MOSS

Multi Operations Survey System

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Concern	:	Description MOSS
TARKA reference	:	
Client reference	:	…

MULTI OPERATIONS SURVEY SYSTEM
(Universal survey tool)

(Picture is the TARKA version of the MOSS, a client specific version can look different)

Contents

Specification of updates:

Version	Description	Author	Date
1.0	MOSS description	**HW**	Oct 2015
1.1	Added PCB info	**HW**	Nov 2015
1.2	Added extra dimensions and MOSS options	**HW**	Dec 2015
1.3	Added battery display and charge info	**HW**	Dec 2015
1.4	Added MOSS options and applications	**HW**	Jan 2016
1.5	Added information on USB	**HW**	Jan 2016
1.6	Added pictures of client specific MOSS units	**HW**	Jan 2016
1.7	Added info on power consumption	**HW**	Feb 2016
1.8	Updated after use of new board	**HW**	Nov 2016
1.9	Added detailed information and corrected some typos	**HW**	Dec 2016
2.0	Improved version	**HW**	Dec 2016
3.0	More universal text	**HW**	Oct 2017
4.0	Added information on 6-channel input board Updated text	**HW**	Dec 2017
5.0	Added information on NMEA multiplexer Created separate chapter on optional hardware	**HW**	Jul 2018
5.1	Additional info on hardware and corrected some typos Added pictures of client specific solutions	**HW**	Jul 2018
6.0	Added information on extended power supply Extra batteries or fuel cell systems	**HW**	Oct 2018

1 INTRODUCTION

The **Multi Operations Survey System (MOSS)** is a multipurpose tool for field applications and survey jobs. The original name was **Marine operations Survey System** but due to the use of the MOSS in other applications the name “Marine” was changed into “Multi”. With the MOSS it is possible to carry out different measurement with the same hardware. With multiple sensor inputs a wide range of sensors can be connected. The basic software reads, displays and stores all sensor values. Client specific software can be programmed and be installed by use of a USB stick even when the system is already in the field.

The MOSS was initially developed on request of a salvage company to be used as a portable freeboard measurement system. This to replace the traditional (old-fashioned) way of measuring the freeboard with a lead-line or going out with a RIB to read the draft marks.

After the first operational freeboard system the added value of a small, portable and battery powered system was noticed and the request for other sensor inputs (incline, temperature) followed soon.

The current version of the MOSS, as described in this document, has combined all requests into one portable measurement system.

2 MOSS

The MOSS is a practical, robust, portable measurement solution for your monitoring and surveying needs. Developed and manufactured by TARKA-SYSTEMS with the needs of Marine Surveyors and Naval Architects in mind. It is not a single tool but a MULTIPURPOSE solution for many different measurements.

Save time and overhead by using the MOSS system for your surveys due to the pragmatic design, clear functionality and the ability of reading a wide range of sensor inputs.
The functionality of the MOSS can be applied for Marine, Offshore, Salvage and Civil applications.
For special functionality the basic system can be extended on clients' request.

The MOSS model is a handheld unit that provides the readout and storage of connected sensors.
The sensor values are gathered, displayed and stored on a USB stick. Average values can be calculated and displayed during the measurements.
Additional to the data-gathering, visualization and storage there are possibilities to forward the data to an main measurement system through one of the available ports on the MOSS.

Additional to the wired connection to a main system it is also possible to transfer data by a wireless datalink to a remote location (ship-shore, ship-ship) over distances of many kilometers. Even connection by 3G/4G or IRIDIUM are possible. This allows the opportunity to present data on a webserver so information can be seen from the client's office.

2.1 MOSS-SPECIFICATIONS

The MOSS has the following specifications:

- Portable / Battery powered
- Sensor data gathering / visualization
- Data logging on USB
- Data forwarding wired/wireless
- Time synchronization
- RS232 or RS485 (Modbus RTU)
- Ethernet / CAN / USB connection
- Timer / Counter input
- Digital inputs/outputs
- Client specific software
- Change of measurement program by reading new program from USB
- (optional) PC-EXCEL tool for generating setup files (ini-file)
- (optional) PC-EXCEL tool for generating reports from gathered data

More details on the above specifications is described in a following chapter.

2.2 MOSS-HARDWARE

The standard MOSS configuration consists of the following hardware:

- Rugged travel case with shoulder strap
- Frontplate with integrated items.
- Battery with control board + charger
- MOSS integration PCB
- Rugged waterproof sensor connectors mounted on the side

Client specific solutions can differ from the basic description of the MOSS in this document.

2.2.1 Front panel items

The Frontplate consist of the following items:

- Data Gathering and Display Module (DGDM)
- Battery status display with control buttons
- On/Off switch
- Multi connector
- ETH connector
- USB connector
- Power indicator light

DGDM

The MOSS is equipped with a **Data Gathering and Display Module (DGDM)** which gathers and displays the sensor data. Data can be stored on a USB-stick through the USB port of the DGDM.
There are two options of the DGDM. Both with all options but version 4 is equipped with a serial RS232 port while version 5 has a RS485 (MODBUS-RTU) port.

Battery status display

The battery display shows the status of the battery system.
To scroll through the battery status display, press the buttons next to the display.
The battery display shows all information which is available on the SMBUS protocol of the battery system. Some of the information is not relevant to the MOSS unit.

On/Off

To switch the MOSS on, switch the on/off switch. The standard configuration switches of the main power after the battery control unit to the system. This provides leaking of current through additional electronics and results in a longer battery life.

Multi connector
The Multi connector is an additional connector which can be used for several options depending on the configuration of the MOSS. Most common use is for optional Digital inputs and/or outputs.

ETH connector
The ETH connector is linked to the Ethernet port of the DGDM and network setups can be achieved.
Time synchronization from an external source (NTP) can be achieved through the Ethernet port.

USB connector
The USB connector is used for uploading new programs into the DGDM. Software programs which uses an ini-file to create specific settings, the USB is also used to read the ini-files.

When the program stores data on the USB, the USB must be connected during operation.
USB must be formatted as fat32, an USB formatted as NTFS is not seen by the system

2.2.2 Side panel items

The side connectors are used to connect to the sensor cables. When client has already existing sensor cables with dedicated connectors the bulkhead connectors on the side of the MOSS can be adjusted.
Depending on the configuration of the system and the demands of the client, the side panel can have different layouts.

Examples of different side-layouts:

Standard layout:

The maximum number of connectors on the side is four with the standard BINDER connectors.

- The 7-pin female connector is normally use for serial sensor where multiple pins are required for power and serial signals.
- The 4-pin female connector can be used for sensors with a 2-wire mA or serial connection.
- The 4-pin male is used for the battery charger of the MOSS.

When not used connectors are protected with dust cap.

Client specific layout 01:

The side-layout with two connectors:

- Ethernet connector
- Charger

With this system the motion sensor is integrated inside the MOSS box so no sensor connections are required on the side.
On request of client the Ethernet connector was placed on the side.

Client specific layout 02:

Client solution with additional side plate with inscription and four mil-spec 7-pin female connectors. For this solution the MULTI connector on the front is used as charger input.

When not used connectors are protected with dust cap.

Client solution with additional fuses added in the V+ line.

3x sensor input
1x charge input

2.2.3 Internal items

Battery system

The MOSS is equipped with a battery system consisting of multiple items:

- Battery
- Control print
- Status display
- Battery charger

The battery is the smart type with SMbus protocol:

- Lithium
- 14.40V
- 6400mAh
- 95.0 Wh

Battery control print

The battery control print controls the behavior of the battery and protect it from unexpected situations.
The control print provides information about the system to the battery display. The control print is integrated on the MOSS-PCB.

The battery control print, right up corner, is integrated on the MOSS-PCB.

Battery status display

The battery displays information about the battery status of the system.

The display is designed, by the manufacture, to give the full information on the parameters on the SMBUS.
Not all information is relevant for the MOSS system and those screens can be ignored.
By pressing the two buttons the user can walk through the screens. The most relevant screens are mentioned below.

TARKA is looking into the possibilities to develop a new display controller with only the relevant screens.

TIME TO EMPTY
This display shows the time that the system can run until the battery is empty with the same power consumption.

RELATIVE CHARGE
This display shows the relative charge of the systems in percentage.

CURRENT
This display shows the current consumption (minus) of the system when operational. When charged the incoming current (plus) is shown.

VOLTAGE
This display shows the voltage of the system.
Voltage with active battery: approx. 14400 mV.

Battery charge

To recharge the MOSS the power supply cable (4-pins) must be connected to the related bulkhead connector on the MOSS. Depending on the model the bulkhead connector is mounted on the side or on the front plate (MULTI) of the MOSS.
The charge loop is before the main switch so the MOSS is charged when system is turned off.

The MOSS (battery controller) is charged with 12 Vdc.

2.2.4 Optional internal hardware

Additional hardware-boards can be added to the MOSS for special signal configuration.
The options of these boards are described in a separate chapter in this document. Please refer to that chapter for more info.

2.3 POWER CONSUMPTION

The MOSS power consumption is specified for different modes:

1. MOSS only
2. MOSS complete (with sensors)

1: MOSS only
The MOSS is active and charged, battery display is on and main switch is ON.
The DGDM screen is operational, no sensors are connected.

2: MOSS complete (with sensors)
The MOSS is active and charged, battery display is on and main switch is ON.
The DGDM screen is operational and all sensors are connected.
The number of sensors and the type of sensors can differ for each setup.

Time frame
Total battery capacity when fully charged: 6400 mAh.

Consumption (example)

1. MOSS only: 175 mA, 6400/175 = 36.5 hour
2. MOSS with motion sensor : indication : 220 mA, 6400/220 = 29.1 hour
   Total consumption is relevant to type and number of connected sensors.

Consumption can differ due to connected sensor(s).

*above numbers are given as indication, real values can differ due to different system setup.

2.4 LONG TERM MEASUREMENTS

The MOSS has an internal battery to be able to operate in the field without the need of external power supply. With this system it is possible to operate for approximately 20 hours depending on the power consumption of the connected sensors.

For measurements that need a longer operational time there are different options:

1. Extra battery case
2. Fuel cells

Both option are described in detail below.

EXTRA BATTERY CASE

When the operational time of the internal battery of the MOSS is not sufficient an additional battery case can be connected to the MOSS.

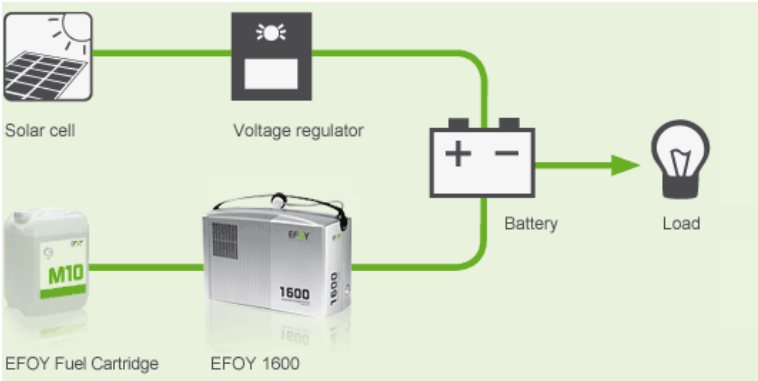
Model	Size (mm)			Weight	Charge Time (hrs)			
	A	B	C		12V 10A	12V 20A	24V 2A	24V 5A
12V 40Ah	300	249	119	6.0 kg	5-7*	3--5	N/A	N/A
12V 80Ah	361	289	165	10.7 kg	12-15*	6-9	N/A	N/A
12V 100Ah	411	322	168	13.2 kg	14-18	9-14*	N/A	N/A
12V 170Ah	462	340	170	22.0 kg	22-30	13-18*	N/A	N/A
24V 20Ah	300	249	119	6.0 kg	N/A	N/A	10-12*	5-7

With the example of the MOSS with motion sensor (see above) the operational time on the internal battery is 29.1 hours, with the battery case of 40Ah the additional time is equal to 40.000mA/220mA = 180 hours (7.5 days)

With the 80Ah battery case the period can be extended with 2 weeks.

FUEL CELLS

When even additional batteries cannot cover the requested stand-alone operational time then the option of fuel cells can be considered.



The fuel cell can be setup with 1 to 4 Cartridges of 5, 10 or 24 liters.

Also Solar panels can be connected. With this setup period of months can be covered.

2.5 SENSOR OPTIONS

Sensors with the following signal output can be connected to the MOSS:

- mA
- V
- RS232
- RS485 MODBUS RTU
- Counter Timer
- CAN

An overview of applications and sensors option are given in the following document
MOSS_APPLICATIONS

MOSS-4

- Digital inputs
- Digital outputs
- Analog inputs
- CAN
- RS232
- Ethernet
- External storage

MOSS-5

- Digital inputs
- Digital outputs
- Analog inputs
- CAN
- RS485
- Ethernet
- Modbus RTU
- External storage

MOSS SPECIFICATIONS

Rugged case	:	305x270x194 mm
Weight	:	approx. 4.5 kg
Battery	:	90Wh (optional 2)
	:	Status display
	:	On/Off switch
	:	Power indicator led
Connectivity	:	see previous page
	:	Ethernet connector
	:	USB connector
	:	Multi purpose connector
Display	:	3.5 inch, 320x240 pixels
Charge	:	12 Vdc
Storage	:	
	:	USB stick (extern)
Software	:	Client specific
DGDM (Data Gathering and Display Module)		
	:	Type 4 or 5
Specials	:	on request

2.6 MOSS SOFTWARE

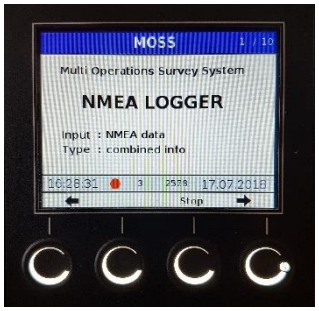
The software running on the Data Gathering and Display Module (DGDM) reads the signals from the sensors and displays these on the display. Multiple screens are possible to keep a clear overview.

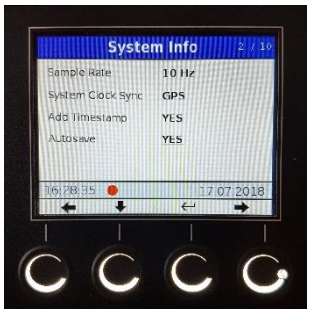
The user can go through the screens by using the pushbuttons on the front.
The basic setup of the screen consist of the following layout:

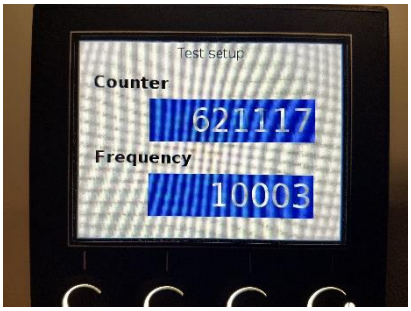
1. Introduction screen
2. Overview raw input signals
3. Engineering screen with sensor value in engineering values (if applicable)
4. Overview screen of all inputs.
5. About screen for system info.

The screens can be adjusted to each project or on client request.

Due to the client specific solutions of all projects the details of the client specific software are mostly given in a separate document.







2.7 MOSS-INTERFACES

The MOSS system has a modular setup so it can read the most common sensor inputs. When the data output type of a sensor is known the raw value can be read. With client specific software the engineering value can be calculated and displayed on the display.

Available interface options DGDM:

- 2 CAN ISO 11898
- USB Host (to connect USB mass storage)(fat32)
- USB Device (to connect to PC)(fat32)
- Ethernet
- RS232 (NMEA) ontype-4 or RS485 (MODBUS-RTU) on type 5
- Analog inputs (0-10V / 4-20 mA)
- Counter / Timer
- 4 digital inputs
- 2 digital outputs

The DGDM is equipped with four special push buttons (tactile) which are used to control the measurement program.

The sensors are connected through rugged waterproof connectors. Depending on the number of inputs the number of connectors can change.

Each connector can have a power source output to power the related sensors, power can be battery-power (15 Vdc) or boosted-power (24Vdc).

2.8 DIMENSIONS

Rugged case	:	305x270x194 mm
	:	Removable lid
	:	Outside use possible when closed
Weight	:	approx. 4 kg
Battery	:	Internal 90 Wh
	:	Status display
	:	Approx. 25 hours operational time Depending on number and type of sensors attached
	:	Additional battery-case (optional, multiple days)
Connectivity	:	Multiple sensor input
	:	1 x Multi input/output
	:	1 x USB (fat32)
	:	1 x Ethernet
Charge	:	1 x input 12 Vdc
Storage	:	External USB stick
Display	:	3.5 inch, 320x240 pixel
Software	:	Basic software
	:	Client specific solutions
On/Off switch	:	1x
Power LED	:	1x

3 OPTIONAL HARWARE BOARDS

The following boards can be added internally to the MOSS

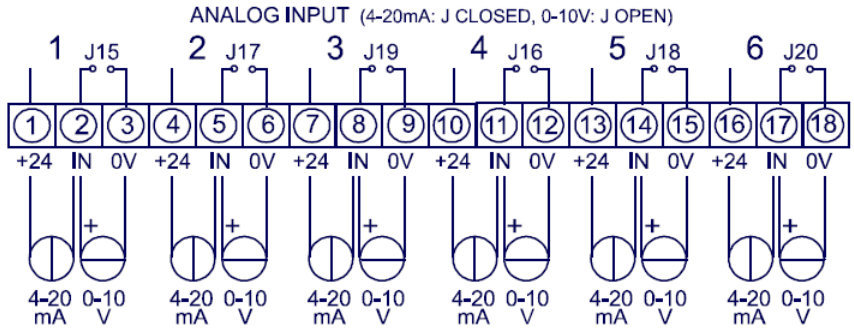
- 6 channel digital input board -> Modbus out
- NMEA multiplexer board
- Wireless NMEA server

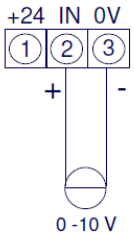
Depending on size and configuration one or more boards can also be combined and integrated into the MOSS.

3.1 Six channel digital input board

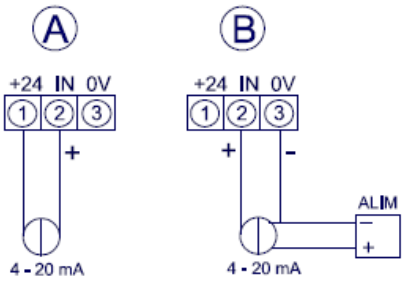
The standard mA input channels of the DGDM use a 10 bits a/d convertor. For high accurate measurements a higher conversion is required. Therefor the MOSS can be equipped with a 6-channel input board with a 15-bits a/d conversion.
The output of this board is connected by the MODBUS-RTU port to the DGDM module.

The board can be set to mA or Voltage input by a hardware switch.
Each input channel has three input lines which can be used for different input setups.





Connection diagram for Voltage measurement 0-10 Vdc.



Connection of 4-20 mA linear sensors supplied by the module (case A) or by an external power source (case B)

The type of input V or mA must be specified at order or all wiring must be specified to the external connectors.

For more than six inputs multiple board can be added to each other. Due to the limited space inside the MOSS a bigger case or an external case for the boards must be selected.

3.2 NMEA multiplexer board

The MiniPlex-3 series NMEA multiplexers enable the connection of multiple NMEA 0183/2000 devices and a host device like a PC, a laptop or a tablet. All models share the same number of NMEA ports and features. They differ in the type of host interface, the interface that talks to the computer. Some models also have an NMEA 2000 interface.

NMEA 0183 data consists of readable text sentences. If you would connect the output of a navigation instrument to the serial port of a computer and start a program that displays the incoming data, you would see something like this:

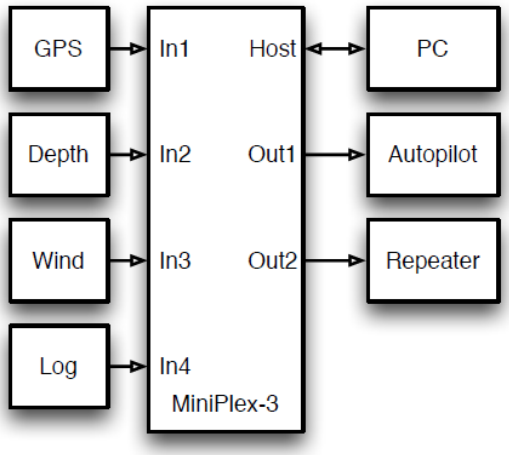
$GPGGA,143357.999,5301.0061,N,00635.5479,E,1,06,1.9,90.0,M,,,,0000*2E
$GPGGA,143357.999,5301.0061,N,00635.5479,E,1,06,1.9,90.0,M,,,,0000*39
$GPGLL,5301.0061,N,00635.5479,E,143357.999,A*22
$HEHDT,67.0,T*1E

This is plain text in a specific format defined by the NMEA 0183 standard. Every device that receives this information would know that the sentence starting with GPGLL originates from a GPS (hence the GP at the beginning of the sentence) and that it contains the geographic longitude and latitude (GLL).
The term “NMEA sentence” is used for NMEA data because it is made up of single lines of text.
Throughout this manual, “NMEA sentences” and “NMEA data” will be used randomly.

The MiniPlex-3 Multiplexer

The MiniPlex-3 multiplexer is an advanced NMEA 0183 multiplexer with four NMEA inputs or listener ports, two NMEA outputs or talker ports and one or two host interfaces. It combines NMEA sentences that are received on the NMEA inputs and it can send these sentences to the NMEA outputs and to the host interface(s). These host interfaces can also be used to send NMEA sentences back to the multiplexer to be forwarded to its NMEA outputs and to send commands to configure the multiplexer.

The picture shows a typical setup where the MiniPlex-3 is used to combine data from four instruments, send it to a PC and, depending on the configuration of the MiniPlex, send the same data to an autopilot and a repeater display. The PC is also capable of controlling the autopilot to steer a programmed route and to display information such as distance to next waypoint on the repeater display.



Galvanic Isolation

Every NMEA input and output of the MiniPlex-3 is galvanically isolated, sometimes called opto-isolation because opto-couplers are used to achieve this isolation. An opto-coupler is an electronic component that transports information by means of light instead of electricity, thus creating a barrier for electrical currents and voltages.

Galvanically isolated inputs and outputs prevent unwanted flow of electrical currents between instruments and the multiplexer. These currents could damage the instruments or interfere with radio signals and should therefore be avoided. Galvanically isolated inputs are required by the NMEA 0183 standard. As an extra measure of protection, the MiniPlex-3 also has galvanically isolated outputs.
The host port of the MiniPlex is also galvanically isolated to protect it against potential damage caused by ground loops or voltage spikes.

Both NMEA outputs can drive up to four listeners each. Flexible routing options allow you to specify which NMEA sentences are sent to these outputs. The outputs are also galvanically isolated. The NMEA 0183 standard does not require this but we added isolation because it makes the outputs more universal when it comes to connecting them to different kinds of inputs (NMEA 0183/RS-422 or RS-232).

3.3 Wireless NMEA server

To create a wireless connection between the MOSS and a laptop/mobile-device a Wireless-NMEA server can be added to the MOSS.

The above describes NMEA multiplexer is also available with a wifi option.

4 APPLICATIONS

With the DGDM-Type 5 the MOSS has the possibility to read:

- RS485 (MODBUS-RTU) up to 32 sensors
- 2 CAN ISO 11898
- Analog inputs (0-10V / 0-20 mA)
- 4 digital inputs
- 2 digital outputs
- Optional – internal storage

With the above scope of inputs signals the MOSS can be used as a modular system for many different sensors and many different measurements. When different measurement programs are required for a different type of project the software can be changed by using a USB stick.

By placing an USB stick into the system the system will check the files on the stick. When a different program is on the stick than installed on the DGDM that program is installed. When each client specific measurement software is on a separate USB stick the MOSS can be used for multiple measurements without changing any hardware.

The type of sensor is not important only the sensor should have one of the above protocols to be used together with the MOSS. Sensors can be provided by TARKA-SYSTEMS.

4.1 Sensor types

Examples of sensors which can be read by the MOSS unit:

Pressure	mA	DGDM type 4/5
Temperature	PT100 with convertor to mA	DGDM type 4/5
Incline	mA	DGDM type 4/5
Incline	RS485 (MODBUS-RTU)	DGDM type 5
Strain gauge	full bridge with convertor to mA	DGDM type 4/5
Distance (freeboard)	mA	DGDM type 4/5
Distance	RS485 (MODBUS-RTU)	DGDM type 5
Wind sensor	Serial RS232 NMEA	DGDM type 4
Water Current	Serial RS232 NMEA	DGDM type 4
GPS	Serial RS232 NMEA	DGDM type 4
Motion (6DOF)	Serial RS232 NMEA	DGDM type 4
Motion (Roll & Pitch)	Serial RS232 NMEA	DGDM type 4

With the MODBUS RTU protocol up to 32 sensors can be connected in a bus-structure which allows the user to carry out multiple measurements.

4.2 Applied applications

A short summary of applied applications:

Freeboard measurement

Sector	**Salvage**
Sensors	Ultrasonic sensor (RS485 MODBUS)
	Incline sensor (RS485 MODBUS)
Software	Read, display, store internal, store USB

Pipeline Services

Sector	**Civil**
Sensors	Pressure sensor – pipe pressure (4-20 mA)
	Pt100 - pipe temperature (4-20mA)
	Pt100 – ambient temperature (4-20mA)
Software	Read, display, store internal, store USB
	EXCEL tool for preparing measurement
	EXCEL tool for generating pdf-report.

Underwater installations

Sector	**Diving**
Sensors	Pressure sensor – absolute (4-20 mA)
	Pressure sensor – atmospheric (4-20mA)
	Temperature sensor – ambient (4-20mA)
	ADP sensor -water speed and current

Motion Measurement

Sector	**Offshore**
Sensors	Motion sensor (6DOF) or
	Motion sensor (Roll&Pitch)

Freeboard and Water depth/speed/temp

Sector	**Salvage**
Sensors	DST800 serial NMEA
	Ultrasonic distance sensor (Serial)

Multiple loadcells

Sector	**Engineering (marine/civil)**
Sensors	Multiple loadcells (mA output)

Maritime seatrial (Motion & GPS)

Sector	**Marine / Offshore**
Sensors	Motion sensor (6DOF)
	GPS

Additional to the above applied applications the MOSS could be used for the following applications:

Salvage monitoring and survey	Marine survey of damaged vessels
Field measurement	Incline experiments
Dry docking monitoring	Floating dock monitoring
Semi-submersible monitoring	Float-on/off monitoring
Heavy lift	Load out
Pressure tests	others……

5 OPTIONS

The MOSS is a multifunctional device and depending on the required specification the MOSS can be configured in multiple ways related to hardware and software.

Below a summary of options:

MOSS (basic)	

• Hardware
  ○ Rugged case with shoulder straps
  ○ Data Gathering and Display Module (DGDM)
  1. DGDM type 4
  2. DGDM type 5
  ○ Internal battery with status display
  ○ Rugged sensor connectors
  ○ USB / ETH connector
  ○ Main switch with power led indicator	

• Software
  ○ Basic Measurement software
  1. Software RS485 MODBUS RTU
  2. Software Analog input (4-20 mA / 0-10 Vdc)
  3. Software RS232
  4. Combi 1 & 2
  ○ Software - Client specific solutions	

Sensors (options)	
• Ultrasonic distance gauge 50 feet range (MODBUS RTU/RS232/ma) • Ultrasonic distance gauge 72 feet range (MODBUS RTU/RS232/ma) • Incline sensor (MODBUS RTU/mA) • Temperature sensor (PT100 (with mA conversion)/ mA / RS232) • GPS (RS232) • Wind (RS232) • Pressure sensors for Diving (absolute, relative, atmospheric) • All sensor of 4-20 mA (2-wire 15 or 24 Vdc source from case) • All RS232 NMEA sensors	

Other options:

- Special requests for software visualization
- Client specific requests for hardware and software

Delivery:
Due to different requests the MOSS systems are made on order, normal delivery time within 8 weeks.

We have several demo systems available for urgent jobs.

Please specify your requirements for a MOSS that suits your demands.

Regards
Henry Wijgerse
TARKA-SYSTEMS