Case Study 01
MutoDrive®

***Figure 1**: The AutoPool® 4.0.*

Overview

MutoDrive® is the specialist control algorithm (included free with every AutoPool® 4.0 pool controller) that optimises a pool's recirculating pump flow rate with respect to the bather load. As recirculation pumps are a large and continuous power draw, optimisation of recirculation in response to changing pool conditions (such as bather load and free chlorine levels), offers the opportunity for significant savings in both energy consumption and cost. Through installation of the AutoPool® 4.0 and very conservative use of the MutoDrive® functionality, The Woodland Spa leisure facility in Burnley (UK) saved over 27% on their annual recirculation pump electricity bill, while maintaining premium quality water. When the calculated yearly energy saving was applied to an Olympic-sized pool an annual saving of £23,037 ($31,228, €26,722) per year and a payback of 1.3 months could be realised.

	The Woodland Spa 360 m³, 95,102 US gallons pool	**Standard Olympic-size 2,500 m³, 660,430 US gallons pool**
Annual saving with MutoDrive® (£)	£3,317 $4,512 €3,848	£23,037 $31,330 €26,723
Year 1 MutoDrive® ROI (%)	34	831
Payback Period (Months)	9.0	1.3

***Figure 2**: Calculated annual electrical energy cost savings, Year 1 ROI and payback period for MutoDrive® for different sized pools.*

The AutoPool 4.0 with MutoDrive®

***Figure 3**: The AutoPool® 4.0.*

The AutoPool® 4.0 (**Figure 3**) is a sophisticated and complete pool controller. Manufactured in the UK by Pi, the AutoPool® 4.0 monitors and controls the disinfection and pH correction dosing in a pool, accurately maintaining the setpoints defined by the user. There are six models, all of which are fully customisable with any other sensor that Pi supplies, such as online turbidity or total alkalinity. Pi's process controllers are used all over the world managing water treatment works and industrial water treatment processes; the AutoPool® 4.0 can control almost any parameter needed to keep a pool in perfect condition. All AutoPool® 4.0 controllers are supplied with pH and temperature sensors, with the option of a free chlorine sensor (ppm), ORP (Redox) sensor or both. In addition all AutoPool® 4.0 controllers come with MutoDrive®, Pi's specialist pump control algorithm. Engineered to provide live, responsive recirculation pump speed control during pool use (during the day when energy prices are highest), MutoDrive® can help make significant savings on electrical costs.

The Theory Behind MutoDrive®

Recirculation pumps (**Figure 4**) provide the driving force for the continuous circulation of pool water through the water sanitation system. Typically, due to the additional capacity required in case of pump malfunction, recirculation pumps are over-specified for the minimum required turnover period (time taken for the entire pool water volume to be completely recirculated). However, recirculation pumps are commonly set at a single high speed which produces a much greater water flow than is required to maintain safe, clean pool water, wasting energy and unnecessarily increasing costs.

***Figure 4**: Swimming pool recirculation pumps.*

Variable Speed Drive (VSD) can be utilised to reduce the flow rate when bather numbers and disinfection demand are low, such as at night during closed hours. However, the simplistic approach of a VSD (turning the pumps down at night when the pool is empty), does not aid in reducing energy costs when energy is most expensive, during the day while the pool is in use. MutoDrive® offers additional value by providing live instruction to the VSD in response to disinfection demand and therefore bather load.

By monitoring free chlorine levels in the pool water MutoDrive® can ramp the pump speed up or down while the pool is in use, which maintains the pre-defined setpoint of free chlorine whilst also keeping electricity use by the recirculation pumps at a minimum. This provides excellent disinfection control, improved filtration efficiency and reduced energy costs during the day (**Figure 5**).

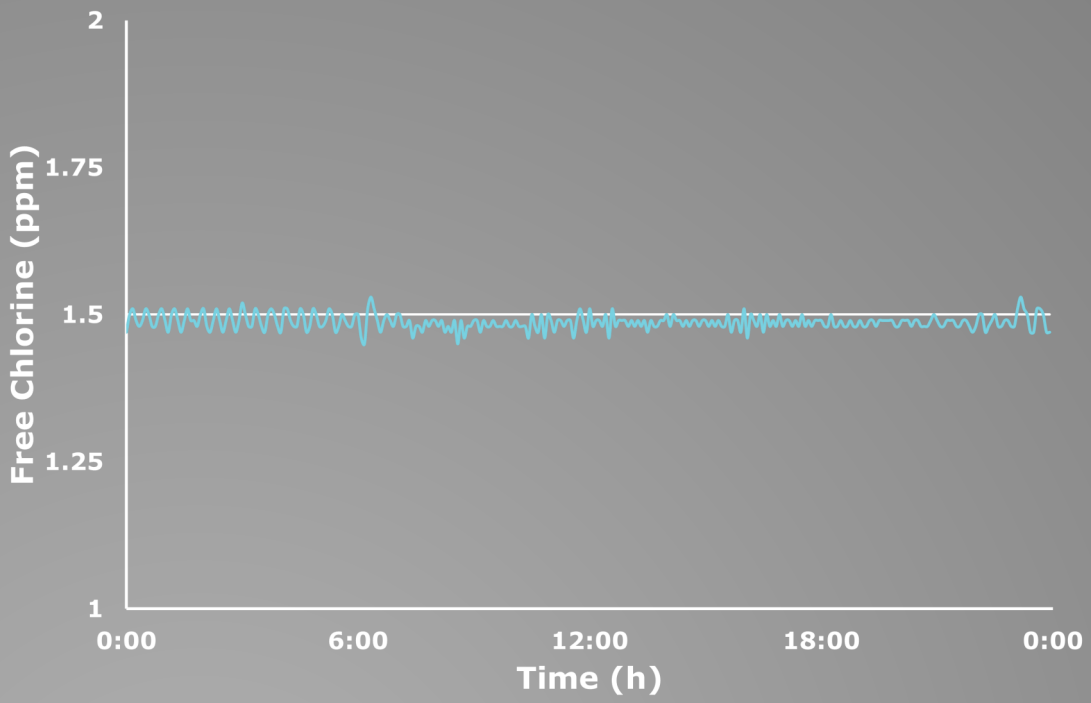

***Figure 5**: AutoPool® 4.0 control of free residual chlorine around the setpoint (1.5 ppm) over a 24-hour period.*

MutoDrive® operates based on thresholds set at different levels of deviation from the desired disinfection setpoint (**Figure 6**). Using these deviation bands, the recirculation rate can be optimised while maintaining the minimum turnover. The dependence of disinfection level on bather load allows for reduced pump speeds during quiet periods as the residual disinfectant level would remain close to the setpoint (Band 1). An upturn in bather load would cause an increased consumption of disinfectant which would be detected by the AutoPool® 4.0.

Depending on the demand, the pump speed would increase up to the maximum speed (Band 4) and then ramp down as the disinfection level returned to setpoint. By applying this intelligent, live response to changes in disinfectant level, energy can be saved during the day while the pool is in use and electricity prices are highest.

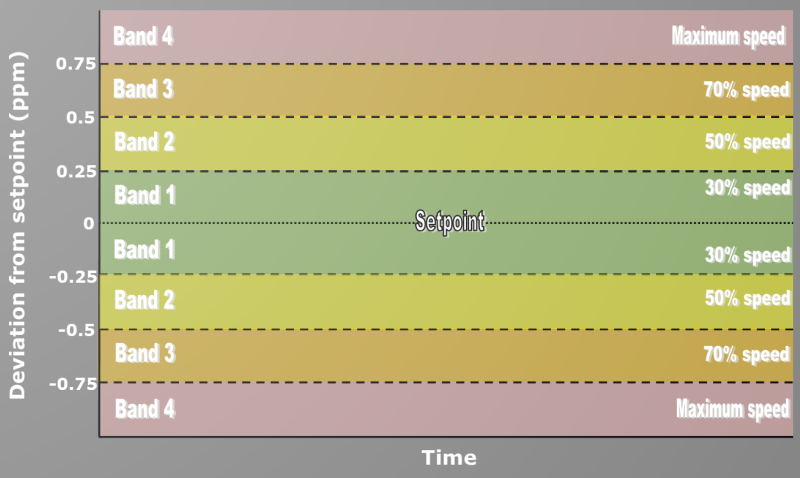

***Figure 6**: MutoDrive® banding percentages based on setpoint deviation.*

MutoDrive® and The Woodland Spa

***Figure 7**: The new Vitality Pool at The Woodland Spa.*

Winner of 'Best UK Hotel Spa' three years running and five times winner of 'Global Spa of the Year', The Woodland Spa is the expertly curated luxury experience offered by the Crow Wood Hotel and Spa resort. With a strong focus on hydrotherapy and hydrothermal experiences, their superior water quality is one of the many reasons why The Woodland Spa has earned and maintained its multi-award winning reputation. The AutoPool® 4.0 with MutoDrive® is The Woodland Spa's online water analysis pool controller of choice to monitor and maintain all eleven bodies of water and ensure safe, efficient and effective operation of each pool.

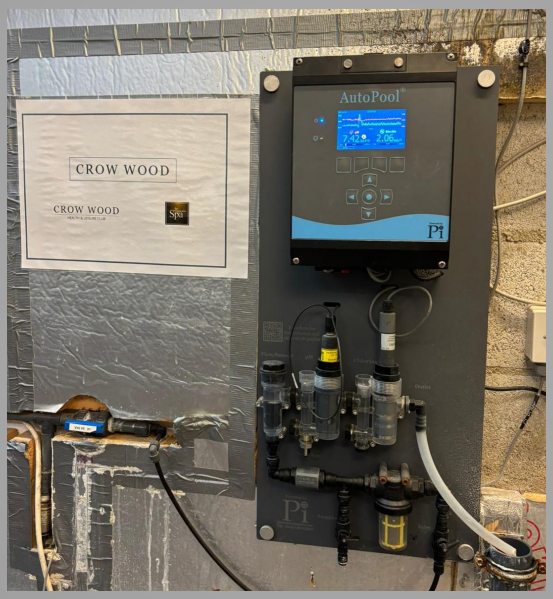

***Figure 8**: The AutoPool® 4.0 Chlorine mounted in the plant rooms at The Woodland Spa.*

Ian Mitchell
Leisure Operations Manager The Woodland Spa

'As multi 'Global Spa of the Year' award winners, we use Pi as market-leaders in their field. We know we are getting the best. We can pick up the phone and trust that any support we need is available. Using Process Instruments means we have a consistency across our pools, and we can rely on their expertise and knowledge when we come across any issues with our pool chemistry.'

Pi collected data from the main leisure pool (360 m^3, 95102 US gallons) at The Woodland Spa over a typical week and calculated the cost to run the recirculation pumps without a VSD (100% at all times), with a standard Day(100%)/Night(80%) VSD and with MutoDrive®. The MutoDrive® bands were set at very conservative user-defined pump speed percentages of 80% (Band 1), 92% (Band 2) and 100% (Bands 3 + 4).

Through utilisation of MutoDrive®, Pi calculated that the spa achieved a 27% reduction in energy usage (kWh) when compared to no VSD control, and a 12% reduction when compared to a Day/Night VSD (**Figure 9**).

	Weekly cost of pump usage (360 m^3, 95,102 US gallons)	**Weekly cost of pump usage (2,500 m^3, 660,430 US gallons)**	**Cost saved compared to no VSD (%)**
With MutoDrive®	£172 $233 €199	£1,193 $1,618 €1,384	27
With Day/ Night VSD	£208 $282 €241	£1,443 $1,956 €1,674	12
No VSD	£235 $319 €273	£1,635 $2,216 €1,897	-

***Figure 9**: Savings in energy cost of pool pump usage achieved utilising MutoDrive® compared to a standard Day/Night VSD and no VSD (data from 2025).*

An overall annual saving of 27% was achieved compared to a system with no VSD, with a Year 1 return on investment (ROI) of 34% and a payback period of nine months. The benefits of MutoDrive® are further highlighted when applied to a standard Olympic-sized pool as the same investment cost equates to an annual saving of £23,037, a Year 1 ROI of 831% and a payback period of 1.3 months. Additionally, by using MutoDrive® alongside the AutoPool® 4.0 controller's accurate disinfectant dosing control, money was also saved on chemical usage through avoidance of overdosing in response to increased bather load.

More effective water filtration is also achieved due to the overall reduced flow rate of the water and therefore the increased efficiency of the filtration system, with a reported improvement in clarity. With some trial and error and small changes to the MutoDrive® control thresholds (Bands), The Woodland Spa would be able to increase energy savings further while still maintaining its award-winning pool water quality.