

Order Code - NTS-001

Note: Specifications are subject to change.

Tesca Technologies Pvt. Ltd.

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1 – PURPOSE OF THE BENCH

The aim is to reproduce the operating principle of a steering gear such as it can exist on board a highly automated ship. Train students of all levels to drive and maintain driving an automated system through nominal situations or degradations close to reality.

Types of activities in terms of principle of conduct:

- Monitor parameters,
- View conduct configurations,
- Operate interfaces that allow nominal or degraded installation management,
- Identify a functional drift or a malfunction,
- Use driving images to diagnose damage,
- Take conduct rights.

Types of activities in terms of conduct maintenance related to the configuration of the systems:

1. Electric type malfunction:
 - i. No or loss of power on type sensors:
 1. Pressure switch
 2. Temperature
 3. Position
 4. Pressure
 5. Tank level
 - ii. No or loss of power on distributors' coils
 - iii. No or loss of power to the motor pump group
 - iiii. Loss of the circuit breaker, of a relay
 - v. Loss of DEP order or loss of DEP
2. Mechanical type malfunctions / adjustment fault:
 - i. Component type adjustment:
 - a. Pressure limiter
 - b. Sensor
 - c. Line break between sensor and PLC
 - d. Pump regulation
3. Bad circuit layout
 - i. Circuit valves
4. Degraded components
5. Thermal type malfunction

Types of driving maintenance activities related to driving configuration:

- Loss of communication in remote HMI and PLC:
Involves the operator to maintain the pipe in the room in automated mode
- Loss of PLC:
Involves the operator to maintain the pipe in the room in non-automated mode (subject to keeping the pump running)
- Loss of a switch:
- Involves the operator to maintain the installation pipe through the interface most suited to the situation

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Teaching level :

Level IV : High School degree or equivalent

- Structure of an electrical, mechanical and hydraulic system,
- Driving modes
- Parameter monitoring (flow, pressure, power)
- Identifying a drift, a malfunction
- Operator round (reading parameters on the installation)
- Use a driving operator file
- Use a maintenance sheet
- Take an oil sample

Level III : Two-year technical degree, two-year university degree in technology or equivalent

- Level IV
- Analysis of the pump regulation of the hydraulic system
- Maintain the management of a local system in automated mode or in non-automated modes
- Malfunction analysis,
- Carry out secure interventions in preventive, predictive and corrective maintenance operations on different systems
- Use the PLC interface and my local driving images
- Know the interactions between bigrams
- Know the network architecture
- Use an oil analysis result

Level II : Three-year university degree in technology or equivalent

- Level III
- Assess a risky employment limit
- Analyze the causes and or the consequences of a malfunction
- Analyze, adjust the position control
- Reload and analyze a PLC program
- Provide solutions in terms of staff security; driving equipment and maintenance
- Use manufacturer's documentation

Level I : Master degree or equivalent :

- Level II
- Structuring a hydraulic system
- Drive in different modes
- Structure a network architecture
- Use the PLC interface and local pipe images
- Provide solutions in terms of personnel, equipment and driving safety
- Identify a drift, a malfunction

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2 - TECHNICAL SPECIFICATION

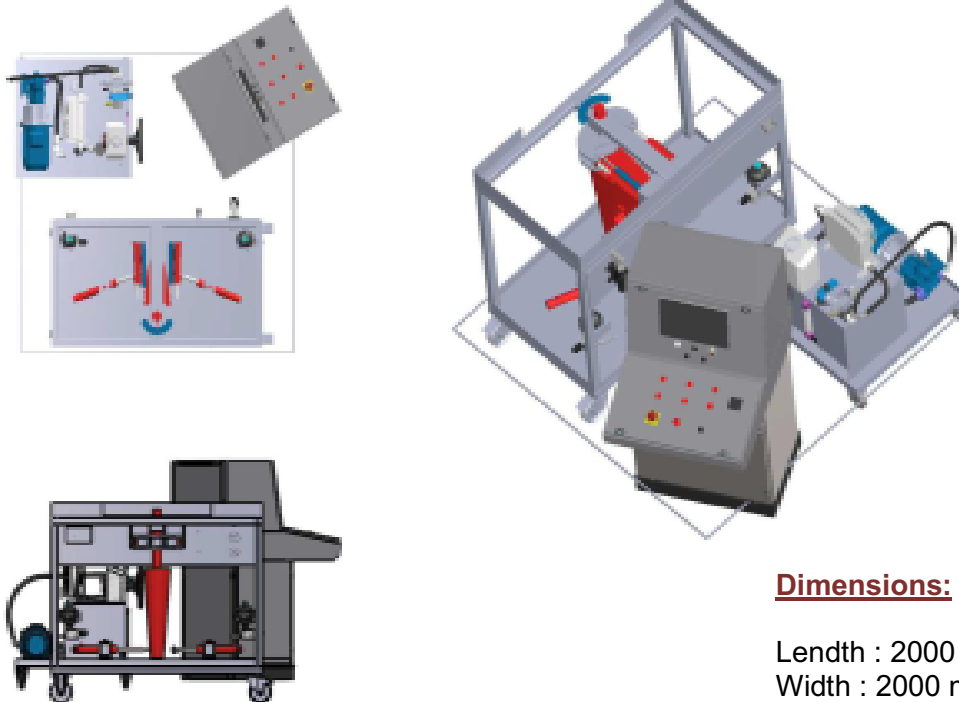
The equipment we offer is an automated and non-automated hydraulic bench composed of three sub-assemblies:

- a. A hydraulic generation composed of a motor pump group, an oil tank with its retention tank as well as all the hydraulic components and accessories necessary for the operation of the rudder.
- b. An operative part on a mechanically welded chassis with translucent casing, reproducing a rudder, with its instrumented control jacks, as well as opposing jacks representing the forces exerted by water on the rudder.
- c. A control console with a power part for supplying the hydraulic generation, a command and control part, with an automaton associated with an HMI for control and display. This desk is also equipped with buttons and indicator lights.

These three assemblies are hydraulically and electrically connected to each other.

The assembly is designed to be installed in a space of 2mx2m excluding the control console.

We only use industrial components from major brands, therefore very widespread, BOSCH REXROTH or EATON VICKERS pump, TOR components Cetop 3 EATON VICKERS, WANFLUH proportional components



Dimensions:

Length : 2000 mm
Width : 2000 mm
Height : 1500 mm

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A – HYDRAULIC GENERATION

The hydraulic power plant is equipped with a motor pump group (3 kW motor, flow rate 10L / min at 100bar) which supplies a hydraulic bored distribution block.

This motor pump group is mounted on load with a suction valve fitted with a position sensor.

Cetop 3 components are mounted on the drilled block with standard M16x200 pressure taps in order to carry out all measurements.

The pump is a variable displacement piston pump with flow cancellation and LS regulation.

A proportional Cetop 3 distributor controls the rudder in automated mode, a position control is achieved with the return of two analog linear sensors.

A manually operated Cetop 3 distributor controls the rudder in non-automated mode.

An autonomous hydraulic helm controls the rudder in non-automated local emergency mode.

Different valves and hydraulic components provide the functions of holding in position, pressure adjustment, flow adjustment.

The tank is equipped with a fixed temperature thermostat and an adjustable temperature thermostat.

The tank is equipped with an electric low alarm level and a very low electric stop level.

An air / oil temperature exchanger cools the oil, a 3/2 valve allows the exchanger to bypass to simulate an oil temperature rise.

All hydraulic flow and pressure settings will be easily accessible on the control unit.

A 6µm absolute pressure filter and a 10µm absolute return filter with electrical clogging indicator, keeps the 46cst mineral oil clean in the cleanliness class of the most sensitive component.

A pressure switch equipped with an isolation valve transmits fault information "low pressure", the isolation valve allows to simulate a failure.

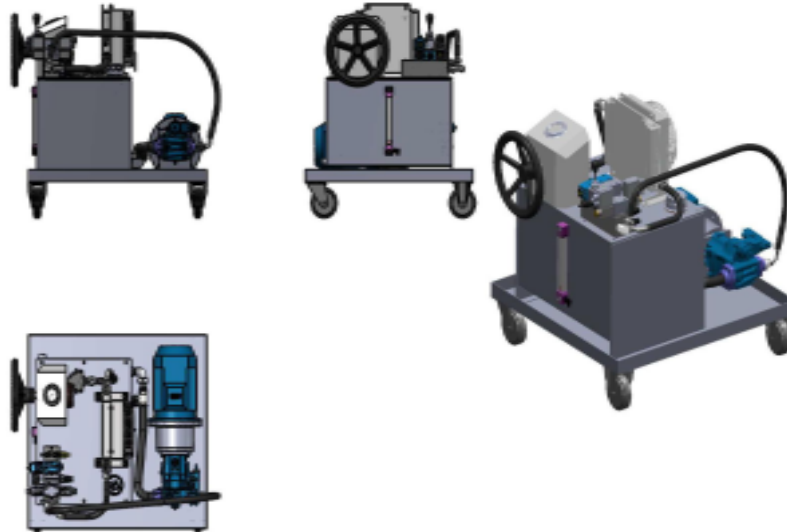
Two pressure sensors on the cylinder supply transmit the pressure value to the HMI.

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Components nomenclature:

- 1 painted steel tank capacity 80L
- 1 total retention tank
- 4 swivel casters
- 1 fixed thermostat 70 ° C
- 1 adjustable thermostat 10 to 90 ° C
- 1 visual level
- 1 visual dial thermometer
- 1 electric low alarm level indicator
- 1 very low level electric indicator
- 1 electric motor 3kw 230 / 400v three-phase 1500rpm with 2 temperature contacts (alarm and security)
- 1 lantern and coupling
- 1 pair of shock absorbing pads
- 1 piston pump 10 cc / rev variable displacement flow cancellation and LS
- 1 suction valve with electrical position contact
- 1 absolute 3µ pressure filter with electrical clogging indicator
- 1 absolute 10µ return filter with electrical clogging indicator
- 1 Cetop 3 bored block 3 posts
- 1 Cetop 3 bypass distributor 4/2
- 1 Cetop 3 manual control 4/3 valve
- 1 proportional distributor 4/3 Cetop 3
- 3 LS circuit selectors
- 1 Cetop 3 flow limiter on P
- 1 double piloted valve on A and B Cetop 3
- 1 double balancing valve on A and B Cetop 3
- 1 anti-shock valve on A and B Cetop 3
- 3 high pressure valves on the rudder supply
- 2 analog pressure sensors on the rudder feed
- 1 pressure switch on the P supply of the drilled block
- 1 pressure gauge
- 1 air / oil cooler
- 1 cooler bypass solenoid valve

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B – OPERATIVE PART RUDDER

The operative part is composed of a mechanically welded steel frame receiving the mechanical reproduction of a rudder.

The rudder is actuated by two cylinders connected in parallel (the rod side of one cylinder with the bottom side of the other cylinder, and vice versa).

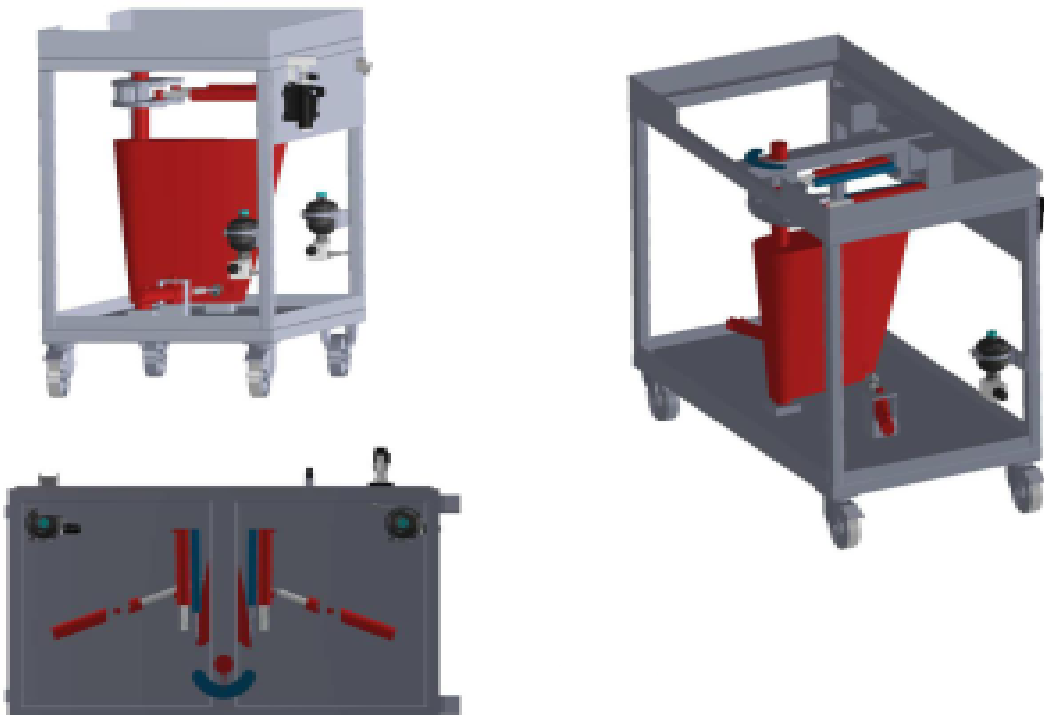
Two measurement rules control the displacement of the rudder and give the actual angular position. The two position values are compared in the PLC, a fault is sent to the automation in the event of too large a deviation. This difference can be modified artificially in the automation by the instructor to create a breakdown.

A load will be created by two opposing cylinders on the rudder to simulate the force of the water applied to the rudder. The pushing force of the cylinders will be achieved by accumulators; the hydraulic pressure will be adjustable with a hand pump used to fill the circuit.

A dial with a needle will indicate the visual position of the rudder.

An axis with an electric limit switch will allow the rudder to be locked at 0 °.

The whole is covered with translucent Lexan panels in order to visualize the movements of the rudder and the reading of the dial.



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Components nomenclature:

- 1 mechanically welded painted steel chassis
- 4 swivel casters
- Translucent Lexan casing
- 1 painted steel rudder with its axis and angle indicator
- 1 0 ° locking pin with presence sensor
- 2 rudder control cylinders
- 2 analog measurement rules
- 2 accumulators
- 1 hand pump
- 2 counter cylinders

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C – CONTROL CONSOLE

The electrical cabinet is of the console type, it integrates the electrical power, and electrical control components, as well as the automation.

The electrical power part supplies the electric motors of the power unit and the chiller motor, as well as the control circuit.

A SIEMENS automaton and HMI controls the rudder in automated mode.

1 PLC assembly:

- 1 CPU315-2 PN / DP, 384 KO
- 1 S7 MICRO MEMORY CARD, 128KB
- 1 Comm. Processor CP 343-1 Lean
- 1 set of remote inputs and outputs
- 1 ET200S, IM151-1 Std, 12MBit / s
- 2 PM-E 24V
- 3 ET 200SP, DI 8x 24V DC ST
- 2 8DO 24VDC 0.5A standard
- 2 2AI I standard 4-wire 4-20 mA 12 bits, +/- 20mA 13bits
- 2 TM-P15S23-A1 screw
- 15 TM-E15S26-A1 universal screw
- 1 Panel with touch screen
- 1 SIMATIC HMI KTP1200 Basic (Profinet)

The HMI has several pages of screens for controlling and viewing the various rudder parameters, namely:

- Automatic helm angle control +/- 35 ° (+/- 37 ° in non-automated)
- Visualization of faults
- Helm angle visualization
- Circuit diagram with visualization of the working condition of the components
- State of inputs and outputs
- A page "Instructor screen" for simulating failures.

The source files of the automation will be provided to you so that the pole can make any changes.

A WANDFLUH SD7 control card controls the proportional valve, the PASO software installed on a PC supplied with the bench allows the different settings of zero, gain, ramps, PID, ect ...

Different driving modes are provided depending on the position of the switches:

- Automated
- Non-automated

With this material, we focus on the reflection of the schematic in On/Off and proportional hydraulics (open and closed loop), on the settings by the learners of components and on the diagnosis of breakdowns.

The different hydraulic, mechanical and automatic characteristics of a rudder are thus highlighted by this equipment.

We place the learner in a situation by reproducing a real system used on board the ships.

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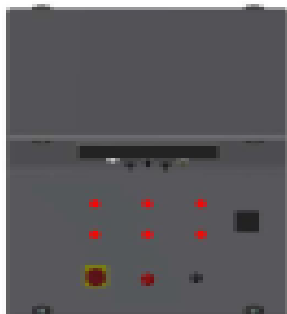
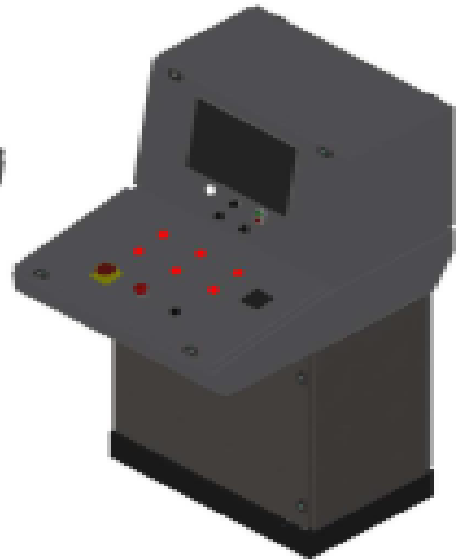
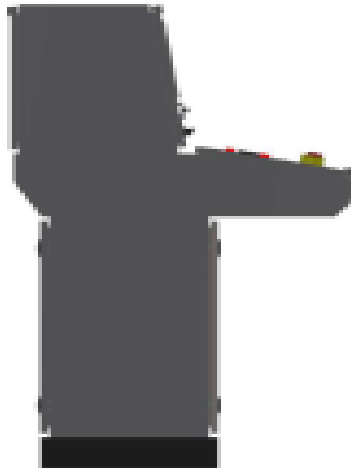
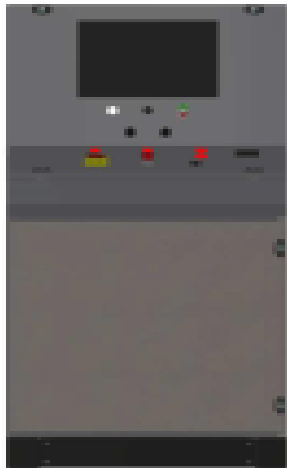
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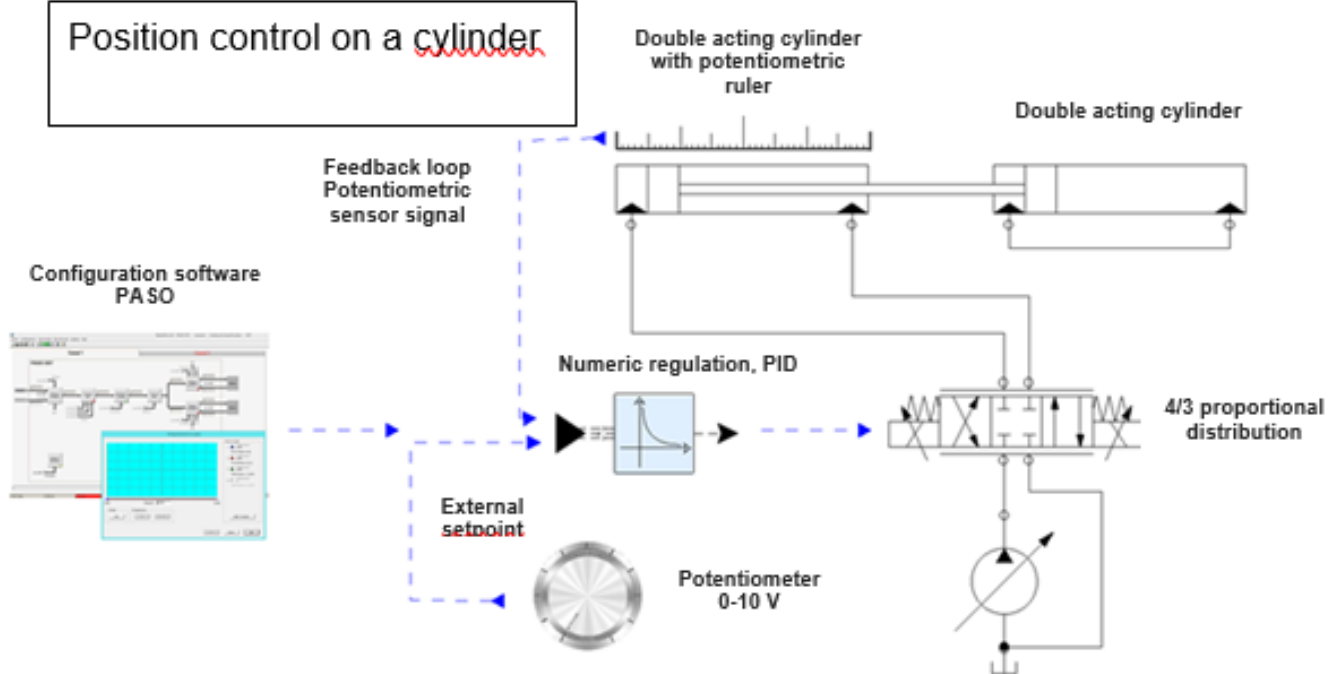
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Position control on a cylinder



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Components nomenclature:

- 1 cabinet
- 1 general disconnecter
- 1 live LED
- 1 emergency stop
- 1 group start switch
- 1 cooler engine start switch
- 1 24Vdc power supply
- 1 control circuit and power circuit protection
- 1 phase controller
- 1 needle ammeter
- 1 buzzer
- 1 engine temperature fault indicator
- 1 voltage fault indicator
- 1 fault indicator for motor protection relay
- 1 emergency stop light
- 1 rudder light locked
- 1 local control light
- 1 indicator test button
- 1 group start button
- 1 group stop button
- 1 local / remote button
- 1 automated / non-automated button
- 1 switchboard switch on
- 1 Siemens S7-300 controller with Ethernet port
- 1 KTP 1200 basic 12 inch touchscreen HMI
- 1 Wandfluh SD7 amplifier card for PID control

D – LINK HOSES

The hydraulic hoses are fitted with anti-pollution couplings with valves with flat faces. This technology prevents any loss of fluid during uncoupling and any introduction of air and pollution during coupling.

ADVANTAGES: The two flat faces facilitate cleaning before coupling ensuring the protection of the hydraulic circuits. The socket is equipped with a safety locking system preventing any inadvertent opening. Automatic coupling by simple push of the male end on the female part.



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3 – LAPTOP

HP Laptop

PROCESSOR

Intel Core i5 - 6200U

OPERATING SYSTEM

Windows 10

SCREEN

HD Screen SVGA BrightView WLED de 15,6 inches

RAM

6 Go DDR3

HARD DRIVE

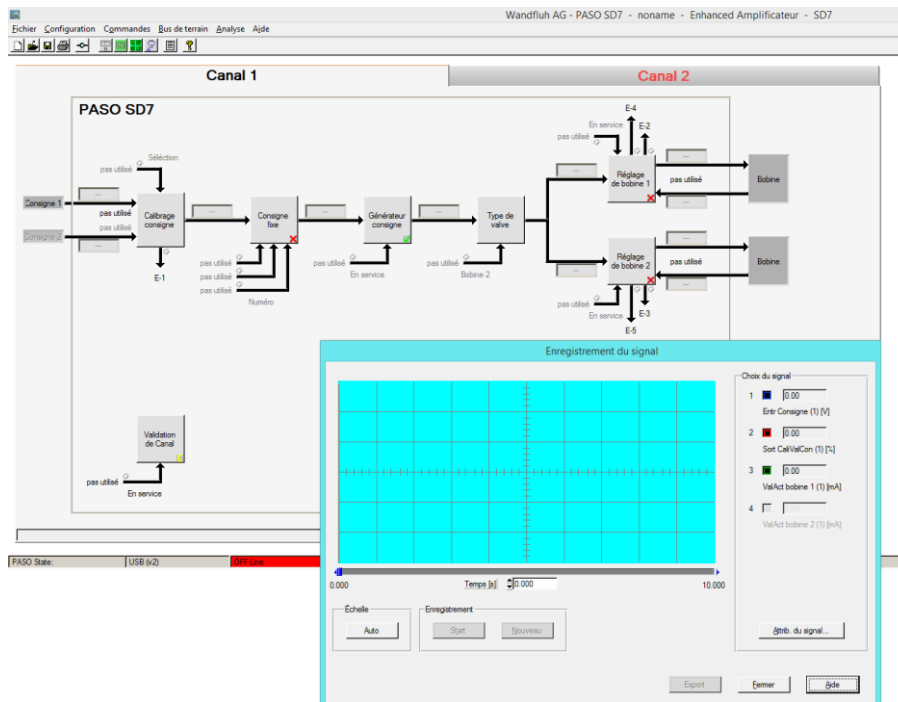
1 To



Webcam with integrated microphone intégré.
Weight : 2.04 kg

4 – SOFTWARE PROVIDED WITH BENCH

Configuration software for the SD7 WANFLUH PASO control card



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5 – SYSTEM OPERATION

Operation modes

Automated mode

PLC monitors and acts appropriately on rudder module following settings and events that have occurred

Main functions assured in this mode are:

- Control from HMI:
 - o Start / Stop the pump
 - o Transmit helm setting angle
 - o Monitor angular evolution of the rudder and its real position

- Monitor from HMI:
 - o Visualize hydraulic circuit condition and principle components configuration
 - o Visualize different alarms
 - o Visualize input/output data
 - o Visualize electrical system condition
 - o Visualize control system condition
 - o Visualise pressure on actuators

Non-automated mode

This is the “rescue” operation mode in case of automatism failure.

System operation is realised by operator from control console after activate non automated mode.

Rudder orientation is performed with command situated on proportional distribution valve or manual distribution valve of hydraulic system.

Rudder evolution or position monitoring is performed with ruler situated on operative part module.

Installation monitoring is performed through synoptic on control console.

This operation mode is conditioned by keep running motor pump group.

High rescue non-automated mode

This is the “rescue” mode in case of electrical power loss.

In case of unavailability of the motor pump group, the rudder should be set in zero position through a flow generator controlled by a direction orbitrol.

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Operation principles

The availability of rudder in any mode is conditioned by:

- Rudder unlocked

The activation of the motor pump group in any mode is conditioned by:

- No moto high temperature
- No emergency stop
- Pump isolation pump open
- Presence of voltage 3 phase in power circuit
- Thermal relay not activated
- No low oil pressure

Note: Low pressure information is a condition of keep running of motor pump group. This information is factored at the end of vacuuming during group start.

If one of this condition is not effective I lead to pump stop in any operation mode.

List of event factored in automated mode:

- Motor high temperature
- Pump isolation valve non open
- Rudder locked
- Oil pressure non ok
- Emergency stop
- Lack of one phase of power circuit voltage
- Thermal relay activated
- Oil tank low level
- Position information of the rudder non conform in following situation:
 - o Breakage of 4-20mA link of 2 or more encoders
 - o Gap between 2 encoders indicating rudder position superior to "x" °
- Communication loss with ET200S automaton
- Movement time of the rudder superior to a set time

These event are available on HMI screen and light indicators.

Each event should be memorised in PLC. In automated mode a reset is necessary, pressing push button on control console before start again.

This reset is effective only if the event reason is identified and repaired.

Consequences of events on system in automated mode:

- Pump stop
- Hydraulic circuit vacuuming allowing circuit pressure drop
- Null value destined to proportional distribution valve
- Proportional distribution valve's servitude circuit deactivation
- Impossible to start again if event is still on PLC programme

List of defects not leading to pump shutdown but must be noticed on operation image:

- Oil low level
- High motor temperature
- Filter clogging

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6 – TECHNICAL DOCUMENTATION

The documentation will be provided in English in paper format in 3 copies and on digital medium (USB key) in 2 copies in Microsoft Word and PDF formats.

It will include:

- The source files of the PLC program
- The manufacturers' documentation of the components
- Commissioning and operating instructions (Plans, diagrams, list and parts lists)
- Safety notice
- Equipment maintenance instructions

CE conformity declaration in accordance with following directives :

- « Directive basse tension » 2014/35/UE
- « Directive machine » 2006/42/CE
- « Directive CEM » 2014/30/UE
- « Directive équipements sous pression » 2014/68/UE

7 – HYDRAULIC COMMISSIONING AND AUTOMATION + INSTRUCTOR TRAINING**HALF A DAY WILL BE DEDICATED TO THE EQUIPMENT INSTALLATION / PREPARATION****System and components Identification:**

- Equipment description and safety instructions reading

Taking in hand:

- Accompanying of teachers for the start of the hydraulic unit and pressurization of the circuit.
- Recommendations while using the equipment

Use and equipment operation:

- Explanations and wiring of the main practical work

Preventive maintenance:

- Awareness on the fluids cleanliness.
- Control level
- Instructions for filter elements replacement

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OPTION 1: DATA LOGGER KIT SERVICE MAN PLUS



Portable, extremely robust and easy-to-use measuring device for measurement tasks in mobile hydraulics or stationary hydraulic systems.

With the automatic sensor recognition, students can simply plug in pressure, temperature, flow or speed sensors and start the measurement immediately. It is easy to use without setting the sensor parameters; the measurement ranges are scaled automatically and the measure is shown on the screen.

This kit includes:



Non contractual photos

	<p align="center">Pressure and Temperature sensors</p> <p>Measurement of pressure from 0 to 160 bar Precision w 0.5% FS *1 sensor by default, additional request for 2 sensors Precise measurement of oil temperatures from 25 up to 105°C Screw-in or manual sensor</p>
	<p align="center">Flow measurement turbine</p> <p>Measurement range from 3 up to 60 l/min Integrated pressure and temperature connections</p>

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OPTION 2: OIL SAMPLING KIT

The sampling kit includes the necessary tools to select a sample of oil from a tank or a pressurized circuit and to confine it in a cleared bottle.

This sampling kit includes:

- Black box with strap and handle,
- Manual pump which can be screwed directly on bottles,
- Rilsan (tank sample flexible tube),
- Stainless steel weight (to accurately choose depth when sampling tanks),
- 10 120 ml clean plastic bottles,
- Dynamic sampling set, including pressure gauge, pressure intake and regulator (flow stop or - limitation), for safe samples, 1.5 m long capillary
- 1 250 ml flexible wash bottle (for solvents)
- 1 500 ml storage bottle (for solvents),
- 1 contamination guidebook (with standard photos for NAS and ISO categories)



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OPTION 3: OIL ANALYSIS KIT

The analysis kit consists of a complete filtration system to isolate the particles on a 0.8µm membrane filter. A Digital Microscope with LCD screen lets you visualize and photograph the particles. Finally, a visual comparison between the picture taken and contamination class guide allows to define the cleanliness class of fluid.

This kit includes :

- Black case with wheels and folding handle (easy to carry)
- LCD microscope, to get a contamination photo or movie of your hydraulic connection, USB outlet to PC, memory card for SD format storage up to 500 photos
- 220 V vacuum pump (industrial quality),
- Büchner flask, vacuum pipe with filter
- Plastic box with 100 x 0.8µm sterile gridded membranes (each wrapped in a single pack)
- Petri dish (Qty = 50)
- 2* 2.5 ml syringes for funnel spraying –
- 2 * 0.8 µm minisart syringe filters
- 1* pair of stainless steel membrane tweezers –
- 1* 250 ml flexible wash bottle (for solvents)
- 1*500 ml storage bottle (for solvents)
- 1 “contamination liquid” guidebook (with standard photos for NAS and ISO categories), this guidebook is a memo on hydraulic fluids contamination



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