Future Trends

Toro Golf Irrigation Products

COURSE CONDITIONS, WHAT MATTERS MOST?

Correct irrigation application will enable optimum playability of the course

OVER WATERING – causes turf health issues requiring time & resource to resolve
Daily over watering wastes water and power

UNDER WATERING – increases turf stress

Both must be avoided to prevent a detrimental impact on playability

Future Trends – Golf Irrigation

- **Course Playability - Efficiency & precision**
- Modern Design Approach
- Installation Supervision & Maintenance
- System Architecture
- Manufacturer Innovations & developments


TORO
COURSE PLAYABILITY - EFFICIENCY & PRECISION

Efficiency & Precision

Delivering optimum course conditions requires the correct water application to the turf, not too much, not too little

Correct water application has a direct bearing on course conditions & playability

- **Overwatering**
  - Causes health issues requiring time & recourses to resolve
  - Increased costs: fertilizers, treatments, wasted water & power usage
- **Underwatering**
  - Increases turf stress in dry conditions – compounded with increased play & footfall with course usage

What determines sprinkler run time?

When it comes to scheduling the correct amount of irrigation, the following factors define how long the sprinkler heads will need to run:

- **Required amount or Application rate (mm)**
  - Evapotranspiration – rate that water is removed from the land to atmosphere
  - Site knowledge, soil type, turf treatments – fertilizer etc.
- **Sprinkler Head Spacing & operating arc setting**
  - Sprinklers will be spaced square, triangular or in line and will have varying arcs of operation
- **Sprinkler Nozzles & Stators**
  - Nozzles are selected according to sprinkler spacing, stators control the flow of water through the sprinkler & speed of rotation
- **Pressure Regulation**
  - Correct sprinkler performance is dependent on delivering optimum operating pressure, and this will be dictated by nozzle and spacing

Industry Innovation

- Manufacturers are leading the way with innovations that will help turf managers do more with less
  - Modern controls offer high speed field communications which deliver 2-way diagnostics and 1+/- second run times
  - Modern part circle sprinklers will complete the end of arc watering with minimum dwell [time to change direction]
  - Performance nozzles ensure consistent water distribution & uniformity

Manufacturer Development & Innovation

- Innovation & technology have brought significant gains in accurate and efficient sports turf irrigation in recent years
- It is vital that irrigation systems are properly designed, installed, maintained and routinely audited to ensure performance is as expected
- Budget constraints will put pressure on designs, but changes in specification will have a lasting impact on the playability and appeal of the golf course
- Watering programs should reflect actual course needs and systems need to operate at the correct pressure, sprinkler arcs need to be accurately defined, and the correct nozzles need to be selected if water is to applied without waste

Future Trends – Golf Irrigation

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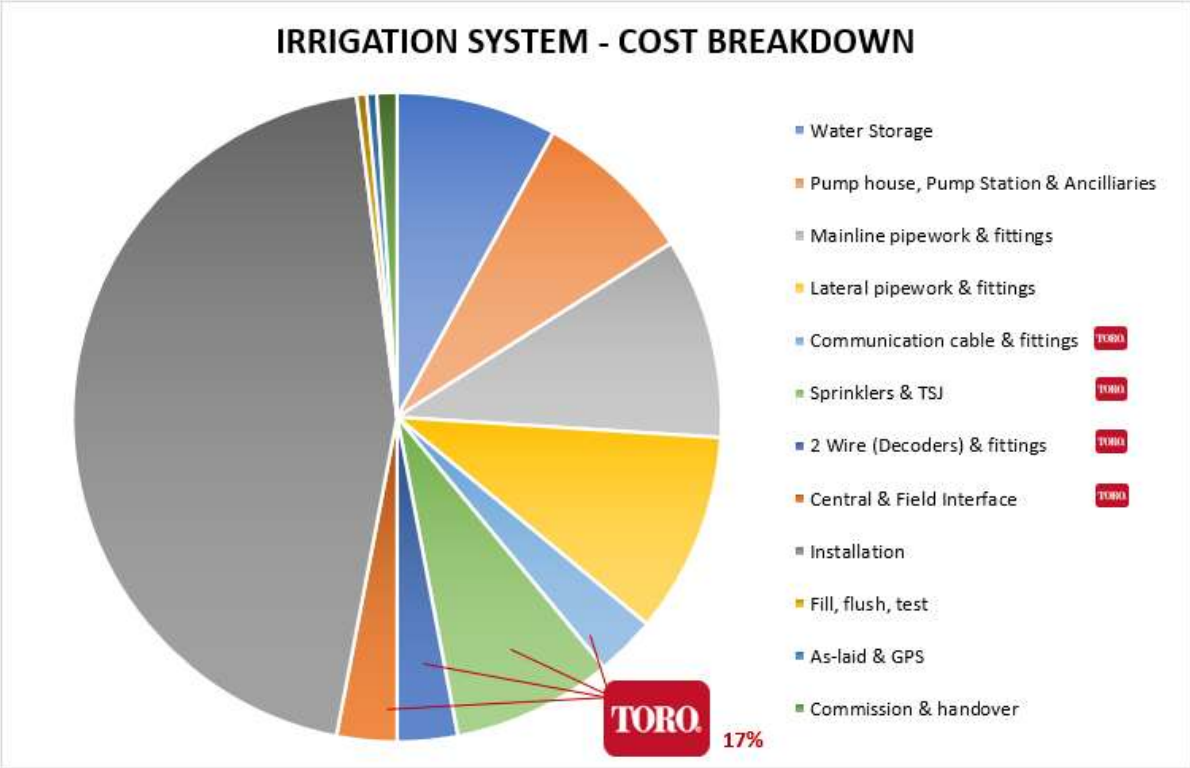
TORO
MODERN DESIGN APPROACH

Design Approach - Considerations

- Design goals now focus on playability and require responsible use of water
  - Optimum watering of turf is dependent on effective coverage
  - Definition of areas to be irrigated
  - Design application/ amount
  - Watering window [run time] available
  - Water supply & storage capacity
  - Beginning with the end in mind; customers goal – investment cost vs. course presentation
  - Generic design vs. manufacturer specific [design to utilise specific product features]
  - Define costs and budgets to deliver your goals

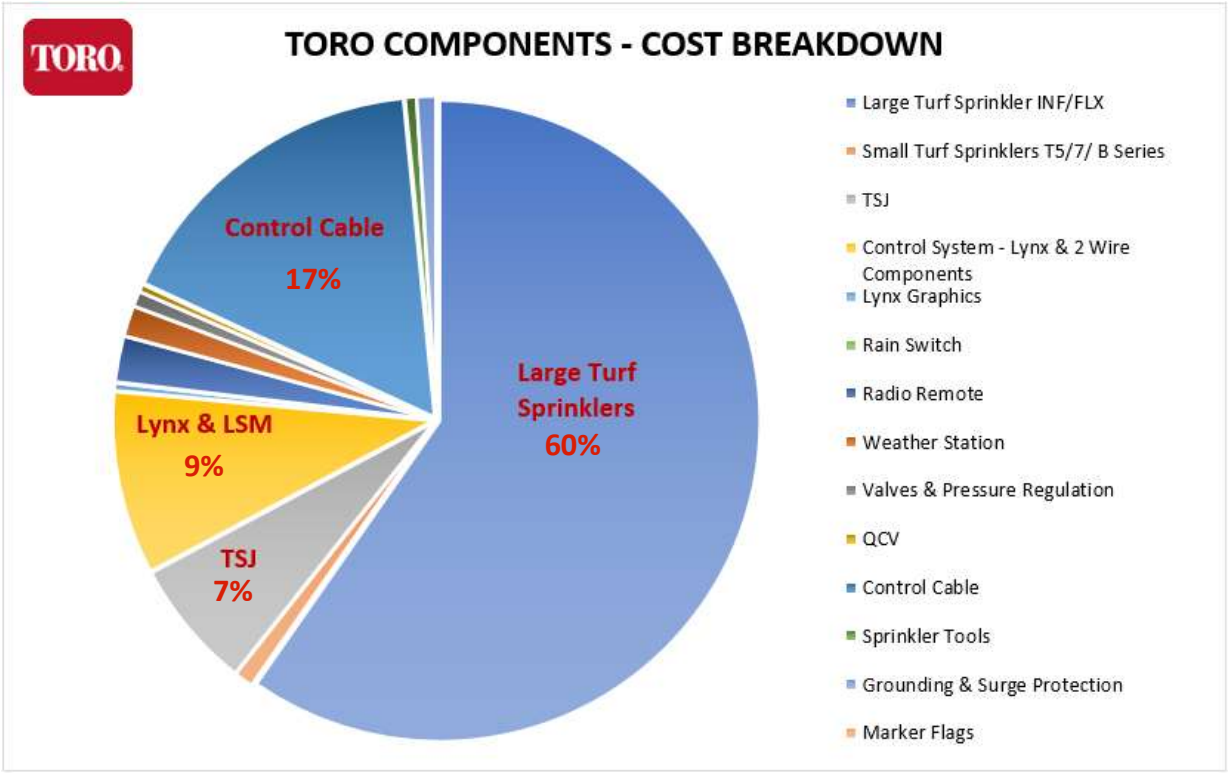
Project Cost Breakdown - Overall

2000 Heads, Greens/ Tees/ Fairways - New System	
Water Storage	8%
Pump house, Pump Station & Ancilliaries	8%
Mainline pipework & fittings	10%
Lateral pipework & fittings	10%
Communication cable & fittings	**3%**
Sprinklers & TSJ	**8%**
2 Wire (Decoders) & fittings	**3%**
Central & Field Interface	**3%**
Installation	45%
Fill, flush, test	1%
As-laid & GPS	1%
Commission & handover	1%
Irrigation System Total	100%
Toro Material Total	**17%**



Project Cost Breakdown - Brand

2000 Heads, Greens/ Tees/ Fairways - New System	
Large Turf Sprinkler INF/FLX	60%
Small Turf Sprinklers T5/7/ B Series	1%
TSJ	7%
Control System - Lynx & 2 Wire Components	9%
Lynx Graphics	0%
Rain Switch	0%
Radio Remote	2%
Weather Station	2%
Valves & Pressure Regulation	1%
QCV	0%
Control Cable	17%
Sprinkler Tools	1%
Grounding & Surge Protection	1%
Marker Flags	0%
Toro Material Total	**100%**

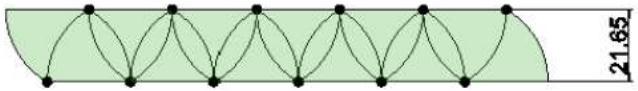



Irrigation product spend ≈ 60 to 70% is in Sprinklers
TORO

Design: Sprinkler Layout – Traditional Double Row Spacing [3mm application]

25m Double Row Spacing 180 degree arc

Total Water Required to apply 3mm of water to fairway
9m³

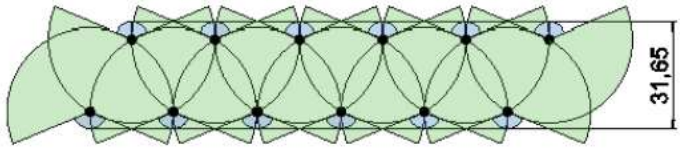


Effective Width (width of Fairway)

21.8m

25m Double Row Spacing 225 degree arc

Total Water Required to apply 3mm of water to fairway
11.3m³



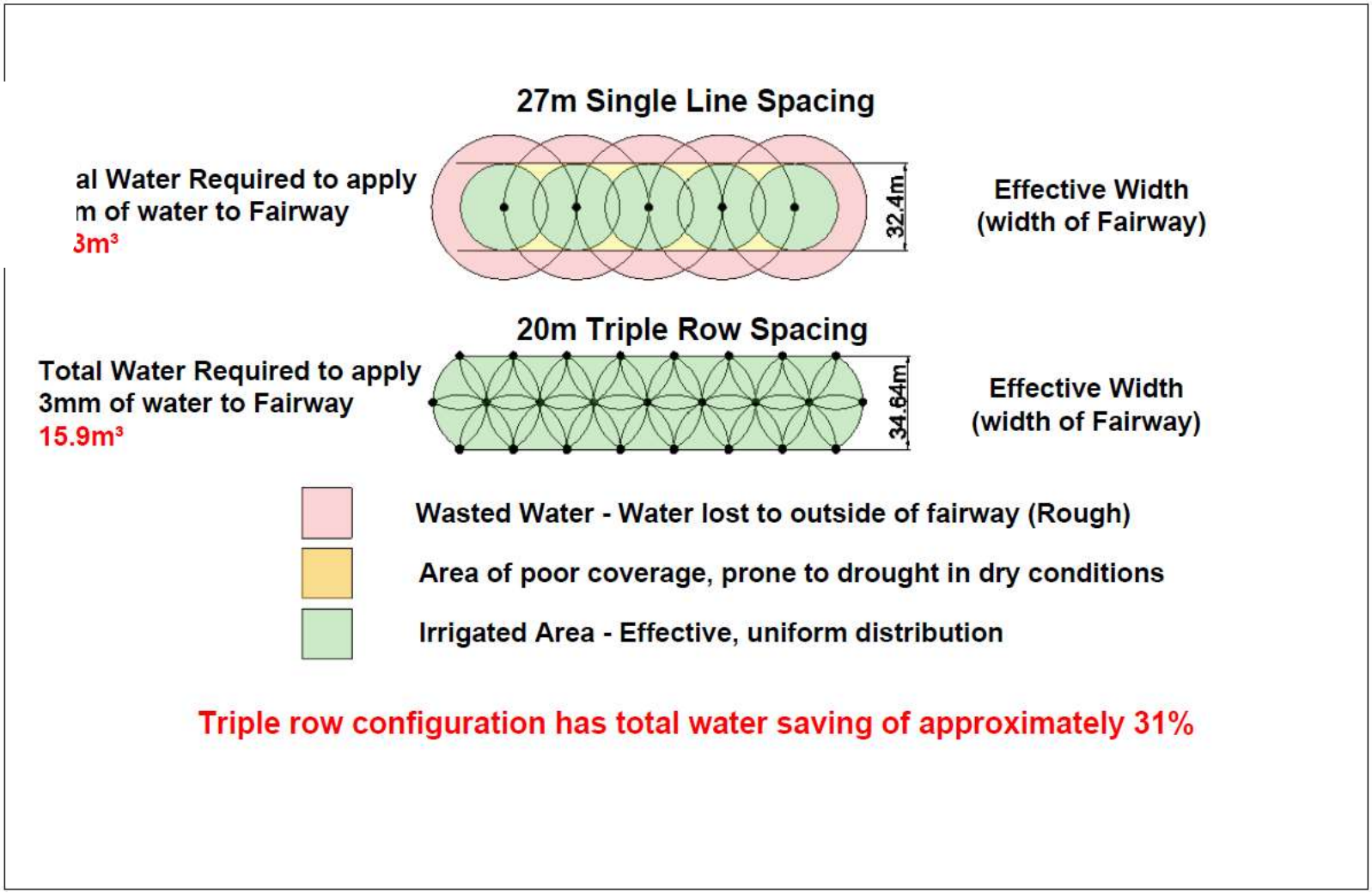
Effective Width (width of Fairway)

31.8m

Irrigated Area - 5m rear nozzle

Irrigated Area - 25m main nozzle

Design: Sprinkler Layout – Single & Triple Row Spacing [3mm application]



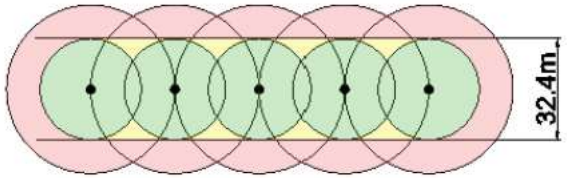
32.4m

34.6m

Design: Sprinkler Layout – Single & Triple Row Spacing [3mm application]

27m Single Line Spacing

Total Water Required to apply 3mm of water to Fairway
23.3m³

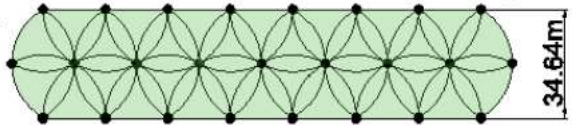


Effective Width (width of Fairway)

32.4m

20m Triple Row Spacing

Total Water Required to apply 3mm of water to Fairway
15.9m³



Effective Width (width of Fairway)

34.6m

Wasted Water - Water lost to outside of fairway (Rough)

Area of poor coverage, prone to drought in dry conditions

Irrigated Area - Effective, uniform distribution

Triple row configuration has a total water saving of ≈31%

Increasing sprinkler numbers gives greater efficiency and will enable long term savings

Design: Sprinkler Layout – Current renovations

Old Course St Andrews – 5th Fairway 'before', sprinklers at 27m triangle spacing – double row

Design: Sprinkler Layout – Current renovations

Old Course St Andrews – 5th Fairway 'after', sprinklers at 18m triangle spacing – multi

Future Trends – Golf Irrigation

- Course Playability - Efficiency & precision
- Modern Design Approach
- **Installation Supervision & Maintenance**
- System Architecture
- Manufacturer Innovations & developments


TORO
INSTALLATION SUPERVISION & MAINTENANCE

Installation Supervision & Maintenance

- An irrigation system will only deliver the correct design performance when installed and set to work correctly
- Considerations to the following areas will help ensure correct installation
  - Installation Contract Management
  - Installer competency
  - Installation supervision
  - Fill, flush, test – system optimisation
  - Post installation planned maintenance
  - Care to develop [and use] watering programs that are in line with course needs

Installation Supervision & Maintenance

- Installation Contract Management
  - GPS Marking out & staking
  - Contract & specification compliance, Valuation of works, payment & retention
  - GPS as-laid recording of works
- Installation Contractor
  - Experience and capacity, works programme
  - Resources, supervision of own works, verification of installed works
  - Correct management of subcontractors
- Installation supervision
  - Is the installer capable of supervising their own works
  - How will you determine that day to day works are being carried out correctly

Installation Supervision & Maintenance

- Fill, flush, test – system optimization
  - It is critical that all installation debris & air is thoroughly flushed from the system
  - All sprinkler arcs & nozzles need to be set in accordance with the design
  - Installed equipment to be fully & accurately recorded in Central software
  - Multiple full auto tests of system in accordance with performance specification
- User watering programs
  - The system can only deliver what the course needs if the end user defines the programs that are scheduled – set the program to deliver what you want
- Maintenance
  - Routine detailed inspection of components and operation
  - Schedule periodic audits of the system to ensure performance is as expected

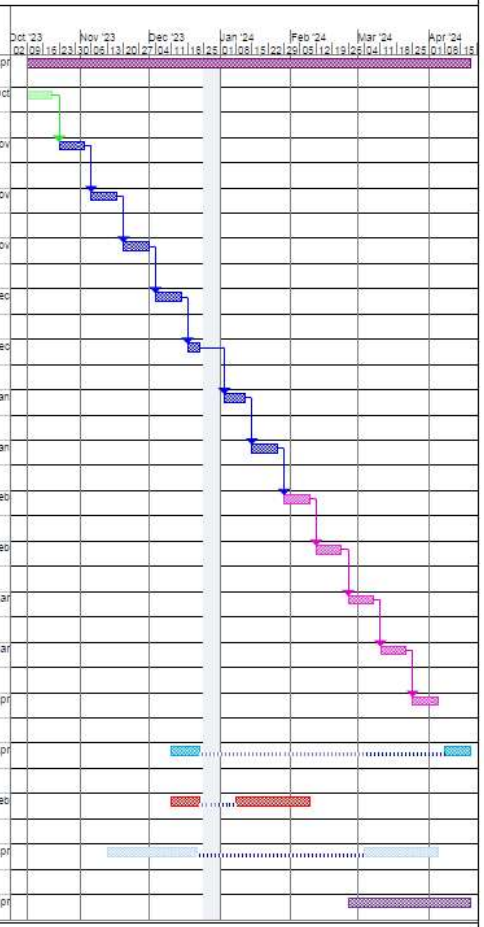
Contract Management: Client Communication

Installation: Works Programme

MJ ABBOTT

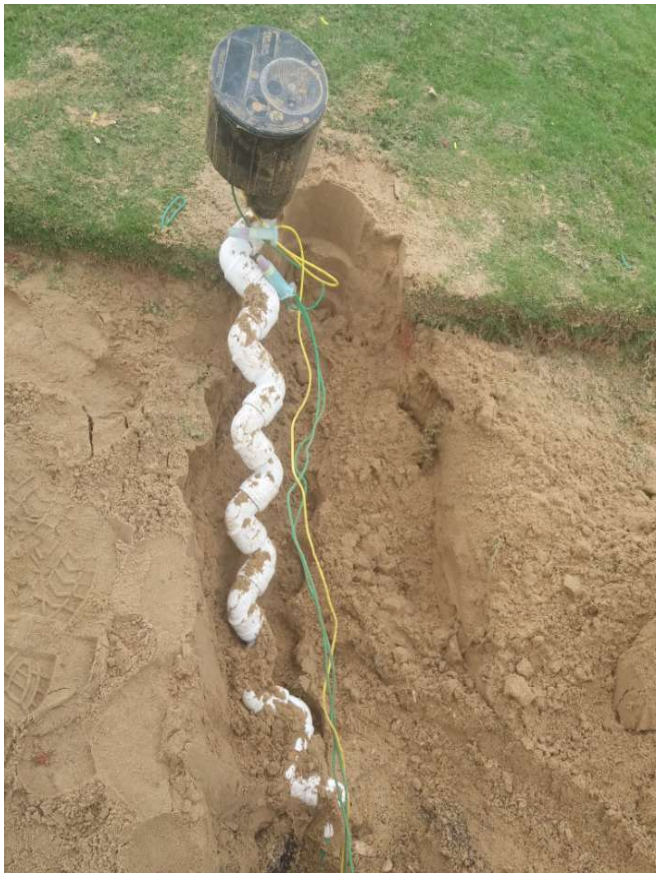
ROYAL COUNTY DOWN GOLF CLUB
PROPOSED IRRIGATION INSTALLATION WORKS PROGRAMME

ID	Task Name	Duration	Start	Finish
1	**ROYAL COUNTY DOWN GC IRRIGATION INSTALLATION**	146 days	Mon 09 Oct	Thu 18 Apr
2	SET UP SITE COMPOUND AND RECEIVE MATERIALS. COMMENCE TRACING OF PIPEWORK AND CABLING	11 days	Mon 09 Oct	Thu 19 Oct
3				
4	INSTALLATION OF IRRIGATION TO CHAMPIONSHIP COURSE 11TH, 8TH & 12TH GREENS, TEES, FAIRWAY, SURROUDS AND APPROACHES	11 days	Mon 23 Oct	Thu 02 Nov
5				
6	INSTALLATION OF IRRIGATION TO CHAMPIONSHIP COURSE 7TH, 6TH & 13TH GREENS, TEES, FAIRWAY, SURROUDS AND APPROACHES	11 days	Mon 06 Nov	Thu 16 Nov
7				
8	INSTALLATION OF IRRIGATION TO CHAMPIONSHIP COURSE 14TH, 15TH & 16TH GREENS, TEES, FAIRWAY, SURROUDS AND APPROACHES	11 days	Mon 20 Nov	Thu 30 Nov
9				
10	INSTALLATION OF IRRIGATION TO CHAMPIONSHIP COURSE 17TH, 18TH & 10TH GREENS, TEES, FAIRWAY, SURROUDS AND APPROACHES	11 days	Mon 04 Dec	Thu 14 Dec
11				
12	INSTALLATION OF IRRIGATION TO CHAMPIONSHIP COURSE 9TH & PG GREENS, TEES, FAIRWAY, SURROUDS AND APPROACHES	5 days	Mon 18 Dec	Fri 22 Dec
13				
14	INSTALLATION OF IRRIGATION TO CHAMPIONSHIP COURSE 1ST, 2ND & 3RD GREENS, TEES, FAIRWAY, SURROUDS AND APPROACHES	9 days	Wed 03 Jan	Thu 11 Jan
15				
16	INSTALLATION OF IRRIGATION TO CHAMPIONSHIP COURSE 4TH, 5TH & ANNESLEY 1ST GREENS, TEES, FAIRWAY, SURROUDS AND APPROACHES	11 days	Mon 15 Jan	Thu 25 Jan
17				
18	INSTALLATION OF IRRIGATION TO ANNESLEY COURSE 18TH, 2ND & 17TH ANNESLEY GREENS, TEES, FAIRWAY, SURROUDS AND APPROACHES	11 days	Mon 29 Jan	Thu 08 Feb
19				
20	INSTALLATION OF IRRIGATION TO ANNESLEY COURSE 3RD, 16TH & 4TH GREENS, TEES, FAIRWAY, SURROUDS AND APPROACHES	11 days	Mon 12 Feb	Thu 22 Feb
21				
22	INSTALLATION OF IRRIGATION TO ANNESLEY COURSE 15TH, 5TH, 14TH & 13TH GREENS, TEES, FAIRWAY, SURROUDS AND APPROACHES	11 days	Mon 26 Feb	Thu 07 Mar
23				
24	INSTALLATION OF IRRIGATION TO ANNESLEY COURSE 12TH, 8TH & 11TH GREENS, TEES, FAIRWAY, SURROUDS AND APPROACHES	11 days	Mon 11 Mar	Thu 21 Mar
25				
26	INSTALLATION OF IRRIGATION TO ANNESLEY COURSE 10TH, 9TH, 7TH & 6TH GREENS, TEES, FAIRWAY, SURROUDS AND APPROACHES	11 days	Mon 25 Mar	Thu 04 Apr
27				
28	PRACTICE RANGE INSTALLATION, SNAGGING AND TESTING	20 days	Mon 11 Dec	Thu 18 Apr
29				
30	BOREHOLE PIPEWORK AND POTENTIAL TANK WORKS	35 days	Mon 11 Dec	Thu 08 Feb
31				
32	INSTALLATION OF PROGRAMMING OF CENTRAL CONTROL SYSTEM	56 days	Mon 13 Nov	Thu 04 Apr
33				
34	HYDRAULIC COMISSIONING AND TESTING	44 days	Mon 26 Feb	Thu 18 Apr



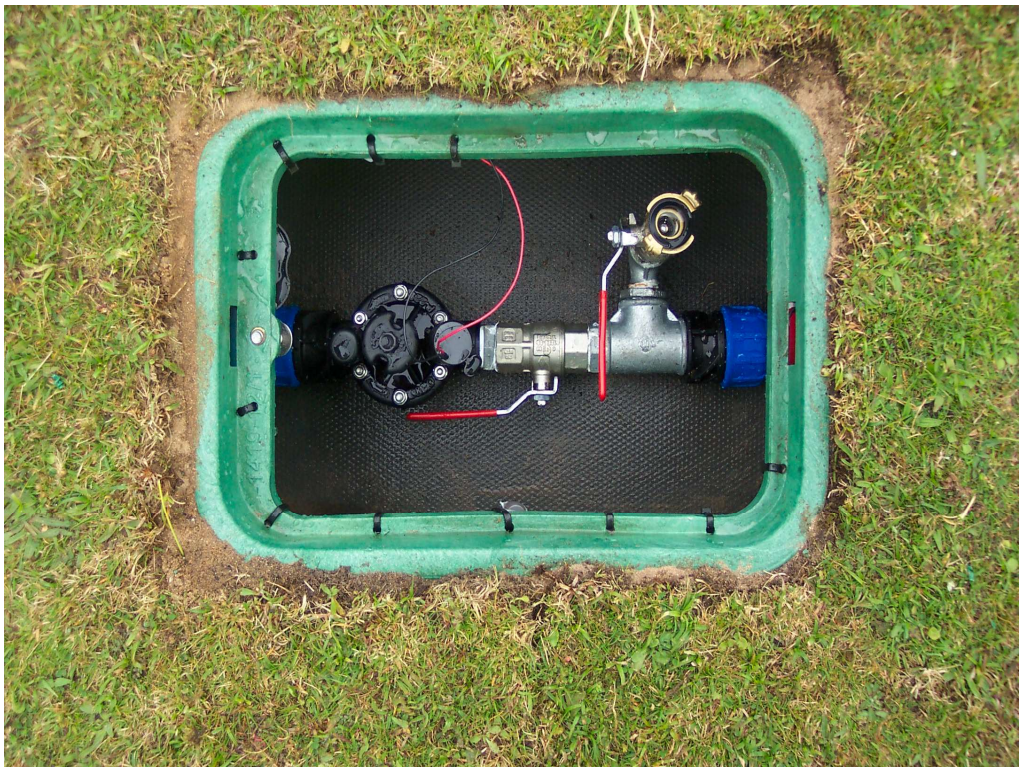
Installation: Resources & Equipment

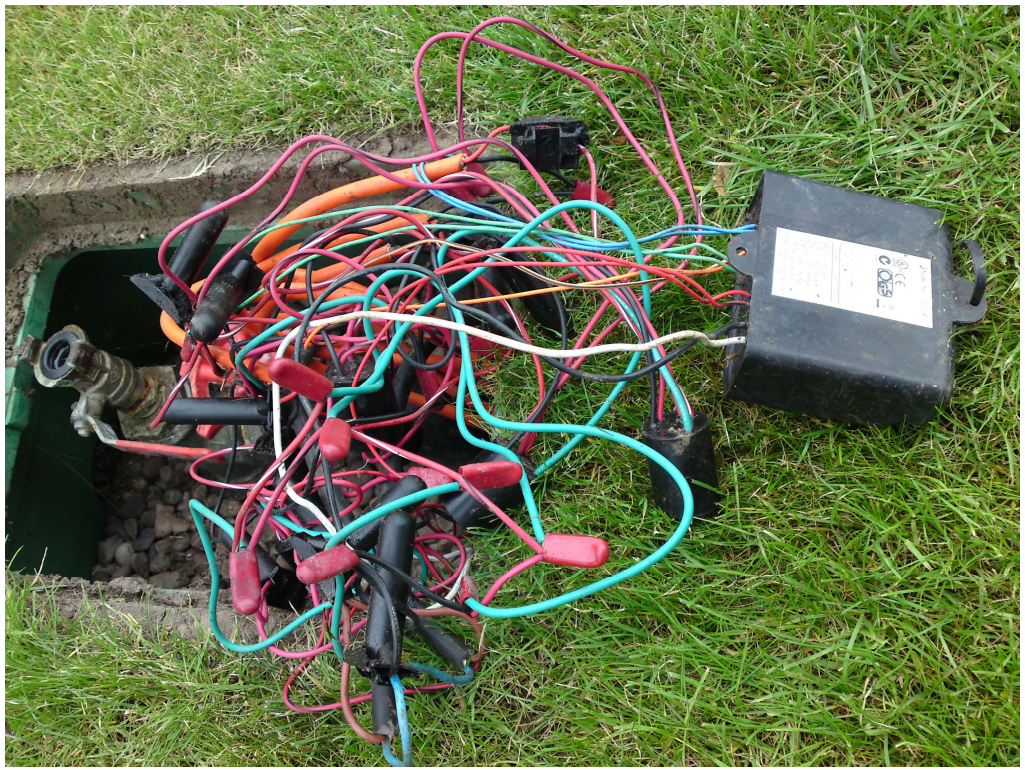
Installation: Verification of Installed Works



The good, the bad & the ugly

Installation: Verification of Installed Works





Tee Valve Assemblies

Installation: Verification of Installed Works

Central Controller

Installation: GPS as-laid recording of works

Optimisation of system performance

Optimisation of system performance

Optimisation of system performance – flow manager

Future Trends – Golf Irrigation

- Course Playability - Efficiency & precision
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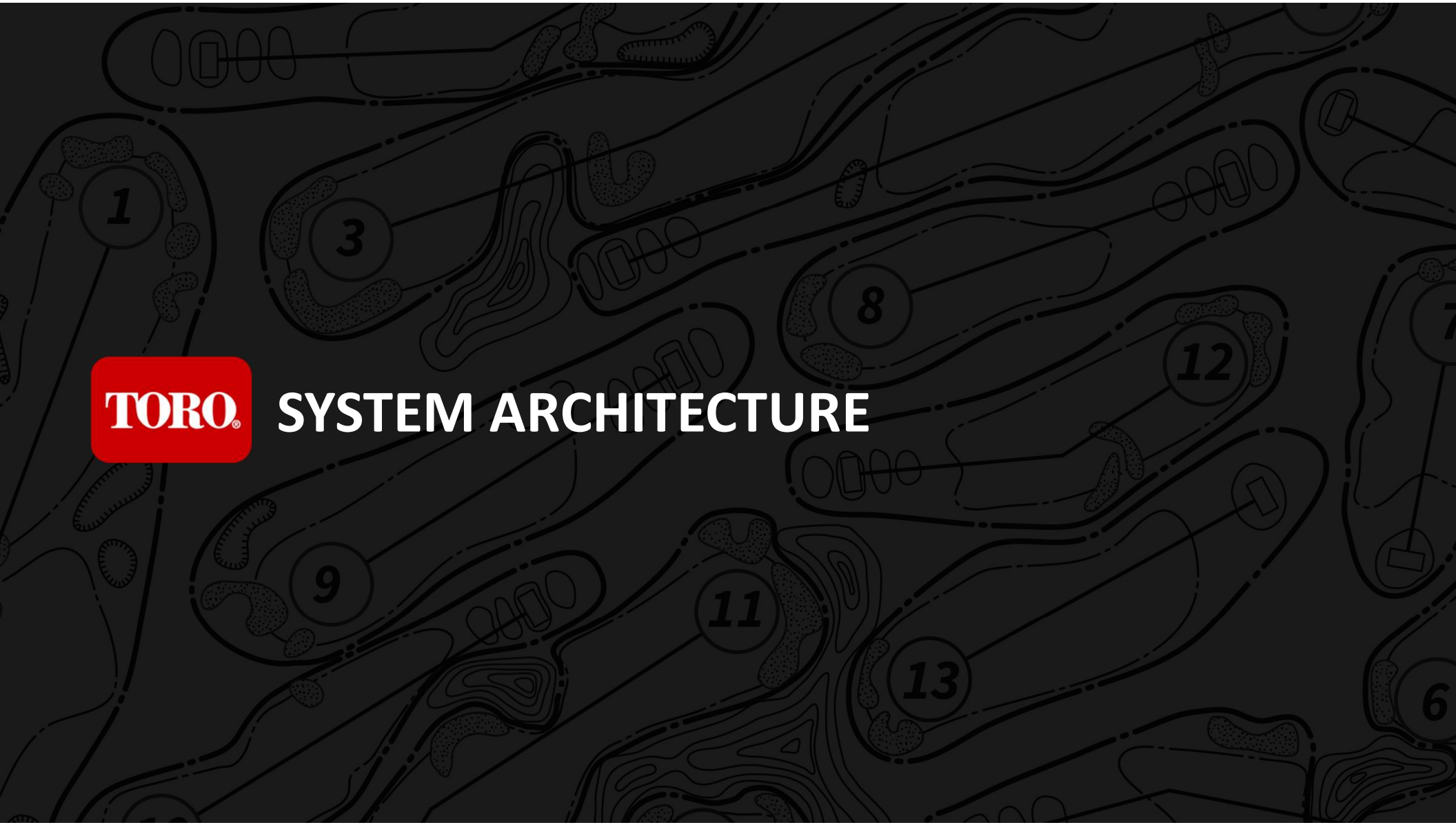
- Installation Supervision & Maintenance
- **System Architecture**
- Manufacturer Innovations & developments


TORO
SYSTEM ARCHITECTURE

System Architecture

- There are 2 types of control system to be aware of
  - Satellite
  - 2 Wire [Decoder]

Lynx Smart Satellite

wall-mount

Lynx Smart Module (LSM)

System Architecture

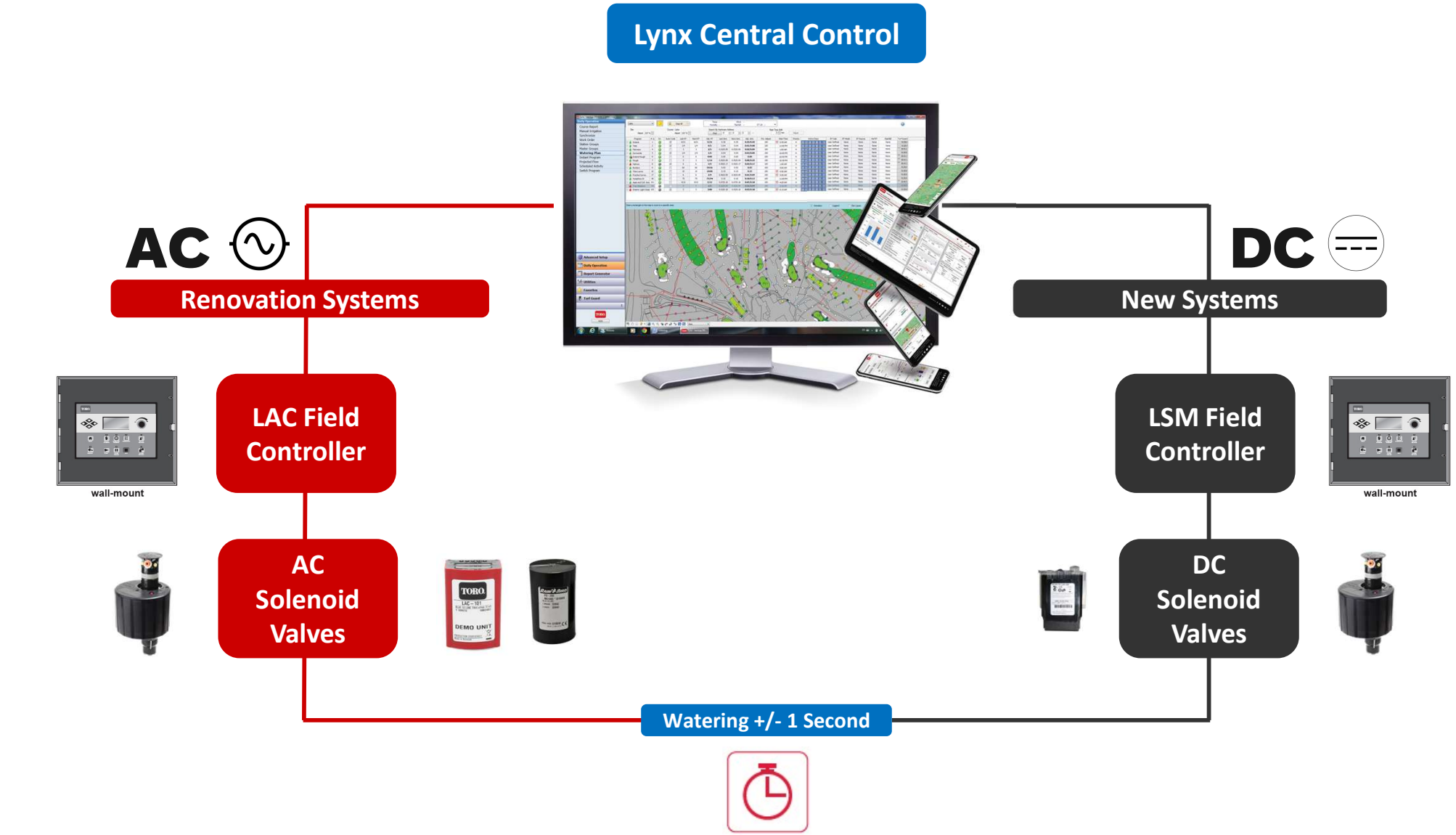
- Satellites vs. Decoders – which is better?
  - Neither, they both work well – it depends on application and climate
  - Are the extra costs worth it for the features?
  - Satellite systems on 1000 to 2000 head layouts will be approx $100k to $200k more expensive to install, plus additional cable materials cost
- What do you get for your money?
  - Back up watering
  - In-field manual control & programming
  - Improved surge protection
  - Serviceability & troubleshooting

If No.1 is not important, then 2, 3 & 4 don't matter

System Architecture

Within the 2-wire segment, there are 2 system types: AC and DC

- AC Solenoid Control [Conventional]
  - Ideal for retrofits and phased upgrades, retain existing heads & valves [solenoids]
- DC Solenoid Control [New Generation]
  - Ideal for full new systems, significant reduction in power consumptions, operate more heads at once, use less cable


Lynx Central Control
AC
Renovation Systems
LAC Field Controller
wall-mount
AC Solenoid Valves
TORO
DEMO UNIT
DC
New Systems
LSM Field Controller
wall-mount
DC Solenoid Valves
Watering +/- 1 Second

Lynx Central Control

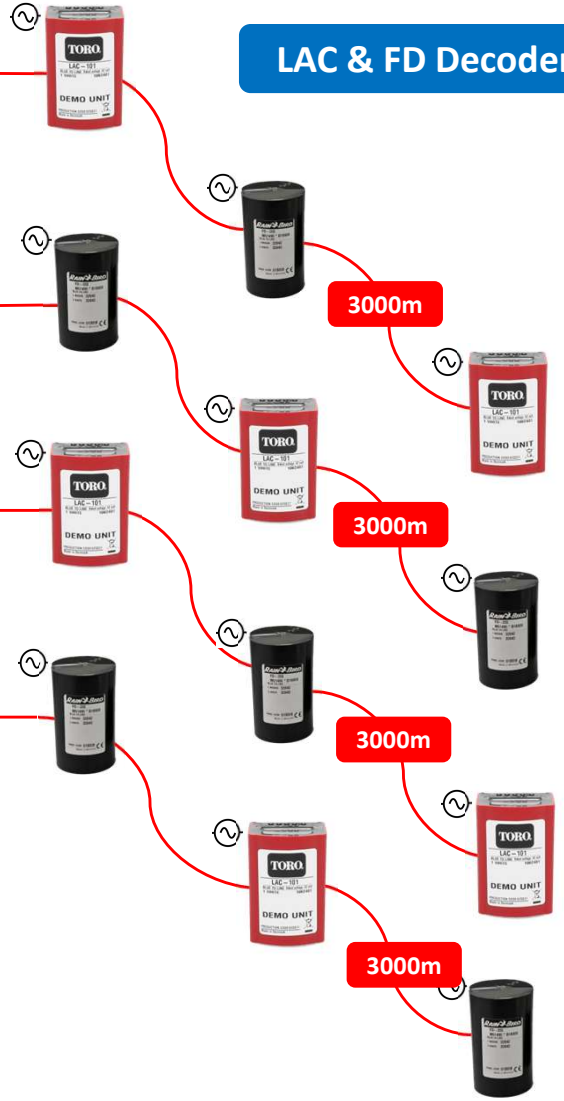
Hubs
20

FD's
10,000

Lynx LAC Smart Hub

wall-mount

LAC & FD Decoders



LYNX LAC System 2-Wire Control System [AC]

Mixed Decoders – Phased upgrade

Lynx Central Control

Hubs
20

LSMs
10,000

Lynx Smart Hub

wall-mount

50 Simultaneous Stations

50

50

50

50

4575m

4575m

4575m

4575m

Max LSMs 250

Max LSMs 250

Max LSMs 250

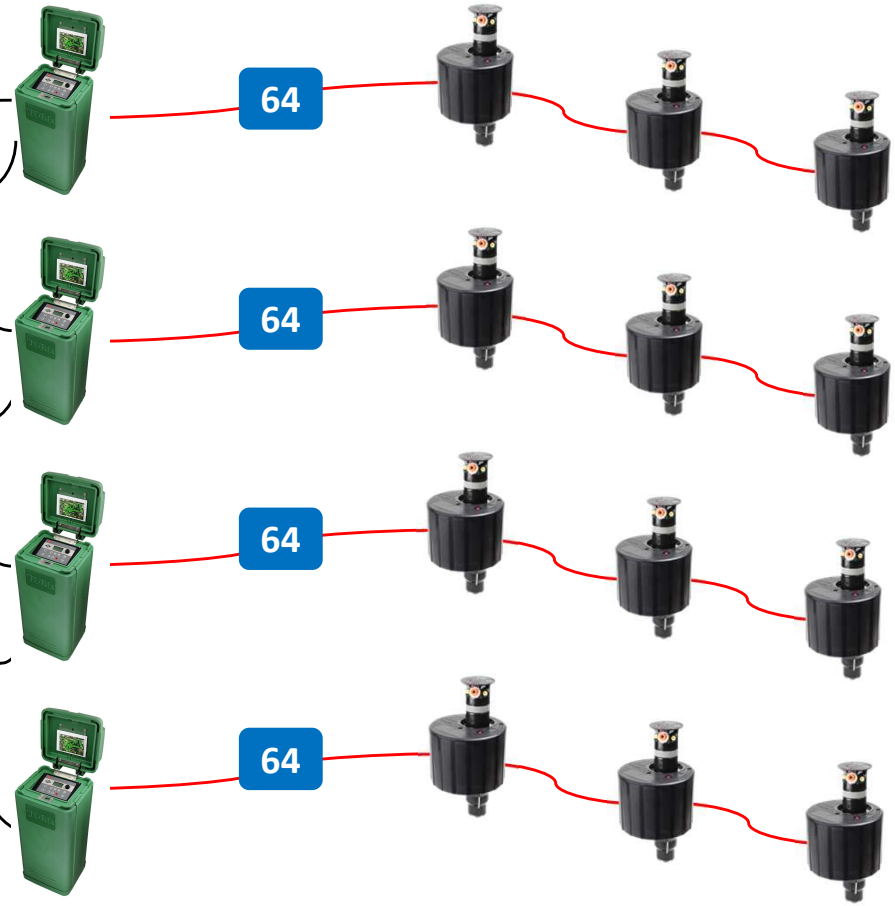
Max LSMs 250

LYNX Smart Module 2-Wire Control System [DC]

LYNX LSM Overview

Lynx Central Control

Lynx Smart Satellite



Sats	Sat Stations
500	32,000

LYNX Smart Satellite Control System

Future Trends – Golf Irrigation

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TORO
MANUFACTURER INNOVATIONS & DEVELOPMENTS

Toro Golf Irrigation Products & Services
Four Essential Advantages

PRECISION

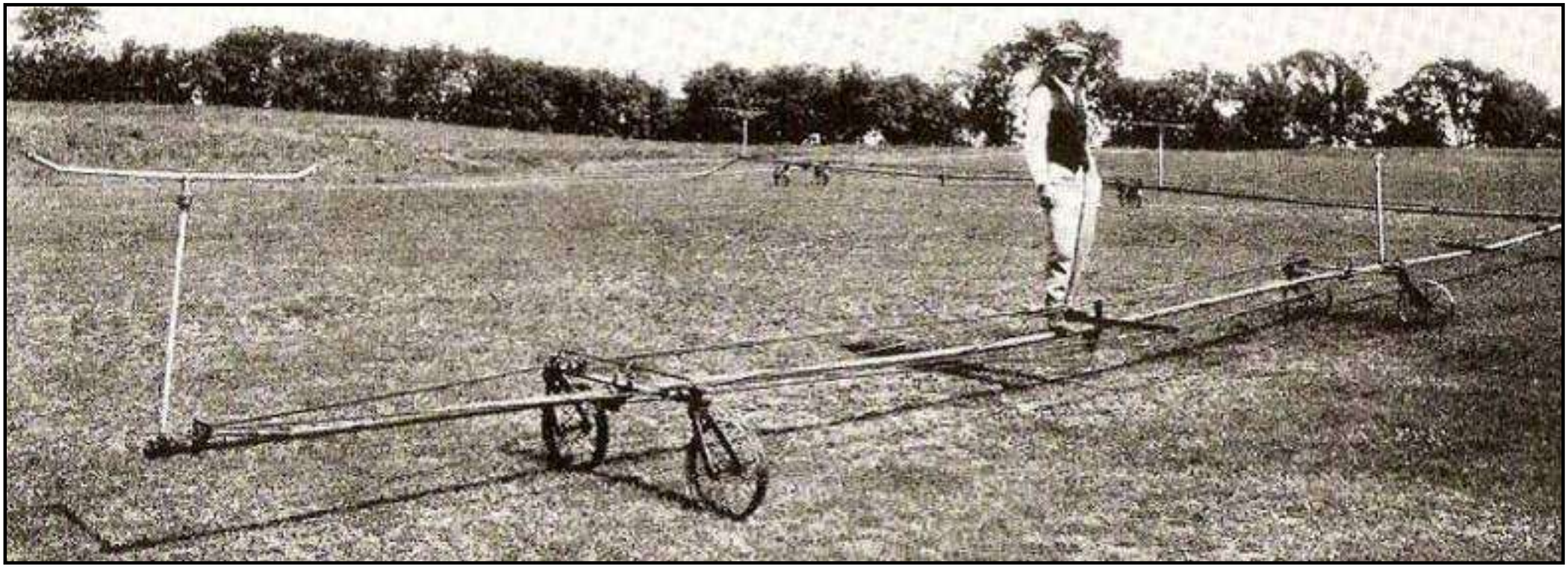
EASE OF USE

RELIABILITY

SUPPORT


TORO
GOLF SPRINKLERS

1923 – The Toro Sea Serpent




Irrigation product spend ≈ 60 to 70% is in Sprinklers
TORO

Greens, Surrounds, Approaches

- Flex Series
- Infinity Series

Fairways

- Flex Series
- Infinity Series

Tees

- B Series
- T5
- T7

Application

FLEX800 & INFINITY Series Sprinklers

FLEX800™ 35-6/55-6
with TruJectory™ and 40°-330° circle

INFINITY® 35-6/55-6
with TruJectory™ and 40°-330° circle

FLEX800 & INFINITY Series Sprinklers

FLEX800™ 35-6/55-6
with TruJectory™ and 40°-330° circle

PRECISION **EASE OF USE** **RELIABILITY** **SUPPORT**

Greens, Surrounds, Approaches, Fairways

- Adj Part/ Full Circle & Full Circle
- Simple Arc Adjustment
- Stainless Steel Valve Seat
- Nozzle Configuration & customisation
- 8.25cm Pop Up Height
- Adjustable Pressure Regulation
- Ratcheting Riser
- Dual & Multi Trajectory adjustment

Radius: 12.8m – 30.5m

INFINITY® 35-6/55-6
with TruJectory™ and 40°-330° circle

INFINITY vs. FLEX - ADVANTAGES

FLEX800™ 35-6/55-6
with TruJectory™ and 40°-330° circle

PRECISION **EASE OF USE** **RELIABILITY** **SUPPORT**

Greens, Surrounds, Approaches, Fairways

- Service Top Access
- Removable Pilot Valve c/w check valve
- Pressure regulation Service Access
- Solenoid/ LSM Service Access

Radius: 12.8m – 30.5m

INFINITY® 35-6/55-6
with TruJectory™ and 40°-330° circle

Infinity Top Access

Body Size Comparison

Same body height

1.5”

1”

Body Size Comparison

Same compartment and cover on 1” and 1.5” models

1.5” Diameter Equal

189 mm vs. 168 mm
21mm Larger


TORO
LYNX CENTRAL CONTROL

Lynx Central Control

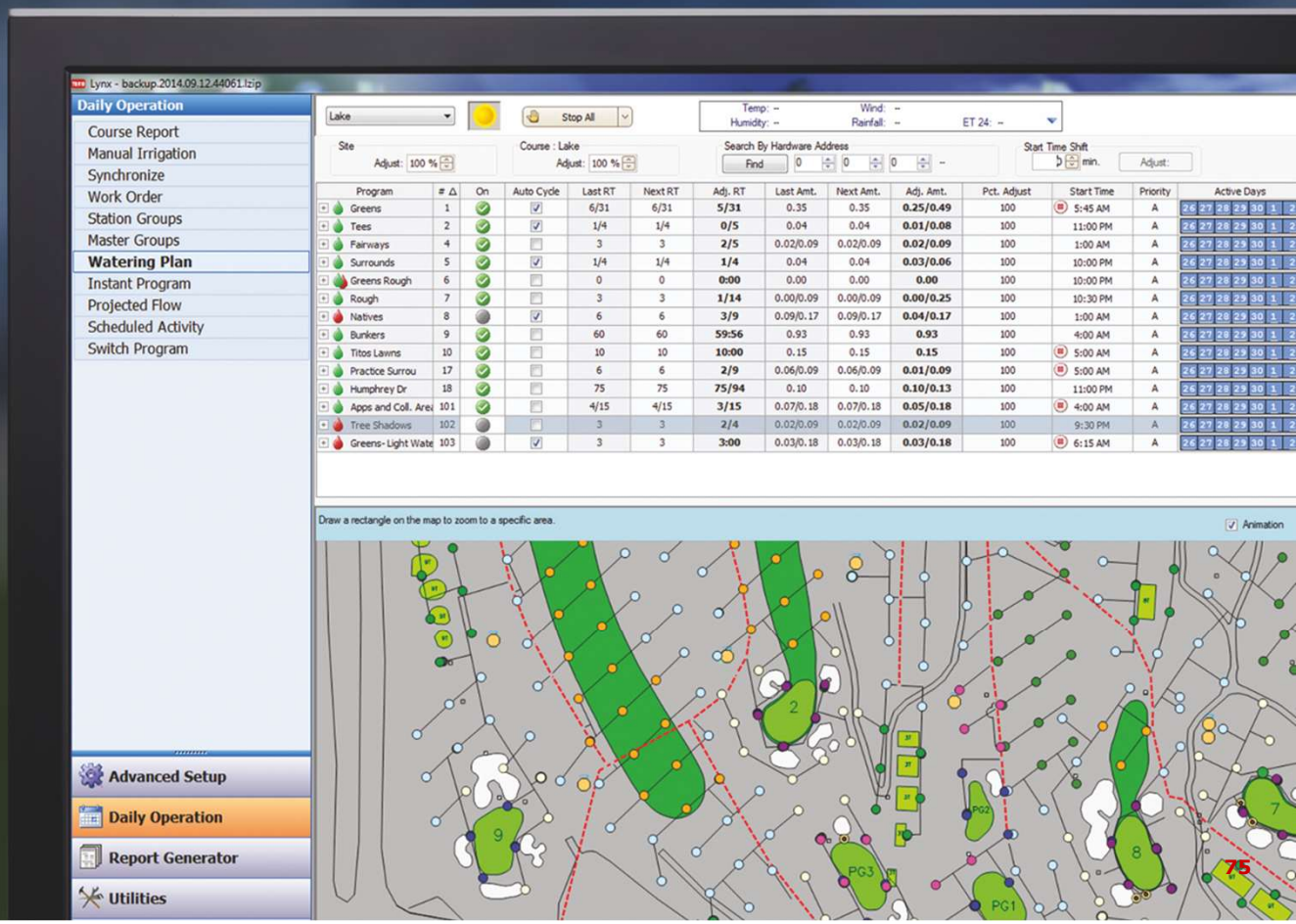
Lynx is our Central Control Platform; Lynx Cloud makes it a mobile solution

- Cloud supported Central & mobile operating interfaces
- Cloud & field updates
  - Easily adjust, amend & customise sprinkler settings
  - Optimise system operation
  - Lynx mobile sync with Lynx Cloud & updates sync to Lynx Central
- Mapping & GPS
  - Wide variety of popular images are supported in Lynx Map
  - Mobile devices use GPS to display proximity to sprinkler heads

PUT PLUG AND PLAY POWER, AT YOUR FINGERTIPS

LYNX – TORO INNOVATION AT ITS BEST

- Easy to set-up
- Easy to use and control
- Available anywhere, anytime
- Expert 24/7 support



Using your new Lynx system

Customers quickly become familiar & at ease with their new Lynx system – typical highlights would be:

- Intuitive & simple Lynx Control system operation
- Clear display of system status in Lynx and Lynx Mobile
- Creation of specific watering plans is simple & unambiguous
- Select by hole; area; direct from Lynx Map
- Schedule programs to operate at intervals & defined times
- Projections give clear view of required watering window to execute

The benefits

Improved Course conditions & presentation:

- Water & Power savings
- Accuracy of water application – better turf health & improved conditions


TORO
LYNX FIELD CONTROLS

Field Control Solutions

There are 2 types of field control system to be aware of: AC and DC

- AC Solenoid Control [Conventional] – Lynx LAC
  - Ideal for retrofits and upgrades, retain existing heads & valves
- DC Solenoid Control [New Generation] – Lynx LSM
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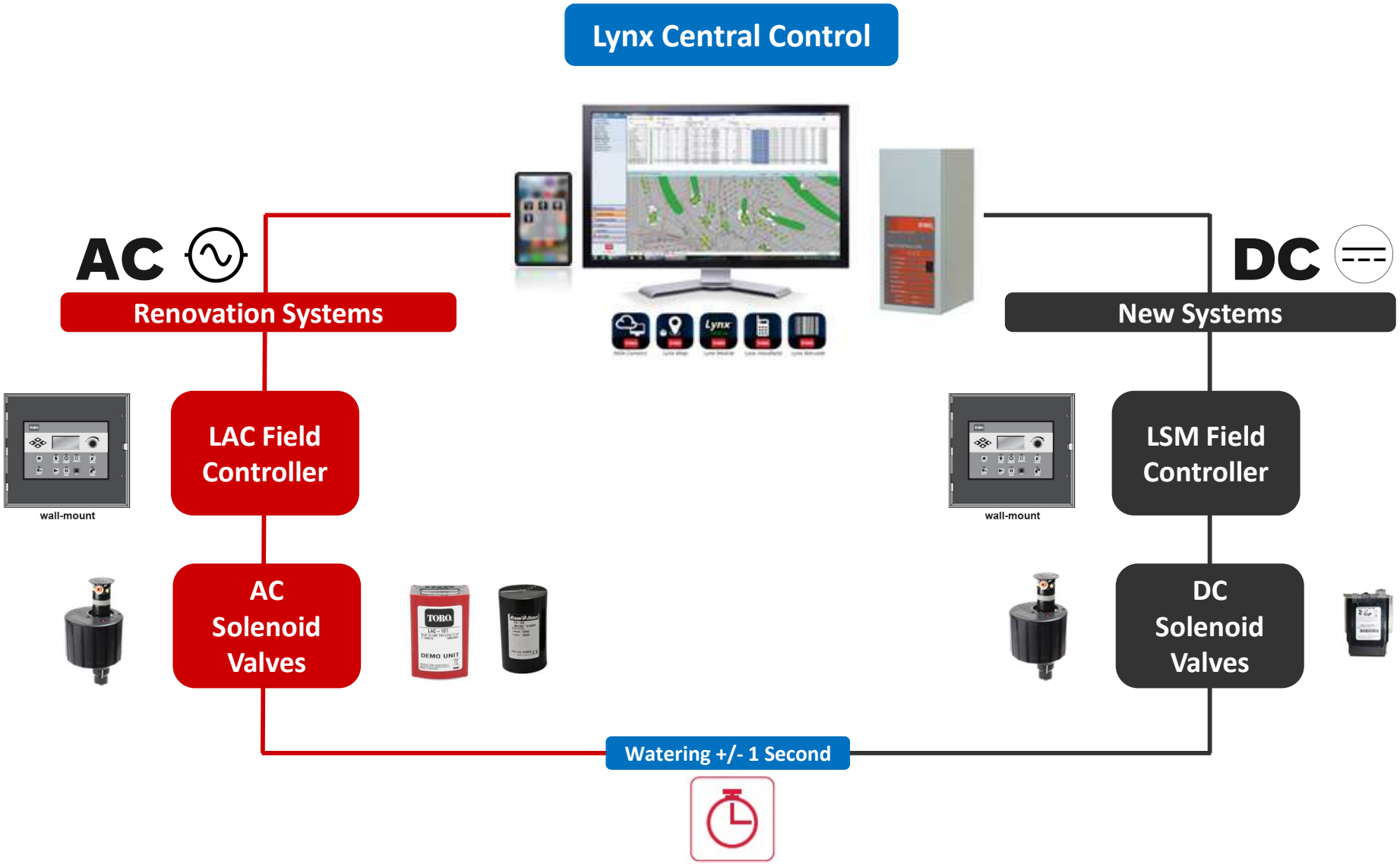

Lynx Central Control
AC
Renovation Systems
DC
New Systems
wall-mount
LAC Field Controller
wall-mount
LSM Field Controller
AC Solenoid Valves
DC Solenoid Valves
TORO
DEMO UNIT
Watering +/- 1 Second

LYNX SMART MODULE [LSM]

Lynx Smart Module LSM (2 Wire)

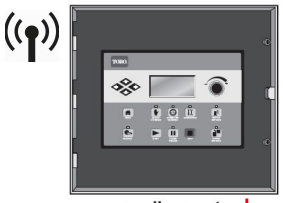
PRECISION | EASE OF USE | RELIABILITY | SUPPORT

- Features & Benefits
  - **Easy system expansion – 20 hubs 10,000 stns**
  - High speed 2w comm, 100 stns/sec
  - 50 Simultaneous Stations/ Cable Path
  - Powerful diagnostics, voltage & amperage
  - Run time to the second – water savings
  - LSM firmware update from Central
  - LSH firmware update by USB
  - Robust 20kVa Surge Protection

Lynx Central Control

Hubs
20

LSMs
10,000



Lynx Smart Hub

Comm Cable 14,484m

50 Simultaneous Stations

50

50

50

4575m

4575m

4575m

4575m

Max LSMs 250

Max LSMs 250

Max LSMs 250

Max LSMs 250

INF Lynx Smart Modules

LYNX Smart Module 2-Wire Control System

LYNX LSM Overview

Lynx Smart Module LSM (2 Wire)

PRECISION | EASE OF USE | RELIABILITY | SUPPORT

- Features & Benefits
  - Easy system expansion – 20 hubs 10,000 stns
  - **High speed 2w comm, 100 stns/sec**
  - 50 Simultaneous Stations/ Cable Path
  - Powerful diagnostics, voltage & amperage
  - Run time to the second – water savings
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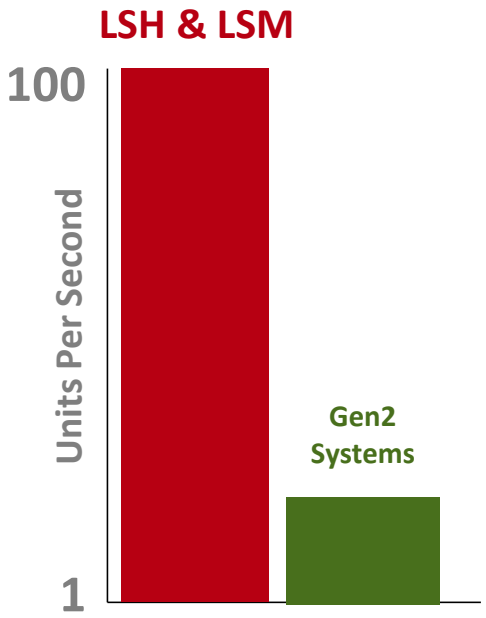
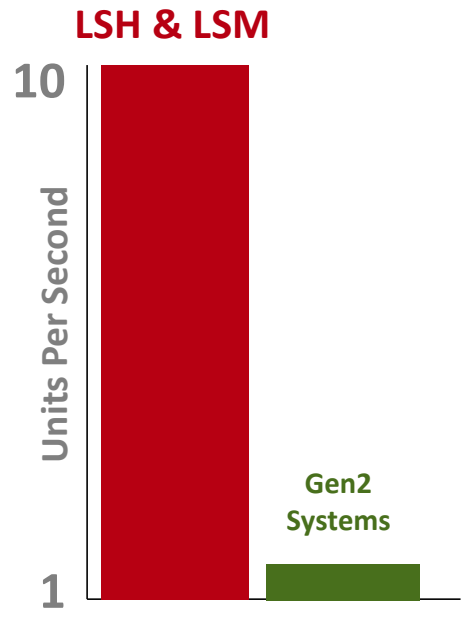
High Speed 2-way Communication



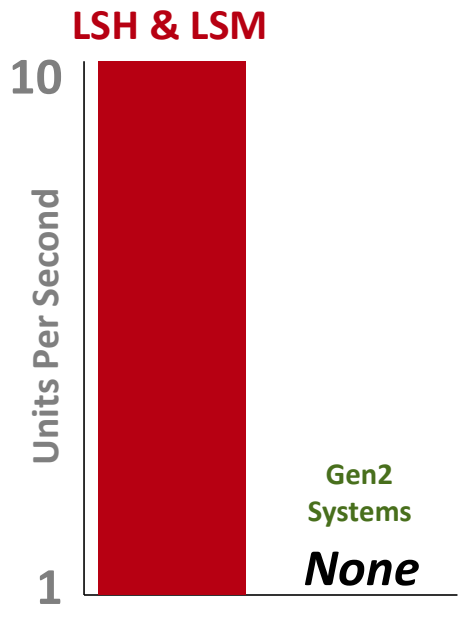
Communication test

100/sec



Voltage Test

10/sec



Amperage Test

10/sec

Lynx Smart Module LSM (2 Wire)

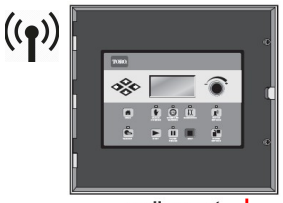
PRECISION | EASE OF USE | RELIABILITY | SUPPORT

- Features & Benefits
  - Easy system expansion – 20 hubs 10,000 stns
  - High speed 2w comm, 100 stns/sec
  - **50 Simultaneous Stations/ Cable Path**
  - Powerful diagnostics, voltage & amperage
  - Run time to the second – water savings
  - LSM firmware update from Central
  - LSH firmware update by USB
  - Robust 20kVa Surge Protection

Lynx Central Control

Hubs
20

LSMs
10,000



Lynx Smart Hub

Comm Cable 14,484m

50 Simultaneous Stations

50

4575m

Max LSMs 250

50

4575m

Max LSMs 250

50

4575m

Max LSMs 250

4575m

Max LSMs 250

INF Lynx Smart Modules

Negligible electrical restrictions to watering window

50 Simultaneous Stations Per Wire Path
4 Wire Paths Per Hub
200 Simultaneous Stations Per Hub

Lynx Smart Module LSM (2 Wire)

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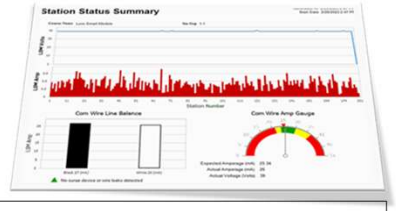
Diagnostics

Run automatically with scheduled irrigation



LSM – Communication Test

Comm
PASS
FAIL

- Test & verify **comm**
- Test & verify comm cable **continuity**
- Test & verify critical splice **continuity**

100/sec

LSM – Voltage Test

Volts	
37-40	Green – Optimum
29-36	Blue – Sufficient
10-28	Yellow – Will Not Operate
0	Red – Out of Range

- Test & verify **voltage**
- Verify cable **integrity**
- Verify splice **integrity**

10/sec

LSM – Current Test

Amps	
>1000	Yellow – Out of Tolerance
1-999	Green – Optimum
0	Red – Fail

- Test & verify **amperage**
- Locate source of high amps
- Deal with issues Pro-actively **Prevention**

10/sec

Lynx Smart Module LSM (2 Wire)

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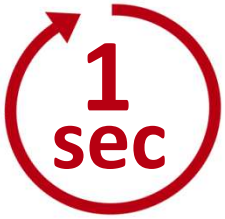
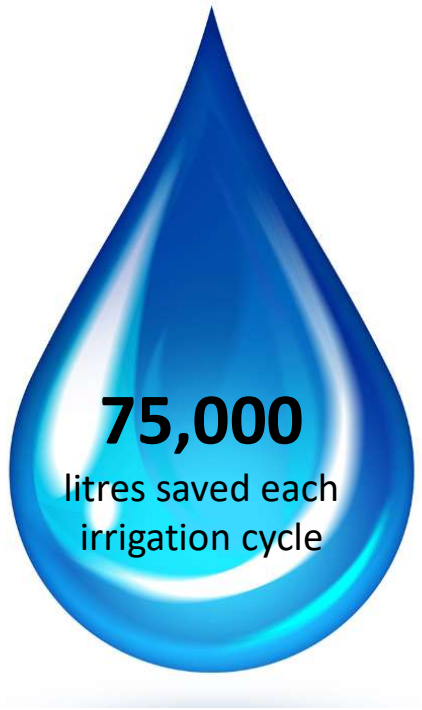
Efficiency – Run time to the second



- Station runtime to the second
- Improved course conditions
  - Enables each sprinkler to apply the exact amount calculated by Lynx for optimum uniformity
  - Prevents over watering when using short cycles or auto cycle
- Water savings
  - If 1,500 sprinklers each ran 30 seconds less, you would save 75,000 litres every irrigation cycle (assuming 100 litres per minute)



Lynx Smart Module LSM (2 Wire)

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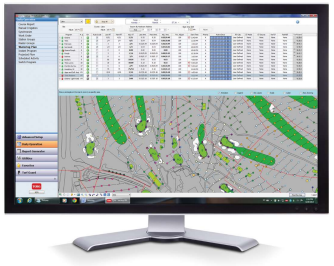
System updates

Lynx Central



TORO NSN

Lynx Smart Hub

USB

Lynx Smart Module LSM

LSM Firmware UG – 40 mins/LSH (1000 LSMs)

Lynx Smart Module LSM (2 Wire)

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  - **Robust 20kVa Surge Protection**

Lynx® Smart Modules

Designed to survive and stay online

Oversized components designed specifically to survive lightning and keep on working

Competitive systems are designed to go offline, requiring decoder replacement

Every Toro internal component has a built-in backup


TORO
MANUFACTUROR & DISTRIBUTOR SUPPORT

Toro System Support

SUPPORT – 2 Points of contact

- Toro NSN – direct to customer
- Hako Finland – direct to customer
  - Toro Field Staff support to Hako

Customer Care

We believe in lasting and caring relationships with our customers:

- Reliable, professional & timely support
- Manufacturers support through NSN
  - 24/7 help with software or programming questions/ assistance
- Distribution provide field support & advice
  - Our channel are supported by Toro's EMEA Sales & Service Team, based in market

System Training, Operation & Support

Customer training is provided by the installer, distributor and by Toro

- Training covers all system Toro components:
  - Cloud/ Lynx/ Smart Hub/ Sprinklers & Valves
- System Database & site configuration data
  - Backed up to Lynx Cloud
- Hako Support
  - Field components: Lynx Smart Hub to Sprinkler Heads
- Toro NSN Support
  - Lynx hardware
  - Lynx software – access cloud data


TORO
NSN Support


TORO.
Toro® National Support Network (NSN)
Live access to certified irrigation specialists
24/7
support
365
days a year

Toro® National Support Network (NSN)

- Live access to certified irrigation specialists
- No system left behind
- Lynx systems built in house from the ground up
- Cloud backup and apps
- Next business day hardware replacement
- Live, remote and online training available


TORO
TurfRad & Spatial Adjust™


TORO

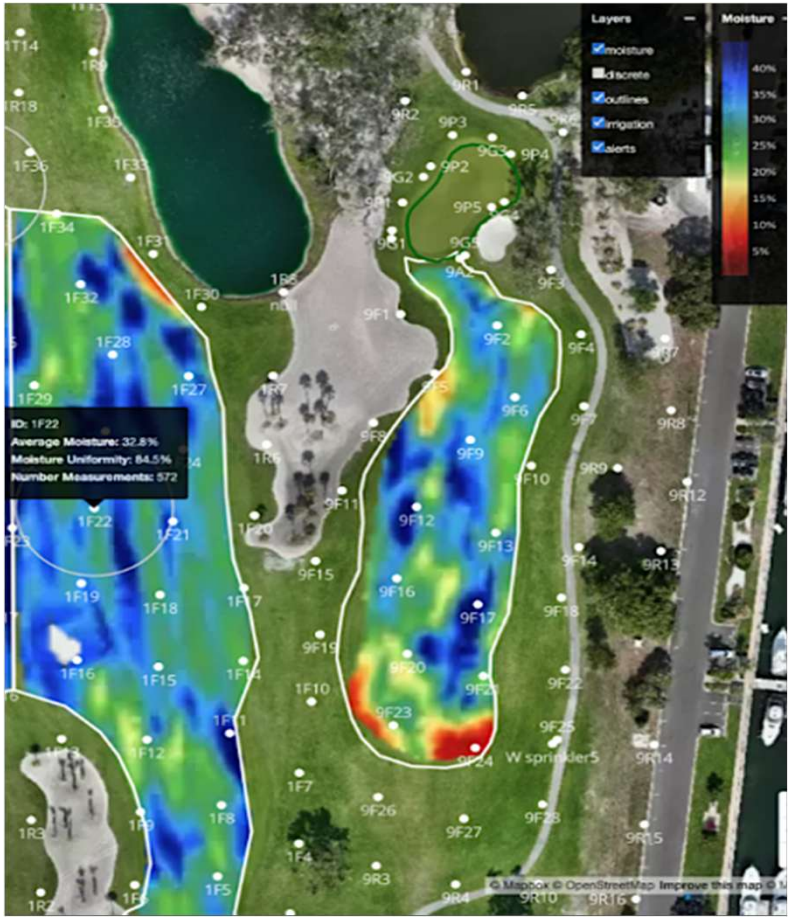

GOLFCO
GRASS SEED
TORO
REELMASTER
CROSSTRAX
TORO

TurfRad & Spatial Adjust™ - How it works

- TurfRad smart passive sensors measure naturally emitted microwaves from the soil – moisture content dictates +/- microwave emission
- Mounted on mowers or utility vehicles, the sensor collects soil moisture data 14 times per second, TurfRad can ‘see’ to a depth of 100mm into the soil
- Real time data collected with GPS location tracking builds a complete picture of existing moisture levels on the course and uploads to the cloud
- That data is interrogated by Spatial Adjust which then produces recommended ‘push’ adjustments to the watering plan – improved course conditions & water/power savings

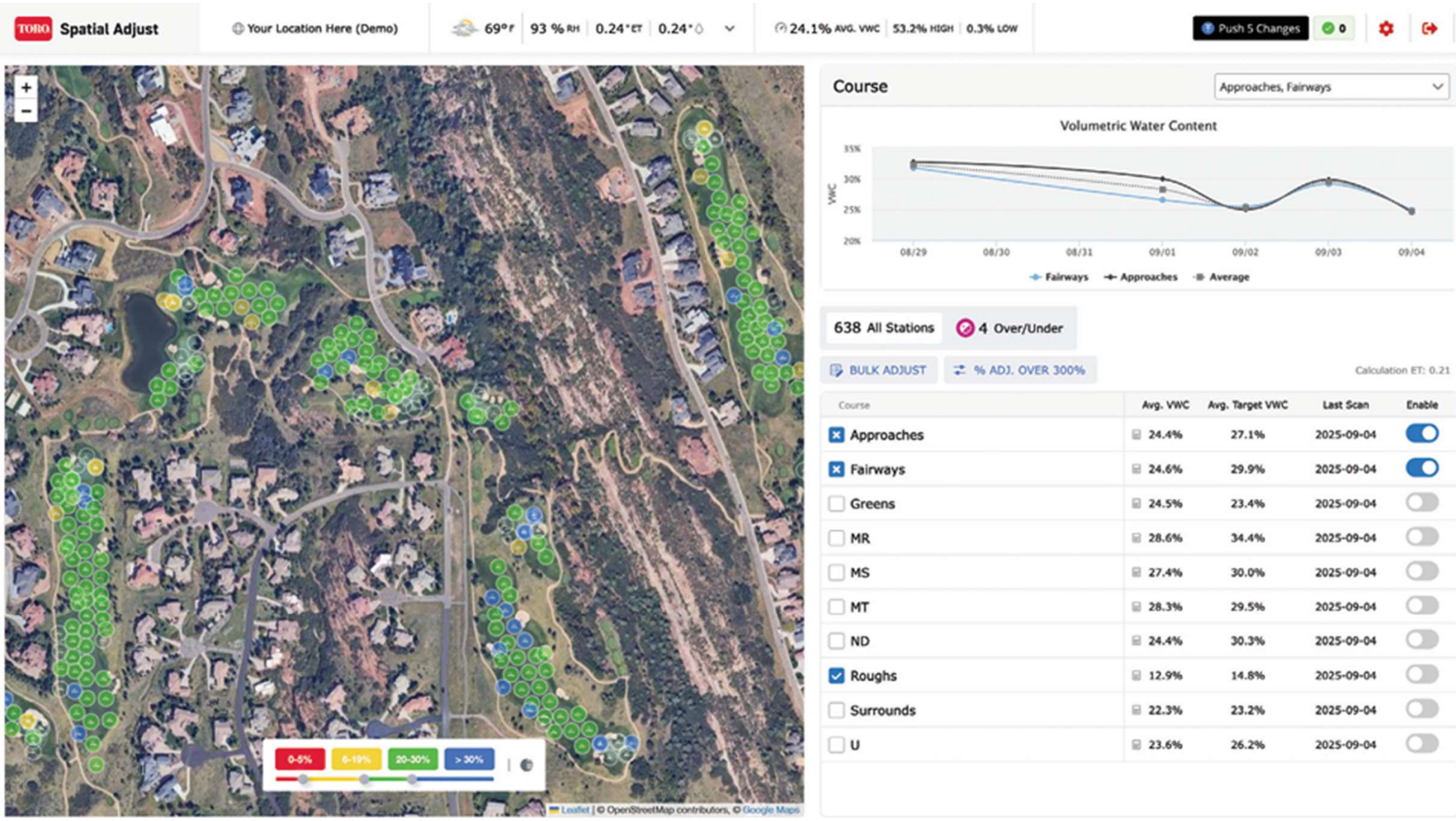
TurfRad & Spatial Adjust™ - How it works

- The TurfRad system features integrated GPS within its sensors, capturing three key data points with every measurement
  - latitude
  - longitude
  - volumetric water content
- The data uploads automatically via Wi-Fi when the vehicle returns to the equipment storage location.
- The data is processed into a detailed moisture map within 30 minutes
- The moisture map and data drive Spatial Adjust ‘push’ recommendations



TurfRad & Spatial Adjust™ - How it works

- TurfRad Smart sensors installed on Toro equipment using Toro brackets map soil moisture levels while you mow
- Spatial Adjust software sends the collected data to Lynx Drive
  - Real time colour coded maps indicate moisture variations
  - Spatial adjust provides individual sprinkler adjustment recommendations which can be ‘pushed to’ and accepted by Lynx Central
    - Large volume changes are made instantly - simple operation
- Irrigation control and application with confidence. No soil probing. No guesswork. Only precision irrigation, only what the course needs


Spatial Adjust
Your Location Here (Demo)
69°F
93 % RH
0.24" ET
0.24"
24.1% AVG. VWC
53.2% HIGH
0.3% LOW
Push 5 Changes
0
0-6%
6-19%
20-30%
> 30%
Leaflet | © OpenStreetMap contributors, © Google Maps
Course
Approaches, Fairways
Volumetric Water Content
35%
30%
25%
20%
VWC
08/29
08/30
08/31
09/01
09/02
09/03
09/04
Fairways
Approaches
Average
638 All Stations
4 Over/Under
BULK ADJUST
% ADJ. OVER 300%
Calculation ET: 0.21
Course
Avg. VWC
Avg. Target VWC
Last Scan
Enable
Approaches 24.4% 27.1% 2025-09-04
Fairways 24.6% 29.9% 2025-09-04
Greens 24.5% 23.4% 2025-09-04
MR 28.6% 34.4% 2025-09-04
MS 27.4% 30.0% 2025-09-04
MT 28.3% 29.5% 2025-09-04
ND 24.4% 30.3% 2025-09-04
Roughs 12.9% 14.8% 2025-09-04
Surrounds 22.3% 23.2% 2025-09-04
U 23.6% 26.2% 2025-09-04

Golf Equipment and Golf Irrigation

- Toro Spacial Adjust brings **equipment** and **irrigation** together to enable customers to collect data through normal mowing operations and utilise that information for the next irrigation cycle

- Toro Golf Irrigation products are designed for accurate and precise water application – this TurfRad & Spatial Adjust solution provides the data to define what that application should be

- Spatial adjust software will ‘push’ recommended changes to Lynx to ensure watering programs reflect course needs

- Course conditions are improved; water and power usage are reduced = lower operating costs


Turf Rat


TORO®

Future Trends

Toro Golf Irrigation Products

Future Trends – Golf Irrigation

- Course Playability - Efficiency & precision
- Modern Design Approach
- Installation Supervision & Maintenance
- System Architecture
- Manufacturer Innovations & developments


THANK YOU
TORO®