



# DAMEN DREDGE MONITORING SYSTEM

Instrumentation package DDM5.0

## GENERAL

The Damen Dredge Monitoring system (DDM5.0) provides the operator a real-time overview of the dredging process on a trailing suction hopper dredger. It supports the operator to control the dredge system and increase the operational efficiency.

The DDM system is available for all trailing suction hopper dredgers within Damen but can also be delivered as an instrumentation package for non-Damen vessels, including retrofits.

## HIGHLY FLEXIBLE SYSTEM

DDM5.0 consists of several modules that can be easily added to the system. This provides the opportunity to customise the monitoring system exactly to the operator's needs. The basis system comes with the trailing pipe position indication module, which is seen as essential for any dredging operation.

Depending on the preferences of the operator, the system can be visualised on one or multiple screens. On each screen, six user selectable fields can be chosen by the operator during operation.

## OPERATIONAL PRACTICALITIES

The DDM5.0 program is installed on a PLC and is visualised by an industrial computer that runs on Windows OS. For all sensors connected to the PLC, the system provides the possibility to investigate the sensor diagnostics. In case of a failure, the operator can verify the exact location of the failure.

Remote access is integrated in the DDM5.0 system. It enables the Damen Services Department to facilitate the operator in case of any issue. This provides a fast and cost-effective way of helping the customer and reduces downtime to a minimum.

## DDM5.0 MODULES

### TRAILING PIPE POSITION INDICATION (TPPI)

The Trailing Pipe Position Indication module visualises the side view of the trailing pipe and calculates the dredging depth. If required, the system can be extended with the top view position, giving the operator a complete visualisation of the trailing pipe. When pre-set angle values are exceeded, the system will inform the operator by generating an alarm on the screen.

## LOADING

The loading module calculates the total amount of cargo and volume inside the hopper. The process is visualised in a real-time loading graph and enables the operator to fill the hopper as efficient as possible. To calculate the total amount of volume inside the hopper, four impulse radar sensors are installed at the fore and the aft of the coaming both on port and starboard side.

## PRODUCTION

The production module computes the amount of material entering the hopper by combining the data from the flow meter with the data of the density meter. It supports the operator to find the right operating point where maximum production is reached combined with minimum energy consumption. The values are visualised on a digital cross needle indicator and show the daily as well as the total production since the start-up of the project.

If applicable, this module can be used to automate the Light Mixture Overboard (LMO) system. This function enables the operator to pre-set a certain density value. Below this value, the mixture is directly pumped overboard using the LMO system. Above this value, the mixture is pumped into the vessels hold resulting in a higher mixture density in the hopper.

## ELECTRONIC MONITORING SYSTEM (EMS)

The Electronic Monitoring System module determines the dredging status and number of trips of the dredging campaign. If the required sensors are available it can also determine the volume of tanks installed on the TSHD and shows the real-time position of the vessel in coordinates. This data is frequently used for logging and analysing purposes.

## LOGGING AND REPORTING

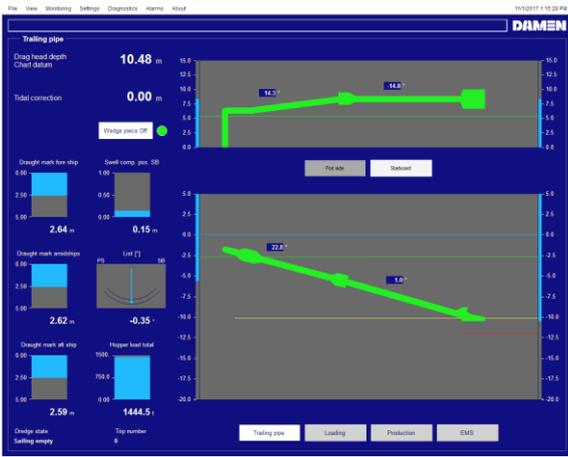
The logging and reporting module collects all relevant data of the dredging process. Thus, it creates daily reports from dredging cycle of the TSHD. These data and reports are often required by authorities to track and monitor the completed dredging work. The data can also be used to optimise the overall dredging process.

## POSITIONING & SURVEY VISUALISATION

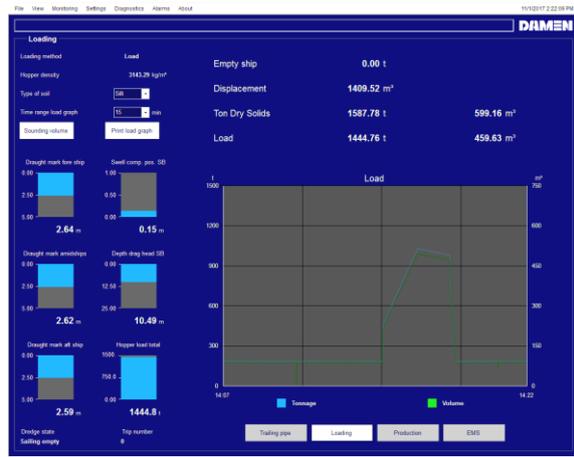
The DDM5.0 system can easily be extended with a positioning visualisation system. This system enables the operator to insert their own survey map and shows a real-time overview of the accomplished dredging track. It prevents unnecessary under and over dredging.

# DAMEN DREDGE MONITORING SYSTEM

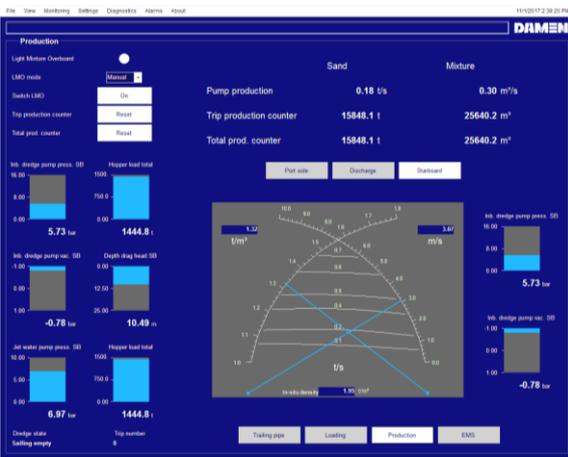
Instrumentation package DDM5.0



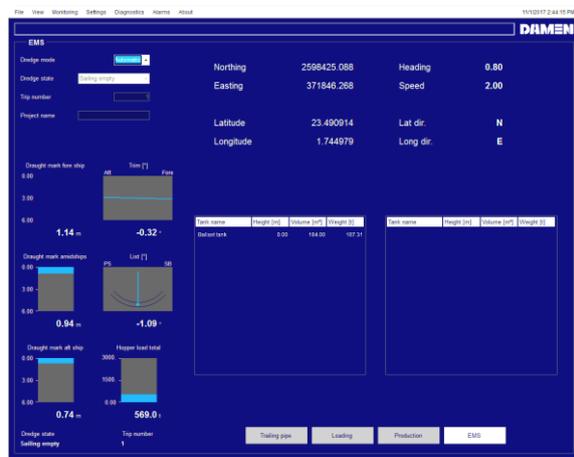
TRAILING PIPE POSITION INDICATION (TPPI) MODULE



LOADING MODULE



PRODUCTION MODULE



ELECTRONIC MONITORING SYSTEM (EMS) MODULE

Timestamp	Production at closed	Displacement	Tip number	Draft mark at ship	Tip	Speed	Time	Total hopper volume	Total hopper load	SD (Draftmark position 2)
09/02/2017 18:36:51	-1	3	3	1.93	0.42	0.11	1.06	17.2	25.25	-2.368
09/02/2017 18:36:53	-1	3	3	1.93	0.42	0.09	1.04	17.16	25.44	-2.285
09/02/2017 18:36:56	-1	3	3	1.96	0.42	0.06	1.04	17.22	25.18	-2.365
09/02/2017 18:36:59	-1	3	3	1.93	0.42	0.09	1.04	17.19	25.22	-2.289
09/02/2017 18:36:41	-1	3	3	1.96	0.42	0.03	1.04	17.19	25.67	-2.29
09/02/2017 18:36:51	-1	3	3	1.93	0.42	0.11	1.06	17.21	25.08	-2.256
09/02/2017 18:36:51	-1	3	3	1.93	0.42	0.11	1.04	17.19	25.25	-2.281
09/02/2017 18:36:11	-1	3	3	1.96	0.42	0.04	1.04	17.19	25.82	-2.256
09/02/2017 18:36:21	-1	3	3	1.93	0.42	0.04	1.04	17.19	25.42	-2.281
09/02/2017 18:36:31	-1	3	3	1.93	0.42	0.06	1.04	17.23	24.97	-2.312
09/02/2017 18:36:41	-1	3	3	1.93	0.42	0.08	1.06	17.21	25.07	-2.303
09/02/2017 18:36:51	-1	3	3	1.93	0.42	0.04	1.04	17.23	25.19	-2.283
09/02/2017 18:37:01	-1	3	3	1.96	0.42	0.07	1.04	17.2	25.17	-2.282
09/02/2017 18:37:11	-1	3	3	1.93	0.42	0.00	1.04	17.23	25.45	-2.259
09/02/2017 18:37:22	-1	3	3	1.93	0.42	0.04	1.04	17.24	24.82	-2.289
09/02/2017 18:37:32	-1	3	3	1.93	0.42	0.08	1.04	17.22	25.2	-2.307
09/02/2017 18:37:42	-1	3	3	1.96	0.42	0.04	1.04	17.23	25.57	-2.28
09/02/2017 18:37:52	-1	3	3	1.93	0.42	0.03	1.04	17.22	26.18	-2.289
09/02/2017 18:38:02	-1	3	3	1.93	0.42	0.04	1.06	17.25	24.83	-2.267
09/02/2017 18:38:12	-1	3	3	1.96	0.42	0.08	1.04	17.22	24.1	-2.289
09/02/2017 18:38:22	-1	3	3	1.96	0.42	0.02	1.04	17.21	25.75	-2.255
09/02/2017 18:38:32	-1	3	3	1.93	0.42	0.08	1.04	17.2	25.31	-2.255
09/02/2017 18:38:42	-1	3	3	1.93	0.42	0.11	1.04	17.22	25.06	-2.307

LOGGING AND REPORTING MODULE



POSITIONING VISUALISATION TELEDYNE

\*The screens shown in the examples contain all options available in DDM5.0. Depending on the customer's choice, these example screens can differ.



DAMEN SHIPYARDS GROUP

Avelingen-West 20  
4202 MS Gorinchem  
The Netherlands

P.O. Box 1  
4200 AA Gorinchem  
The Netherlands

phone +31 (0)183 63 99 22  
fax +31 (0)183 63 21 89

info@damen.com  
www.damen.com

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