

## Mode vs Duty

In order to adjust the injection rates precisely, two parameters have been predicted in the Aquarius controllers: Mode and Duty. Here is a brief look at the definition and applications of these two parameters.

**1. Mode:** There are different settings under Mode which enable the user to decide when an injection happens. The most general settings for Mode are defined as below:

**OFF:** Output is SET OFF; the pump remains OFF and no injection happens

**FLOW/FLW:** Output only cycles while there is flow in the manifold and FLOW=ON. By selecting this mode, as soon as there is no flow in the manifold the chemical injection will be stopped.

**CONT/CON:** Output cycles continuously; independent of Timer or Flow in the manifold. It should be noted the CON mode doesn't mean the relevant pump runs continuously forever! But it runs (by the selected duty) until reaches to the set point and then stops running.

**TMR/TIMER:** Output only cycles while the Timer is ON. This mode is only applicable for Biocide injections (Bio A and Bio B for Non-ORP controllers and ORP and Bio B for ORP controllers). There are 6 different timers available in Aquarius controllers to cover the all required injection settings. When the Timer mode is selected, the relevant timer should be activated.

**T&F/T&FLO:** Output only cycles when Timer and Flow are ON simultaneously.

**BLEED:** Output only cycles when Bleed Solenoid is ON.

The following table represents a complete list of all modes which are used in Aquarius controllers.

Mode	Definition	ORP	pH	Inhibitor	Dispersant	Bio B	Conductivity
OFF	No Injection (or no Bleed)	Y	Y	Y	Y	Y	Y
Flow/FLW	Flow	Y	Y	Y	Y	-	Y
CON/CONT	Continuous	Y	Y	Y	Y	-	Y
T&F/T&FLO	Timer & Flow	Y	-	-	-	Y	-
TMR/TIMER	Timer	Y	-	-	-	Y	-
BLEED	Bleed	-	-	Y	Y	-	-
CORFL (KPI Only)	Corrosion & Flow	-	-	Y	-	-	-
WM	Water Meter	-	-	Y	-	-	-
ORP	ORP	-	-	-	Y	-	-
INHIB	Inhibitor	-	-	-	Y	-	-

**Definition of the Modes and their availability for different Modules of Aquarius controllers**

**2. Duty:** Duty is used to regulate the output capacities. As an example, when duty is 30%, the relevant pump runs only  $0.30 \times 60 = 18$  seconds per each minute. By correctly adjusting the Duty, a big pump can be used for small injections or the overshoots can be avoided.

**Note 1:** No Duty is defined for Inhibitor and Dispersant, only the Pump (size) and Dose (rate) must be adjusted.

**Note 2:** Except KPI, which has an option to dose the Inhibitor according to the corrosion set points; there are no set points applicable for Inhibitor, Dispersant and Non-oxidizing biocide. These three modules only follow the Duty (or Dose rate) and Mode.

**Note 3:** If the system is too slow to reach to a set point; the pump duty should be increased or the pump should be exchanged with a bigger one.

**Note 4:** If the system overshoots frequently, the pump duty should be reduced or it should be exchanged with a smaller pump.

**Note 5:** If the duties of above 50% are needed, it is recommended to use a bigger pump.

#### FAQ:

**Question:** How long does an ORP pump run when its Duty is 100% and Mode is CON?

**Answer:** At these settings, for any deviation from the set point, the pump runs 60 seconds per each minute until reach the set point and then stops.

**Question:** How long does a pH pump run when its Duty is 25% and Mode is FLOW?

**Answer:** For any deviation from set point and FLOW=ON, the mentioned pump runs 15 seconds per each minute until reach the set point and then stops. If there is no Flow in the manifold (FLOW=OFF) the acid pump won't work at all.

**Question:** How long does the pump run when the Duty is 20% and the Mode is CON?

**Answer:** As soon as any deviation from the set point happens, the controller sends signals to this pump making it running 12 sec per each minute until reaches the set point and then stops running. The needed time depends mainly on two parameters: 1. How far is the reading from the set point and 2. How fast the deviation has happened.