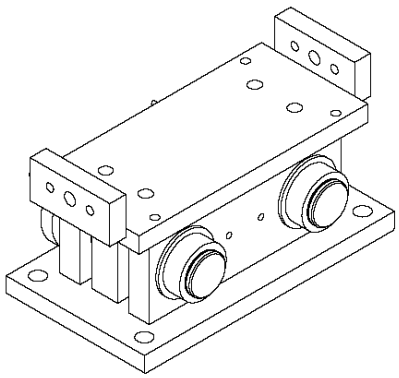
INSTRUCTION MANUAL FOR INSTALLATION OF TENSIOMETER TYPE FMU-5



1. GENERAL

The tensiometers type FMU-5 has been specially designed for measuring the tension forces on paper machines or on steel strips in steel industry.

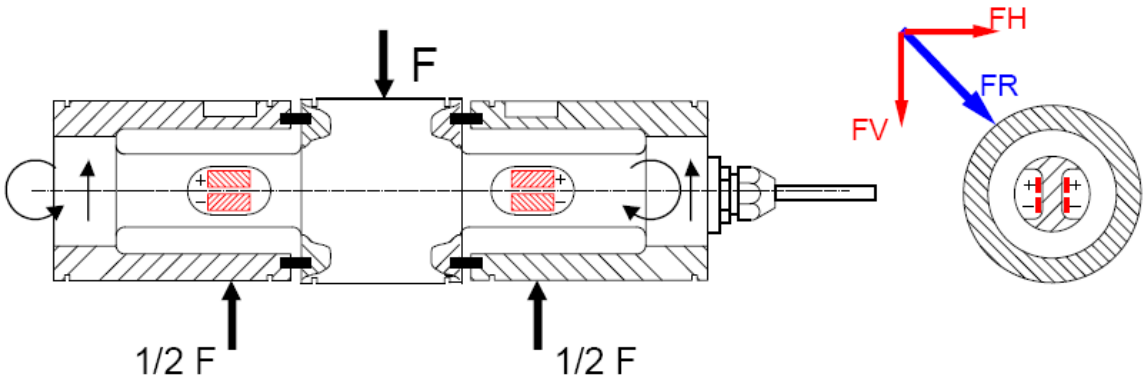
The tensiometers FMU-5 will consist of:

- Two standard pins KISD-6 load cells when an accuracy of < ±0,1 % of nominal tension is needed.
- Or one standard pin KISD-6 load cell and one dummy KISD-6 load cell, when an accuracy of < ±0,5 % of nominal tension is needed.
- On special mechanical assembly made for customer application in order to fit as well as possible to the existing mechanical installation.

The electrical outputs of the KISD-6 load cells are directly proportional to the force applied on the measuring roll, and therefore proportional to the tension applied on the paper, felt or steel strip.

For an easy application, it will be more simple to use fixed wrap angle on the measuring roll, in order to have a measurement of the tension force directly proportional to the applied reactive force on the measuring roll. If the wrap angle on the measuring roll is not fixed (winders or de-winders for example), a sinus or cosines function will be needed (in a PLC or a calculator) in order to have a reactive force on the measuring roll directly proportional to the tension force applied on the roller and the wrap angle variations.

2. KISD-6 LOAD CELL CONCEPT AND BENEFITS



The reactive force FR on the roller or on the KISD-6 load cell will consist of three basic forces:

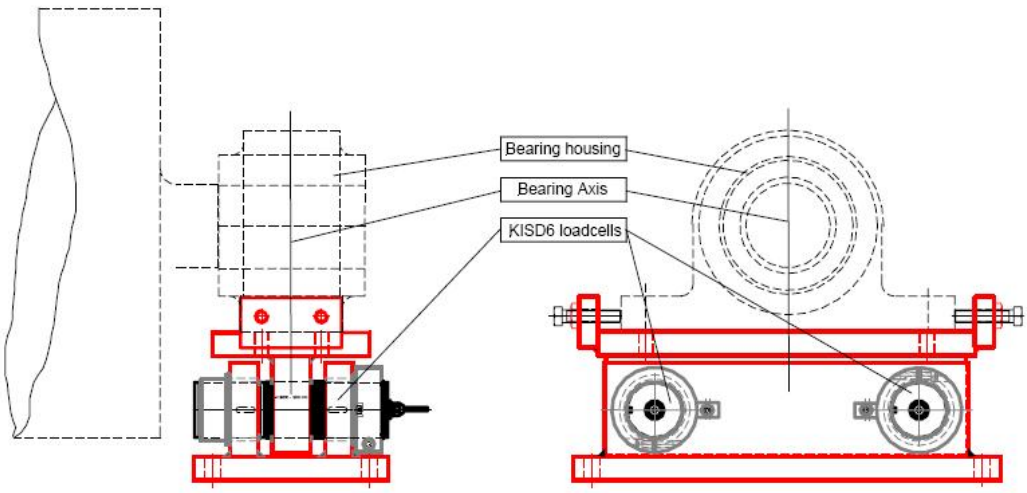
- FV: which is the vertical force of the reactive force FR. The KISD-6 load cell is using the shear principle, and is only electrically sensitive to all forces passing vertically through the shear section (through FV in the picture above).
- FH: which is the horizontal force of the reactive force FR. The KISD-6 load cell will accept a side force (in static) up to 100 % of the KISD-6 load cell nominal capacity. This side force (FH in the picture above) will have not have any impact, electrically, on the KISD-6 signal output.
- FRa: which is the horizontal and axial force of the reactive force FR. As for the side force, the KISD-6 load cell can accept (in static) an axial and horizontal force up to 100 % of the KISD-6 load cell nominal capacity. This axial and horizontal force will have not have any impact, electrically, on the KISD-6 signal output.

In conclusion, the KISD-6 load cell is only sensitive, electrically, to forces passing vertically through the shear section (through FV in the picture above). All other forces are mechanically supported, but will not have any influence on the measurements.
Depending on applications, the KISD-6 load cells can be oriented, either vertically, horizontally or in the direction of the resultant force FR (shear section of the load cells oriented vertically, horizontally or in the direction of the resultant force FR), measuring the horizontal force, the vertical force or the full resultant force. If a full set is used (two KISD-6 load cells) per FMU-5 and the load cells are directed in the direction of the resultant force FR, the electrical output will be equal to the resultant force FR. If measuring the vertical force, the horizontal force or if one KISD-6 load cell and one KISD-6 dummy is used, the electrical output will not be equal, but proportional, to the resultant force FR.

3. PRINCIPLE AND CONCEPT OF THE FMU-5 TENSIOMETER

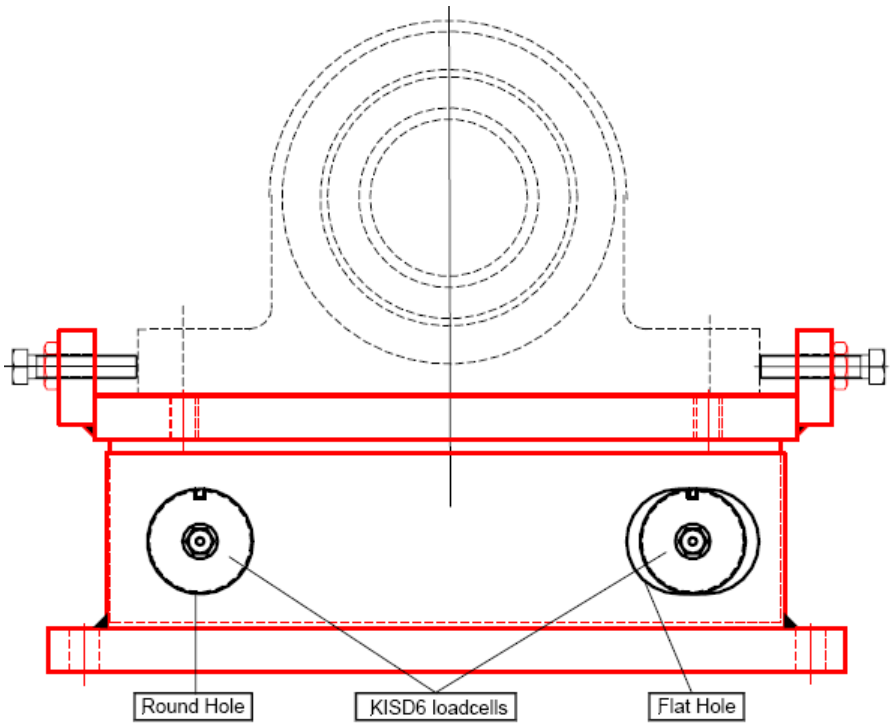
The FMU-5 tensiometer is mainly used for all type of standard tension measurement on cold deflection rollers, where the axial forces on the rollers are small (most of the cases).

The basic principles of the FMU-5 tensiometer are based on the features of the KISD-6 load cell: **Their non-sensitivity to all side and axial forces**.



Other basic principles are used for the FMU-5 tensiometers:

- The bearings used at each end of the measuring roll must be universal bearings.
- One end of the measuring roll must be fixed and the other end must be free for thermal expansion.
- In order to avoid forces induced by thermal expansion of the bearings (deflective roller hot or heat due to friction of the bearing into the bearing housing) the KISD-6 load cell mounting should allow horizontal thermal expansion. For this reason one of the KISD-6 load cells or the dummy KISD-6 load cell is mounted into a hole – the fixed hole, in the FMU-5 tensiometer. The other KISD-6 load cell is mounted into a flat hole – the flexible hole (see drawing below). On the FMU-5, the fixed hole is marked B and the flexible hole is marked A. Normally these holes are positioned so that the total resultant force (the resultant force from the web FR and the tare weight of the roller) “passes” through the flexible hole.

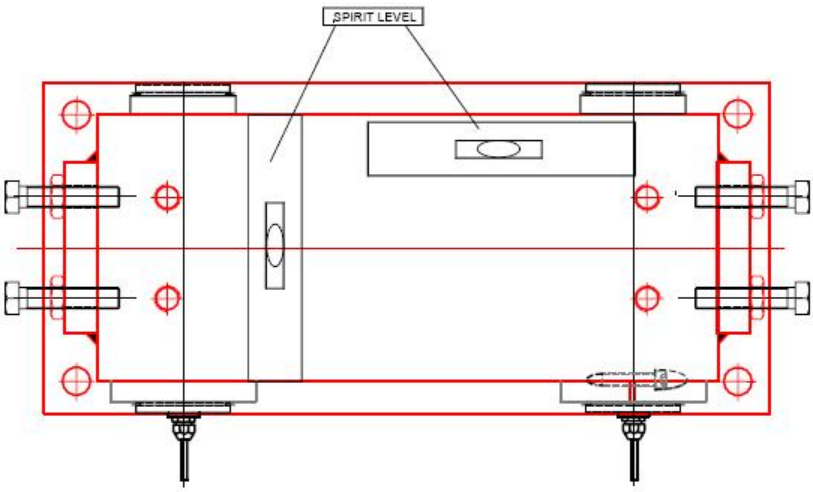


Then, all the mechanical FMU-5 mounting is built up around these principles.

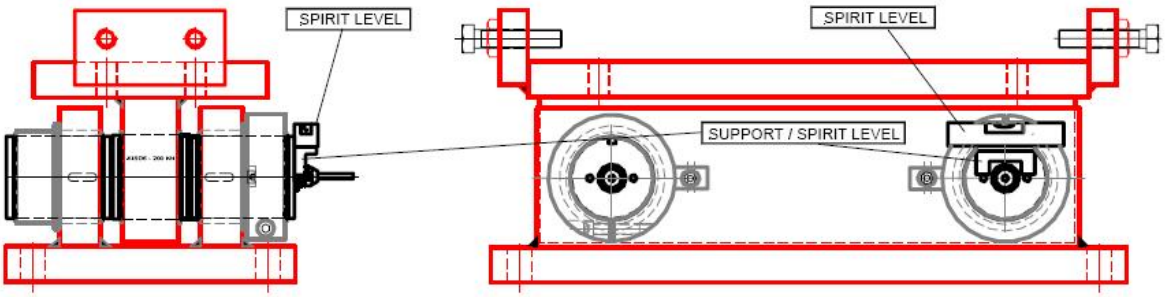
4. INSTALLATION AND COMMISSIONING OF THE FMU-5 TENSIOMETER

The FMU-5 tensiometers works like a weighing scale, and certain number of rules should be respected during installation on site.

a) Install the tensiometer FMU-5 on the mechanical support of the machine, and check with a spirit level, that the FMU-5 is perfectly horizontal (see drawing below), or vertical if wall mounted. Do the same operation on Work Side and on Drive side.

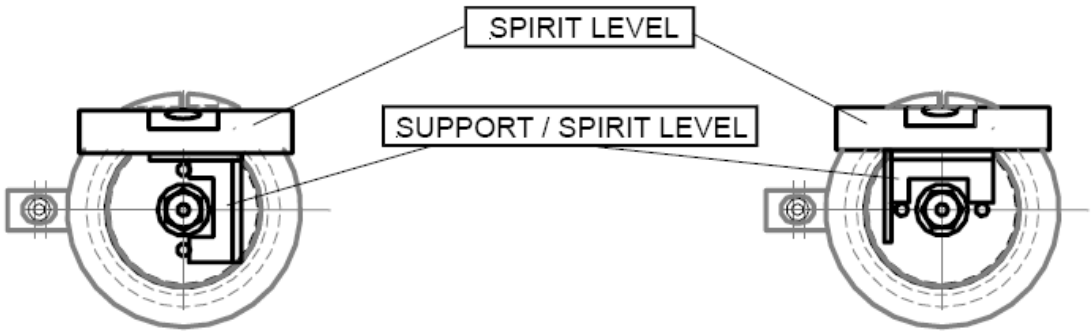


b) Check that the KISD-6 load cells are properly orientated vertically, horizontally or in the direction of the resultant force FR, depending on the application. Normally this is already performed at delivery.

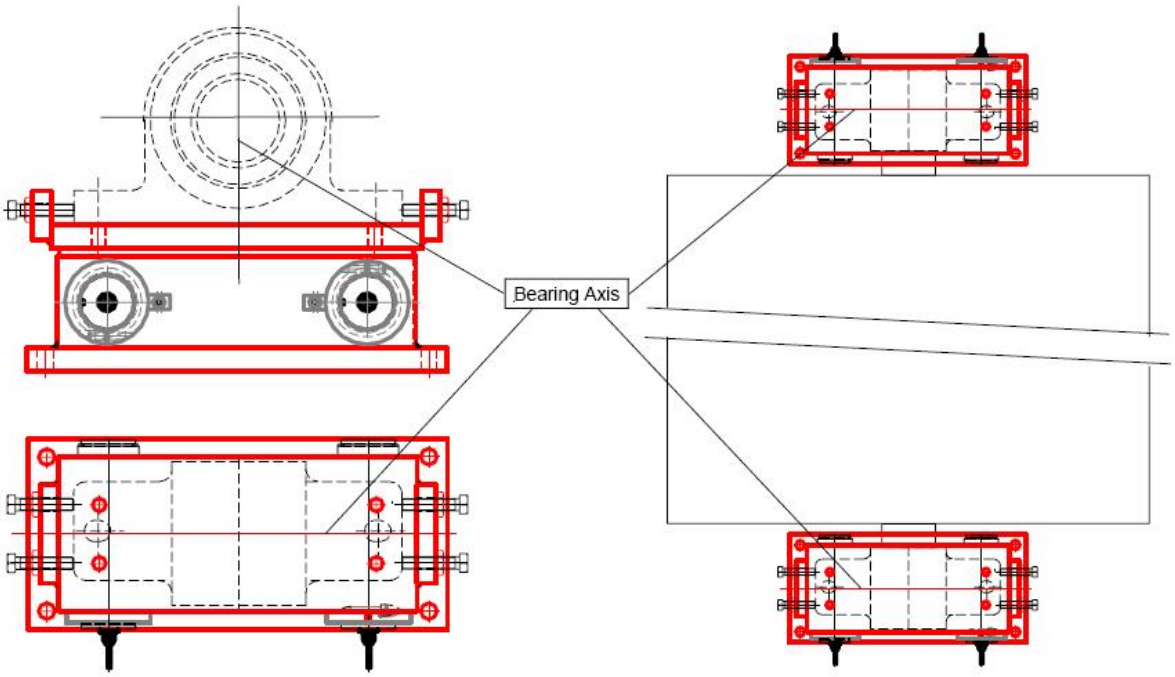


Depending on the application, the wrap angels and the nominal tension forces, the KISD-6 load cells can be orientated either vertically, horizontally or in the direction of the resultant force FR. In order to have the KISD-6 load cells properly orientated, check the arrow direction.

In order to perform this load cell orientation, use a spirit level to check horizontality or verticality of the KISD-6. For directing the load cells in the direction of the resultant force, use a spirit level graduated arc.



c) Setting of the bearings / tensiometer parallelism on the measuring roll.



Adjusting the parallelism of the measurement roll relative to the other rollers of the machine. This can be done manually, or if requested at order, the FMU-5 tensiometers can be delivered with screw adjustments on each side of the top plate, to simplify this operation.

The FMU-5 tensiometers are then ready for electrical set up of amplifiers according o the nominal tension and to the wrap angles on the measuring roller.