IHC Systems

Dedicated to Efficient Dredging

Suction Tube Position Monitor

(IHC STPM®)

The technology innovator.
‘Efficient Dredging’ helps contractors to make the most of their dredging equipment: to generate high economic and ecological benefits, achieve optimal utilisation rates, reduce dredging time, make the dredging process smoother, simplify fault diagnosis, reduce downtime and wear, prevent under- and over-dredging, and maximise crew satisfaction.

Even after a shipbuilder has built reliable and efficient equipment, and even after contractors have optimised equipment utilisation, the Efficient Dredging concept continues to make a significant contribution, providing dredgers with extra ‘senses’ and ‘hands & feet’.

Relatively modest investments in instrumentation, automation, surveying and simulation techniques produce major improvements in efficiency and accuracy. Automation under dredge master supervision can enhance production by up to 30%.

IHC Systems draws on all kinds of conventional and innovative control, automation, communication and presentation technologies. We also make the most of the knowledge and resources of the entire IHC Merweide group.

The concept is honed in close alliances with contractors and worked out in specific products, systems and services for every category of dredger and in every field. The products can cope with all dredging and mining conditions.

Our knowledge, expertise and experience are dedicated to reducing over-dredging, spillage, energy consumption, emissions, turbidity, ecological side-effects and operational costs. They represent our contribution to a sustainable future for all our stakeholders.

...our contribution to a sustainable future
Benefits

Efficient Dredging starts with dredging in the right place and at the right depth. Dredging in the wrong locations and over-dredging can involve major energy wastage and costs. Under-dredging may mean being called back to finish the job correctly. All dredging scenarios of this kind mean high costs for the dredging contractor, if not the client, and they can also have a negative impact on the hydrodynamic and environmental aspects of the dredging job.

In terms of the operations of trailing suction hopper dredgers (TSHD), the need for accurate dredging implies that operators must know the position of the draghead relative to the actual dredge track at all times, together with its exact geographical coordinates, and that they must be able to make adjustments whenever they are needed. And it would also seem desirable to have a number of automation routines that can help operators to achieve this goal, so their performance isn’t impaired by fatigue, lowered attention levels, traffic or other dredging process parameters.

IHC Systems’ Suction Tube Position Monitor (STPM®) matches these requirements seamlessly. It provides an ongoing picture of two groups of parameters for vessels with one or two suction pipes. These parameters are:
• the three-dimensional position of the suction pipe and the draghead relative to the vessel centreline and orientation in a local grid
• the position of the TSHD relative to the water surface.

These relational data, if combined with geographical data obtained from DGPS or a survey system, for example, provide the dredge operator with an adequate picture of the correct geographic location and dredging depth.

The STPM® provides both adequate and ergonomic presentation and optional automation routines. Alone or in combination, they enable TSHD operators to just get on with dredging as efficiently as possible. This is evidenced by the fact that nearly every sizeable TSHD in the world has IHC STPM®.
Typical System Architecture

The IHC Systems STPM® function draws on proven hardware and software, including a programmable logic controller network (PLC) monitored by a fast PC-based, server-client, supervisory, control and data acquisition (SCADA) network. The core of the system is a separate, dedicated PC containing the STPM® algorithms and models. These run on a shared Microsoft Windows and IHC Systems’ Digisys platform. The software is dongle-protected to prevent unauthorised use.

The PLCs manage the standardised signal isolation and signal processing to and from the connected instrumentation and sensors, and – depending on the eventually specified configuration and extent of options – the drives for the suction pipe winches, gantries and swell compensator.

The supervisory control and data acquisition system (SCADA), also referred to as the Human-Machine Interface (HMI), is the link between the operator and the automation, control and instrumentation components. Touch-operated TFT screens present coloured process values and statuses on functionally designed screen pages using standardised diagrams, symbols, bar graphs, imitated analogue indicators, numbers and words. Functions are also initiated and controlled on these touch screens.

Currently, the STPM® function is in most cases an integrated and/or distributed part of a larger monitoring and automation system such as IHC Systems’ dredging control system (see brochure DCS, available on the website). However, the function can also be supplied in a stand-alone version and it is then described as an STPM® system. In both versions the content and extent of sensor equipment varies with the functionality that is ultimately specified.
Sensors, transmitters and/or actuators

Depending on the specific STPM® configuration, suction pipe configuration and required options, IHC Systems-made rugged sensors and other connected equipment may include:

- measurements of winch paid-out length
- suction-pipe vertical position transmitters
- suction-pipe horizontal position transmitters with a hinge-wear insensitive lever system
- water-hammer-resistant suction-inlet position measurement, maintainable without dry docking
- robust watertight cabling on the suction pipe, including submersible quick connectors and dedicated moulding boxes, dedicated conducts, pipes and strips
- analogue gantry position measurements
- analogue swell-compensator position measurement
- contactless limit switches for gantry, pipe and service frame positions and detection of slack wires
- relevant solenoids, pressure switches, level switches and hydraulic pump starters of the hydraulic gantry, winch and swell compensator control installations
- relevant I/O of electric suction pipe winch drives, if installed.
Typical functionality

Depending on the specific STPM® functionality and options, the dredging depth and/or lateral position of the suction pipe are presented as ‘dressed wire models’ on the touch screen with respect to the waterline and the vessel’s centreline. The top, side and back views of the ship, with suction pipe and gantries, are presented together with detailed draghead and bathymetric information in a digital terrain model (DTM) of the dredge area. The DTM is updated continuously with the draghead depth of the latest vessel track.

The touch screen allows for the online adjustment of operational parameters, while configuration parameters can be entered off-line. Transgressing set points generates audible and visible alarms. Presentation colour preferences, zoom and shift functions are available. Local grid resolution can be adjusted off-line. In the DCS-integrated version, screen pages are available for fault diagnosis and alarms.

Equipment geared to performance

The STPM’s local grid presentation may be interfaced with data from DGPS, survey and/or track systems, resulting in the availability of absolute geographical position x-y-z presentation. Of course, the final STPM accuracy cannot be better than the DGPS or survey/track system accuracy.

IHC STPM® options

Automatic draghead winch control (ADWC) function

The ADWC option relieves the operator of routine tasks and helps prevent fatigue. It continuously monitors and controls several suction pipe operations and executes them in the correct sequence:

• monitoring and control of the swell compensator position by control of the draghead winch
• keeping the draghead at the desired dredging depth, as inputted manually or obtained from DTPS
• maintaining either a constant angle of the lower pipe with respect to the sea floor, or a constant angle between the two suction pipe main parts by controlling the intermediate winch
• lifting the draghead when lateral angle limits are transgressed.

ADWC utilises a part of the sensor and transmitter equipment referred to on the previous page. Its control operations are presented on suction-pipe-related pages on the touch screens, and they are also included in the fault diagnosis and alarm presentation, if integrated in DCS. ADWC functions and set points are entered on the touch screens. The basic assumption for the installation of this function is that the vessel’s equipment must be able to correctly process ADWC output signals such as swell compensator blocking and releasing.
Combinations

**STPM and STPM**
Two IHC STPM® functions/systems – for the portside and starboard side suction pipe – may be combined in the same hardware and software environment without significant additions, except for sensors and I/O capacity. For both STPM functions, all options are available and can be applied if desired.

**STPM and DLM**
One or two IHC STPM® functions/systems may be combined with the IHC draught and loading monitoring function - IHC DLM® - in the same hardware and software environment. No significant additions are required, except for specific DLM sensors and I/O capacity. The combination provides an integrated presentation of the entire loading and unloading process of a TSHD.

The DLM® function accurately and continuously presents the vessel's draught and loading status in a graph, together with a tangential line for advice on useful loading time in relation to the total cycle time. The load calculation is derived from the displacement and trim of the ship, obtained using bottom-mounted pressure transmitters, in relation to a table calculated from the carene diagram and stored in the memory of the Digisys computer.

DLM® itself comes with a number of options that can be very useful for enhancing the hopper loading and unloading process. A brief summary:
- possibility of adjusting DLM calculations using information from the tank sounding system, if connected
- load recorder
- automatic light mixture overboard (ALMO)
- hopper volume and dry solid mass (TDS) measurement
- automatic draught control (ADC)
- artificially intelligent overflow loss estimator (OLE)

For a detailed overview of the benefits of this combination, see the IHC Systems DLM® brochure.