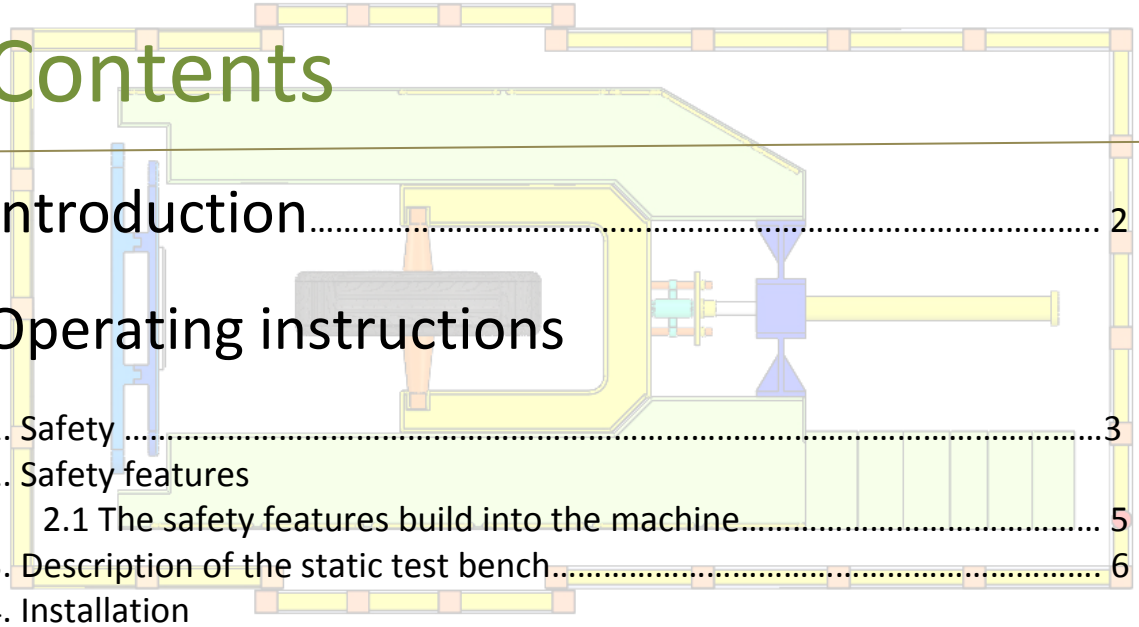
Static Test bench

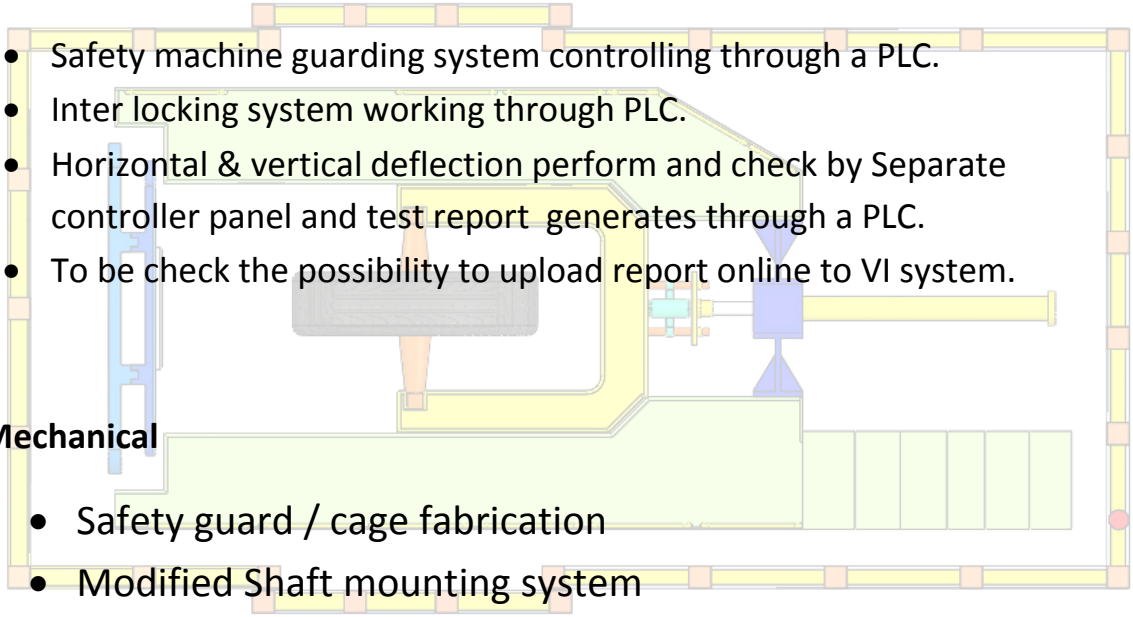


Contents

Introduction

Understanding the performance of tires and tire mechanics is critical in determining their influence on the ride, handling and safety of vehicles. The goal of this Static test bench is to determine the tire mechanical behavior under certain loads in different directions of motion.

Electrical



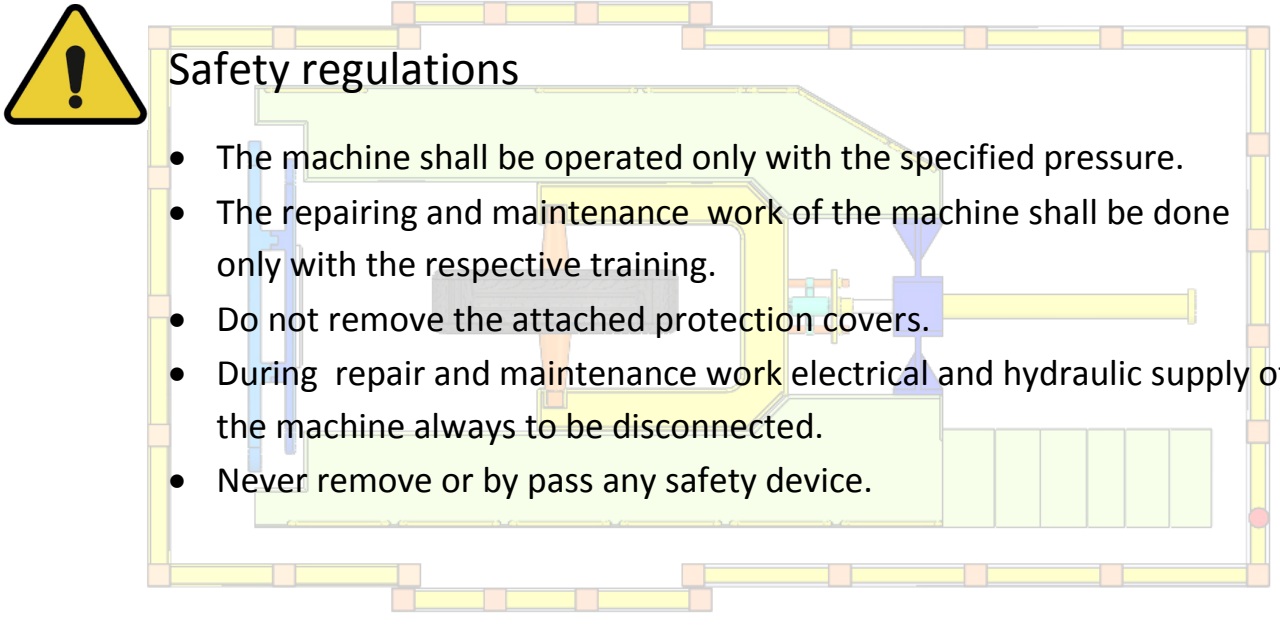
- Safety machine guarding system controlling through a PLC.
- Inter locking system working through PLC.
- Horizontal & vertical deflection perform and check by Separate controller panel and test report generates through a PLC.
- To be check the possibility to upload report online to VI system.

Mechanical

- Safety guard / cage fabrication
- Modified Shaft mounting system
- Machine flat form capacity to be increase
- Machine painting (5S)
- Jack shaft covering system
- PLC control Hydraulic system with new component

Safety

Safety should be the number one priority when working with any kind of a machine at the work place. Therefore having knowledge of safety matters important for the machine operator. The static test bench has been modified to eliminate, as far as practicable, all possible accidents that could arise from normal use of the test bench. It is the responsibility of each and every person working on or in the vicinity of the test bench to become fully acquainted with all of its safety features.



Safety regulations

- The machine shall be operated only with the specified pressure.
- The repairing and maintenance work of the machine shall be done only with the respective training.
- Do not remove the attached protection covers.
- During repair and maintenance work electrical and hydraulic supply of the machine always to be disconnected.
- Never remove or by pass any safety device.

Safety features

Safety cage

Pull rope

Emergency stop

Tower light

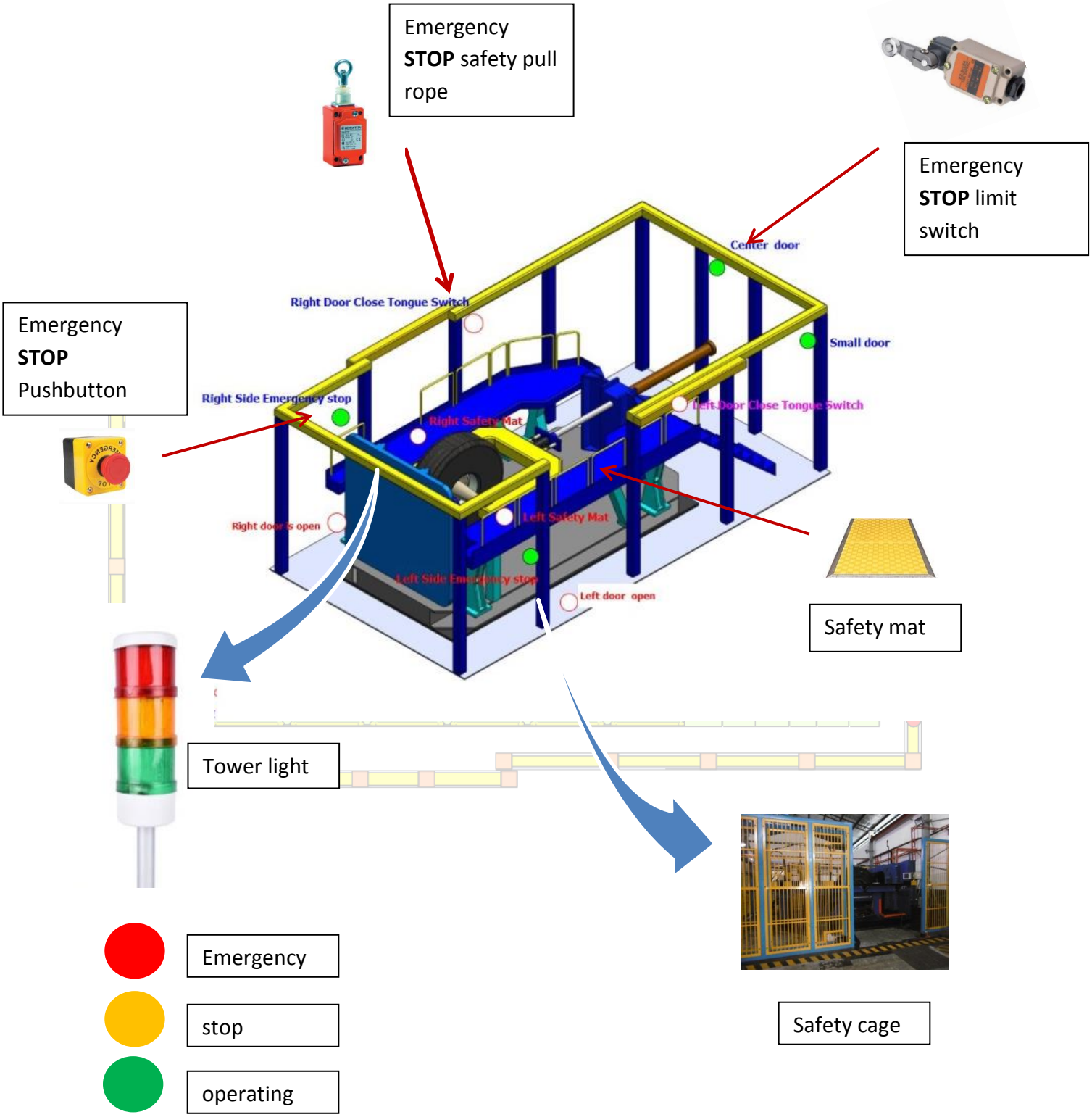
Protection cover

Always wear eye protection!

Always wear safety shoes!

It is your safety!

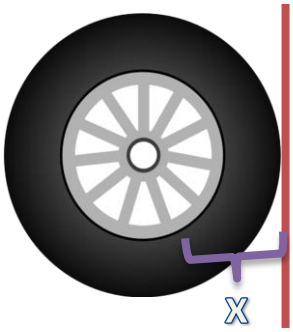
The safety features build into the machine are as follows



Description of the static test bench

static test bench

RADIAL DEFLECTION

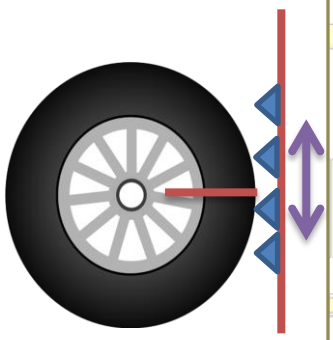


Length that a tire has deflected in radial direction from its original shape under zero radial load to a maximum radial load, given in [mm]

AXIAL DEFLECTION

Displacement of the contact area of the tire in axial direction under a radial load (nominal load), when an axial load is submitted to the contact plate.

SLIP TORQUE



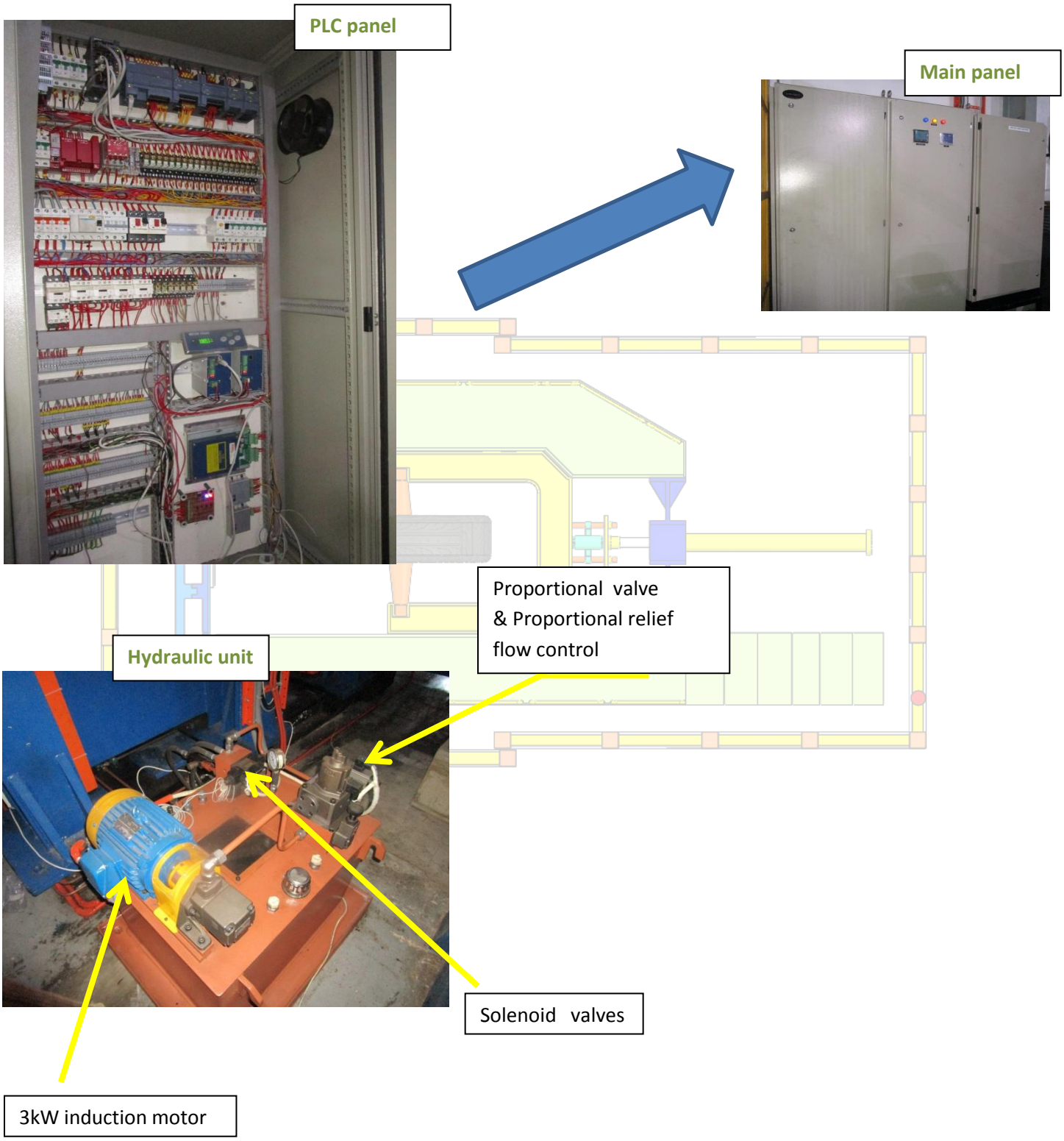
Displacement of the tire relative to the tire rim when rough plate moves up and down.

FOOT PRINT

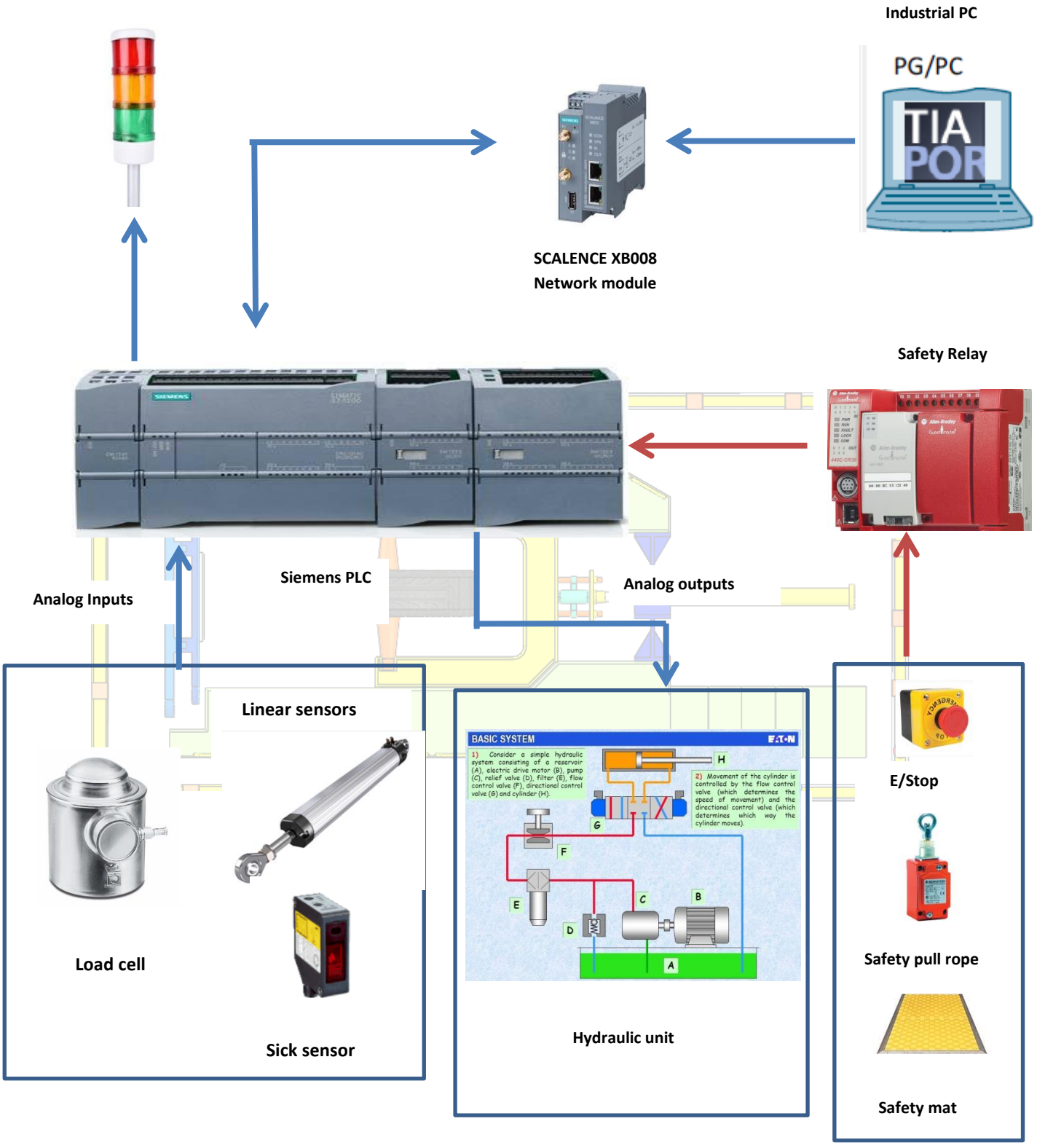
Contact Area The area that the tire is in contact with the surface, given in [cm^2]

Installation

Basic installation



The diagrammatic representation of PLC panel



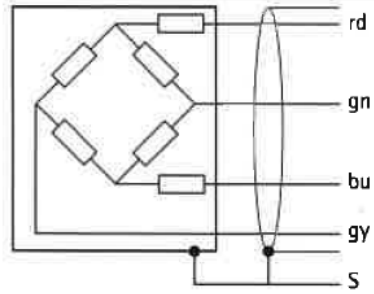
Load cell for measure the weight

Weight that applies to the tire measure via a Sartorius 50T load cell mounted to the moving part of the test bench. The pendulum support principle, combined with patented measuring element geometry, ensures that force transmission into the sensor is always at the optimum level and, in this way, the effect on measurement accuracy is minimized. At the same time, the load cell offers a particularly high overload range, high repeatability and perfect linearity. The weight of the load must be maintained to perform all the tire tests.

Color Code

rd	=	red
gn	=	green
bu	=	blue
gy	=	gray

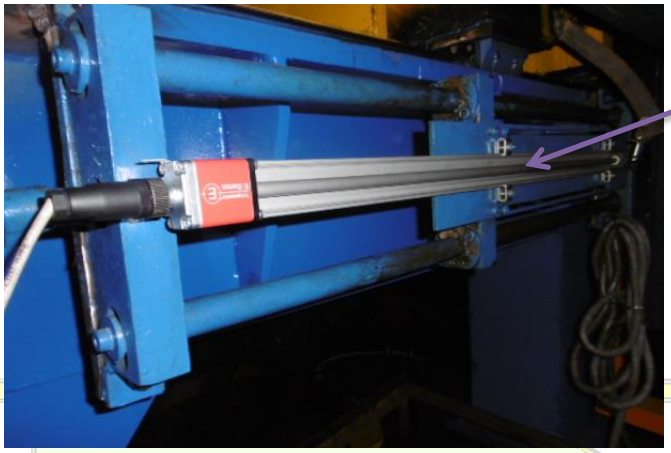
Type L, D1/N, D1E/NE, Cx, CxE



rd =	+ supply/LC in	+ supply voltage/+ load cell input
gn =	+ meas./LC out	+ measuring voltage/+ load cell output
bu =	- supply/LC in	- supply voltage/+ load cell input
gy =	- meas./LC out	- measuring voltage/- load cell output
S =	screen	Screen

Linear sensor for measure radial displacement

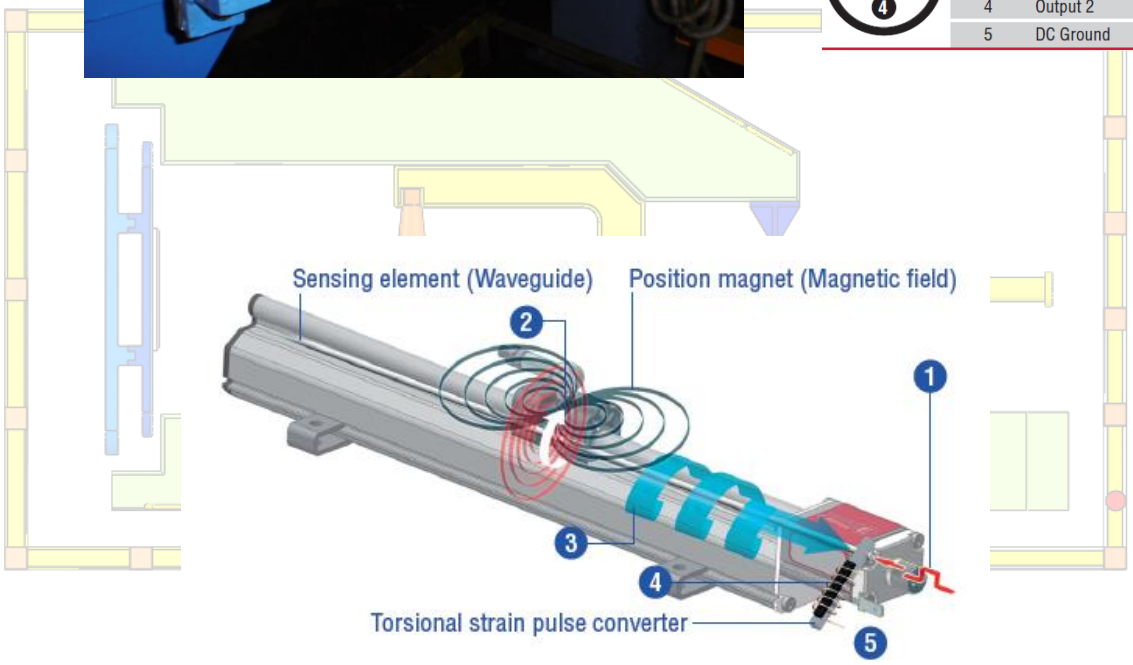
When the pressure applies to the tire it shows radial displacement. The static test bench has ability to measure the displacement with desired weight.



Linear sensor

Color code

M12 A-coded	Pin	Function
	1	+24 VDC (–15 / +20 %)
	2	Output 1
	3	DC Ground (0 V)
	4	Output 2
	5	DC Ground

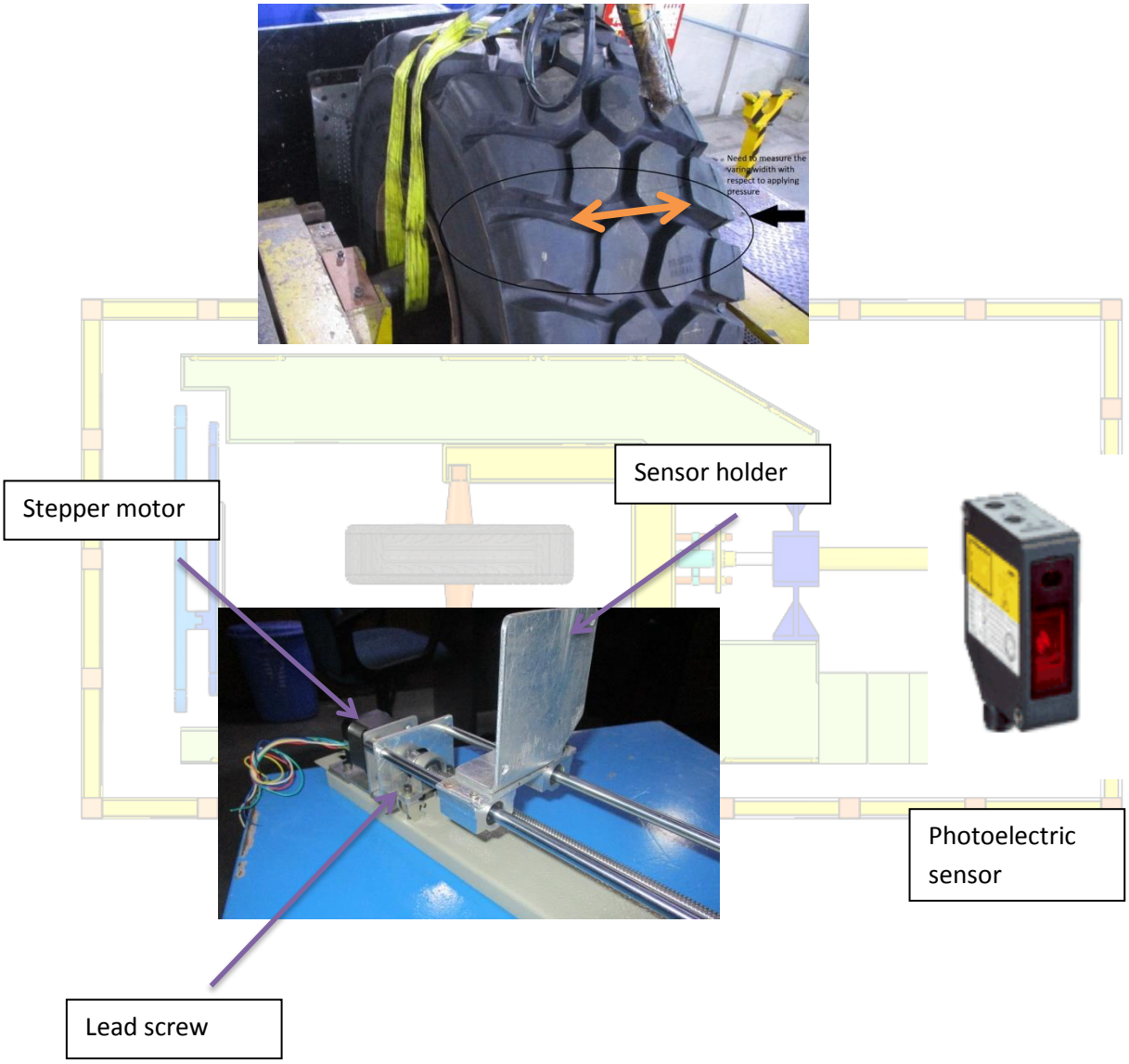


Measurement Cycle

1	Current pulse generates magnetic field
2	Interaction with position magnet field generates torsional strain pulse
3	Torsional strain pulse propagates
4	Strain pulse detected by converter
5	Time-of-flight converted into position

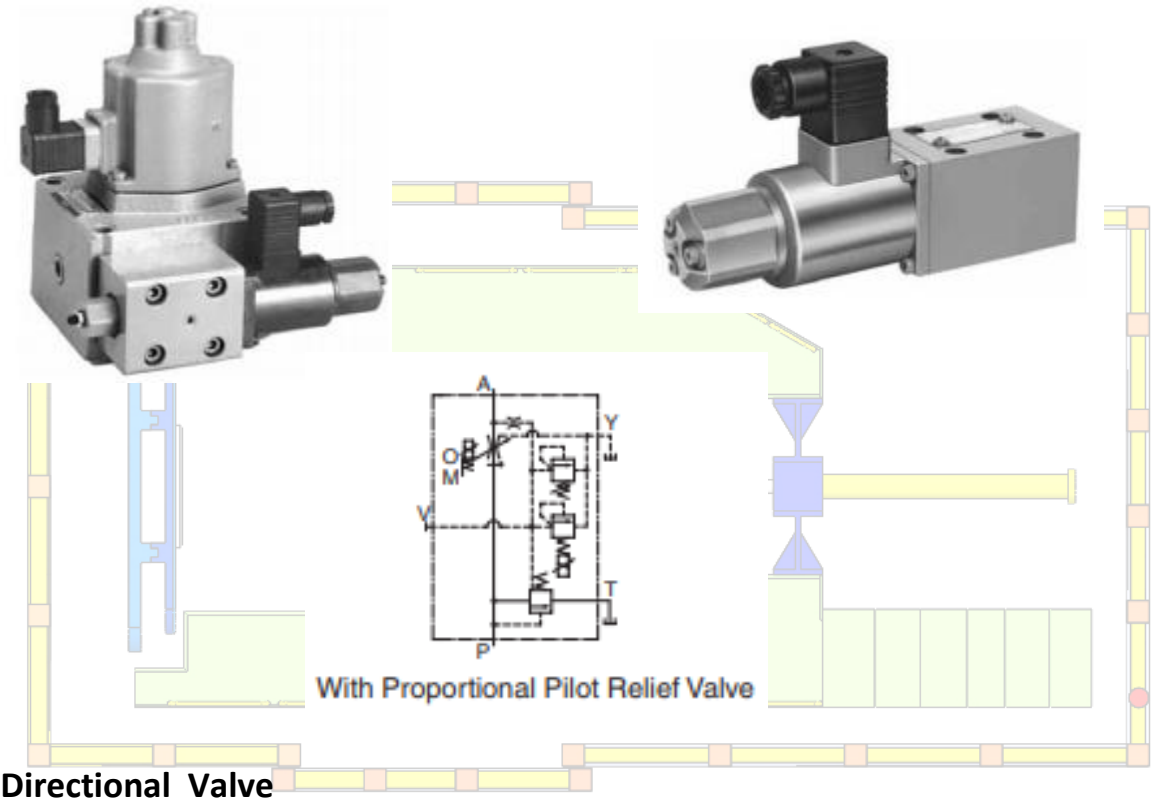
Photoelectric sensor for measure axial displacement

Static test bench uses movable photoelectric sensor to measure the horizontal displacement of the tyre with apply pressure. The unit has stepper motor with lead screw which is responsible for movements.

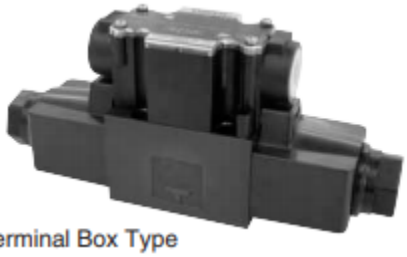


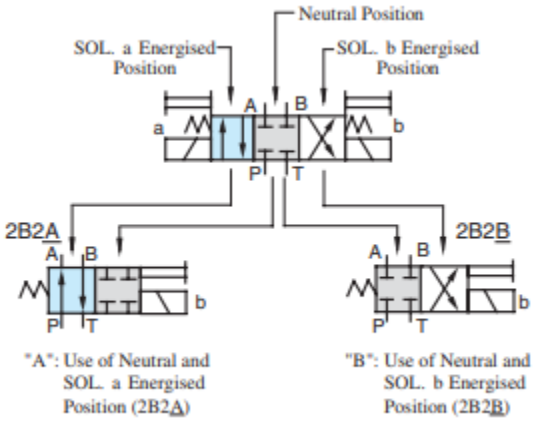
Proportional Electro-Hydraulic Flow Control and Relief Valves

This flow control and relief valve is an energy saving valve that supplies the minimum pressure and flow necessary for actuator drive. Since this valve controls the pump pressure by following the load pressure while keeping the differential pressure minimized. it serves as a low power consumption energy saving, controlled flow control valve. Further, since a temperature compensation function is incorporated, this valve provides consistent flow control without respect to the fluid temperature.



Directional Valve

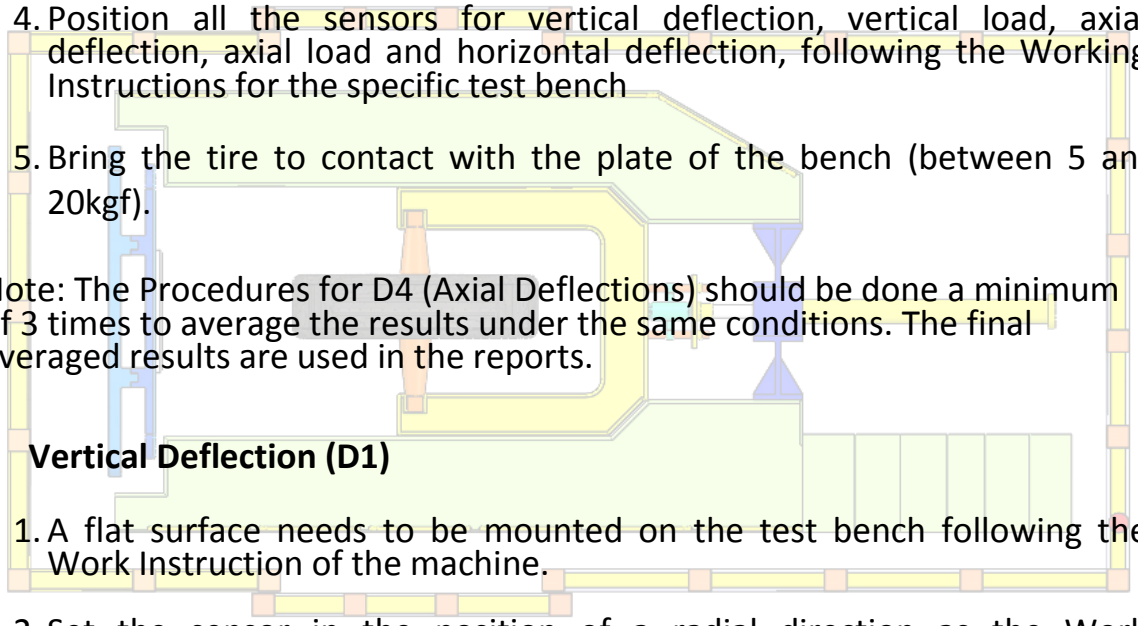

Terminal Box Type



Running the static test bench

The measurements of deflections can be performed at once on the same test bench, hence, there is no need to demount the tire. There are general steps that the technician can do to retrieve all required parameters. Next, the different steps to take the measurements are described:

1. Choose the correct program to the test to perform.
2. Retrieve the Nominal Load from the Load Index file according to the type of tire size.
3. Fill in all the information required for type of tire.
4. Position all the sensors for vertical deflection, vertical load, axial deflection, axial load and horizontal deflection, following the Working Instructions for the specific test bench
5. Bring the tire to contact with the plate of the bench (between 5 and 20kgf).



Note: The Procedures for D4 (Axial Deflections) should be done a minimum of 3 times to average the results under the same conditions. The final averaged results are used in the reports.

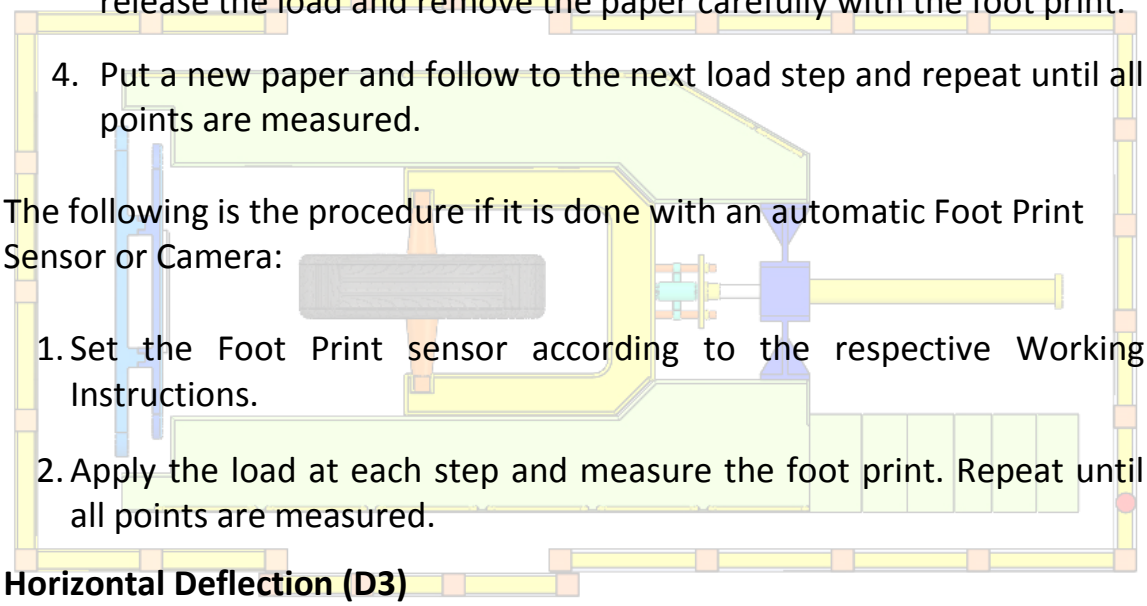
Vertical Deflection (D1)

1. A flat surface needs to be mounted on the test bench following the Work Instruction of the machine.
2. Set the sensor in the position of a radial direction as the Work Instructions for the test bench specifies in WIXXX.
3. The Software will calculate a minimum of six different points with increasing loads up to 151% of the nominal load, at which the operator should measure the deflection.
4. Continue to the next load step and repeat until all points are measured.
5. The Spring Rate should be calculated for the current load.

Contact Area (D2)

The following is the procedure if it is done with Ink and paper:

1. Apply the ink over the contact area of the tire in a small layer and let it dry (maximum 30minutes). If the ink is too wet the results of the foot print are not satisfactory due to the spreading of the ink over the paper. Make sure it is covering more than the expected area.
2. Put a sheet of paper on the flat surface of the test bench and attach it following the respective Working Instruction of the bench.
3. Apply the loads at different steps as for D1 and D3. At each step release the load and remove the paper carefully with the foot print.
4. Put a new paper and follow to the next load step and repeat until all points are measured.



The following is the procedure if it is done with an automatic Foot Print Sensor or Camera:

1. Set the Foot Print sensor according to the respective Working Instructions.
2. Apply the load at each step and measure the foot print. Repeat until all points are measured.

Horizontal Deflection (D3)

1. A flat surface needs to be mounted on the test bench following the Work Instruction of the machine.
2. Set the sensor in the position of an axial direction as the Work Instructions for the test bench specifies in WIXXX. It should be next to the side wall where a larger deformation is expected; for solid tires it is in the middle of the side wall. for pneumatic is usually between the middle of the tire and the 60J line.
3. The Software will calculate a minimum of six different points with increasing loads up to 150% of the nominal load, which the operator should check the measured deflection.
4. Continue to the next load step and repeat until all points are measured.

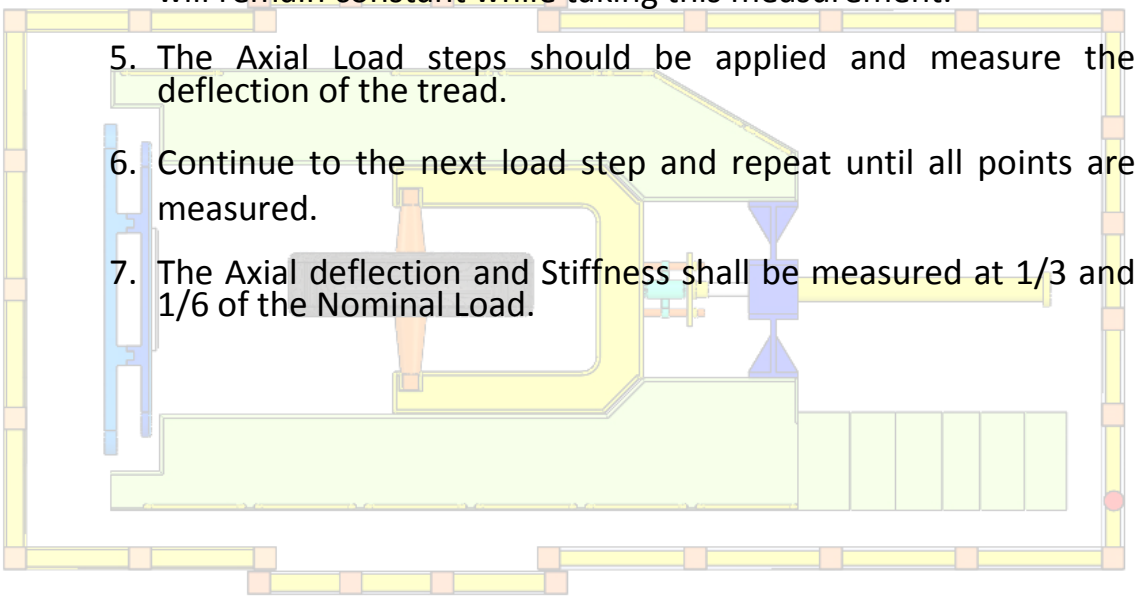
Axial Deflection (D4)

1. A studded/bolted surface needs to be mounted on the test bench following the Work Instruction of the machine.

2. Set the sensor in the position of an axial direction written as the Work Instructions for the test bench specifies in WIXXX. The displacement of the plate is measured and recorded.

3. The Software will calculate a minimum of five different points with increasing Axial Loads up to 1/3 of the Radial Nominal Load, which the operator should check the measured deflection.

4. Apply the nominal load in the radial direction of the tire, which will remain constant while taking this measurement.



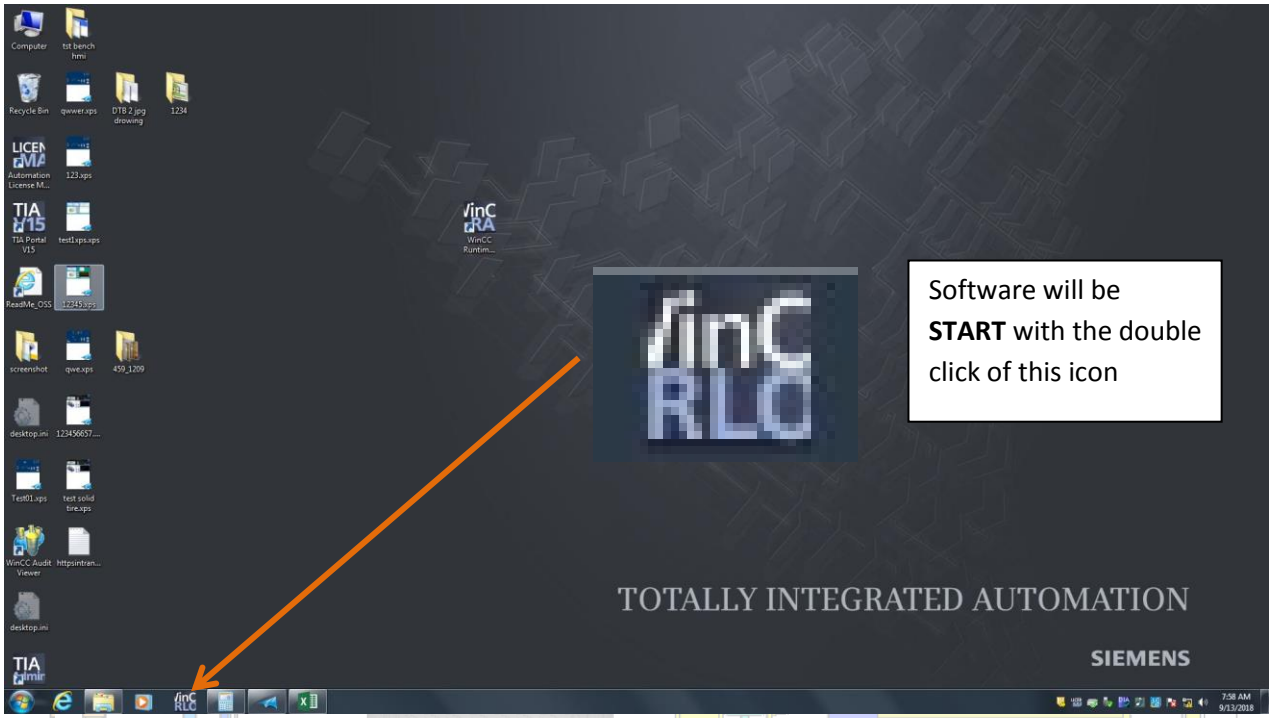
5. The Axial Load steps should be applied and measure the deflection of the tread.

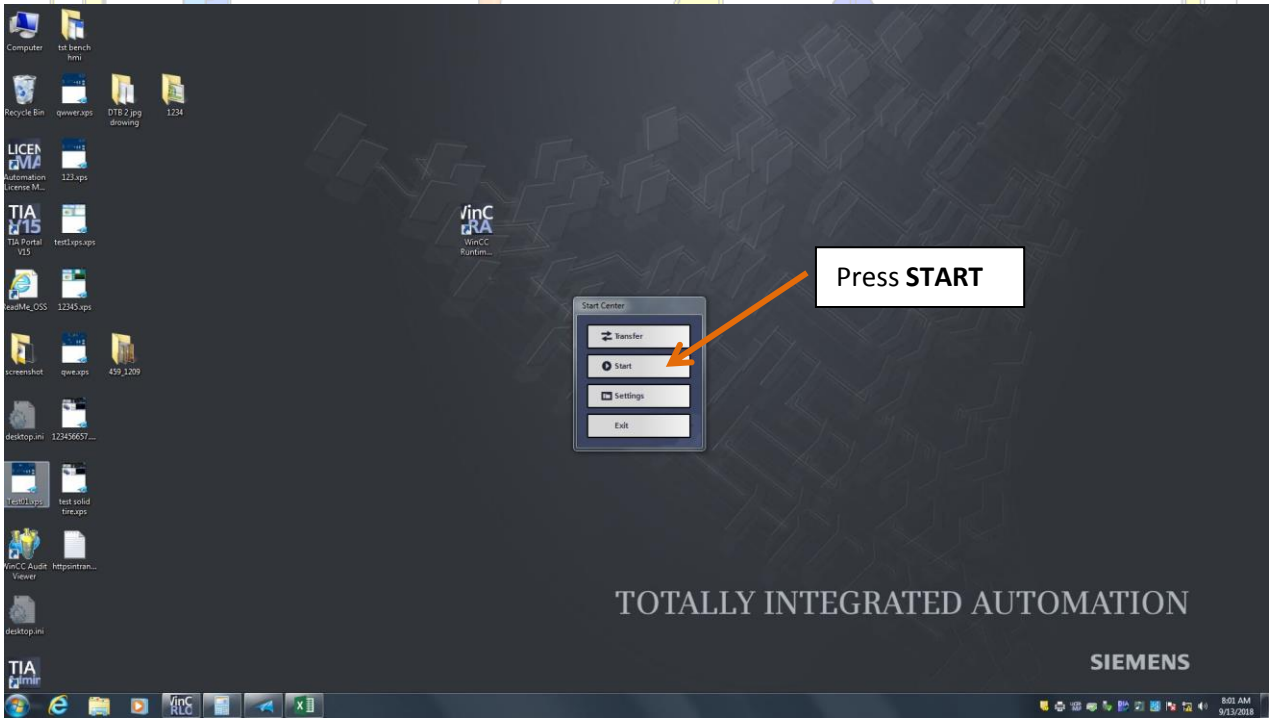
6. Continue to the next load step and repeat until all points are measured.

7. The Axial deflection and Stiffness shall be measured at 1/3 and 1/6 of the Nominal Load.

User interface

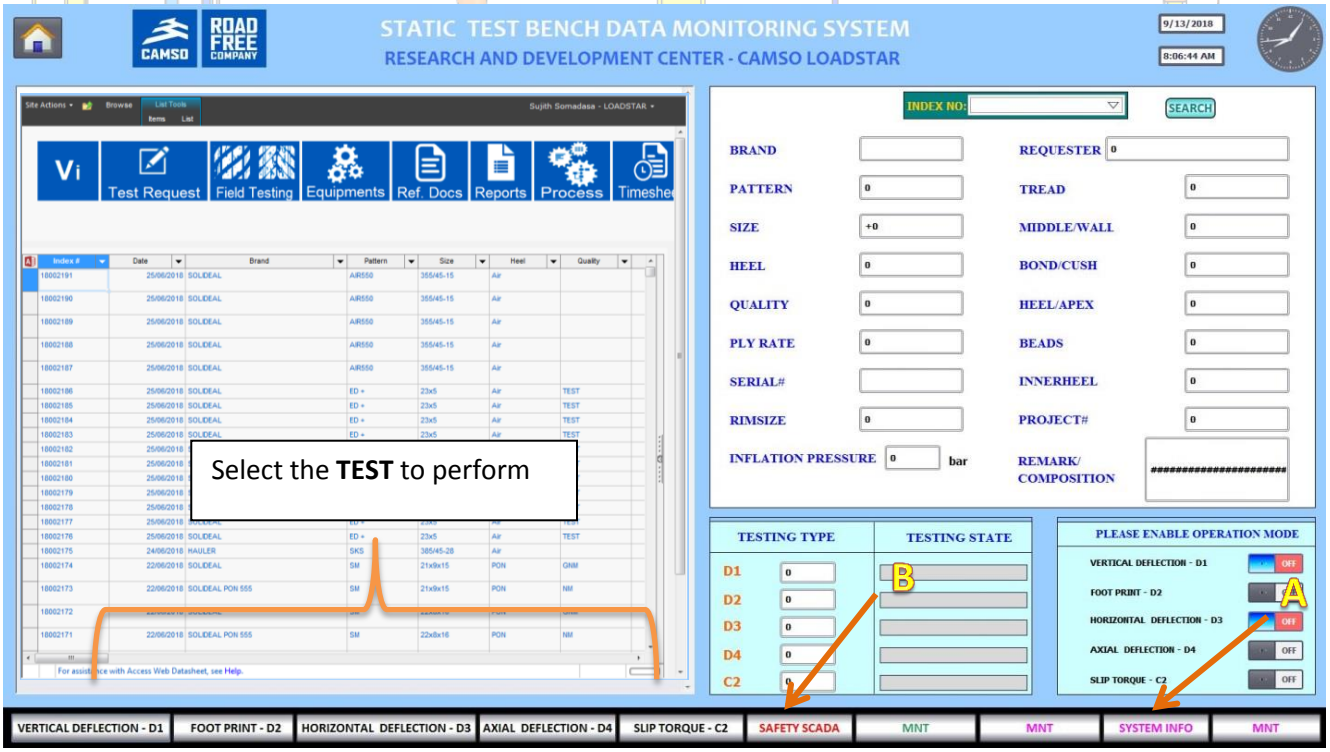
Starting the software



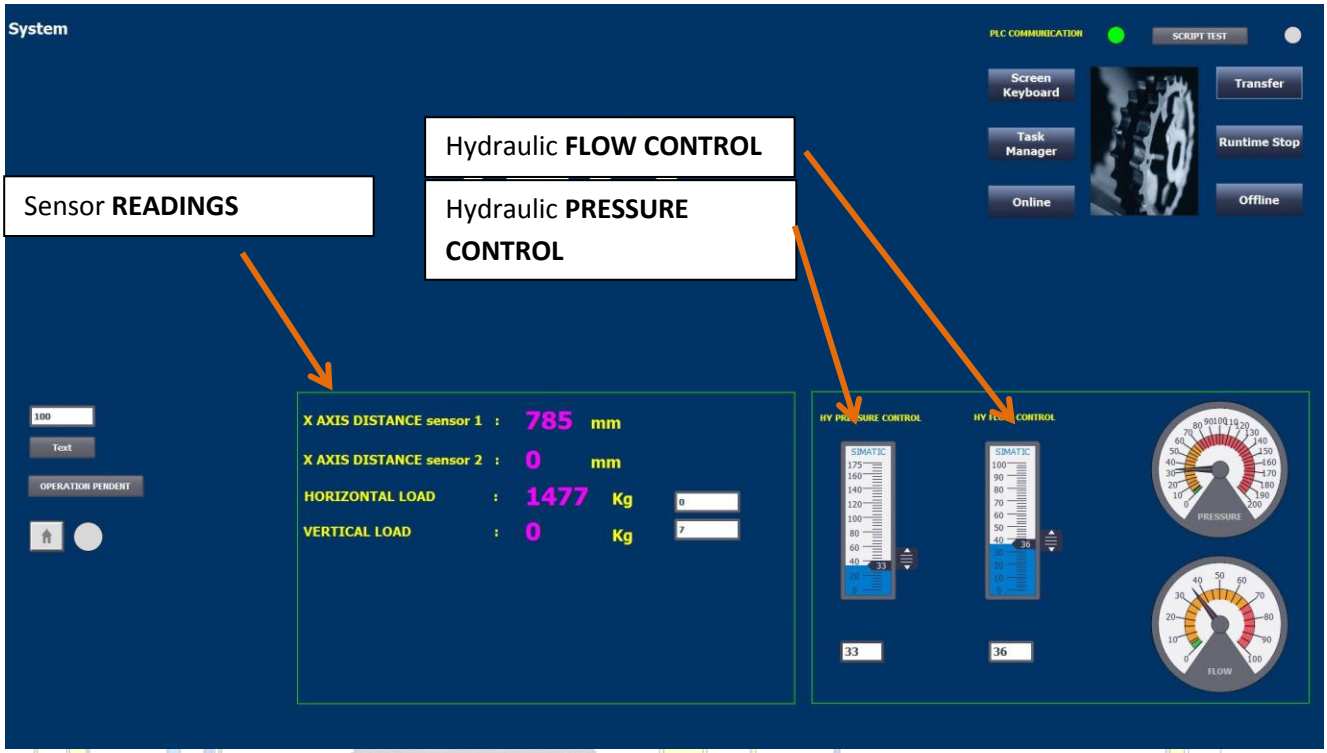


Startup screen

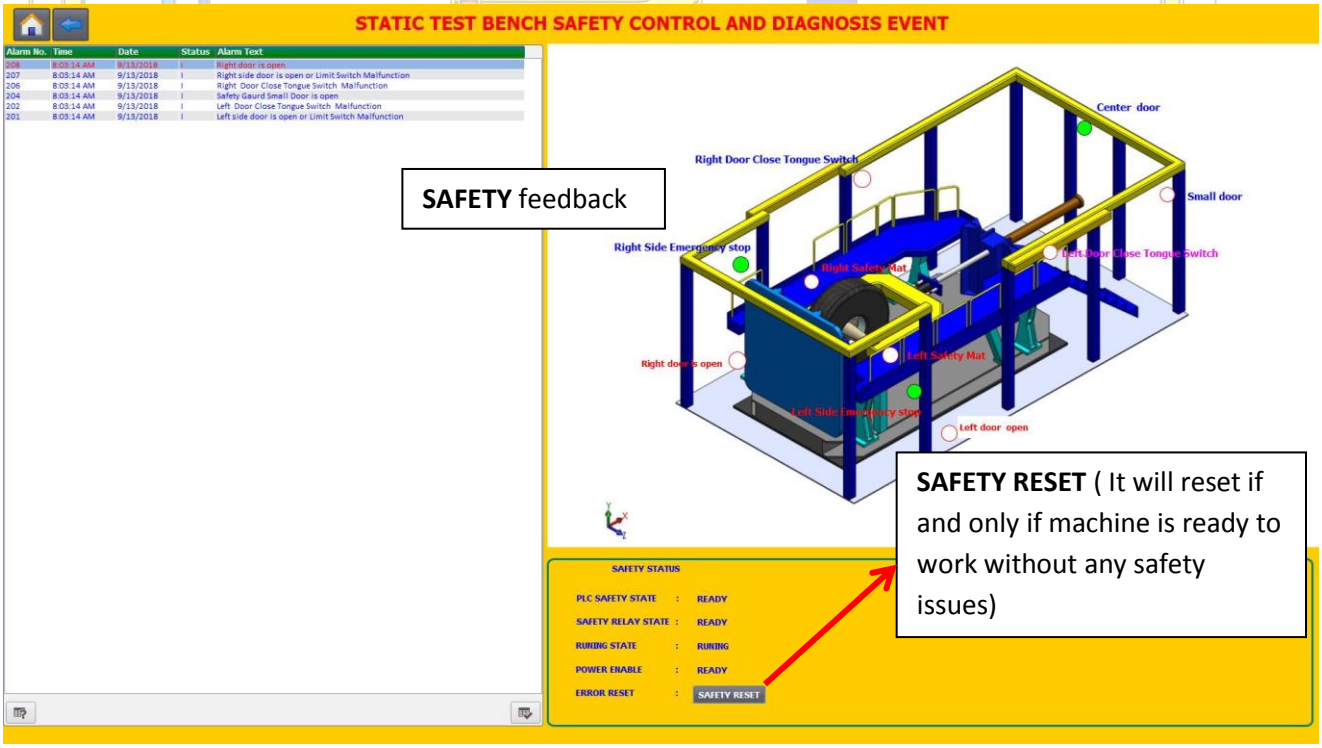
Main screen appears



A System interface



B Safety interface



Hydraulic drawing