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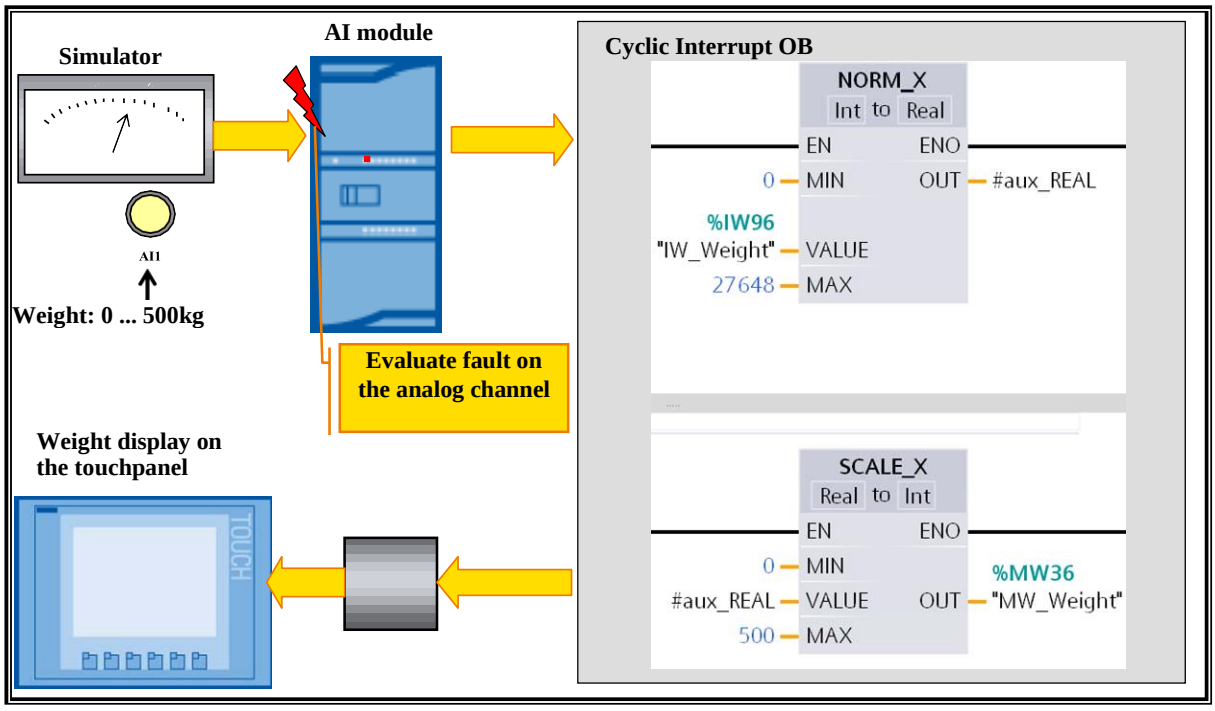
Basics of PLC

A Task using Analog Value Processing

Task using Analog Value Processing

Task Description



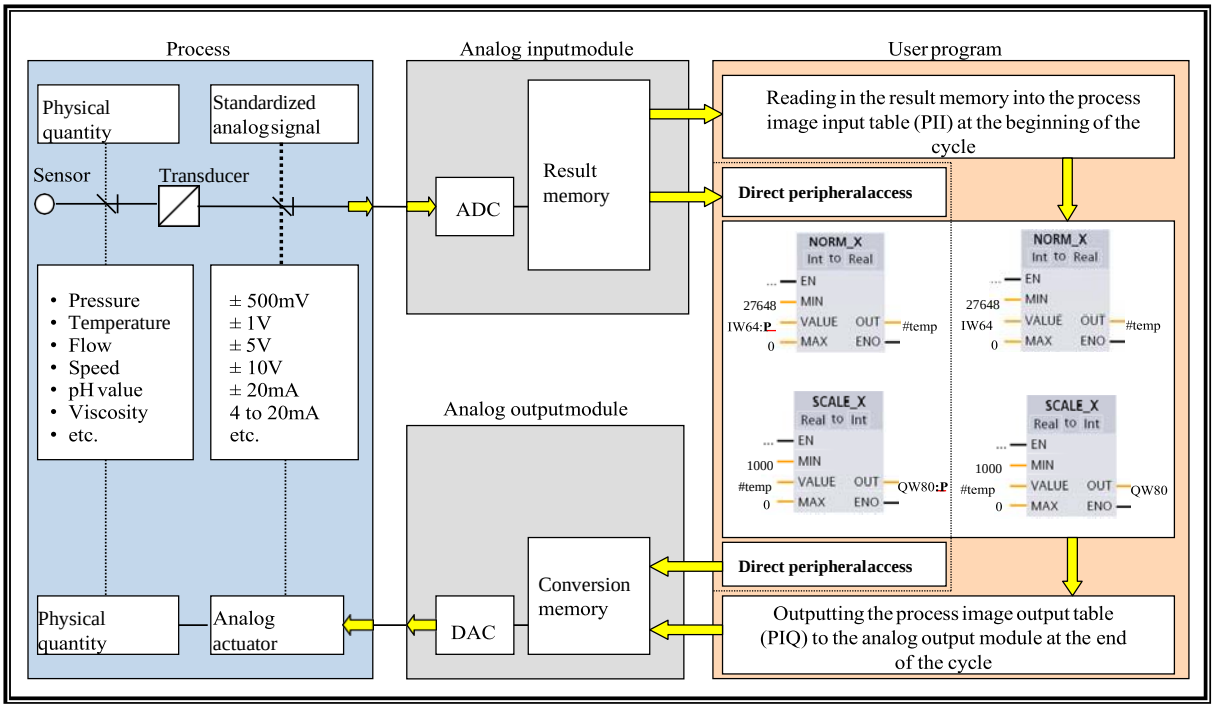
Task Description

In this chapter, the conversion and processing of analog signals is handled.

For this, a voltage is to be set and read in on the simulator potentiometer. This voltage simulates part weight values. It will be your task to convert the read in values every 250ms in the cyclic interrupt into weight values between 0 kg and 500 kg using the operations NORM_X and SCALE_X. The weight is only valid in the range of 100kg to 400kg. If the weight of the part exceeds or falls below these limits, the part is considered invalid and no further transport sequence can be started (Bay LEDs remain dark and conveyor movement to the right cannot be started).

As well, you will learn how you must proceed when there is a channel fault of an analog module in order to get detailed information on the fault event.

Principle of Analog Value Processing



Principle of Analog Value Processing

In a production process, there are a variety of physical quantities (such as pressure, temperature, speed, rotational speed, pH value, and viscosity) that need to be processed in the PLC for automation purposes.

Sensor

Measuring sensors respond to changes in the quantity to be measured by such things as linear expansion, angular distortion, and alteration of electrical conductivity.

Transducer

Measuring transducers convert these above-mentioned changes into standard analog signals, such as: ± 500mV, ± 10V, ± 20mA, 4 to 20mA.

These signals are supplied to the analog input modules.

ADC

Before these analog values can be processed in the CPU, they must be converted to digital form. The ADC (Analog-to-Digital Converter) on the analog input module handles this conversion.

The analog-to-digital conversion is performed sequentially. This means the signals are converted for each analog input channel in turn.

Result Memory

The result of the conversion is stored in the result memory and remains there until it is overwritten by a new value.

You can use the "L PIW..." load instruction to read the converted analog value.

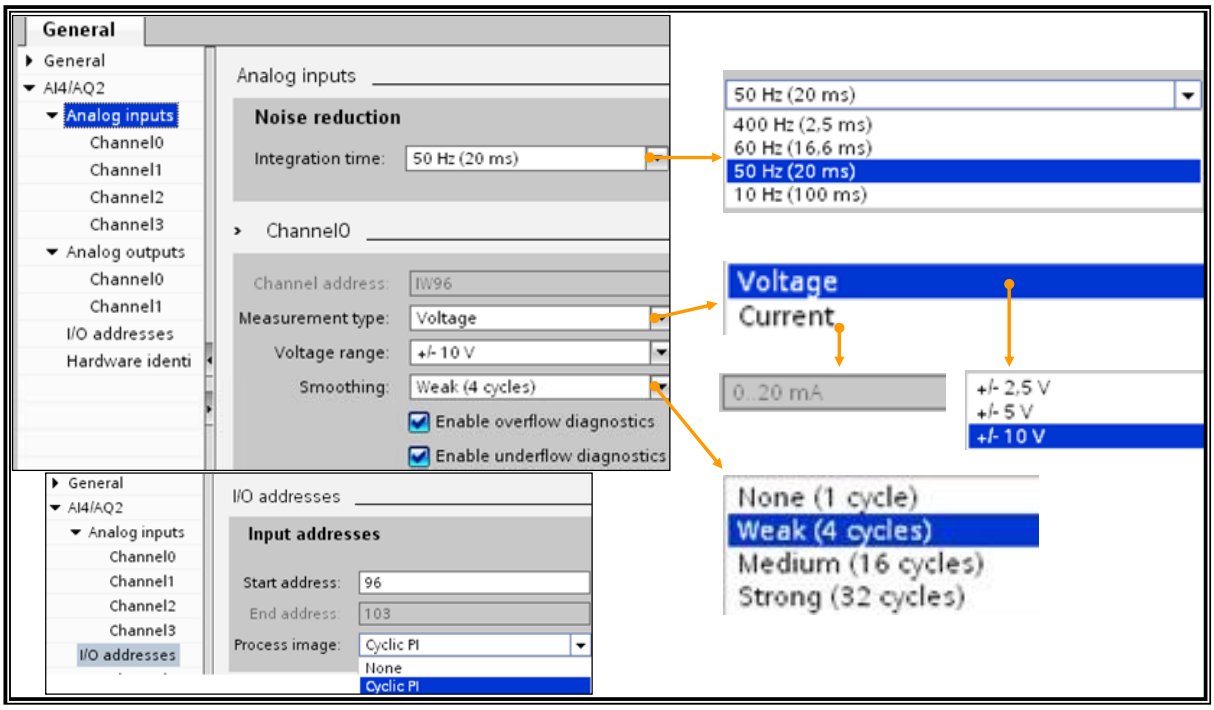
Analog Output

The (MOVE) transfer instruction is used to write the analog values the user program calculated to an analog output module, where a DAC (Digital-to-Analog Converter) converts them to standard analog signals.

Analog Actuators

Standardized actuators can be connected directly to the analog output modules.

Analog Input Modules



Analog Input Modules

Analog input modules are configured and parameterized in STEP7 in the device configuration of the respective PLC. The settings or parameters of all modules are downloaded into the CPU which must be in the STOP state to do this. When a subsequent (warm) restart is carried out, the CPU distributes the parameters to the appropriate modules.

Parameters

For the respective module, differentiation is made between module parameters and channel parameters.

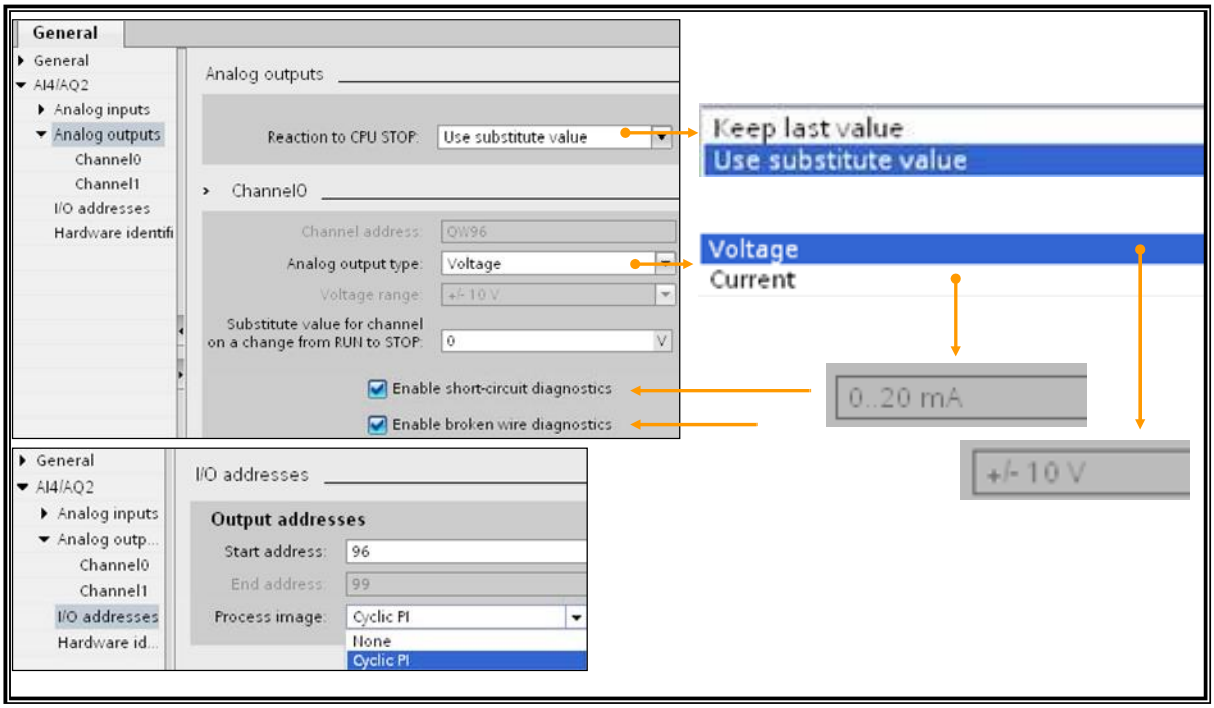
Module Parameters

- General
  Name and comment for the integrated analog inputs of the CPU.
- Noise reduction
  In the noise reduction, the noise frequencies of the specified frequency (in Hz) are suppressed by the integration time which is set.
- I/O addresses and Hardware identifier
  The address space of the entry addresses as well as the process image is defined. The hardware identity of the device is displayed.

Channel Parameters

- Measurement type
  With this parameter, the type of measurement is set, for example, voltage. An unused channel must then be deactivated since it is otherwise also converted thus making the total conversion time for the module worse.
- Measurement range (in the picture – Voltage range)
  With this parameter, the range of measurement for the selected type of measurement is set.
- Smoothing
  The smoothing of analog values generates a stable analog signal for further processing. Smoothing the analog values is recommended in case of fast signal changes (measured value changes), for example, in the level measurement of fluctuating liquids.
- Overflow diagnostics
  Through this parameter, the overflow diagnostics is activated. If the measured value exceeds the overflow range of the channel, a diagnostic interrupt is triggered.
- Underflow diagnostics
  Through this parameter, the underflow diagnostics is activated. If the measured value falls below the underflow range of the channel, a diagnostic interrupt is triggered.

Analog Output Modules



Analog Output Modules

Analog output modules are configured and parameterized in STEP7 in the device configuration of the respective PLC. The settings or parameters of all modules are downloaded into the CPU which must be in the STOP state to do this. When a subsequent (warm) restart is carried out, the CPU distributes the parameters to the appropriate modules.

Parameters

For the respective module, differentiation is made between module parameters and channel parameters.

Module Parameters

- General
  Name and comment for the integrated analog outputs of the CPU.
- Reaction to CPU STOP
  - Switch off
    The peripheral device goes into safe mode. The process image output table is deleted (=0).
  - Substitute value
    The peripheral device outputs the value previously set for the channel.
  - Keep last value
    The peripheral device retains the value last put out before STOP.

Attention!
Make sure that the system is always in safe mode in the case of "Keep last value"!

- I/O addresses and Hardware identifier
  The address space of the entry addresses as well as the process image is defined. The hardware identity of the device is displayed.

Channel Parameters

- Analog output type
  With this parameter, the type of output is set, for example, voltage. Unused outputs have to be deactivated since they are otherwise also converted thus making the total conversion time for the module worse.
- Output range (in the picture - Voltage range)
  With this parameter, the output range of the selected type of output is set.
- Broken wire diagnostics (in Current mode)
  With this parameter, the diagnostic Wire break is generated when there is a wire break. This diagnostic is not noticeable in the zero range.
- Short-circuit diagnostics (in Voltage mode)
  With this parameter, a diagnostic is generated when there is a short-circuit of the output wire. This diagnostic is not noticeable in the zero range.
- Substitute value
  With this parameter, a substitute value is specified which the module is to output when the CPU goes into STOP. The substitute value must be in the rated range, the overrange or the underran