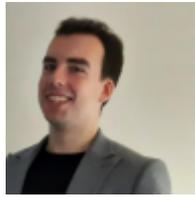


Analog I/O configuration for imperix controllers

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This page outlines the configuration methods for analog I/O channels on [imperix controllers](#). While digital I/Os are configured exclusively via software and remain consistent across all controllers, analog I/Os require configuration both through software and through hardware, directly on the target device, which varies by controller model.

The following sections provide an overview on how to configure both types of settings on different imperix controllers.

Hardware configuration

Hardware settings vary by controller model. Configuration is performed via the front-panel interface (screen and button) or Cockpit, depending on device compatibility. The table below summarizes the possible analog I/O hardware configuration methods and provides references for each controller.

A detailed comparison of imperix controllers, highlighting their hardware differences, is available in the article about [How to choose between imperix controllers](#).

Controller	Configurable through	Detailed configuration instructions
B-Box 4	Front-panel screen, Cockpit remote view	Analog I/O configuration on B-Box 4
B-Box RCP 3	Front-panel screen	Analog front-end configuration on B-Box RCP 3.0
B-Board PRO 3	N/A	Analog chain design and configuration left to the user
B-Box micro 3	Cockpit remote view	Analog inputs configuration on B-Box Micro
TPI 8032	N/A	Over-current, over-voltage, and over-temperature thresholds are configured automatically. More details are provided in Getting started with the TPI 8032

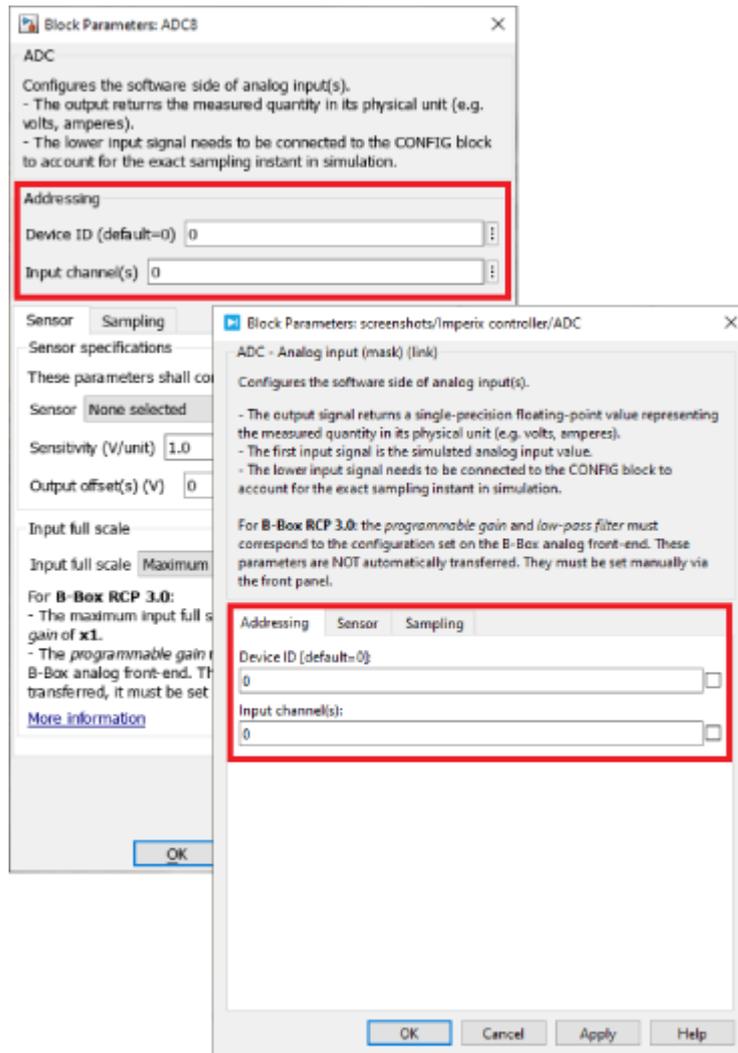
A critical step of the hardware configuration is the **proper selection of safety limits**. Related information is provided in the article about [Over-current and over-voltage protection](#). Once the thresholds are appropriately chosen, hardware-specific documentation on how to implement them is given within controller-related documentation (see table above).

Software configuration

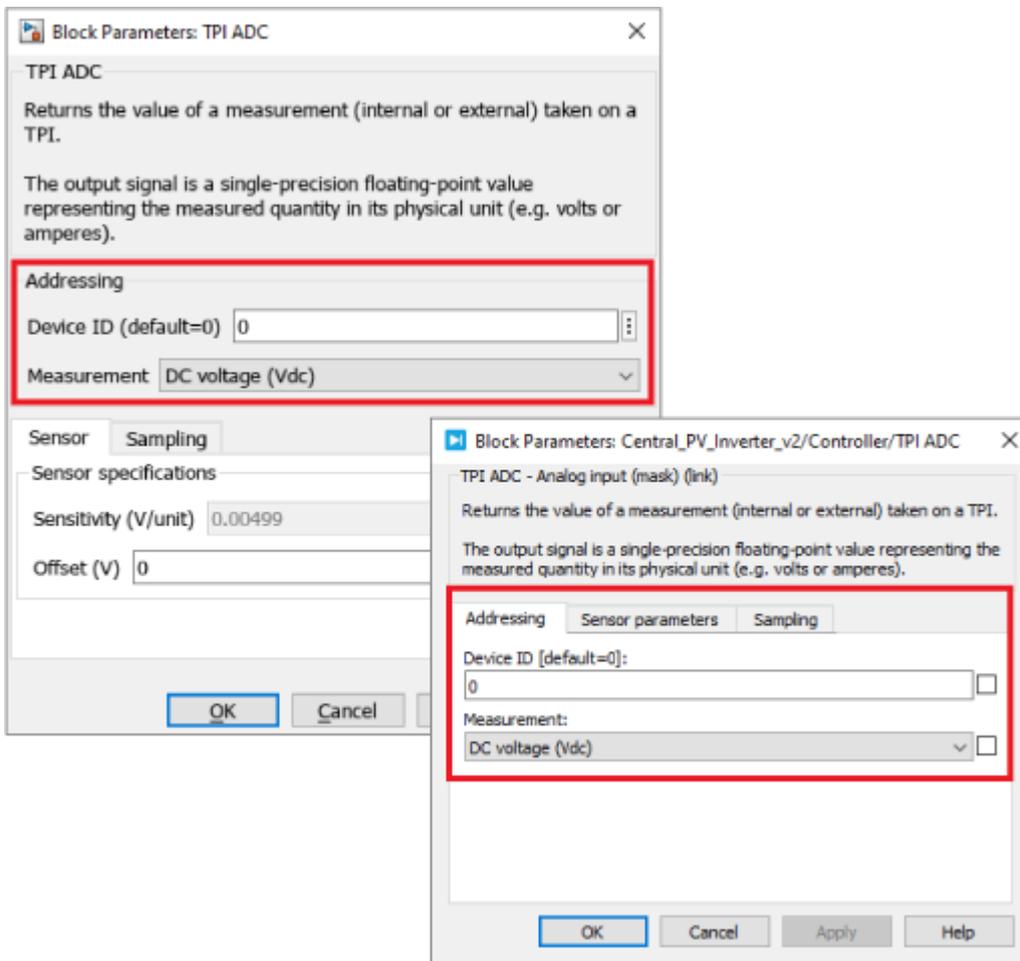
Software settings are configured from the user code and are compatible across controllers, with minor hardware-specific variations. In Simulink and PLECS, these settings are configured using the [ADC block](#) (for B-Box/-Board controllers) or the [TPI ADC block](#) (for the TPI8032). The main software settings are described below.

Addressing

- The **Device ID** defines which device is addressed when a [multi-device configuration](#) is implemented. With a single controller, the default ID must be used, which is 0.
- The **Channel number** (B-Box/-Board only) selects from which physical input data is read. The vector notation (e.g. [0:2]) can be used if multiple channels are desired to be configured identically.
- The **Measurement** (TPI8032 only) offer the same selection mechanism, but as a function of the measured variable. The sensor type is also set automatically. The hardware resources mapping is given in [SD200](#).



Addressing settings in the ADC block.

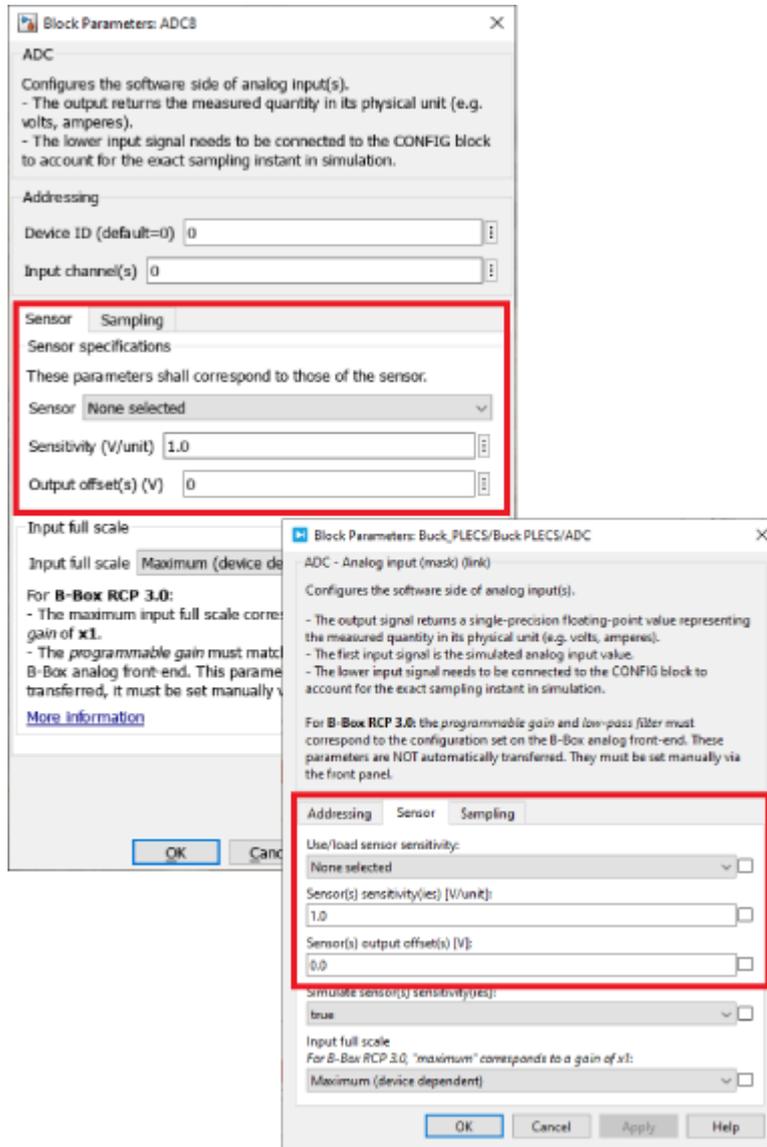


Addressing settings in the TPI ADC block.

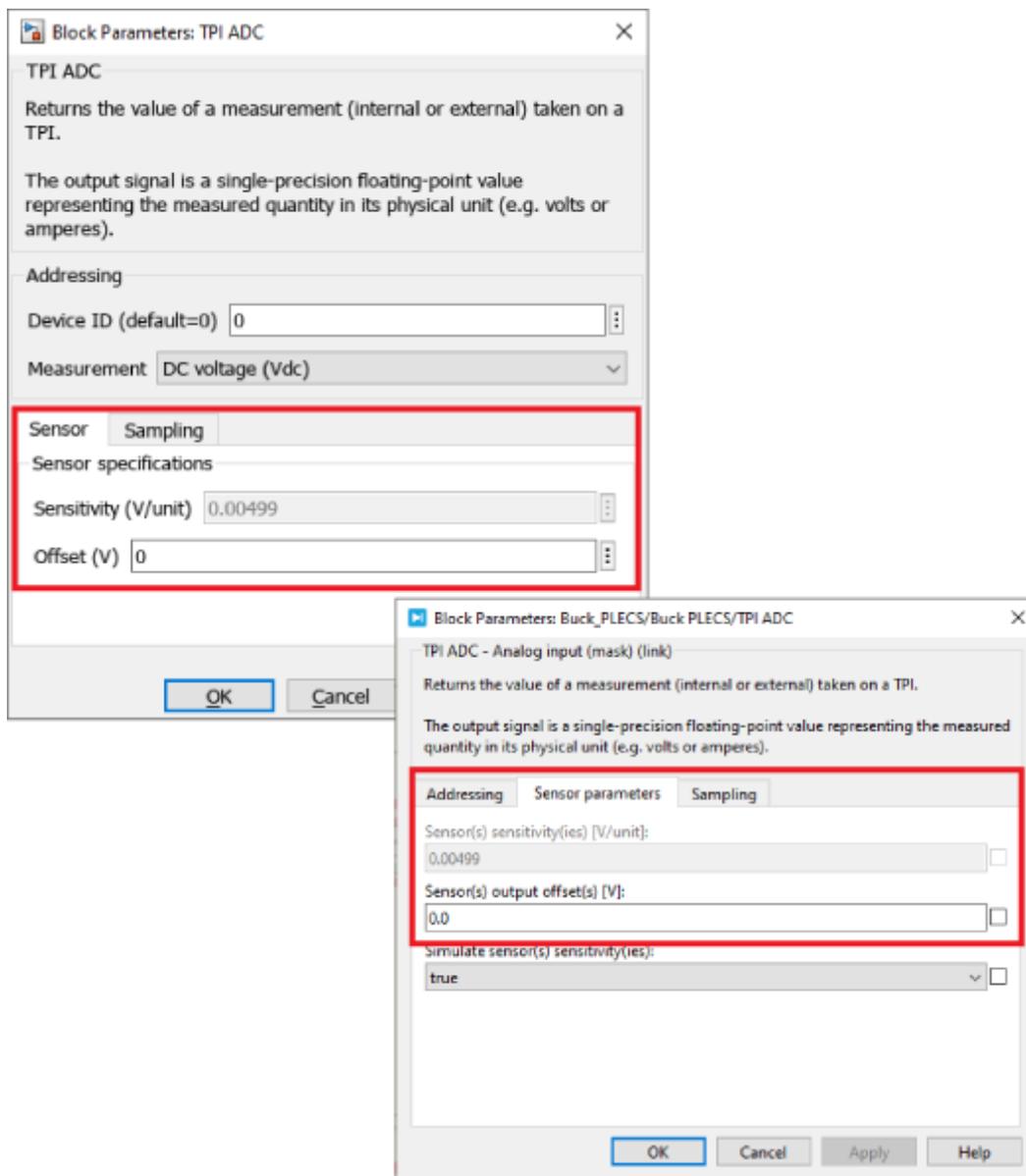
Sensor specifications

- A list of imperix **Sensors** is provided to facilitate the configuration. Choosing a sensor automatically sets the corresponding sensitivity. This information is used so that the raw ADC value – a 16 bits integer – is transformed into a meaningful floating-point quantity (e.g. 230.6V) before processing in the CPU. If necessary, an offset can also be indicated, and compensated for during the same conversion.
- On the TPI 8032, the sensor type is automatically selected once the **Measurement** is chosen.

The B-Box 4 supports the auto-identification of the most recent sensors (see [PN255](#)), so that possible configuration mismatches can be detected (warnings or errors displayed in Cockpit). This, however, does not make the above-mentioned configuration dispensable, because the sensor information still needs to be defined from within the user code.



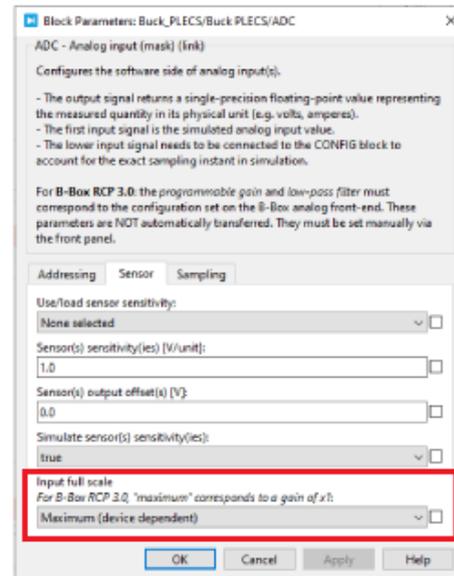
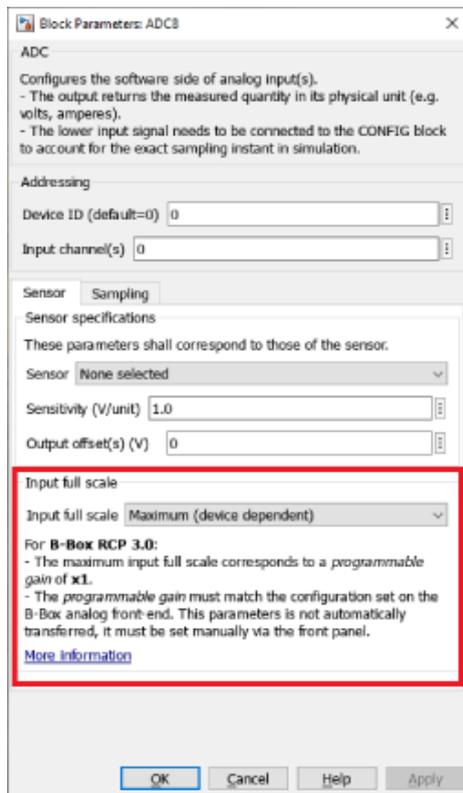
Sensor specifications settings in the ADC block.



Sensor specifications settings in the TPI ADC block.

Input full scale

- The **Input full scale** only applies to B-Box/-Board controllers. Two options can be selected: *Maximum (device-dependent)* and *Programmable (B-Box RCP 3.0 only)*. The *device-dependent* setting automatically accounts for the controller model. If the *Programmable* setting is selected for the B-Box RCP 3.0, the same gain must also be manually configured at the hardware level using the front panel (see [PN105](#)).



Input full scale settings in the ADC block.

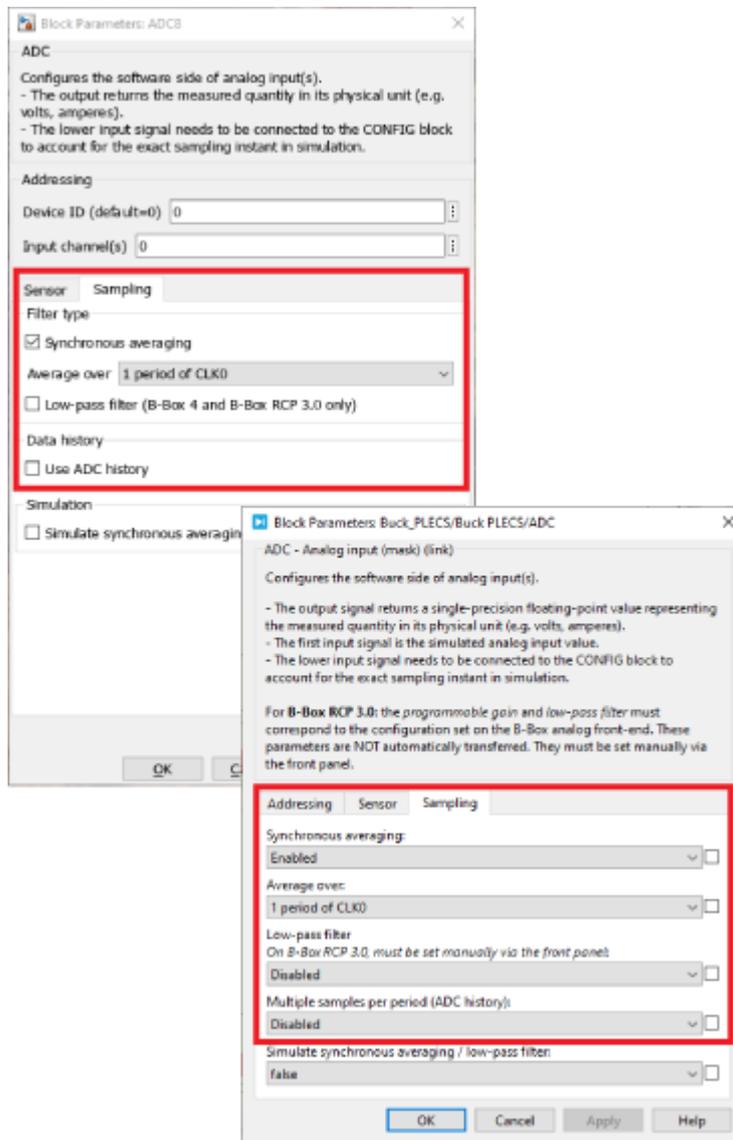
Sampling

All imperix controllers always sample across all channels and devices simultaneously. For this reason, the **Sampling frequency and phase** is a common setting located within the [CONFIG block](#). On the other hand, filtering or down-sampling strategies are configured on a per-channel basis. The available options are:

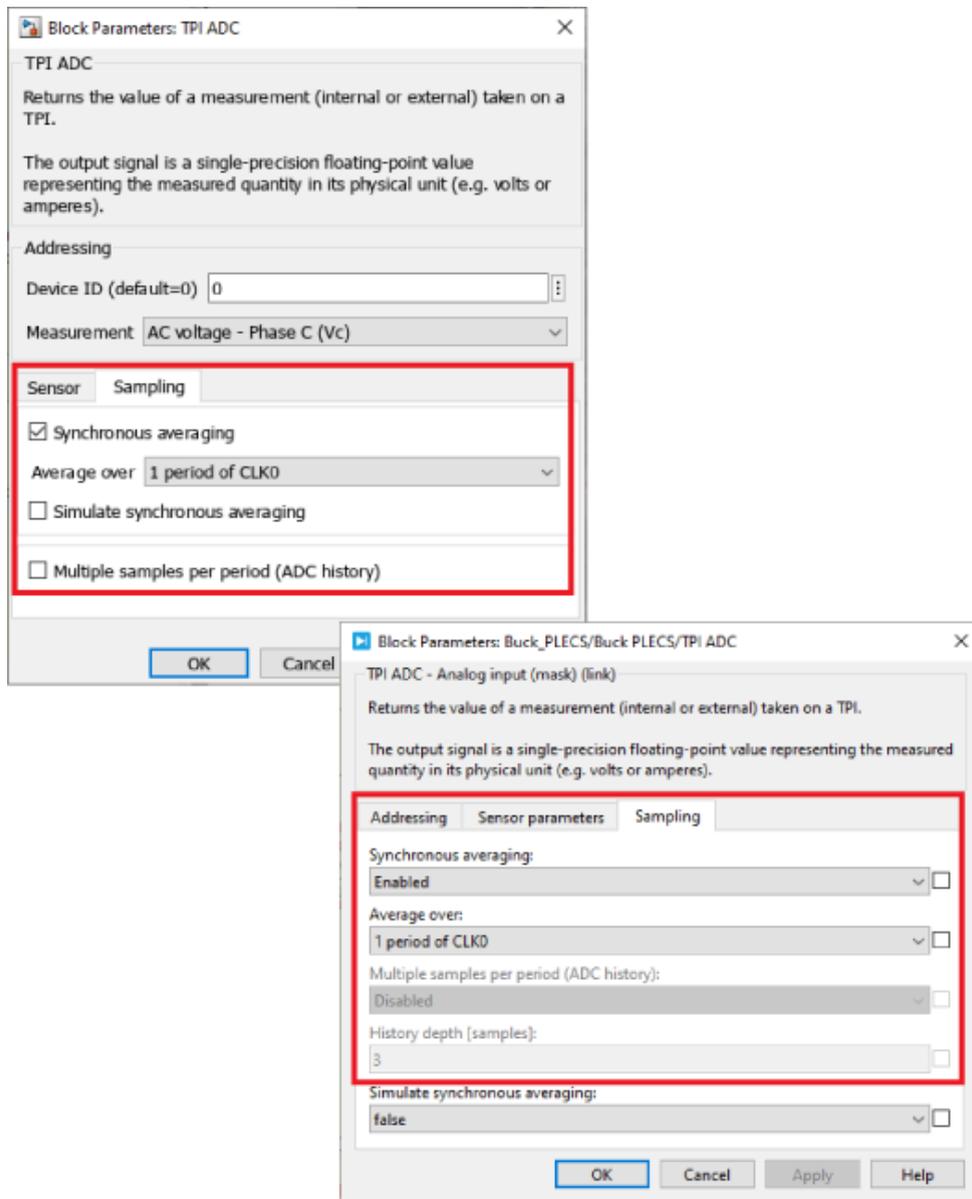
- *Synchronous averaging*. This computes the average of multiple samples over one or two PWM periods. This technique is the default recommended strategy. It is available for all controller models.
- *Low-pass filter* (B-Box 3 and 4 only). This is a software parameter on the B-Box 4 (configured inside the model), but a hardware parameter on the B-Box 3 (configured using the front panel).
- *Data history*. This provides a vector containing the N most recent ADC samples. This generally makes most sense when used with a Postscaler between the effective sampling and CPU execution rates.

If none of the above options are selected, regular *synchronous sampling* is used.

Imperix recommends using synchronous averaging in most cases. For more information on this topic, the article [Sampling techniques for power electronics](#) compares the different methods and can help decide between them.



Sampling settings in the ADC block.



Sampling settings in the TPI ADC block.

Going further

Detailed information about the analog I/O configuration for each controller can be found in:

- [Analog I/O configuration on B-Box 4](#)
- [Analog front-end configuration on B-Box RCP 3.0](#)
- [Analog inputs configuration on B-Box Micro](#)
- [Getting started with the TPI 8032](#)

For the software settings, the next pages provide more information about the ADC and TPI ADC blocks:

- [ADC block](#)
- [TPI ADC block](#)

Finally, more information about the operating and programming principles of imperix controllers are provided in the next page:

- [Programming and operating imperix controllers](#)