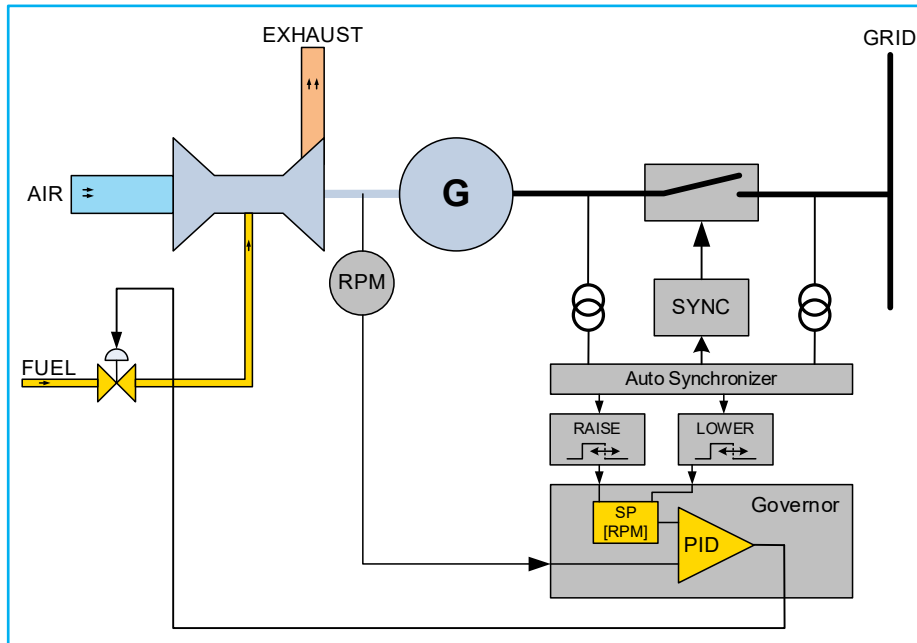# HC-QUICKSYNC

For a quick, smooth and consistent synchronization of your electrical generator to the grid, Holland-Controls has developed HC-QUICKSYNC.

Traditional synchronization principle

On many installations our engineers experienced that it may take excessive time to synchronize the generator to the bus. Typically the synchroscope almost reaches the 12 o'clock position but then a small upset in the grid occurs and it starts all-over again.

In the diagram above the traditional principle is outlined. While the breaker is still open, the auto synchronizer measures the frequency and phase difference between the generator and the grid. This generates a speed raise or lower width-modulated impulse to the fuel governor setpoint driver. The governor will adjust the fuel valve opening. With some delay this then accelerates or decelerates the generator in an attempt to match both frequency and phase-angle at the same time. This rarely works in one try.

Traditional synchronization method – disadvantages

PWM (Pulse Width Modulation) & speed control is very rough, it is either:

- Too fast (overshoot 12 o'clock)

- Too slow (not reaching 12 o'clock before another minor grid change occurs)

- Sometimes trying for minutes to get a reasonable match.

Synchronization is only permitted by going through the 12 o'clock position with a positive speed slip to avoid reverse power after breaker closure:

- Circuit breakers may take 60-200 ms to close.

- For 3 to 10 full cycles, this is loading the breaker with a phase difference. This is bad for the breaker, the generator and the coupling – even if the synchronizer pre-empts the breaker closing time.

Static synchronization would be much better but traditional systems seldomly manage this.

Holland-Controls

HC-QUICKSYNC works differently. Through a metering device the governor receives two additional pieces of information: the grid frequency (F), and the difference in phase angle (Δ-φ) between the generator and the grid. Typically the metering device is an intelligent generator protection *relay*, or a generator excitation system communicating with the PLC in which the governor is also residing.
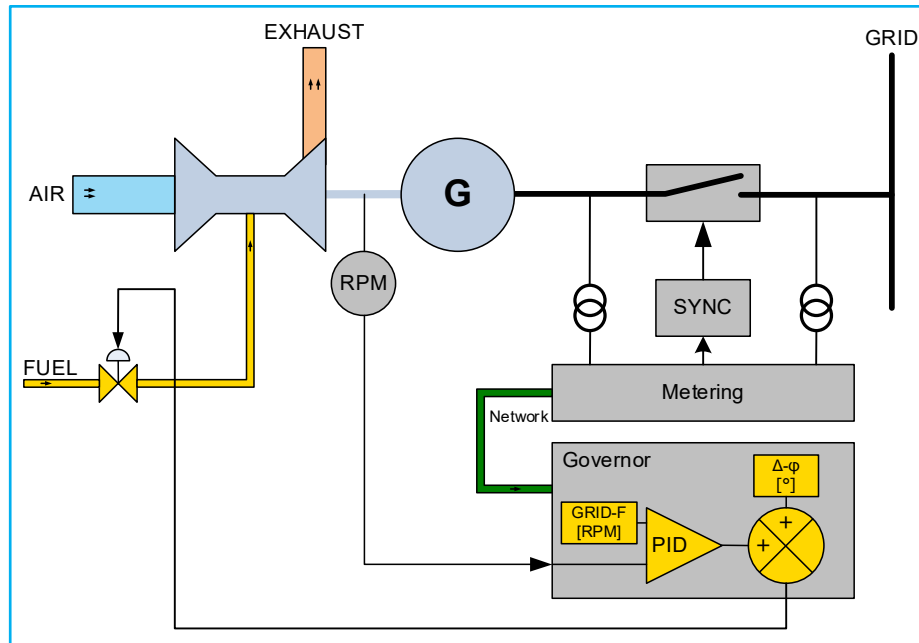
HC-QUICKSYNC

The grid frequency is recalculated to a generator speed setpoint. If the grid frequency changes, then so does the speed setpoint. The phase angle delta is used to bias the fuel demand to the engine. If the generator is lagging, a small bias is added causing the generator to accelerate until the lag is zero reaching the 12 o'clock position. Similarly if the generator leads, a bias is subtracted and the generator slows down. This allows the 12 o'clock position to be 'locked-on' for seconds even with small changes in grid frequency. The breaker close command is then issued. With no phase shift the breaker can then close over multiple cycles without any stress to the machinery nor breaker. Once the breaker is closed, the software adds a small positive bias to the power setpoint (synchronous operation) or speed setpoint (droop operation) which ensures no reverse power condition can occur even if the grid frequency drops.

HC-QUICKSYNC – advantages

- Immediate synchronization at actual bus frequency.

- Fuel controller knows exactly how much phase shift is required resulting in quick, smooth and consistent synchronization.

- Consistent static synchronization.
  - No stress on the breaker - static for 2 s is achievable
  - No stress on the generator
  - No stress on the grid – smooth loading of the generator

- See also YouTube "hc quicksync".

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