operator Panels
- History and trend functionality built-in
- New list views
- Dialogues for all control objects
- Process Mimic change on the fly
- Pdf-viewer built-in
- Dual LAN integration to K-Gauge
- Two screen solution
- No change in DPU HW/SW
Automation Systems

Water ingress, Draft & Level Gauging

K-Gauge - fully integrated with Kongsberg sensors and transmitters
LAN integration to K-Gauge

- Dual LAN
  - Tank calculation in OS
  - Load Computer
    - NCA DL-94
    - MSI
    - RCU
    - LAN
      - LAN/LON
      - LAN/LON
      - LAN/LON
      - GLK
      - GLK
      - GLK
      - RADAR + 3 x temp
        - 1 x IG
      - RADAR + 3 x temp
        - 1 x IG
      - RADAR + 3 x temp
        - 1 x IG

- Dual CAN
  - Ballast TK sensors
  - Service TK sensors

K-Chief OS 500
### K-Chief OS 500 Cargo Tank Display

**Draft (m)**
- **A**: 5.00 m
- **M**: 5.00 m
- **T**: 5.00 m

**Trim (10.00 m)**
- **A**: 30.8
- **M**: 30.8
- **T**: 30.8

**List (5.00°)**
- **A**: 30.8
- **M**: 30.8
- **T**: 30.8

**Atm (1000 mbar)**
- **A**: 30.8
- **M**: 30.8
- **T**: 30.8

---

**Cargo Tank % for Volume**

<table>
<thead>
<tr>
<th>Cargo Tank</th>
<th>CT01P</th>
<th>CT01S</th>
<th>CT02P</th>
<th>CT02S</th>
<th>CT03P</th>
<th>CT03S</th>
<th>CT04P</th>
<th>CT04S</th>
<th>CT05P</th>
<th>CT05S</th>
<th>CT06P</th>
<th>CT06S</th>
<th>CT07P</th>
<th>CT07S</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT01</td>
<td>77.5</td>
<td>81.1</td>
<td>43.2</td>
<td>47.0</td>
<td>26.2</td>
<td>26.6</td>
<td>24.6</td>
<td>23.8</td>
<td>29.8</td>
<td>29.6</td>
<td>35.3</td>
<td>39.4</td>
<td>40.8</td>
<td>38.7</td>
</tr>
</tbody>
</table>

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**Village (m)**
- **CT01**: 7.348
- **CT02**: 7.949
- **CT03**: 7.906
- **CT04**: 7.831
- **CT05**: 7.733
- **CT06**: 7.840
- **CT07**: 7.755
- **Total**: 7.860

**Level (m)**
- **CT01**: 7.951
- **CT02**: 7.887
- **CT03**: 7.963
- **CT04**: 7.939
- **CT05**: 7.942
- **CT06**: 7.961
- **CT07**: 7.951

**Volume [m³]**
- **CT01**: 656.90
- **CT02**: 687.30
- **CT03**: 638.20
- **CT04**: 694.10
- **CT05**: 683.20
- **CT06**: 661.00
- **CT07**: 657.20

**Temp [°C]**
- **CT01**: 125.0
- **CT02**: 125.0
- **CT03**: 125.0
- **CT04**: 125.0
- **CT05**: 125.0
- **CT06**: 125.0
- **CT07**: 125.0

**Density [Mt/m³]**
- **CT01**: 5.000
- **CT02**: 5.000
- **CT03**: 5.000
- **CT04**: 5.000
- **CT05**: 5.000
- **CT06**: 5.000
- **CT07**: 5.000

**Weight [T]**
- **CT01**: 6276.80
- **CT02**: 6276.80
- **CT03**: 6276.80
- **CT04**: 6276.80
- **CT05**: 6276.80
- **CT06**: 6276.80
- **CT07**: 6276.80

**Net [ton]**
- **CT01**: 206
- **CT02**: 206
- **CT03**: 207
- **CT04**: 212
- **CT05**: 210
- **CT06**: 208
- **CT07**: 196

**Rate [t/h]**
- **CT01**: 0.6
- **CT02**: 0.5
- **CT03**: 0.5
- **CT04**: 0.5
- **CT05**: 0.5
- **CT06**: 0.5
- **CT07**: 0.5

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**THE FULL PICTURE**

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Automation System

The K-Chief 500

The modular concept of K-Chief 500 allows flexibility in system architecture.

**K-Chief 500**
- flexible installation

- No centralised processing
- I/O and local processing in one unit
- Extremely reliable DPU’s
- No special maintenance skills required
- Open system network solutions
- From 16 to 20,000 signals
K-Chief 500 - Alarm & monitoring
Standard graphics

- System information display
- Monitor & OCP dimmer display
- Alarm summary display
- Alarm history display
- Autolog display
- Tag details display
- Selected points log display & configuration
- Selected points bargraph display & configuration
- Selected points trend display & configuration
- Exhaust gas temp deviation
- Misc, log display
- Inhibit tags display
- Offscan tags display

ROS
K-Chief 500 - Alarm, monitoring & control
Standard graphics

Positioner handler
PID controller
Stand-by pump handler
Starter handler
Performance monitoring system
Counter display
OCP display
Ships display
Level correction display
General tank display
Cargo tank density
K-Chief 500 - Alarm, monitoring & control
Example of customized graphics

- Lub. oil service system
- Fuel oil service system
- Cooling fresh water system
- Sea water system
- Inert gas system
- Ballast system
- Generator control system
- Power management system, one touch auto sequence
- Heating, ventilation & air conditioning (HVAC)
- Selected cargo pumps display
K-Chief 500 - Vessel applications

- Ferries & Passenger vessels
- Gas carrier
- Chemical tanker
- Oil tanker
- Container vessel
- Bulk carrier
- Ro-Ro vessel
- Small vessels