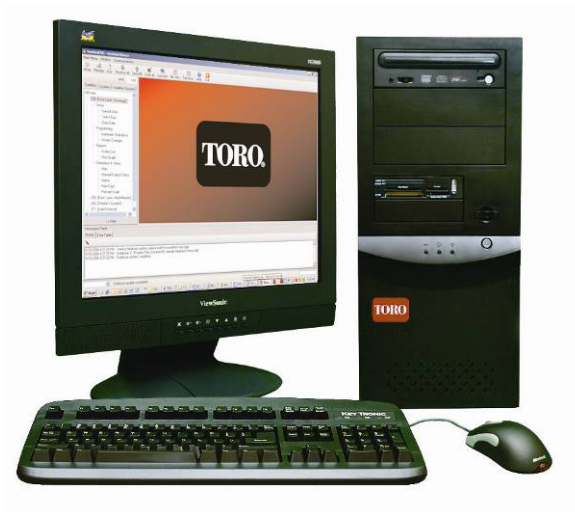




Toro[®] Sentinel[®]

Water Management System



Product Guide & System Overview

October, 2011

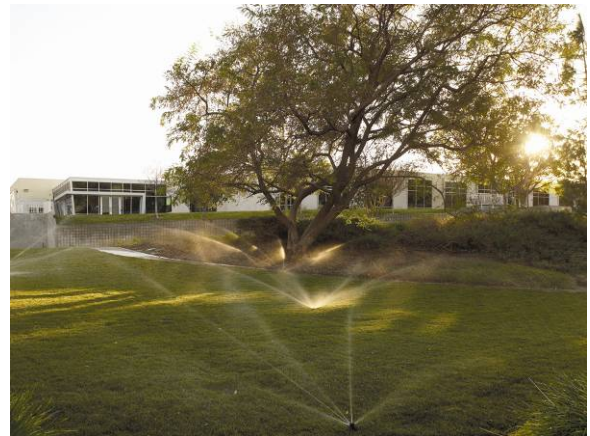
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ARE YOU LEADING BY EXAMPLE?

Water is quickly becoming the next crude oil. Resources are depleting and prices are increasing all over the United States. Competition for water is intense between public use, agriculture, and manufacturing. Who tends to be at the bottom of the food-chain when it comes to water allocation? Usually, landscape and sports field irrigation. Water use for these applications is scrutinized more than most and therefore conservation is paramount. The “status quo” is no longer acceptable, and planning for a more sustainable program to efficiently utilize your water is becoming the norm. The United States Green Building Council has initiated a program to rate projects for their efficient design. This program goes by the acronym LEED and includes a component on water efficiency. Points are awarded based on a 50% reduction of potable water or the non-use of potable water all-together. Many new projects are being designed and constructed to these sustainable requirements.

How do you face this increasing challenge to allocate water resources without compromising the beauty of your landscape or the playability of your sports fields? By designing with high efficiency products manufactured by Toro you can decrease your current water consumption while still maintaining a healthy vibrant campus landscape.



Replacing your existing controllers with ET (Evapo-Transpiration) based control will reduce, in most cases, 25% to 35% of current water use. Monitoring for and automatic isolation of system issues, line breaks, or vandalized sprinklers minimizes associated water loss and damage to landscapes. Optimization of system operation can ensure irrigation occurs in the shortest time possible at the peak efficiency of pumps or source restrictions. By incorporating central control, like Toro's Sentinel® Water Management System (WMS), system operation and performance can be monitored and easily adjusted from a central computer.



The Toro Company has worked with several major institutions around the country to help manage their water resources utilizing Sentinel as well as achieve LEED certification on built projects. Some of these include the University of Notre Dame, the University of Minnesota, Disney's Wide World of Sports, Central Park in New York, and many more. Many of these projects also have or are on track for LEED certification.

If you are facing these same or additional challenges with water management, then contact The Toro Company and we can help analyze your system and needs and determine the most cost effective means for you to start using your water resources more wisely.

Overview - Sentinel Central Control System

The dictionary defines Sentinel [sɛn'tə-nəl] as “a soldier stationed as a guard to challenge all comers and prevent a surprise attack: *to stand sentinel*.” Its roots are found in the Old Latin word “sentina” which means “vigilance.”

Toro defines Sentinel as a product that will watch over your irrigation system and safeguard it against potential problems resulting from excess flow, incorrect programming, varying weather and many other conditions. As a result, the intrinsic value of the landscape is protected, and water waste is minimized or eliminated. The term “Central Control” identifies Sentinel’s ability to watch over a single site or multiple sites in a localized area or across a broad geographic area from one location (computer).

Whether it’s a stand-alone controller or a large centrally based system, the Sentinel product line offers numerous features that address a broad array of customer needs.

Two words... **Reliability & Confidence**

Toro customers expect control products to work continually in harsh environmental conditions and to last for many years. Unrelenting sunlight and heat, followed by cool nights and humidity, lightning ground strikes and other electric surges, constant updating of programs dictated by constant weather changes, ants and or vermin who make enclosures their home, dusty conditions, and temporary power are just some of the conditions that can impact controller operation. Customers want a product they can install and depend upon for reliable performance, not one that must be constantly disassembled and sent in for repair.

Toro’s development focus for the Sentinel Central Control System was to create the most full-featured, easy-to-use, and reliable product possible. A closed-case controller module design provides protection against many environmental variables that might negatively impact functionality, but allows easy troubleshooting in the field. Options for multiple enclosure types and multiple levels of surge protection ensure regional and customer-specific durability needs are met.

We didn’t stop there. We backed this product up with Toro NSN® support to provide your customer with 24/7 telephone support for computer system components or software-related problems. Although competitors may claim to have a similar service, NSN is recognized worldwide as the premier organization for irrigation central control issues. As with other Toro control systems, NSN takes a proactive approach by assembling and configuring the Sentinel central computer and software for maximum performance and reliability in less-than-favorable environments.

Don’t forget about Toro distribution. Toro distributors are recognized wherever they operate as being customer-focused companies with well-trained staff members that are there for their customers. Trained and supported by the best Field Service Managers in the industry, Sentinel distributors must be certified to sell and service this product. Their skills are continually enhanced in service schools that are part of the mandatory curriculum at Toro University.

The Challenge: Effective Water Management

Putting together an efficient irrigation system is no small task. Concerns such as watering precision, broken pipes and mainlines, or dealing with electrical shorts and power outages have been problematic for landscape managers for decades. These along with increased competition for water supplies, scarcity of resources, and recent irrigation mandates have left those in irrigation management roles searching for the most efficient, yet simple, way of combating all of these issues.

The Solution: Sentinel Central Control

The Toro Sentinel System was introduced in 2002 and has established itself in the marketplaces as one of the leaders in wireless communication for central control systems. Sentinel allows the user to communicate to up to 999 satellite controllers wirelessly rather than forcing the customer to install lengthy wire runs that tie field controllers together. Sentinel provides a variety of Central Computer to Satellite communication options, including radio, Ethernet, telephone, cellular, and others, so you can choose the one that best meets your site-specific needs or mix-and-match across multiple sites.

Multiple Site Applications: Sentinel provides the ability to program, control, and monitor multiple remote controllers from one location. Whether controlling one large, contiguous site like a sports complex or housing association, or multiple remote sites like a school district or parks & recreation department, a central control system provides easy, rapid access to the irrigation system from a computer.

System Control: Sentinel allows all irrigation control actions to be carried out easily and efficiently from a central location. Control actions such as adjusting runtimes to changing weather conditions or stopping irrigation in the event of rain or high wind can be automatically accomplished without requiring a technician to visit individual controllers. However, if a technician is on-site and sees a need for programming changes, like shortening runtimes after a grow-in period, true two-way communications allow changes to the program at the field controller on-site and can also be uploaded to the central computer.

Sensor Integration: Sentinel can incorporate many different sensors, including flow sensors, tipping rain cans, wind sensors, freeze sensors, and full weather-stations. These sensors and instruments monitor site and climatic conditions and report to the central computer. Runtime adjustments are automatically made based on these inputs and combined with information on plant material and soil types. Sentinel Satellites can react automatically to readings outside of pre-defined limits set by the system operator, like isolating stations when excessive flow indicates a piping break.

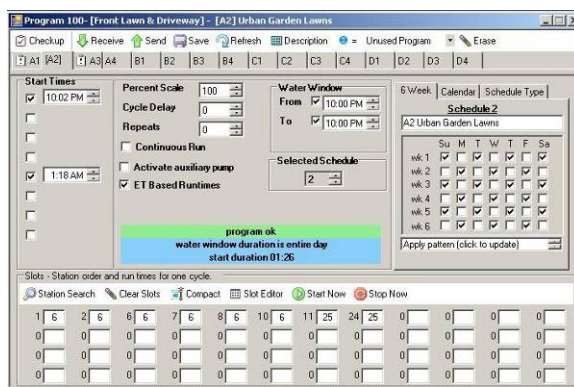
Multiple Communication Options: A Sentinel system consists of a central computer, irrigation controllers, sensors, weather stations, and a communication system that ties it all together. No matter whether the central computer is located onsite or at a remote location, communication options like radio, telephone, cellular, and Ethernet can be mixed and matched to meet system needs.

Software Simplicity

As a Microsoft® Windows-based software, Sentinel is easy-to-use and intuitive, and it's one of the most powerful irrigation control systems ever offered. Information is graphically displayed—so it's easy to see and use. And, all similar functions are grouped together making it simple to find information quickly. Plus, the customer uses only the features they need... Basic features or advanced functionality; the choice is yours.

Sentinel Master Control Panel: Provides easy access to all programming functions—no keystrokes or sequences required, and no need to go searching for functions.

Automatic Operations: Daily operations and scheduling are made quick and easy. All essential programming information is contained in one window so it's easy to understand and manage.



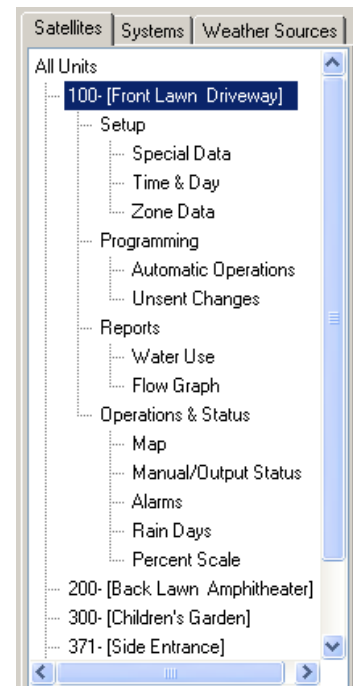
System Navigation – Easy & Full Featured:

Expandable/collapsible navigation tree that puts all the data for individual field controllers one click away. Tabbed Access to what you need to work with:

Satellites (Units): Individual Field Controllers within the Sentinel System. Capable of, up to, 999 individual controllers numbered 001...999.

Systems: Groups of controllers that share operating parameters. Organizing these controllers into Systems enables edits, operational status checks, and reporting (total Water Use) to be performed on multiple satellites simultaneously.

Weather Sources: Weather Sources provide weather-related data to the Sentinel WMS software. This information can be used by the satellites to automatically adjust run times based on ET demand and rainfall activity. Sentinel WMS can also monitor weather parameters and react at preset thresholds. For example, monitoring rainfall to automatically shut down a satellite System when measured rainfall reaches a predefined amount.



Effective Water Management

Water Savings

Use of a weather station, providing effective Evapo-Transpiration (ET) based system management can lead to water savings of 25% to 35% per year. Depending on current management practices, water savings may be greater, or in the case of extremely well managed stand alone systems, somewhat lower. As an additional source of savings, pipeline breaks, malfunctioning valves, and missing heads are automatically detected and shut down, preventing excessive water loss.



Before Optimization



After Optimization

Flow Optimization

Start times of programs can be automatically optimized to maintain system demand at the optimum level; ensuring demand does not exceed preset limits while maximizing efficiency in systems with pumps. Flow optimization also shortens water windows.

And, many more customer-driven features that optimize water management...

- Theoretical (predictive) Flow Graphs
- Set control parameters for each station
- View water usage and compare to historical
- Extensive alarm and reporting capabilities
- Map-based feedback of system operation
- Intuitive visual cues and operator aids

System Flexibility - Making Sentinel Work for You

Communications

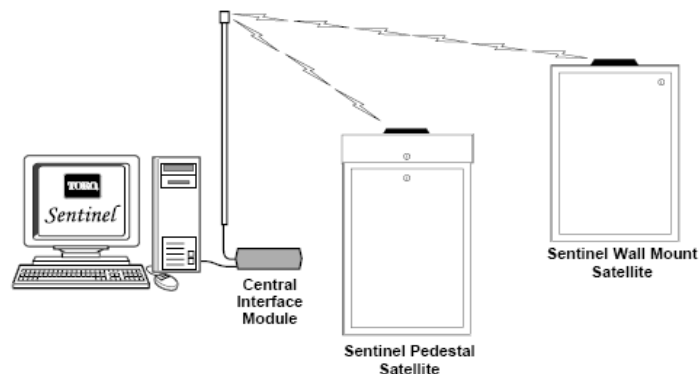
The Toro Sentinel System has established itself in the marketplaces as one of the leaders in wireless communication for central control systems. Sentinel can communicate with up to 999 satellite controllers wirelessly, rather than forcing the customer to install lengthy wire runs that tie field controllers together. Sentinel provides a variety of Central Computer to Satellite communication options, so you can choose the one that best meets your site-specific needs or mix-and-match across multiple sites including:

Radio Communications - Radio communication from the Central Computer to Sentinel Satellites allows you to install Sentinel at sites with little or no disruption of existing landscapes and is ideal for single-site installations. Sentinel can also utilize radio protocols to communicate with MapTo Satellites, maximizing system capabilities.

Telephone Communications - When reliable communication to multiple geographically-remote satellites is needed, standard telephone communications can meet your needs. Installation can be accomplished anywhere a standard telephone line can be run to a Sentinel Satellite. A standard internal or external phone modem is all that is required at the Central Computer, which communicates to a commercial-grade modem in the Sentinel Satellite.

Cellular Communications - When remote-access benefits of telephone communications are needed, but a phone line is not available at the Satellite location, cellular networks provide a wireless communication option. By installing a cellular IP modem in the Sentinel Satellite, the user can communicate wirelessly from anywhere in the world.

Ethernet/Internet Communications - In an increasingly “wired” world, Ethernet/Internet is one of the fastest growing segments of central control communications. The simple combination of an IP address at the computer and an Ethernet adapter in the field can allow for network access and control of your Satellites.



Central → Field Controller Communication Options



Typical Communication Solutions	Advanced Communication Solutions
Narrowband Radio (450-470 MHz)	Cellular Enabled Data Modem (internet to IP Data Modem at Satellite) – U.S. Only
GSM Cellular Modem - Europe	Fiber Optic Modems
Ethernet / Internet	Short Haul (RAD 4-wire) Modems (long distance direct connect)
POTS (Landline Phone Modem)	Hybrid / Combination Communications
Spread Spectrum Radio	
Serial Cable (short distance direct connect)	

Turf Guard® Wireless Soil Monitoring System

Protect your Turf: Toro Turf Guard® Wireless Soil Monitoring System helps you improve your turf health, soil conditions and irrigation efficiency. The Turf Guard sensor accurately measures moisture, temperature and salinity levels of your soil at two depths to let you know what's going on beneath the surface of your sports field. Real-time display allows you to make timely, more-informed adjustments.



Web Access with Toro® NSN Connect

Web-access to your Sentinel Computer from Anywhere

NSN Connect Overview

NSN Connect gives you the ability to access your irrigation controller anywhere - simply and securely! You can access your Sentinel Central (and all your programs, files and e-mail) whether you are at home or on the road. All you need is a web-capable computer or hand-held device and Internet access. No need to learn another piece of software; and there is no charge for the full feature set for current NSN subscribers with a Toro Sentinel Central!

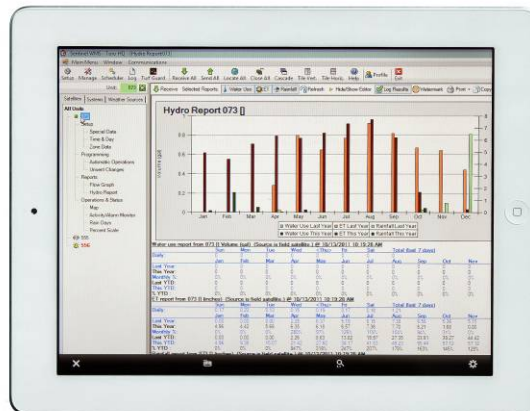


Have secure access to your irrigation computer through a partner that has earned your trust, made your job easier, and been there to make sure you are always up and running - Toro NSN.

System Requirements

To use NSN Connect, your irrigation computer must be running Windows XP or Windows 7, and it must have an “always on” connection to the internet.

You can control your irrigation computer from any Windows XP, Vista, or Windows 7 computer with Internet Explorer 5.0 or greater. Or, if you happen to be on the road, just use your iPhone, iPod touch, iPad, or touch-screen Windows Mobile device to access your irrigation computer.



Controller Options

Sentinel also provides the widest array of standard Satellite configurations in the industry, ensuring system installation meets the requirements of your site. Enclosure options to choose from include powder-coated metal and stainless steel wall mounts, stainless steel pedestal, and plastic pedestal.

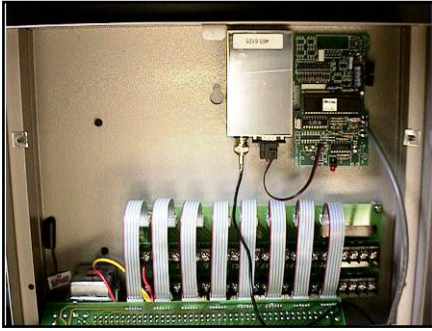


Advanced System Options

Two-Wire System

Sentinel's compatibility with Toro's TDC (Two-Wire Decoder Control) system offers an energy efficient, highly cost-effective way to irrigate large commercial installations. Using a two-wire path to communicate to buried decoders, the TDC system eliminates high costs associated with traditional valve wiring, trenching and trouble-shooting. This proven aerospace technology allows for longer wire runs, smaller-gauge wire sizes and control of up to 200 stations. Simultaneous operation of up to 16 stations, including remote pump and master valves, can take place from up to 2.8 miles away. Simply splice and add another decoder and valve, with no need to run wire back to the controller. With multi-lingual Sentinel WMS software and hardware, you can manage flow, adjust programs, track alarms and review the entire network to spot leaks, breaks or plugged nozzles from any direct connect laptop or over several wireless communication protocols.



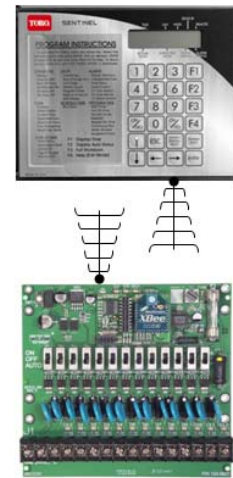


Retrofit Existing Controllers

Water is a precious and finite resource. You have already invested in a controller, but want more flexibility to meet local water conservation requirements without having to finance a complete control product replacement. The Sentinel Retro-Link Kit provides the water conservation features and benefits of a Sentinel Central Control system at a greatly reduced cost. The Sentinel Retro-Link Kit allows an existing Irritrol® MC or MC-E or Dial A/B, Superior Controls Sterling, or Rain Bird® ESP-MC controller to be upgraded to a Sentinel field satellite. Retro-Links are 100% compatible with Sentinel Central Control software.

Wireless Connection to Station Outputs

Need more flexibility or surge protection? Sentinel Wireless Output Boards allow you to remotely mount the station output boards away from the Satellite Control Module and communicate to them using wireless radio communications. 12-station Wireless Output for Sentinel Satellites provide a solution with no cabling between terminals and control module for improved lightning protection and the ability to mount station outputs at a location remote to the control module. Additional capabilities of Wireless Output Boards include sensing of real-time current draw per station, for quick identification of failing solenoids. DC-powered Wireless Output Boards provide a solar-powered option for locations without power like roadway medians.



EICON Special Build

No matter what your central control system requires, from controller enclosures to communications type, Toro's Sentinel® can meet the demand. With EICON Special Build (ESB), if a standard Sentinel controller is unable to do the job, the ESB team can custom-produce exactly what your system needs. ESB has extensive experience in systems utilizing every kind of communications option – just let us know what works for you. Enclosures – not a problem, we understand that every installation is not the same and one enclosure will not fit every situation. Need to retro-fit an existing controller? ESB can help configure the upgrade. Whether it is solar-powered controllers, a non-standard voltage supply, or any other issue, tell us what you need. We'll tell you if it's possible. EICON Special Build is here to build what works for you.

The Sentinel Advantage

Distributed Intelligence

Each field controller in a Sentinel System is a fully intelligent unit. The programming that drives irrigation is resident within each controller, but is also saved within the Central Computer. This provides distinct advantages for users of Sentinel:

- **No loss of irrigation because a computer or a middle manager/master controller fails:** Each Sentinel Controller is responsible for its own irrigation. In other systems, the controller is just a dumb slave to a computer or middle manager telling them when to turn a valve on or off.
- **Redundant Programming:** The controller programming is saved in both the controller and the central computer. If either of those units fails, the programming can be pulled from the other to repopulate (reprogram) the replacement.
- **Two-Way Programming:** Irrigation Programs can either be changed at the central computer and sent to the controller, or changed at the faceplate of the controller and pulled back into the computer.
- **Protection from Unauthorized Changes:** If someone makes an unauthorized change to the irrigation program in a controller, the program can be easily compared to the program saved in the central computer. If the programming in the controller is incorrect, it can be easily changed back to the program stored in the central computer.

Easy-to-Use Software

Sentinel Software is simple to set up and easy-to-use.

- **Microsoft® Windows-Style Navigation:** The layout of Sentinel software looks familiar to anyone who has used Microsoft® Windows. From easy-to-see Main Menu buttons to an expandable/collapsible navigation tree that puts all the data for individual field controllers one click away.
- **All required programming accomplished in three screens:** Water Managers can utilize as many features as they want, or just the basics. All the programming required for automatic irrigation to occur can be accomplished in three screens. And, to make it even easier, all the primary information for an irrigation program is visible in a single screen, including start times, stations & run times, watering day schedule, water windows, etc., etc.
- **Purchase Software Only or Software + Computer:** For reliability, performance, & support, we recommend you purchase a Toro NSN Sentinel Computer. However, if you already have a computer or an IT department that frowns on outside computers, just purchase the software.
- **The Microsoft® .NET (dot-net) Advantage:** Sentinel software is developed using Microsoft's .NET Platform – the latest and greatest for software development. .NET enables developers to do more with less code, meaning fewer mistakes, higher productivity and a better end product. .NET is Microsoft's latest, and leverages many of Microsoft's development insights and accounts for the many computing changes over the last decade. It also has an army of experts and technicians supporting it in the event that our engineers encounter problems.

Flexibility

No Matter what your system requirements are, from controller enclosure design to communications type, Sentinel can meet your need. If the standard Toro Sentinel Controller won't get the job done, our Eicon Special build (ESB) Team will build custom product to meet your needs, for a fee, of course.

- **Communications:** Not only has Sentinel been at the forefront of narrowband radio technology as an irrigation control and data transmission method, but we also have extensive experience in systems utilizing Ethernet, Internet, Spread Spectrum Radio, Cellular Phone, Landline Phone, Fiber Optics, Radio Repeaters, or a combination of the above. So, if narrowband radios don't work, tell us what will.
- **Enclosures:** Every installation is not the same and one enclosure does not work in every situation. Toro offers four standard enclosures to meet your needs, including Stainless Steel Wall Mount and Pedestal Controllers, Green plastic Pedestal Controllers, and Small Metal wall mount Controllers in 12-, 24-, 36-, and 48-station models. But, if you prefer sandstone-colored plastic, because your landscape is in a semi-Arid environment where green plastic just does not work, or painted metal enclosures, or enclosures with 96 stations, instead of just 48, let us know.
- **Other:** Whether it is solar-powered controllers, a non-standard voltage supply, or other issues you need solved, tell us what you need. We'll tell you if it's possible.

World Class Support

Every Sentinel System sold is backed by the world-class support of Toro NSN® (National Support Network). Whether you have an operational issue that requires quick remedy, you need advice on water conservation and time-saving techniques, or you need education and training for operators and field technicians, Toro NSN is always there for you.

- **24-hour, 365-day support:** Worldwide, Toro NSN is always available to answer your questions, troubleshoot your system and solve your problems. And if needed, our 24-hour central component replacement service ensures minimal disruption to the operation of your irrigation system (U.S.).
- **Web Access to your Sentinel Computer from anywhere:** NSN Connect offers access your Sentinel Central (and all your programs, files and e-mail) whether you are at home or on the road. All you need is a web-capable computer or hand-held device and Internet access.
- **The confidence of working with the best in the business:** Toro NSN is a Microsoft® Certified Partner. Our support technicians are licensed irrigators, and our hardware technicians are A+ certified. NSN has a diagnostic lab on-site for each irrigation platform, all field hardware, plus ancillary products. The lab is used to duplicate field issues and investigate causes and solutions as part of Toro's commitment to continuous improvement. NSN is dedicated to irrigation—we know your business and expectations.
- **Total operational confidence:** If your central hardware goes down, our TORO central control component replacements arrive at your facility Toro-tested, ready to keep you up and running.

End User Benefits

Customers want this product to work across a wide variety of applications, like temporary power, dusty and hot conditions, and where lightning or electrical surges are commonplace. They don't want to know their field representative on a first-name basis. They want the product to do its job—to watch their irrigation system and safeguard against potential problems over a long period of time. They want all this for a competitive price.

Perhaps they want to start out slowly with maybe just a few stand-alone units. Then maybe someday, they'll want add a central computer. They want to see the benefits of reducing their liability with sensors that work and report field changes. They want something their landscape crews will use, not abuse. It has to be simple yet powerful and it has to change as their needs change. Most of all, it has to be reliable.

Sentinel feature sets allow the customer to expand the product, as their needs change. It offers sensor and hand-held capability as standard features, not the costly add-ons found with competitive products. The user-friendly interface doesn't require a Ph.D. to operate or make changes. Its five-year track record and long list of satisfied customers are testament to its reliability to withstand the rigors of day-to-day operation.

Look at what some of our customers have to say....

"Installing the Sentinel is one of the best things we ever did here. It gives us total control of the amount of water being put down."

Will Schnell, Turf Superintendent, The Rose Bowl

"I tell people it's just a great system. It'll do everything they ever wanted it to do, and more."

Rick Schultz, Highlands Ranch

Who's there to help the customer, if and when it's needed? All control products come with a five-year warranty from the date of installation. For central computer users, two years of NSN offers technical computer hardware and software support as a standard feature. In addition, NSN offers end-users additional coverage in one-, three-, and five-year increments. A toll-free number is available to customers seven days a week, 24 hours a day, with a real-live person to assist them through their product-related questions.

These are the tangibles that the customer can see, but what about those that they can't? What about upgrading with new features? The Sentinel uses flash memory as part of its brain. This enables it to be upgraded from a laptop or via the central computer during non-operational periods with a few keystrokes. If customers are worried about liability from broken sprinklers or irrigating during freezing conditions, Sentinel's sensor capability is a standard feature, allowing the customer to design from the start or add on later with no additional hardware for the control product. Then, there's the hand-held radio feature. The hand-held allows many functions such as mainline repairs to be conducted by one person so that landscape resources, vehicles and personnel can be allocated and prioritized to maintain the value of a property.

Customer Success Stories

Gaylord Texan

Toro Sentinel System: Impressive Control for an Impressive Hotel

It is often said that “everything is bigger in Texas.” If the Gaylord Texan Resort is any indication, this may well be true.

Located between Dallas and Ft. Worth, the spectacular Gaylord Texan opened in April 2004, and immediately generated lots of excitement—partly because everything about it is so big.

With over 1,500 guest rooms and suites, the hotel itself encompasses 23.5 million square feet, (2,2 million square meters) highlighted by a magnificent atrium featuring 4.5 acres (1,8 hectares) of lush indoor garden under glass.



The Gaylord Texan Resort spreads over 150 acres (61 hectares) in Grapevine, Texas, near Dallas.

The exterior of the hotel is equally impressive. The property takes in 150 acres (61 hectares), most of which were beautifully landscaped with shrubs, trees, manicured lawns and more than 25,000 units of blooming color.

It's all big...and so is the responsibility to keep it looking perfect.

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It's all big...and so is the responsibility to keep it looking perfect.

“We have 38,000 sprinkler heads on the site, and 14 different satellites,” says Ann Maner, exterior grounds supervisor for the Gaylord Texan. “We had to find a company with the technology to run all of those, and that’s why we had Toro install the Sentinel system.”

For two years before the hotel’s opening, Toro engineers and technicians were on-site at the

Gaylord to carefully implement the Sentinel system and its components, including a big drip irrigation network inside the atrium.

“The Sentinel runs it all,” says Maner, “and it’s just been a great system to work with.”

Customized Flexibility

Given the size of the Gaylord’s property, the variety of vegetation and the high expectations of quality, Maner and her staff have complex demands with little margin for error. “Since this is a resort and convention center, it has to look pristine at all times,” she explains, “but you have to be able to work around things. In nice weather, you have guests who want to walk and jog and get out, so they can’t get sprayed. With the Sentinel system, if I need to water specific parts of the hotel at 2, 3 or 4 in morning, I can pick just those areas to water at those times.”

This example is only one aspect of the Sentinel’s flexibility that appeals to Maner and the hotel.

“The system has so much flexibility,” she continues. “I can go into different controllers and different zones and program all of our blooming color to run every other day for a 10- or 15 minute soak cycle, and then come back in another two hours later and water for 10 minutes. I can have the shrubs go one time a week, or three times a week, or three times a day, if I need to. Our 14 different controllers run over 400 different zones, and we can program those to run 16 or 17 different types of customized schedules at all different times of day or night, weekends or evenings. We can program just about anything you can think of with it.”



Toro Sentinel Field Controller

This level of flexibility is a big factor with an operation as varied as the Gaylord’s, and so is the Sentinel’s reliability. “Once you learn the system and get it up and running, it’s basically worry-free,” she says. “You know that on certain days the zones are going to run, and you don’t have to guess. I can set six weeks of programs and clusters, and send that all out at one time to these different units, and they will all be synchronized. Then it all runs. The convenience and dependability are just wonderful.”

Remote Capabilities add Control

The Sentinel system also features hand-held radio controls— complete with two-way voice communication—that enable the user to run programs in the field, or make changes and upload them to the central computer. “I walk every inch of the property, 10 - 15 miles (16 – 24 km) a day on average, and the hand-held radio is a life saver for me,” Maner says. “I can walk up to any particular zone we have and turn on all the heads, adjust heads or locate any that have been broken by traffic or damage. We’ve had groups that set up tents, and they hammer stakes in the ground that sometimes go right through the irrigation. So I’ll flag places where I see a problem, and we’ll make those necessary repairs.”

The remote-control capabilities of the Sentinel even go beyond the hand-held radio.

“You can run it off of a laptop computer,” Maner adds. “I could be in the Bahamas, plug into the Internet and pull it up. I can make sure everything is running, or correct issues or send out reprogramming features—the whole nine yards.”

Toro® Sentinel® Water Management System

The Gaylord's Toro Sentinel also controls the drip irrigation in the hotel's atrium, which has over 700 varieties of plants in 24 different zones, as well as an outdoor vineyard. Another aspect of the system that Maner likes is that the Sentinel system helps to conserve water.

"We have to think about the amounts we use, and not have runoff water," she adds. "The Sentinel lets you add a weather station with sensors all over your property that automatically communicate to the central controller. They'll tell you if an area is too moist, so instead of putting out, say, 1,700 gallons (6,5 cubic meters) of water, it might only need 700 (2,6)."

The Gaylord Texan Hotel is truly a special place, and Toro is glad it uses a special control system to irrigate it efficiently.

"You can really customize it, and that's one of the things that makes it such a great system," Maner concludes. "Working with it has been a good experience all around."



The atrium of the Gaylord Texan Resort uses a Toro drip irrigation system to maintain the lush garden.

University of Minnesota **Minneapolis, Minnesota, USA**

The University of Minnesota was founded in 1851, seven years before Minnesota became a state. Now one of the nation's largest public research universities, its Twin Cities campuses in Minneapolis and St. Paul are larger than many cities. These campuses host over 17,000 employees and more than 50,000 students in 265 buildings set on 1,233 surface acres – and, the Mississippi River runs through the Minneapolis campus.

Over a two-year period, the University's complex, multi-campus irrigation system was upgraded with new Toro valves and sprinklers and Sentinel® Central Control, which utilizes the university's Intranet for communication with field controllers. Gardener Becky Schmidt is in charge of the 100 campus Sentinel controllers. She and Landcare Supervisor Doug Lauer say it is delivering an ever-expanding range of benefits.

"It's phenomenal. Amazing," Lauer said. "Within minutes you can make major adjustments to run times and frequencies... We've seen huge increases in terms of efficiencies and effectiveness. It's a night-and-day difference."

Schmidt cited Sentinel's ability to broadcast rain delay mode as one of its many efficiencies. "Being able to make a change to all 100 controllers by typing in one thing rather than visiting them all, that's great," she said. "It used to be if you wanted to go on rain delay, it was a person's full-time job for the entire day."

They praised Sentinel's flow sensor function for alerting them promptly to flow interruptions due to vandalism or damage by a construction crew. Sentinel also makes it easy for Schmidt to adjust schedules to accommodate on-campus events or specific watering needs such as new plantings or new sod.



"It has given us great control, and we really know a lot more about our water usage, breakdowns and everything going on with our system," said Schmidt. "I can't say enough good things about the central control system. I'm really glad we've got it."

Any of the Landcare Maintenance Department's 20-plus gardeners can e-mail programming requests to Schmidt, who makes the changes using Sentinel and notes when to revert to previous schedules. "Everything funnels through me by e-mail, so it's very centralized now," she said. "Everyone has the ability to give their input, but I'm the only person making changes."

Lauer said the Sentinel Central Control also makes it easy for the staff to use Toro handheld remotes. "You don't have to go to the clock with a box and plug it into the system and do one system at a time," he said. "You grab a remote, punch in the codes, hit send and the

system runs – just like that – and that’s phenomenal. That is worth its weight in gold, so I hardly ever let this remote out of my sight. It stays within arm’s reach of me.”

Each campus has its own weather station and the landcare staff is gradually expanding the use of ET-based programming for the most efficient and automatic watering. “That’s where the Sentinel system will really shine, when you have that ET value and the computer automatically adjusts watering based on temperature, humidity, wind – pulling all the data together,” said Lauer.

“Our goal is to be the best stewards we can be in terms of water usage and using the amount of water that we really need, but not overusing it,” Lauer said. “We want to have water in the root zone at the time when it’s needed to keep the turf as healthy as can be, and this Sentinel controller running off ET is the best system we’ve seen so far.”

Highlands Ranch, Colorado, USA

34 Square Miles of Irrigation: More Control, Less Water

How often have you heard or used the expression, “In a perfect world...”? Well, just 12 miles south of Denver, one community has been taking exciting steps to create the perfect place in which to live.

Highlands Ranch, Colorado, is a 22,000-acre “master planned community”—a residential area specifically conceived and developed to provide an exceptional quality of life. Highlands Ranch features new neighborhoods of beautiful homes and apartments within an outstanding school district, and it offers an unprecedented range of green spaces and facilities that cater to its residents’ active lifestyles: parks, ball fields, playgrounds, hiking/biking trails and much more.

Highlands Ranch has received national recognition for its great quality of life and amenities. It was recognized nationally by *Forbes* as one of the top places to move in the nation. In 2010, *Business Week* also named Highlands Ranch one of the best places to raise kids.

“Our residents literally do everything here,” says Rick Schultz, “tennis, football, baseball, softball, soccer, lacrosse and even rugby.” Schultz is Operations Administrator of the Metro Districts of Highlands Ranch Parks, Recreation and Open Space. “We have 19 parks right now, with a total of 25 planned,” Schultz explains, “so we have a few more to be built. It’s really quite large.”



Relying on Toro

From the earliest days of the Highlands Ranch planned community, the developers anticipated the need for a good integrated irrigation system. However, their original central control system was hard-wired, which posed problems. Bob Claiborne, Parkways Supervisor for the Metro Districts, made the decision to go with a radio control system.

“We had literally miles of wires running from our shop where the computer was located out to these controllers at different points in the field,” recalls Schultz. “You can imagine

the problems we had. Our community was growing rapidly with a tremendous amount of new construction work coming in—pipelines, water lines, phone lines, electric lines—so our wires were constantly being dug up and broken. Because of that, the irrigation system never worked the way it was intended to. Finally we said ‘let’s go with radio control’ and Toro came in and made it work.”

Since the early ‘90s, Highlands Ranch has depended on the Toro Sentinel™ System, an advanced central-control system that provides a range of modular options for unparalleled flexibility. Using hand-held radios and field satellites, the Sentinel system allows true two-way communication, so changes in the field can be uploaded to the central computer.

In the stand-alone mode, users are able to program MapTo-Assembly satellites within radio reception to manually turn stations on/off, initiate a program or even perform complete shutdown. The Sentinel system at Highlands Ranch now commands a network of some 160 Field Satellite controllers throughout the community.

“The savings in time and manpower alone are just incredible,” says Schultz. “With the remote programming capability, you can easily respond to changing weather conditions to increase or decrease the amount of water applied. Think of the labor it would take to drive around and adjust and readjust those 160 controllers if we weren’t on a central control system. The radio remote is an amazing tool,” he adds. “And from a maintenance standpoint, now one technician with a radio can do the same work that two technicians out there used to do.”

Since the irrigation system at Highlands Ranch covers several miles, they use 25-watt radios and repeaters to increase their radio communications’ range. The standard Sentinel system comes with a 2-watt radio, which has a range of three to five miles depending on topography, population density or manmade structures that can deflect radio signals.



Saving Water

Being able to adjust irrigation controllers so quickly and conveniently naturally pays big dividends in water conservation and cost-savings.

“The system has really helped us decrease the amount of water we use,” Schultz explains. “Colorado has been in a fairly significant drought for the last three to five years, and the Sentinel system has allowed us to respond and to apply the most appropriate amounts of water. Even though we’ve continued to grow here, and we’ve gotten bigger and bigger over the last five years, we’ve actually decreased our irrigation.”

The Toro Sentinel could be called a “smart” system, because it’s designed to help you make critical decisions about your water applications. Special Toro software links the control system directly to an onsite weather station, and it automatically polls the weather station to provide daily updates on rain values and ET (evapotranspiration) values for that day. Optionally, this ET value can be automatically downloaded to the field satellites at a user-designated time.

“We’ve really come to like that,” Schultz says. “The most useful weather information for us are the rain and ET values. We use those values to adjust the system to prevailing weather conditions. And now we don’t have to monitor it, because the Sentinel software monitors it for us every day and sends it to us in an e-mail.”

Additionally, depending on geography, soil type, plant material, etc., each zone can be set to automatically use a little more or a little less water than indicated by the actual ET value. This allows for the maximum in water savings, while still ensuring that all areas get exactly the amount of water they need.

Covering All The Bases

Obviously, Highlands Ranch presents many special challenges simply in its size and complexity. Having the Toro Sentinel is making a dramatic difference in how Schultz and his staff address the many irrigation issues they face.

“As far as the total number of units and the total area served, I can certainly say we’re one of the largest users,” Schultz adds. Highlands Ranch was also one of the earliest users of the Sentinel system, and the input of Claiborne and Schultz over the years has been extremely valuable in helping make improvements to the system.

“We can look at several of the features, and several things this system does, and point to it and say, ‘They have that because of us,’” says Schultz. “We didn’t necessarily help develop it, but we were a driving force, and it shows they really listen to their customers.”

Because the Toro Sentinel central control system provides significant savings in labor, water, time and trouble, contractors are using it in a variety of larger installations including sports complexes, parks, school districts, airports and corporate campuses.

“I tell people it’s just a great system,” Schultz sums up. “It’ll do everything they ever wanted it to do, and more.”

Rose Bowl, Pasadena, CA

A Classic Venue with a Contemporary Upgrade.

When it comes to famous sites for athletics, one of the most well-known is the Rose Bowl in Pasadena, California. Since the first football game played there in 1902, the storied Rose Bowl has hosted thousands of sporting events, from high school to college to the pros, including five Super Bowls.

Literally billions of people around the world have seen the Rose Bowl's field on one occasion or another, so is there added pressure to keep such a high-profile venue looking its best?

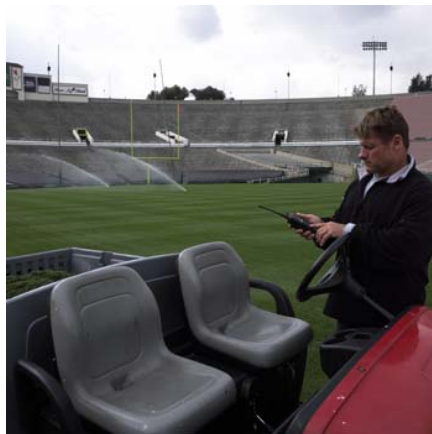
"Our expectations here are higher," explains Will Schnell, Turf Superintendent of the Rose Bowl. "We want the best surface in the country, and we want it perfect all the time— like a pool table. Even if we're not on national TV that day, if it's just a Little League game, you always want the surface to be perfect."

Given such high standards, Toro was very honored when the Rose Bowl chose a Toro Sentinel irrigation control system.

The Sentinel is a "smart" system that delivers the ultimate flexibility and performance. With a range of modular components including hand-held radios and satellites, Sentinel allows changes in the field to be uploaded to the central computer.

"It's one of the best things we ever did here," Schnell says enthusiastically. "It gives us total control of the amount of water being put down, and we can keep exact records of it.

With that remote control, you'll be out riding on a mower, and if you see a hot spot, you can just turn it on.



Things weren't always so rosy before the Sentinel. The facility's previous irrigation system was badly outdated, and required much more work and attention.

"We got a call from the Rose Bowl one day, and when we got there, we found a 20-year-old controller," recalls Don Ghella, Toro's Central Control Manager. "And it was all hand valves, so every day they had to send people out to turn hundreds of valves on and off by hand." Toro then installed a new Sentinel control system. "We were done in three hours," Ghella says about the installation, "and then because of its simplicity, they were able to operate the controller immediately."

"Even a person who has no computer background can be taught with this," adds Schnell. "It's pretty self-explanatory."

Today the Rose Bowl actually operates on two Sentinel controllers, one on each side of the stadium. In addition to the playing field, Sentinel controls the irrigation for the Rose Bowl's beautiful exterior landscaping and vegetation—even running its famous neon sign over the main gate.

"It's been a tremendous asset to the whole facility," Schnell adds, "and I'm still learning what the system can do."



Calvin College

Grand Rapids, Michigan, USA

Overview

Founded in 1876, Calvin College in Grand Rapids, Michigan, is one of the largest Christian colleges in North America. Its 411-acre main campus includes irrigation of 120 acres of turf, flowers, shrubs, trees and athletic fields. The campus grounds' appearance is important to the administration, faculty, staff and students, and in the early 2000s, the administration agreed an irrigation system upgrade would be beneficial.

Challenges

In 2000, the college irrigation system used 58 separate controllers to irrigate its 140 acres and the grounds crew spent a great deal of time traveling between controllers and troubleshooting issues. Supervisor of Landscape Operations Geoff Van Berkel said, "[we] looked at how big and awkward our system had gotten," and knew we needed a different way of doing things.

The Solution

Van Berkel researched new irrigation control systems; he consulted with Spartan Distributors Inc. (SDI), the local Toro distributor. SDI evaluated the school's existing irrigation system as well as the size, diverse makeup and varied soil types of the campus. SDI recommended an irrigation approach utilizing the Toro Sentinel® Central Control System. It would be the first Sentinel system used in Michigan, and the SDI team felt it would provide the most efficient management of the college's complex and growing irrigation needs.

The project's irrigation contractor, Kenowa Companies, installed the new control system according to the SDI recommendations for integrating the Sentinel system into the existing irrigation. The use of innovative, efficient irrigation solutions reflects SDI's long-time commitment to green industry in Michigan.

SDI worked with Van Berkel and Kenowa Companies to ensure the upgraded system met the college's needs, and the Kenowa team enhanced the project's value with cost-efficient installation. SDI's Bruce Funnell met periodically with Van Berkel on-campus to review project progress, and the college's grounds crew attended SDI classes to become familiar with the Sentinel system.

The Toro Sentinel system's central control functions at the college have expanded steadily. In 2003, the irrigation system consisted of 171 Sentinel-controlled zones and well over 100 non-Sentinel zones. Over the next five years, the college upgraded or installed 300 Sentinel-controlled zones in the system. Today, the Calvin College irrigation system is comprised of 470

Sentinel-controlled zones in 13 locations, and the expansion continues as 81 more zones are being put under the Sentinel system's central control. This irrigation system expansion has been possible because of the Sentinel system's simplicity and versatility.



Results

Van Berkel uses the Sentinel's reporting capability to monitor operations and troubleshoot any issues at the irrigation system's numerous off-site locations. By using his laptop instead of driving to these sites to manually inspect each zone, labor costs are greatly reduced. "[Calvin College] has so many remote locations now, I need to know that last night it did exactly what it was supposed to do," Van Berkel said.

One example of the Sentinel system's versatility is the college-owned Glen Oaks Apartments complex, which is more than a mile off-campus. The apartment property required irrigation control, but it was not feasible to install a complete satellite controller onsite, nor to run valve wires from the nearest controller. To solve this challenge, SDI configured Michigan's first EICON 12-station Wireless Output Radio Module to run the valves locally, but control them wirelessly from the nearest Sentinel controller. Thus, the Glen Oaks site operates using the functionality of the Sentinel system, and without the cost of a complete controller or the extensive wire runs.

The Toro Sentinel system has provided Calvin College with expandability, versatility and impressive irrigation efficiency. For the past four years, Van Berkel has used the Sentinel system to track college water usage for annual reports to the Michigan Department of Environmental Quality while also utilizing the data to effectively monitor system performance.

As with any college, irrigation at Calvin College needs to occur with minimal disruption of student activities. Six wells are utilized throughout the system, and Sentinel helps optimize the use of these sources to ensure irrigation gets completed within a narrow watering window. Irrigation efficiency is optimized in great part because of the Sentinel system's ability to adjust settings using the ET-based program and the college's weather station software. Once the run time for each zone is adjusted daily, Sentinel's automated scheduler manages start times to maximize utilization of pump capacity and efficiency and thereby minimize the time it takes for all irrigation to complete. Using this technology, Sentinel can help the college save water by irrigation based on evaporation, rainfall and other factors, while still accommodating narrow watering windows.

Along with water savings, the college saves on the labor that would be required to manually calculate and adjust the programming daily. The college saves water and the staff is free for other projects rather than manually analyzing weather and ET factors and adjusting irrigation programming. As a result, Calvin College is enjoying efficient irrigation that saves water and expenses while nurturing healthy, appealing landscapes that enhance the school's image.

Worldwide Customer References

Proven Worldwide in municipalities, hotels & resorts, professional sports complexes, airports, parks and recreation facilities, hospitals, universities, military bases, corporate headquarters, and many other locations, like:

- Disney's Wide World of Sports, Orlando, FL, USA
- Minnesota State Capitol, St. Paul, MN, USA
- Palace of Versailles, Versailles, France
- Olympic Forestry Park, Beijing, China
- University of Notre Dame, South Bend, IN, USA
- Central Park, New York, NY, USA
- V.A. Cemetery, Suffolk, VA, USA
- State Farm Insurance, Charlottesville, VA, USA
- Frederik Meijer Gardens, Grand Rapids, MI, USA
- City of Amarillo, Amarillo, TX, USA
- University of Alberta, Alberta, Canada
- University of Phoenix Stadium, Phoenix, AZ, USA
- Australian Institute of Sports (AIS), Canberra, Australia
- City of Florence, Italy
- Navarinio Hotel, Greece
- Port Ghalib Resort, Red Sea, Egypt
- Aspire Stadium, Doha, Qatar
- Crowne Plaza Hotel, Abu Dhabi, UAE
- Riyadh Municipality, KSA
- City of Saskatoon, Canada
- Shanghai World Expo, Shanghai, China
- Seattle Seahawks Practice Facility, Renton, Washington
- Quantico Military Base, Quantico, Virginia, USA
- University of North Carolina, Winston Salem, NC, USA
- General Mills Headquarters, Minneapolis, MN
- U.S. National Zoo, Washington D.C., USA
- Richmond International Airport, Richmond, VA, USA

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