

BRIGHTNESS MONITORING AND CONTROL SYSTEM

Brightness/ shade Monitoring and Control System is developed by CDAC, Thiruvananthapuram for sensing and controlling the shade(color) of pulp to produce quality paper. The optical sensor (Omega-200), used for sensing the color, developed by ASIL, Uzbekistan, was integrated with the control system (APACS - Advanced plant automation and control system) developed by CDAC to realize the brightness/shade monitoring and control system.

PROCESS DETAILS

Bleached pulp is cleaned off sand and foreign particles in a series of centricleaners. The pulp then requires beating and refining to produce slurry, which is uniform and free flowing.

The equipment used to get the desired quality of pulp is a refiner. This consists of a conical shell on the inside of which grooved stationary disc. Revolving inside the shell is also grooved disc. The clearance between the discs can be varied which gives the defibering action on the pulp. (Refining the fibers make paper stronger, more uniform, dens,opaque and less porous).

Various pulp (wood pulp, pulp from unconventional raw material (ucr pulp) , rag plant pulp) are blended to give the desired density and uniformity. The filler is added after sufficient refining sizing is put and mixes thoroughly in the blending chest. Colour is added to get the desired colour in the paper. Alum (aluminum sulphate) is added to produce coagulation and desired coating on the fiber.

All papers except absorbent papers (tissue paper/toilet paper/bloating paper/filter paper) must have filler added to fill the space between fibers. Thus giving a smooth surfaces more brilliance and improved opacity. The fillers are naturally occurring materials such as talc/white clays/manufactured products like calcium carbonate, titanium dioxide, barium sulphate etc. Sizing is added to paper to impart resistance to penetration by liquids. Rosein is used for sizing.

After thorough mixing in the blending chest the pulp is pumped into the constant head box. From the constant head box the pulp is going through the centricleaners, screens, flow box and finally to the paper machine. The intake to the paper

machine depends on machine speed and the weight (GSM) of the paper produced. The overflow of the head box is connected to the blending chest as the re circulation line.

The process flow schematic is as shown in the Figure 1 below.

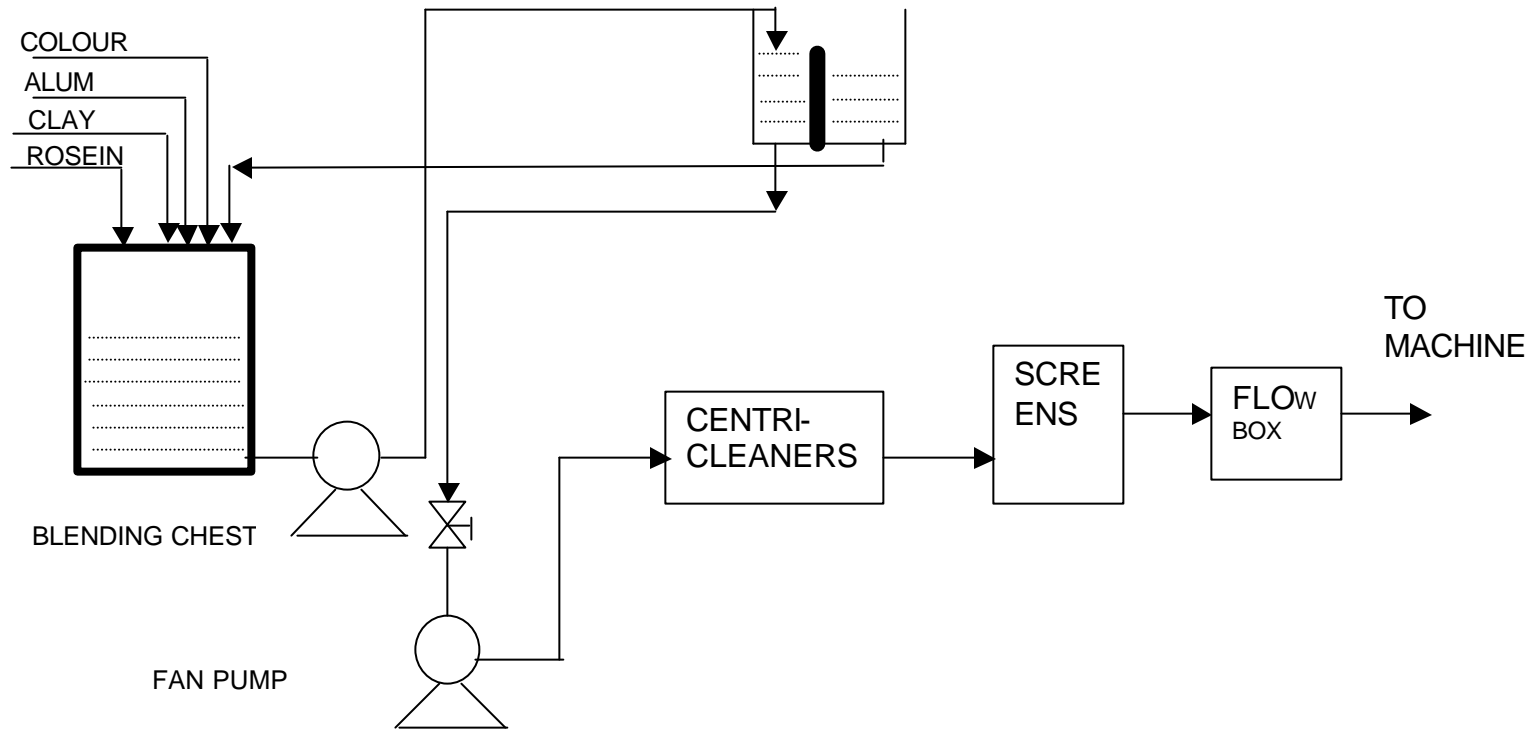


FIG 1

MONITORING SYSTEM

The total arrangement of the sensor and control system installed for the monitoring and control of shade is as shown in Figure 2

The shade sensor is installed in the vertical pipeline, which carries the blended pulp to paper machine. The sensor gives L, a, b values (color co-ordinates representing the color) through its RS232 port. A selection switch has been provided to connect this port to console (PC) or to PCU (process control unit). The user can connect the sensor directly to the COM port of PC to check and to save or download the calibration values. For this purpose a dedicated DOS program has been provided with the console. During the normal running, the sensor will be connected to PCU, and the program running in PCU sends the requests to collect the L, a, b values. The L, a, b values reaching the PCU is treated as physical inputs along with other 4-20mA signal it receives from other field transmitters.

The control system finds out the shade variations from the L, a, b values and compares the same value (which indicates the shade to be controlled) with a set value and generates the 'required the color flow' to get back the shade to set shade. This 'required color flow' signal is then given to a SLC(single loop controller) to control the color flow.

The working principle and other details of the sensor and control system is explained in Section-3 "The Sensor and colorimetry' and Section-6 'The control system' respectively.

Functional description of sensor

Working principle:-

The light generated by the lamp in the sensor gets reflected from the medium and the reflected and direct light from the sensor is passed through different filters fixed on a rotary disk. The output of these filters corresponding to reflected and direct light is converted to electrical signals and used for computations based on theory of optics.

Functions:-

The reflected and direct light from the sensor is directed through the two fibre optic cables to the bottom of the rotatory disk and both the light beams are passed through all the five filters one by one. The outgoing lights from the filters are

directed to the photosensor by fibre optic cable and it gets added up and converted into one mV signal. Among the five filters fixed on the rotatory disk, outputs from only three are used. Other two are one filter as per Russian standard and black filter. The peak generated by the Russian filters is neglected and the black filter doesn't generate any signal at all. The mV waveform from the photo sensor is as shown in the figure below. From the wave form of the mV signal, peaks (maximum values) corresponding to reflected and deflected light is extracted (U_{xr} , U_{xd} , U_{yr} , U_{yd} , U_{zr} , U_{zd}) and it is used for further computation of X , Y , Z , L , A , B and ΔE .

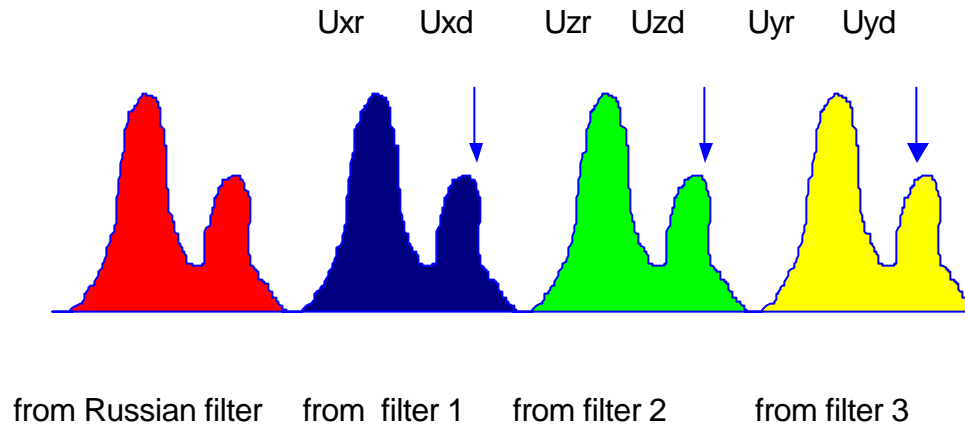
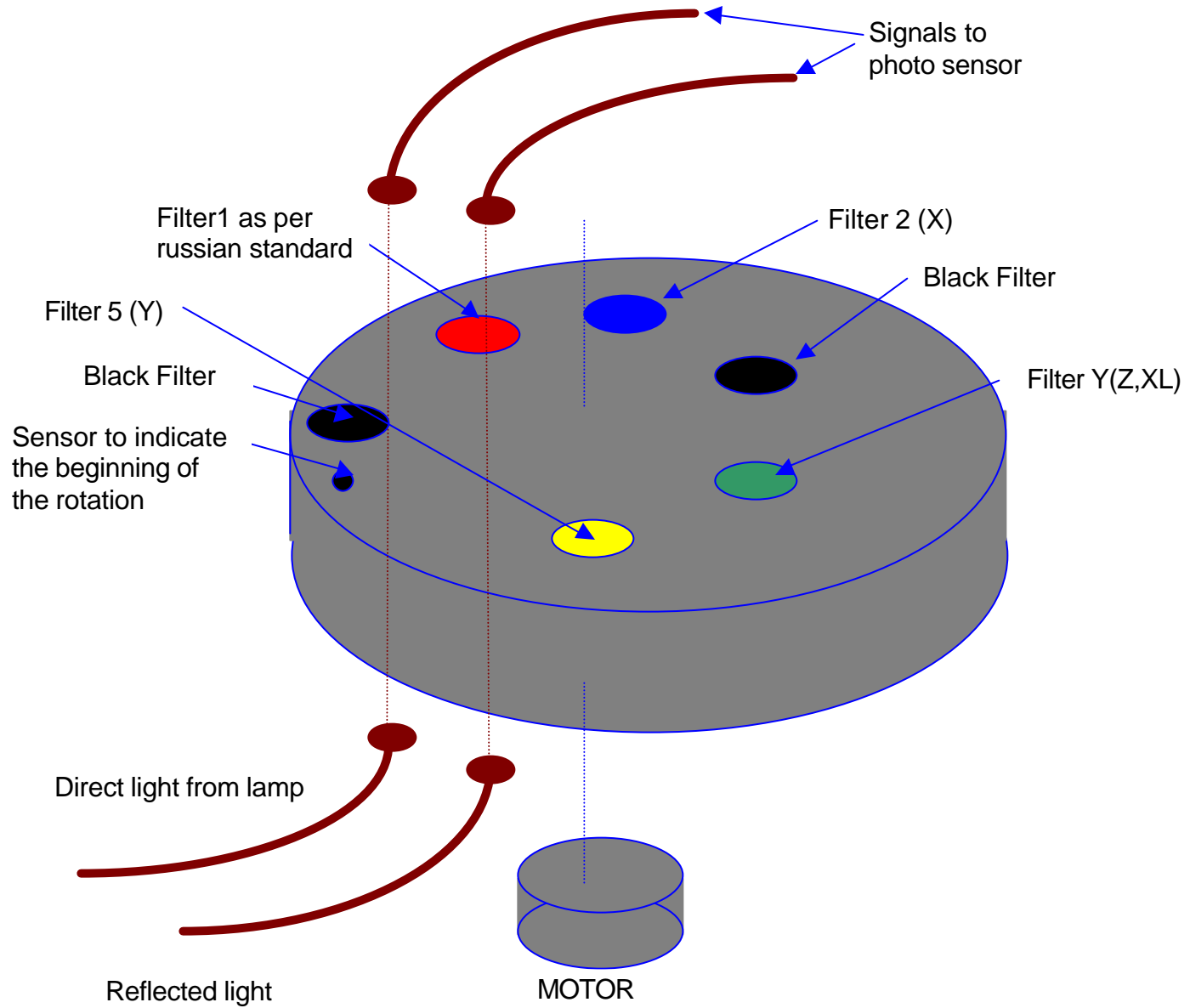


Fig 2



The speed of the motor is controlled by the processor by synchronised pulses through relays to complete each rotation by 300msecs. Also, the processor executes all the computations required to produce the final results and it takes care the communication with PC and display and keyboard controller. The sensor installed in the plant as shown in the figure 3 below

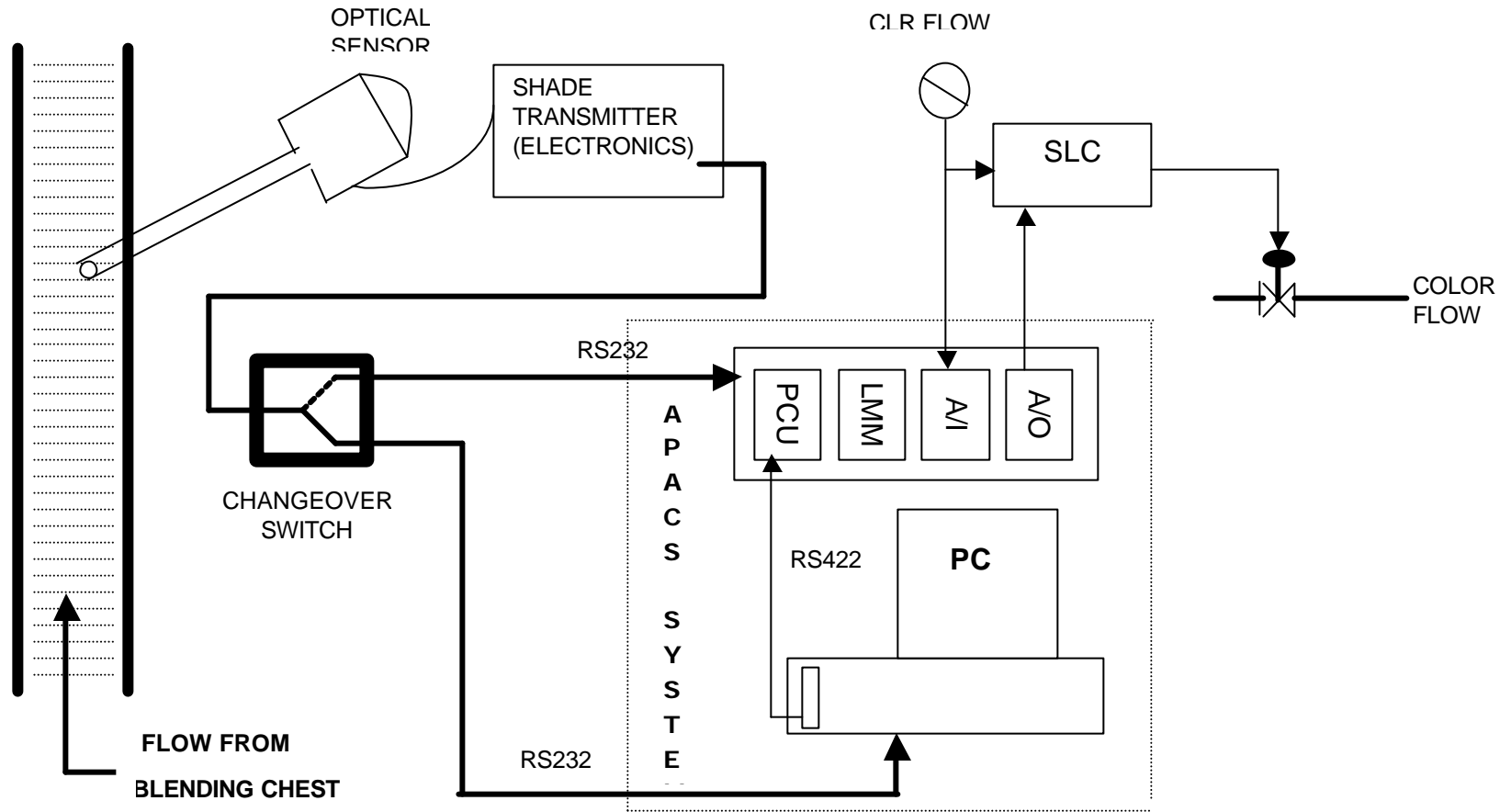


FIG 3