Product Family: PLCs **Number:** AN-MISC-023

Subject: Filters of noisy process variables **Date Issued: 2-19-2004**

Revision: Original

FILTERS OF NOISY PROCESS VARIABLES DURING THE TIME.

The problem of noisy signals in the measurement of process variables can typically be solved by careful selection of the design taking into account components, layout, wiring, grounding, shielding, etc. However, no matter which layout you select, the electrical noise may still be present in the input signal of a PLC.

In the most severe cases it is necessary to resort to signal filtering either by hardware or by software to smooth the reading.
The value of the process variable can be unstable also due to the quality of the measuring instrument. For example, it is known in the cement industry that the signal output generated by impact flowmeters of granulated or dusty raw materials results in a value that must be averaged.
Even the value of the gasoline level in an automobile tank needs to have an algorithm that calculates the average of several readings to prevent that the needle of the indicator be always jumping due to the automobile in movement.

Running average is one of the methods used to smooth readings of analog values; In this algorithm the parameters are the number of samples and the sampling period of the signal.

This method consists of taking a consecutive number of readings, not necessarily at the same frequency of the CPU scan, and placing them in a table. In each sampling, the new value is placed at the top of the table and all the other values will move downwards. The oldest value is lost. At the same time all the values of the table are added and the arithmetic average of those values becomes the running average. Then in each reading we can get a value that is the average of all the samples.

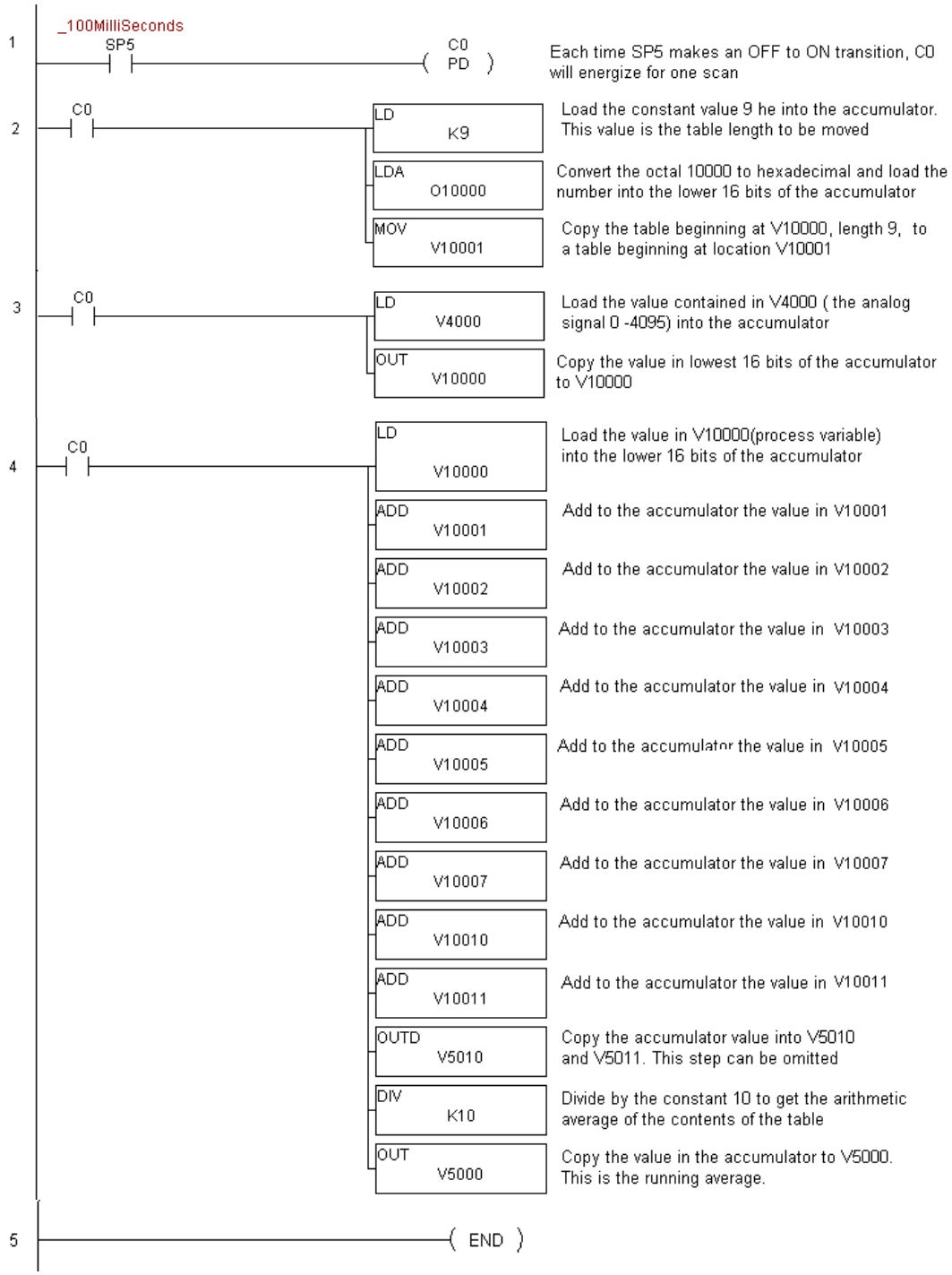
If it is known that the process variable varies slowly as it is the case of temperatures or water level in a tank this method can be easily applied.

In this document we present a solution with PLCs Directlogic.

In the case that follows we assume that we have a range of temperature with a noise signal that can cause the value of the signal jumps instantaneously. This can cause a nonacceptable deviation which can activate an alarm, action that is not desired.
In the example we say that we want to smooth the reading of an 12 bit analog signal read by a PLC that has a scan time of 9 milliseconds, that is to say, on each 9 mseg there is an update of the reading.

The table to use is V10000, with 10 consecutive memories, that is to say a table of a length 10 (V10000 until V10011). The signal value to be averaged is V4000. The result is obtained in V5000 as a BCD value. See next an implementation of the algorithm with a period of sampling of 100 milliseconds and 10 samples. Evidently this can be extended to more samples, and the period be changed within the possibilities of the CPU (for example to 50 ms, that is, every 5 readings or every other scan, that is, every

18 ms). Furthermore, the averaging and sampling in each CPU scan can be done by slightly modifying the program.



Technical Assistance: If you have questions regarding this Application Note, please contact us at 770-844-4200 for further assistance.