NAMADIN SANAT CO.
PROCESS CONTROL SOLUTIONS

TRAPEN
BULGARIA, 1324 SOFIA, LULIN, BL.717/B/21

MICROPROCESSOR SYSTEM MILLCONT 2

PASSPORT

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1. PURPOSE OF THE SYSTEM

Microprocessor system MILLCONT 2 is purposed for automation and optimization of different kind of mills for grinding of cement, raw materials, ores, coals, coke etc in cement, dressing and power industries and other related branches.
The system works at optimization criteria "Maximum productivity, respectively minimum specific power consumption for grinding at changes of the material qualities as size, hardness, grindability". At the direct flow mills the fineness of grinding is upheld within set-up ranges as at the separator mills the optimal ratio coarse/ready product at the mill's outlet is upheld (law of Rosin – Ramler)

2. PRINCIPLE OF THE SYSTEM OPERATION

By means of special remote sensors SRIP, mounted approximately 20mm from the case of rotary mills or special direct sensors SDIP, mounted on the case of stationary mills are measured impact pulses generated at material grinding.
The signals of the two sensors are sent to double-loop microprocessor module, where by software way are formed synthetic "factor of grinding FG", which are related with material resistant layer against the penetration of grinding bodies in the zone, where the sensors are mounted.
The resistance of material layer depends on its thickness , as well as from the size, hardness and grindability of materials. FG reflect one-way and with high sensibility the changes of layer thickness and the qualities of materials.
FG are programmed for each concrete case by the choice of the frequency domain in which the impact pulses are located and by the coefficient, defining the FG range. The rest part of the FG structure is common for all cases and represents firm "know-how".
The forming FG are sent to two specialized PID-controllers, which change the flow rates of inlet materials so, that the optimization law to satisfy. The outputs of the controllers into dependence on the type of the actuators are programmed 0(4) ÷ 20mA or are relay-operated.
The two control loops are solo, but can work in cascade regime. In this case the two sensors are mounted in different zones of the mill or one of them is mounted on facility fixed to it.
At wet grinding of raw materials and ores when the second sensor is mounted in zone of slime formation, respectively pulp formation, the slime viscosity is measured, respectively pulp density, and it is controlled by inlet water. For this aim "factor of slime FS" is synthesized.
The advantages of the used principle of operation are followed:

- FG and FS aren't influenced from the work of near-by mills and other aggregates;
- Measuring of resistant properties of material layer in the zone of sensor mounting and obtaining in time truthful information for their changes as the control accuracy is increased and the start regime of the mill is decreased a few ways as well;
- Eliminating of uninformation resonance vibrations of mill's case;
- In case of FG change it can control the wearing out of grinding bodies and lining;
- At abruptly FG change it can define a mill breakdowns (destruction of grids and lining, clogging up from inner bodies etc);
- The sensor signal is sent at distance up to 200m without additional amplification.

3. COMPOSITION OF THE SYSTEM

The delivery of MILLCONT 2 contains:
3.1. Microprocessor module MILLCONT 2 – 1 number (fig.3, 4)
3.2. Impact pulse sensor – 2 numbers (fig.1, 2)
3.3. Install elements of sensor – 2 kits
3.4. Measuring cable – ТЧП 4 x 1mm^2 – 200m
3.5. Passport of the system – 2 numbers
3.6. Instruction for adjustment – 2 numbers
3.7. Instruction for system exploitation – 2 numbers

4. DESCRIPTION OF THE SENSORS

4.1. The sensor for remote measuring of impact pulses SRIP is with dimension 45 x 80 x 42mm and weight 0,9kg. It consists of two elements, in which electrical signals are generated with amplitudes, proportional to the steepness of impact pulses at the grinding of materials. The sensor elements are connected differential for eliminating of parasitic electromagnetic fields. The signal is transmitted through double-core armoured cable with isolated shield. By means of special elements, screens, compound etc it is provided high sensibility and selection at the measuring of impact pulses at distance 15-30mm. In this case the parasitic vibrations and sound signal, provoked from near-by mills and aggregates are avoided.
4.2. The sensor for direct measuring of impact pulses SDIP has dimension 50 x 80 x 65mm and weight 1kg. Constructively it is similar to SRIP as additional are built-in fixing elastic elements and magnets for fastening to the case of the stationary mill.

5. DESCRIPTION OF MICROPROCESSOR MODULE

5.1. The microprocessor module consists of two solo control loops by means of which can automatizate and optimizate the work of all kind of rotary and stationary mills.
5.2. Each of the loops consist of:
5.2.1. Input differential amplifier with programmable gain coefficient 1, 2, 4, 8;
5.2.2. Analog high frequency filter from 2nd order with cutting frequency 50Hz, that eleminates low frequency oscilations provoked from mill-ovalness as well as from hatchways and bolts closly to the measuring band;
5.2.3. Two control points after the differential amplifier and after analog filter, which are on the terminal deviece and serve for controlling of the signal;
5.2.4. Analog amplifier of the filter signal with gain coefficient 2;
5.2.5. 12-bit ADC;
5.2.6. Microprocessor for the signal treatment and the forming of "factor of grinding FG", which is transmitted in normal or inverse type to the input of PID-controller, to the analog output 0(4) ÷ 20mA and to the display F on the front pane, in %;
5.2.7. Microprocessor (common for the two loops) for the forming of PID-controller;

Fig.1 Remote sensor SRIP

Fig. 2 Direct sensor SDIP

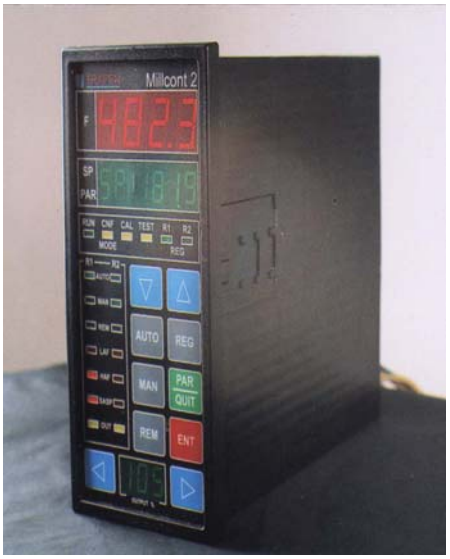

Fig. 3 Microprocessor control module

Fig. 4 Front panel of the module

5.2.8. PID-controller contains the followed elements:

5.2.8.1. Set point locale from the keyboard of the front panel either from remote input 0(4) – 20mA or from serial channel RS 485. The set point is indicated on display SP in %;

5.2.8.2. Normal or inverse output which can be current 0(4) ÷ 20mA or relay-operated;

5.2.8.3. The specifics and laws inserted in PID-controllers are detailed described in instruction for adjustment.

5.3. The front panel of microprocessor module is shown on (fig.4) and it consists of:

5.3.1. 4-decade red display "F" for indication in % of the factor of grinding FG or outer control signal if is programmed such;

5.3.2. 6-decade green display "SP/PAR" for indication of the set point in % and the breakdown situations in regime of operation and in regime of programming – the its servicing;

5.3.3. 3-decade green display "OUTPUT%" for indication in % of control output, respectively the actuator situation;

5.3.4. Line of light diods for indication of situations at operation of the module, which are described in instruction for exploitation;

5.3.5. Two columns of light diods for indication of the regimes of operation and programming, which are described in instructions for exploitation and programming.

5.4. Terminal device for outer connection on the rear part of the module, consisting terminals as following:

№	Designation
1	Loop №1, factor of grinding (FG) + analog current output
2	Loop №1, factor of grinding (FG) - analog current output
3	Controller№1 + analog current output
4	Controller№1 - analog current output
5	Loop №2, factor of grinding (FG) + analog current output
6	Loop №2, factor of grinding (FG) - analog current output
7	Controller№2 + analog current output
8	Controller№2 - analog current output
9	Not is used
10	Not is used
11	Controller№1 Relay, +control, normal open contact
12	Controller№1 Relay, +control, normal open contact
13	Controller№1 Relay, -control, normal open contact
14	Controller№1 Relay, -control, normal open contact
15	Controller№2 Relay, +control, normal open contact
16	Controller№2 Relay, +control, normal open contact
17	Controller№2 Relay, -control, normal open contact
18	Controller№2 Relay, -control, normal open contact
19	Alarm relay, normal open contact
20	Alarm relay, common point
21	Alarm relay, normal close contact
22	Supply, 220VAC
23	Supply, 220VAC
24	Ground
25	Loop№1, control point after analog filter

26 Loop№1, control point after analog amplifier
27 Analog ground
28 Loop№1, input of differential impact pulse sensor
29 Loop№1, input of differential impact pulse sensor
30 Loop№1, middle point of sensor (analog ground)
31 Not is used
32 Controller№1, analog current remote input 20mA
33 Controller№1, analog current remote input 0(4)mA
34 Loop№2, control point after analog filter
35 Loop№2, control point after analog amplifier
36 Analog ground
37 Loop№2, input of differential impact pulse sensor
38 Loop№2, input of differential impact pulse sensor
39 Loop №2, middle of sensor (analog ground)
40 Not is used
41 Controller№2, analog current remote input 20mA
42 Controller№2, analog current remote input 0(4)mA
43 Not is used
44 Not is used
45 Serial channel RS 485
46 Serial channel RS 485
47 Protective switch at calibration and programming
48 Protective switch at calibration and programming

5.5.PVC box with dimension 35 x 135 x 165mm, into which are installed 3 plates: of the module, of the front panel and of the terminal device.

6. TECHNICAL CHARACTERISTICS AND OPERATING CONDITIONS

6.1.Supply voltage: (220+22, minus 33)V with frequency (50+1, minus 1)Hz
6.2.Power consumption: 10W
6.3.Current output: galvanic isolated
6.4.Contacts of the relay: 6A, 250VAC
6.5.Fuse: 1A
6.6.Nominal operating conditions:
6.6.1. Ambient temperature:

- for the module: 0 ÷ +45° C

- for the sensors: -40 ÷ +100° C

6.6.2. Relative humidity:

- for the module: up to 80%

- for the sensors: 100%

6.6.3. Ambient dust:

- for the module: 5mg/m^3

- for the sensors: without limit

6.6.4. Atmosphere pressure: 86 ÷ 106kPa

7. INSTALATION OF MILLCONT 2

7.1. The module is inserted in aperture with dimension 67 x 137mm and it is fixed by the installed elements of the box.
7.2. The sensor SRIP is installed on the stand hardly connected to the fundamental or other stationary body as its adopt part is directed from 15 - 30mm against the waterfall side of the mill under 30 - 40°.
7.3. The sensor SDIP is fixed on the case of stationary mill by means of incorporated magnets as it is chosen smooth surface.
7.4. The armoured cables, connecting the sensors with the module are transmitted on the cable stack a far from high voltage cables and high frequency tyristor or transistor motor drivers in order to escape a disturbances.

It is wished the cables to be withdraw in steel pipes for protection from disturbances and outer intervention. At the installation the outer PVC shell of the cables don't must hurt .

8. WARRANTY AND SERVICE

8.1. The system is provided with 18 months warranty from the date of implementation, but not later than two years from the date of delivery.
8.2. The service of MILLCONT 2 out in warranty term is performed by "TRAPEN" company.

9. ADDITIONAL DATA

9.1. MILLCONT 2 is manufactured and sold by "TRAPEN" company.
9.2. Microprocessor module of MILLCONT 2 is manufactured by "UNISIST ENGENEERING" Ltd.
9.3. "UNISIST ENGENEERING" Ltd. is certified to ISO 9001:2000 with certificate for manufacture QBE 99082 and certificate for service QBE 99081, prominent from SGS (Belgium).
9.4. In 2001 the system "MILLCONT of "TRAPEN" Company was awarded with silver medal and certificate at the International Exhibition "IENA 2001" in Neurenberg and with bronze medal and certificate at the 50th International Fair "EUREKA 2001" in Brussels.