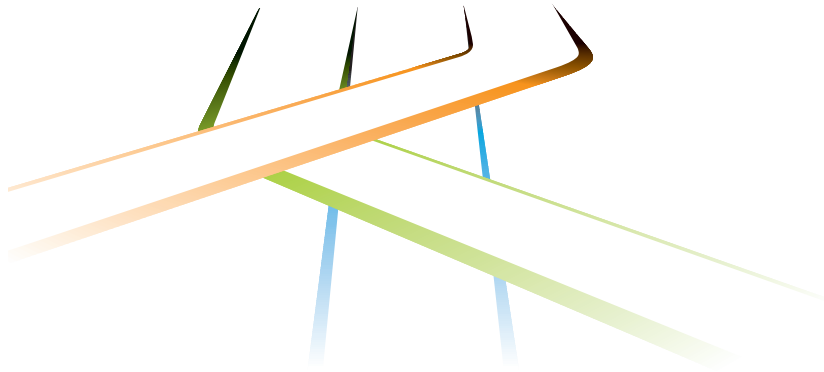




As operators struggle with diminishing water quality and availability, rising energy costs and pressures to increase productivity, a new control system from ITT Flowtronex sets the bar in overcoming these tough market dynamics.

# MCA

## MASTER CONTROL ARCHITECTURE



Water management has certainly changed in the past 30 years. While source water becomes scarce and its quality diminishes, an array of equipment has emerged to treat, monitor and control water supply and usage.

Energy prices are hitting record highs while the VFD (Variable Frequency Drive) has become affordable and commonplace, even for fractional horsepower applications.

Also, hiring more people to meet ever-increasing workloads is in conflict with demands for higher productivity.

Using technology to address these major changes in market dynamics, ITT Flowtronex® offers a new control system, the MCA (Master Control Architecture).



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**FLOWTRONEX®**

# Source Water Quality & Availability Decline as Energy & Labor Costs Rise

WILLIAM HAWKINS, ITT FLOWTRONEX

Despite the decline in quality and availability of source water, operators must ensure an adequate supply that meets certain minimum quality requirements. The intelligent application of technology is the best solution to assist water managers with meeting these daily requirements.

## Precious Water

Today, municipalities require that distribution system operators make maximal use of non-potable water to offset shrinking availability of potable water and golf course superintendents are pushed to simply reduce overall water consumption. Punitive peak demand penalties and drought-tolerant grass are options but there are less costly, technology-driven alternatives.

With centralized access to key data from networked water handling equipment, the Flowtronex MCA control system facilitates water conservation while providing remote monitoring and control of water quality equipment.

Working with irrigation control systems suppliers, the MCA provides superintendents with key data, helping them optimize water usage by tuning the station's usage to detect leaks and improper head calibration. Delivering only as much water as is needed, where it is needed, conserves the precious resource and lowers operating costs.

Leak detection systems, like the Flowtronex APS (Automatic Power Saver), can help a city reduce its water usage simply by reducing pressure on the system. Comparing off-demand flow rates to predicted values over time gives municipal operators an indication of the condition of their piping

system and helps optimize its usage. Technology like APS can also be extremely valuable in the golf irrigation industry, where stress on PVC piping is a major cause of leaks and blowouts.

New technologies targeting water treatment have dramatically reduced operators' historical dependence on only clean, potable source water. Electronically controlled aeration, filtration, UV, ozonation and chemical injection equipment now broaden source water options to include non-potable, effluent or gray water as usable sources. Reverse osmosis and desalination equipment enables operators to draw from the ocean. And because this equipment is electronically controlled, operational data and equipment control is readily available via the MCA.

Given a broadening range of source water and treatment tools, though, operators still need weapons to fight rising energy costs and increasing consumption rates.

## Efficient Energy

Energy costs will continue to pressure operators to improve energy efficiency while reducing associated water management costs. Mandatory compliance with ever more stringent regulations can complicate meeting

customer demand. By adapting to an efficient, networked system operators can mitigate increasing power costs while building for the future.

In the 1980's, the incorporation of the VFD into pump system controls dramatically improved energy-efficient water distribution. VFDs work by changing output frequency to regulate motor speed according to a programmed demand. By operating the pump at the best efficiency point, the VFD reduces overall energy consumption, extends pump life and eliminates the need for a power-wasting pressure control valve. Inrush current at startup is greatly reduced from 600% full load amps to as low as 115%, reducing stresses on the motor and associated switchgear. While pump selection and station usage impacts the potential energy reduction, savings approaching 20% are achievable.

VFD technology also lets station controls operate at variable station discharge pressures. In the late 1990's Flowtronex developed the APS system which modifies the set point based on flow rate using the Hazen-Williams formula to determine the optimum discharge pressure. This lowers the maximum pressure seen on any point in the system thereby reducing leaks by as much as 10%. System size, overall integrity and usage play a large

role in the effectiveness of APS. A system with a large flow variation that primarily operates in the “middle” of the pump curve will benefit the most. True power and water savings are realized, directly by reduced discharge pressure and indirectly by reduced leakage volume.

Efficient station operation reduces power costs. Control systems should operate only the pumps necessary to meet demand and quickly retire pumps that are no longer required while ensuring that pumps are not short-cycled. This is a deceptively difficult controls

problem. Flowtronex SmoothFlow control software, tailored specifically for pump station operation and a key component of the MCA, incorporates decades of turf and municipal application experience to provide reliable, efficient station operation.

SmoothFlow factors in pump capacity, availability and run time to autonomously make intelligent decisions about which pumps to use as flow demand increases and decreases. A large system with several pumps is a good example: SmoothFlow can operate one pump on the VFD while

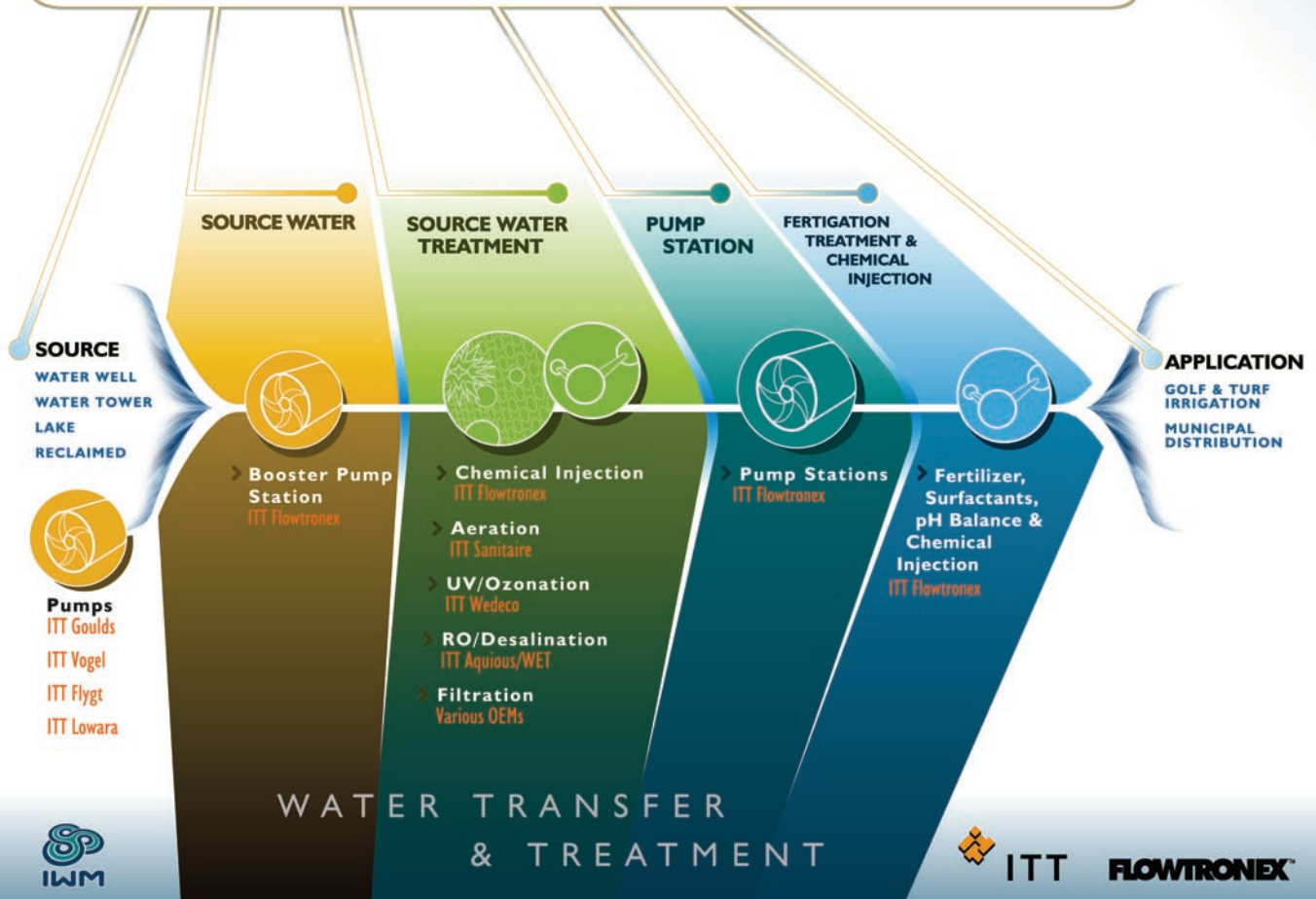
the rest are started across the line with soft starters or by the VFD. As pressure drops and the system brings on additional pumps, SmoothFlow accurately compensates for the increased supply by reducing the output speed of the VFD to “cushion” the start of the additional pump.

Should a large demand suddenly be placed on the system when the irrigation lines are full, the pump station reacts by gradually increasing pressure back to the set point. The PID (Proportional-Integral-Derivative) in a typical control system would ramp

# Integrated Water Management Approach

## The MCA (MASTER CONTROL ARCHITECTURE)

Radio Connected, Internet Empowered, Accessible by Factory Certified Service



too quickly when the pressure is far from the set point, thus using excessive energy, shortening equipment life and possibly damaging the irrigation system.

SmoothFlow uses a modified PID loop that recognizes the large difference in pressure and gently ramps the system back to set point pressure; quickly enough to maintain the performance of the irrigation heads but slow enough to maximize pump life.

Often, peak demand time restrictions are placed on pump stations due to their large power consumption. Programmed lockout times limit station output while still allowing the pumps to run.

During these lockout periods, accidental or unplanned excess usage caused by syringing greens or a broken pipe can be avoided, minimizing the risk of peak demand overage charges. Where an entire billing period is based on a single 15-second measured demand the electric bill can be reduced dramatically.

By recording and reviewing station operation details operators can compare predicted flows to actual flows, determine exactly when and how often pumps are brought online, and make informed adjustments in the irrigation program to avoid peak demand penalties.

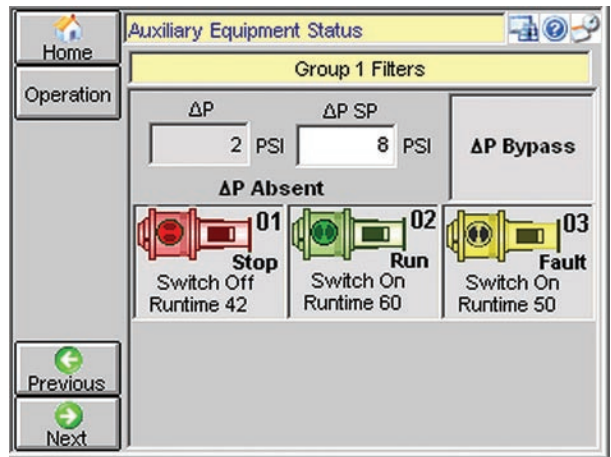
The networked MCA control system provides critical single-point access so operators can address these monitoring and control issues collectively, saving both time and money.

## Productivity & Scalability

The challenge is to improve productivity and minimize labor costs while building an expandable irrigation or distribution system.

Productivity is maximized when labor is applied to high value activities requiring decision making, such as landscaping or equipment repair, while routine tasks like data reporting are left to technology. It's inefficient to send an employee around gathering operational data from field devices that

The MCA facilitates browser-based remote monitoring and control of networked water quality and handling equipment.



could instead be networked directly to the operator for centralized control, monitoring and reporting.

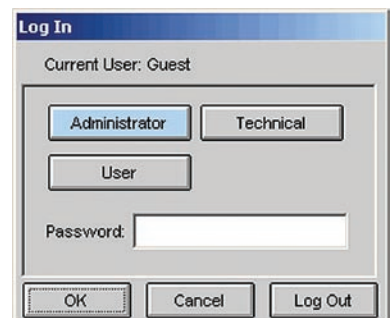
Because budgets, plans and resource allocations often limit near term purchases, equipment bought today must be expandable to accommodate future demands in both irrigation and treatment systems. With scalable software and expandable hardware, the MCA has a flexible initial purchase configuration that allows for future upgrades such as analytical instruments, chemical injection systems, booster pumps or unique needs like municipal supply water tower level monitoring.

The MCA offers many of the basic benefits of a traditional SCADA (Supervisory Control and Data Acquisition) system. But because the MCA is an integrated control system specifically designed to provide these monitoring and control features to municipalities, golf courses and commercial landscape pump system operators, it does so at significantly lower cost as compared to traditional SCADA.

Networking source water and water quality treatment equipment data to the MCA pump station controller via cables or radio signals makes data available to the user at the HMI (Human Machine Interface) or on the Internet. The MCA gathers data from a wide range of equipment that can be logged, graphically displayed to show trends, create reports and generate telephone calls on alarm events.

Sharing the data with the main irrigation controls facilitates automated operational decision-making, thus reducing operator workload. For example, the pH monitoring system can feed data to the main pump station, which can combine this with the current flow rate to produce a controlled output signal to an acid injection pump.

The MCA offers automated pump station supervision via a centralized



Remotely-based server password authentication ensures system security.

server accesses the pump system on a secure Internet connection, polling and logging operational data from the station and all networked devices, 24 hours a day, seven days a week.

If a problem exists, the server automatically alerts the operator, local service technician and the Flowtronex technical support center. Maintenance

logs and fault prediction help avoid surprise system failures and repairs can be scheduled prior to the event when downtime can be accommodated.

Communicating with traditional PLC-based systems often requires proprietary protocols, each different for each manufacturer. Some protocols are more useful in certain circumstances, though, and so have become common standards among manufacturers. Modbus® is an excellent example of a de facto standard protocol used for most municipal PLC and remote telemetry unit (RTU) applications. With the advent of Ethernet and TCP/IP, Modbus® is being replaced by Modbus/TCP®, which allows Internet communications with the PLC and lets the PLC coexist with other network equipment without interfering with business communications such as email.

Like PLCs, HMI devices have improved greatly. Originally only PLC operation parameters could be accessed but HMIs are now equipped with data viewing capabilities, trending, Ethernet communications, web server, email alerts, event logging, alarm enunciation and auto-dialer

Home	Lockout Setup		
Setup	Lockout 0 - 5	Lockout 6 - 11	Lockout 12 - 17
	<b>Lockout 00</b>	<b>Lockout 01</b>	<b>Lockout 02</b>
	Day: Sat Str Time: 6:00 Duration: 8:00 Combo: 1 SP: 120 Speed: 1700	Day: Wed Str Time: 17:00 Duration: 03:00 Combo: 2 SP: 120 Speed: 1700	Day: Wed Str Time: 12:00 Duration: 03:00 Combo: 1 SP: 120 Speed: 1700
	<b>Lockout 03</b>	<b>Lockout 04</b>	<b>Lockout 05</b>
	Day: None Str Time: 0:00 Duration: 00:00 Combo: 0 SP: 0 Speed: 0	Day: None Str Time: 0:00 Duration: 00:00 Combo: 0 SP: 0 Speed: 0	Day: None Str Time: 0:00 Duration: 00:00 Combo: 0 SP: 0 Speed: 0
Previous			
Next			

Using lockout times to programmatically dictate which pumps may run avoids peak demand time penalties.

functions - all functions typical of advanced SCADA applications. With the MCA, a web browser on a high-speed Internet connection give a vacationing operator secure, direct access to the pump station HMI. Multiple secure access levels let users control who can only view data and who can

make changes to the system operation. If personnel changes occur, remotely based server password authentication ensures security.

Flowtronex MCA reporting capabilities relieve the operator from much of the more mundane work. Data exported to spreadsheets become reporting tools to management companies and government agencies or other reports regarding the overall system.

Compared with most municipal applications, golf irrigation systems tend to be "high performance". With required features not normally used elsewhere, these irrigation systems run unattended at night. Should a power outage or supply water problem prevent the system from pumping, it's designed to autonomously correct the problem. Not only does the station restart automatically, gently refill the lines and continue irrigation, the system logs and communicates the event to the irrigation central controller.

Turf grasses extremely sensitive to dry conditions rely on irrigation control programs sophisticated enough to recognize the gap and reschedule irrigation to compensate for the lost time. Since replacing a single golf green can exceed \$150K, this capability is mission-critical.

Packaged systems providers must offer a solution that meets end-user specifications for pressure, flow and features while delivering it on time and at a competitive cost. To this end, manufacturers work from standard master programs and modify each program per job. For highly complex ladder programs this becomes cumbersome with successive versions because, unlike most high-level languages, ladder logic is not a modular language like IEC61131-3.

With IEC61131-3, MCA software uses isolated function blocks that can be modularized so significant modifications can be affected without compromising the integrity of the program. Intellectual property is "hidden" within the proprietary algorithm function blocks while the customized logic can be distributed to system integrators,

maintaining the ability to produce or modify the programs quickly.

This software modularity means that an MCA pumping system feature can be added on-site after the station is installed and operating. A golf course or municipality can purchase a station within their budget today and later add Internet connectivity, reporting features, auxiliary equipment, even VFDs in a scheduled-upgrade approach. The system control architecture includes grow-out for features current and future.

With an MCA system, operators enjoy the unique benefit of being able to integrate features over time as budgets allow or needs change.

## Conclusions

The future of water management centers on the intelligent use of technology to treat, monitor and control source water and its usage.

The integration of modular monitoring and control software, scalable hardware, enhanced communications and Internet connectivity produces energy savings, optimized productivity and superior water management.

As energy and personnel costs continue to climb and water quality and availability drop, the MCA-networked pump station will become central to energy conservation and intelligent water management.

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