IC System™
Design Guide V 2.4

Updated 2024

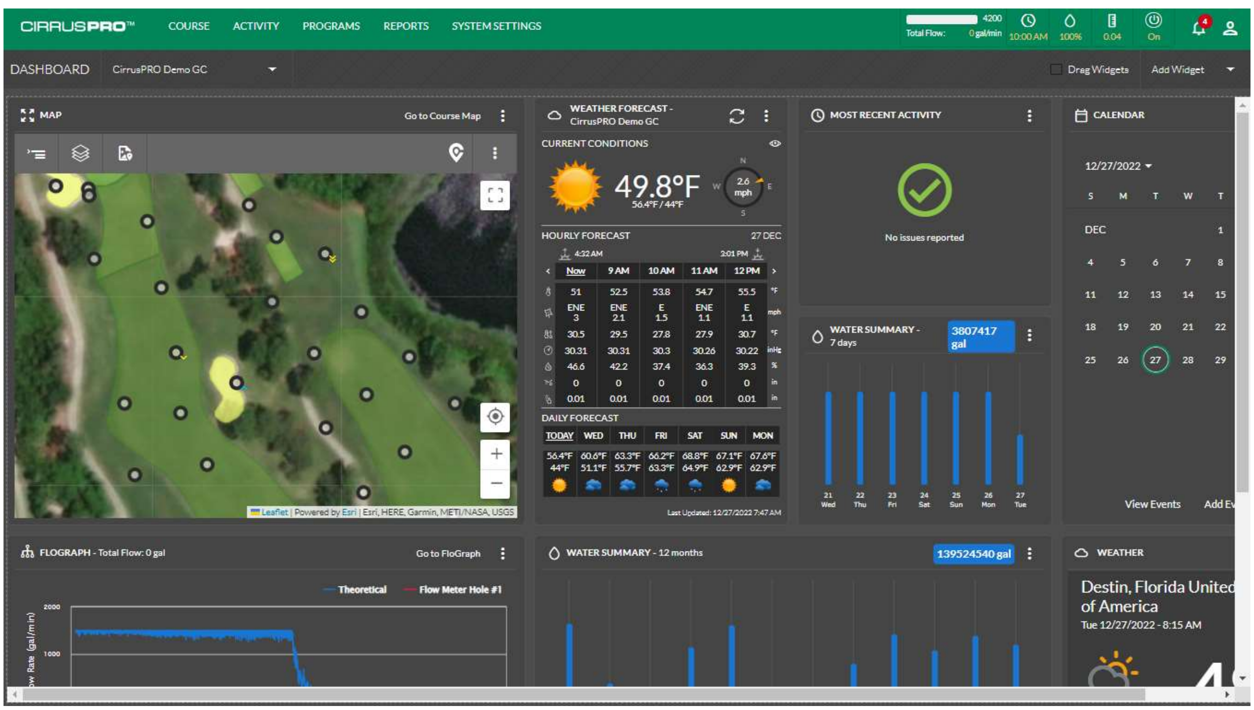
Introduction

This Design Guide is presented to clarify standard design questions for the IC System and IFX hybrid capabilities. For additional information please contact your Rain Bird Golf Specification Manager or Sales Manager.

IC System – Product Definitions

Central Control Software

CirrusPRO™ is the Central Control software which operates the IC System. The software is used to establish the irrigation system parameters, operate the system and perform troubleshooting tasks. There are many diagnostic features within the software that help the user quickly identify and diagnose the location of field issues. Cirrus™, Nimbus II™, Stratus II™ and Stratus LT are no longer sold, but are still supported and compatible with the Rain Bird IC System.



Integrated Control Interface Plus (ICI+)

The Integrated Control Interface Plus (ICI+) is the electronic hardware and firmware that accepts commands from the Central Control Software and directs them to the field. The ICI+ also communicates with the field to update the status back to the Central Control Software. This interface is compatible with both IC Systems and IFX Connected satellites including PAR+, MSC+ and PAR+ES Satellites.

Integrated Control Module (ICM)

The Integrated Control Module (ICM) is mounted on Rain Bird manufactured valve-in-head golf rotors or in-line valves. The ICM communicates directly to the Rain Bird central control software via Rain Bird MAXI™ cable two-wire path and the IC interface (ICI+). The central control software automatically operates the rotors and valves throughout the golf course by activating each individual ICM as needed. If the ICM is to be installed on an existing Rain Bird electric (non-IC) in-line valve, an ICM valve kit (ICMVLVKIT) is required.

Golf Solenoid Valve for Integrated Control (GSVIC)

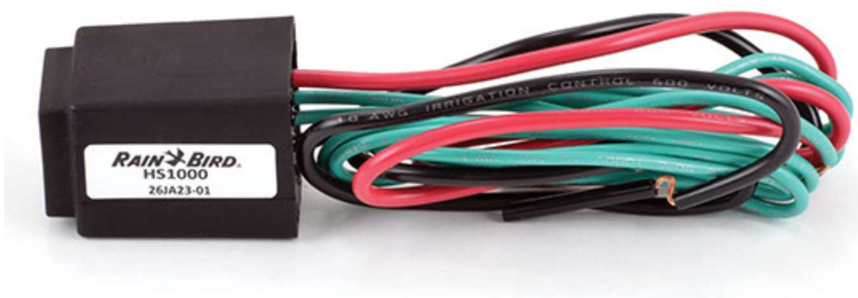
The Golf Solenoid Valve for Integrated Control allows control of stations for a variety of uses including but not limited to block rotor areas such as Tee complexes or pop-up zones. This valve comes pre-configured with a Pressure Regulations System-Dial (PRS-D) which maintains a constant outlet pressure from 15 to 100 psi (1.04 to 6.90 bar) within ± 3 psi (± 0.21 bar). The GSVIC is engineered for reclaimed water with a chlorine-resistant diaphragm, with an optional purple flow control handle.

Integrated Control Module Valve Kit (ICMVLVKIT)

To adapt an existing Rain Bird in line Electric Valve to an IC valve an ICM Valve Kit (ICMVLVKIT) is used. The ICM Valve Kit is compatible with the GSV, PEB, PESB, BPES and EFB-CP series valves.

Integrated Control Surge Device (ICSD)

The Integrated Control Surge Device (ICSD) provides an exit path for surge energy that has entered the system due to lightning strikes, transients, or other surge events.



Integrated Control Sensor Input Device (IC-IN)

The IC-IN Sensor Input Device is part of the IC CONNECT™ product line providing the ability to bring external sensor data into the Central Control software. This includes any sensors with the following output types: 4-20mA, 0-10 VDC, static or pulse output. For additional details please reference the IC-IN Manual.

Integrated Control Output Device (IC-OUT)

The IC-OUT Output Device allows for control of external devices including but not limited to fans, fountains, aerators, gates, fuel systems, lighting systems, etc. Control of external equipment is accomplished through use of a DC Latching Relay giving great flexibility on the application. For additional details please reference the IC-OUT Manual.

IFX Board

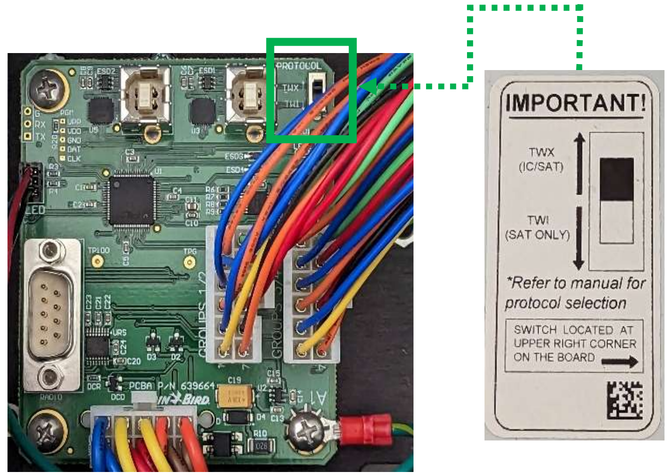
The IFX board is used to upgrade older satellites, providing IFX hybrid capabilities to the PAR+, MSC+ and PAR+ES satellites for communication along the IC System MAXI wire path. This allows control of both IC rotors and satellite controllers on the same wire path, creating flexibility during a phased renovation, or if a customer is looking for expansion opportunities within an existing Rain Bird satellite system. IFX boards come standard in current production PAR+ES satellites (since February 2020).

Note: IFX Hybrid systems require upgrading from a MIM to an ICI+.

Components of the Integrated Control Interface Plus (ICI+)

CPU Board

The CPU Board provides communication between the Central Control computer and each of the driver boards. The CPU board includes 3 different connections. For normal operations the USB connections are used, the left USB port is for Satellite equipment, the right USB port is for IC System equipment. For a remote located ICI+ (running IC System products only) the Serial connection is used with a MAXI Remote Location Kit (MRLK). The CPU board will communicate based on whichever communication protocol is selected, TWX or TWI. TWX is for IC System and IFX hybrid communication, TWI is for satellite system communication only.



Driver Board

The Driver Board provides communication between the CPU board and the equipment in the field. The driver board has two 2-wire paths on each board. Within an IC System each wire path controls a maximum of 750 ICM addresses. This same wire path can also communicate with IFX connected satellites such as the PAR+ES but may not exceed the limit of 750 stations per wire path.

Uninterruptable Power Supply (UPS)

Rain Bird recommends the use of a pure sine wave UPS to provide battery backup in cases of power fluctuations or loss of power to the Integrated Control Interface Plus (ICI+). When operated by battery the IC System requires a “pure sine wave” signal; not a modified, square or PWM wave. Use of an improper UPS may cause adverse system operation.

The computer running the Central Control software and ICI+ should be the only equipment plugged into the battery side of the UPS, any other equipment should use the non-battery plugs on the UPS. Rain Bird has verified **APC model Smart-UPS 1500** as a good option for the IC System. Different countries may have differing requirements. APC typically makes a Smart-UPS for each country according to the needs of that country. If sourcing a UPS for a different country, please source the UPS in the country in which the system will be operated. For example, do not purchase a Smart-UPS in the United States and ship it to Asia. The local Rain Bird distributor can assist in sourcing the appropriate UPS in-country.

Less expensive UPS models are available in a variety of stores, but it has been our experience that many of these do not produce the “pure sine wave” signal required by the IC System. Please specify the APC Smart-UPS 1500 model for the IC System. If another UPS has been identified, please work with your local Rain Bird representative or distributor to ensure proper specification.

How the system works

The IC System uses a data transfer method that sends packets of information across a two-wire path. Each ICM has a unique hexadecimal address that allows the central control software to communicate with each ICM individually.

The ICM has a unique “Long Address” pre-assigned from the factory that identifies it in the central control software. The Long Address is like having a phone number for each ICM. Each ICM has a label on the outside of the housing with a barcode and the printed Long Address. The user must enter the Long Address into the central control software at initial start-up. This Long Address is used for station On/Off commands, ICM Voltage diagnostics and the Quick Check.

The central control software communicates with the ICMs in the field through a high-speed method of communication. For this communication each ICM is assigned a Fast Connect Address. The Fast Connect Address is assigned automatically by the central control software when the ICM is first connected to the system.

The Fast Connect Address is a method by which the Central Control Software can quickly communicate with more than one ICM at a time. Fast Connect Addressing is used for basic diagnostics and not for irrigation control.

Basic Design Data

1. The central control software communicates via an Integrated Control Interface (ICI) or Integrated Control Interface Plus (ICI+) to the ICMs on the course. The ICI(+) should be mounted indoors and located as near the central control computer as possible. It is possible to remotely locate an ICI(+) by radio. See page 21 for additional details. System capacity is determined by the level of central control software as well as the hardware within the ICI(+).
2. The IC System operates a maximum of 750 individually controlled ICMs per wire path.
    a. For IFX Hybrid systems (Satellite controllers and ICMs on the same wire path) the maximum station count remains 750 stations per wire path.
3. Each ICI(+) contains a maximum of two (2) IC 2-Wire Driver Boards. Each Driver Board has a maximum capacity of two (2) wire path outputs.
4. Driver Board maximum capacity is 1,500 stations when both IC wire path outputs are used.
5. The ICI(+) has a maximum capacity of 3,000 stations when all four (4) wire paths are used on the two (2) Driver Boards.
6. Systems that require more than 3,000 stations will require additional interfaces.
7. The ICI+LINK interface is used to communicate wirelessly with LINK satellite controllers. ICMs cannot be connected downstream of a LINK satellite controller.

NOTE: LINK communication is not compatible with IC System devices. An ICM must be hardwired to an ICI+ wire path and cannot be connected through a LINK satellite.

Interface Capacities

Wire Path	Maximum of 750 total stations. This may be a combination of hard-wired satellite or IC stations		
Driver Board	Two (2) separate wire paths. Maximum 1,500 stations per driver board		
ICI+ Configuration Options	**IC System * (IFX Hybrid Compatible)**	**IC System-LINK** Hybrid (North America Only)**	**LINK System** (North America Only)**
Part Numbers	HS6020 – 120V HS6085 – 240V HS6090 – 100V	HS6099 – 120V Optional: 214111 – 2-wire driver board	HS6099 – 120V North America Only
Interface Configuration	Two (2) - 2-Wire driver boards	One (1) - LINK driver board with added 2-Wire driver board	One (1) - LINK driver board
Interface Capacity	3,000 Stations per interface	2,688 LINK Stations and 1,500 2-Wire stations (IC or Hardwire Satellite)	2,688 LINK stations

*Standard Configuration for most IC Systems
** LINK communication is not compatible with IC System devices. An ICM must be hardwired to an ICI+ wire path, and cannot be connected through a LINK satellite

Flexible Design

The IC System was designed to be as flexible as possible to accommodate the future needs of a golf course. While each wire path supports 750 ICMs, if the wire path is expected to be at or near maximum capacity, installing an additional wire path will create additional capacity for future expansion, such as IC CONNECT products. When designing with multiple wire paths, it is suggested to balance the load between the wire paths to ensure there is room for future expansion on each wire path.

Example – Total golf course need is 1,100 ICMs. We would suggest you plan on implementing two primary wire paths with approximately 550 ICMs on each path. The purpose of this is to leave room for expansion in the future.

Wire Path

The low power requirements of the ICM simplify wire path design. Here are some considerations when sizing the wire path for an IC System:

1. Number of ICMs and IC CONNECT devices on the wire path.
2. Total length of wire path from the interface to the farthest ICM.
3. The initial length of wire path between the ICI+ and the first ICM on the wire path.
4. Current number of satellite stations to be retained on the wire path (If applicable)

Take the time to carefully plan out the wire path and utilize the following documentation to aide in planning. The simplest wire path design often works best for an IC System.

IFX Hybrid Satellite and IC System Wire Paths

When either a new or existing wire path will have both satellite controllers and IC System stations, a simple calculation should be completed to confirm wire path quantities. The total number of satellite stations should be deducted from the total ICM station count available on each wire path (750). This number is the remaining number of ICMs that can be added to the existing wire path; however, you must also confirm wiring is appropriately sized based on the wire sizing chart on **page 12**.

Example – A course is maintaining 288 satellite stations (6, 48-station satellites) on a shared wire path. You will take the initial available IC Station count of 750 and subtract the 288 satellite stations. The remaining total available IC Station count would be 462 stations. Next, confirm the number of ICM stations to be added and confirm the wiring gauge is properly aligned with the wire sizing chart.

Wire Sizing

The following wire sizing charts provide the specified wire sizing for the wire path. The most important calculation is that of the **Primary Trunk wire length** (main line) on each wire path. The Trunk wire length is considered the “longest single run of wire” that will be needed for accommodating the design quantity of ICMs on the wire path. The Trunk wire length does not consider any branches from the main wire run in the calculation of wire length. Branches are wire runs that branch out from the Trunk wire in the field.

1. If a branch wire is less than 25% of the entire Trunk wire length, it can be one size smaller than the gauge of the Trunk wire. A minimum of 14 AWG (2.5 mm^2) wire size is required.
2. When the wire sizing chart indicates that the Trunk wire length requires 14 AWG (2.5 mm^2) wire, the branches should still utilize 14 AWG (2.5 mm^2) wire minimum.
3. When the wire sizing chart indicates that the Trunk wire length requires 12 AWG (4 mm^2) wire, the branches can still utilize 14 AWG (2.5 mm^2) wire.
4. When the wire sizing chart indicates that the Trunk wire length requires 10 AWG (6 mm^2) wire, the branches can utilize 12 AWG (4 mm^2) wire.

5. If an individual branch exceeds 25% of the total Trunk wire length, that branch shall be designed with the same gauge wire as the Trunk wire.
6. Other branches less than 25% can be designed with a wire size no more than 1 size smaller than the Trunk wire size, minimum of 14 AWG (2.5 mm^2).

If there is a question regarding a hybrid IC and Satellite wire path sizing, please contact your local Rain Bird Representative or Rain Bird Distributor.

Wire Sizing Charts

	Wire distance in feet														
Number of Units	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000	15000
50	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG
100	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG
150	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG
200	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG
250	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG
300	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG	12 AWG	12 AWG	12 AWG
350	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG
400	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG
450	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG
500	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG	10 AWG
550	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG	10 AWG	10 AWG	10 AWG
600	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG	10 AWG	10 AWG	10 AWG	10 AWG
650	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG	12 AWG	12 AWG	12 AWG	12 AWG	10 AWG	10 AWG	10 AWG	-	-
700	14 AWG	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG	12 AWG	12 AWG	12 AWG	10 AWG	10 AWG	10 AWG	-	-	-
750	14 AWG	14 AWG	14 AWG	14 AWG	12 AWG	12 AWG	12 AWG	12 AWG	10 AWG	10 AWG	10 AWG	10 AWG	-	-	-

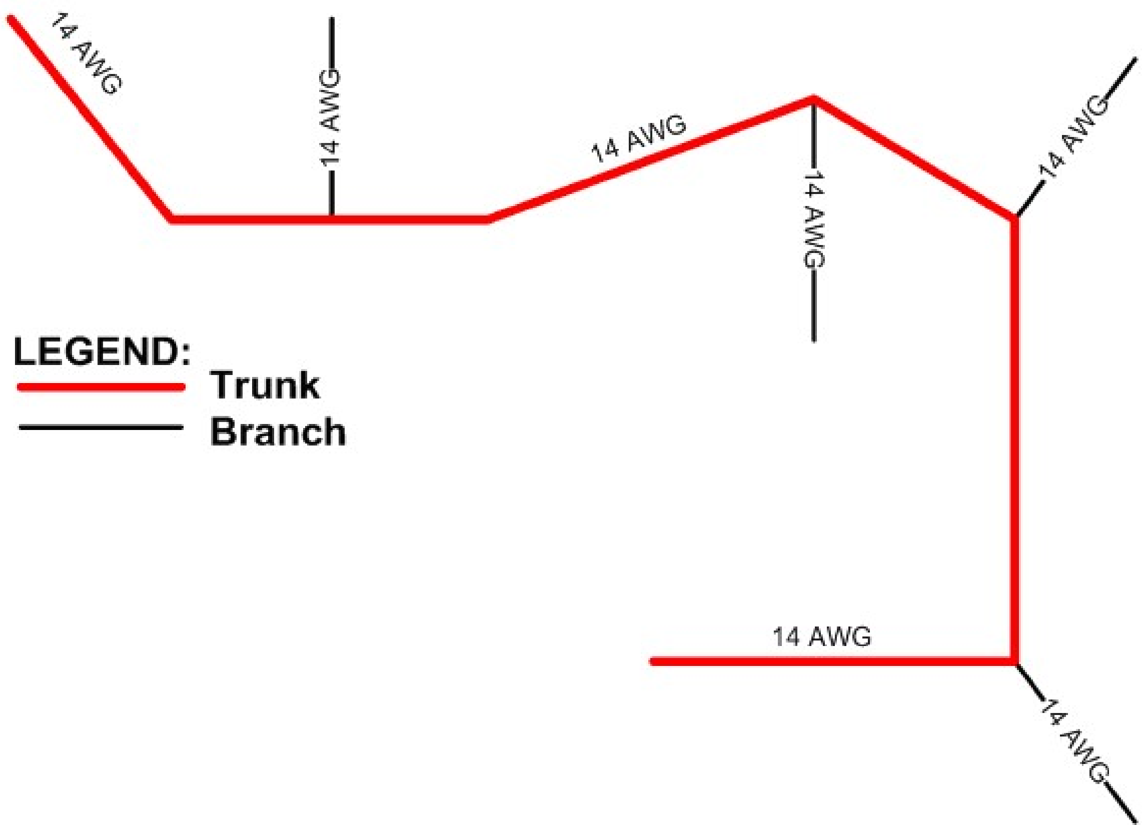
	Wire distance in meters														
Number of Units	1000	1250	1500	1750	2000	2250	2500	2750	3000	3250	3500	3750	4000	4250	4500
50	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2
100	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2
150	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2
200	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2
250	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2
300	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	4.0mm^2	4.0mm^2
350	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2
400	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2
450	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2
500	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2
550	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	6.0mm^2
600	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	6.0mm^2	6.0mm^2
650	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	6.0mm^2	6.0mm^2	6.0mm^2	6.0mm^2
700	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	6.0mm^2	6.0mm^2	6.0mm^2	6.0mm^2	-
750	2.5mm^2	2.5mm^2	2.5mm^2	2.5mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	4.0mm^2	6.0mm^2	6.0mm^2	6.0mm^2	6.0mm^2	-	-

Initial Length of Run from Interface to First ICM

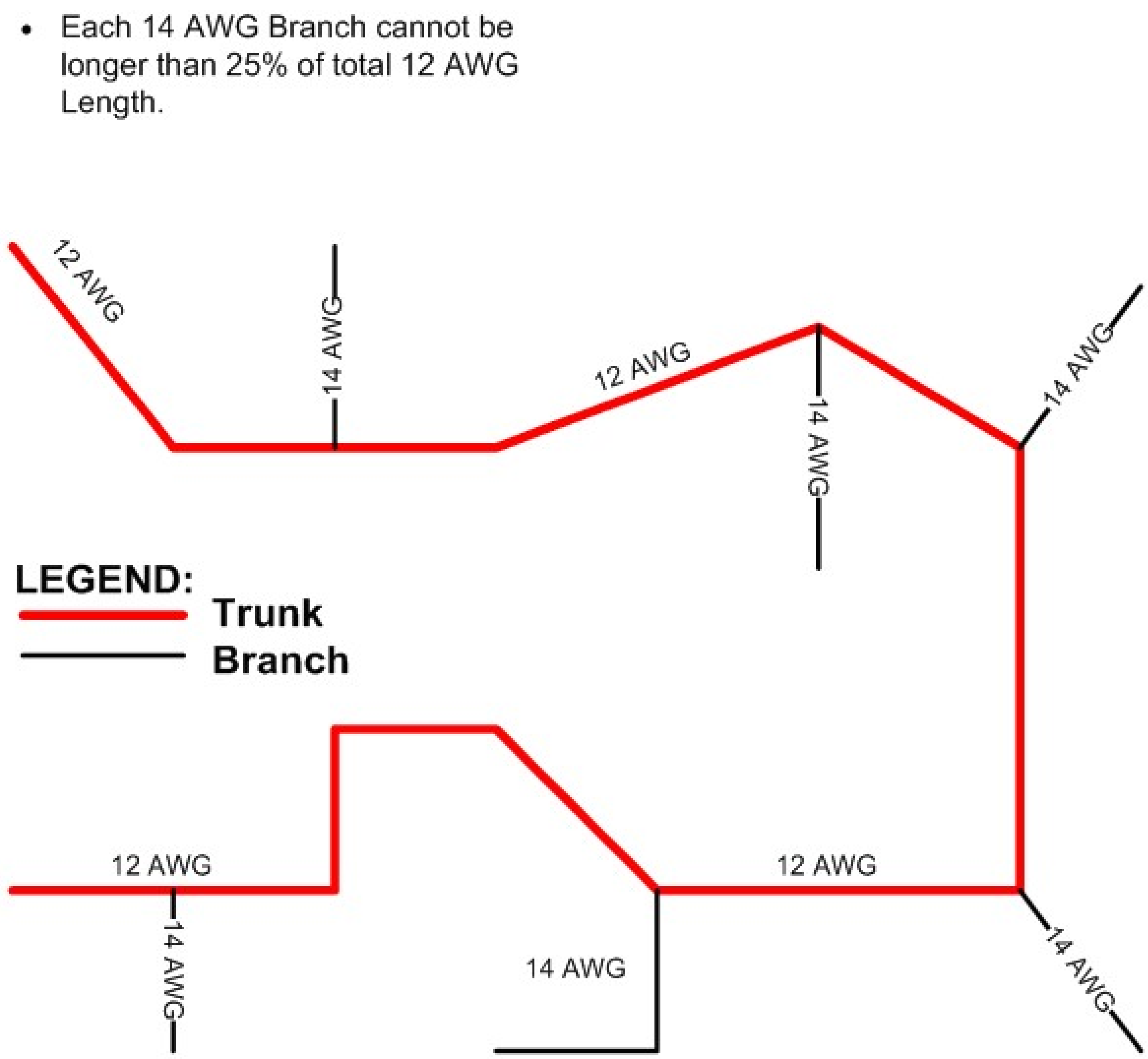
In addition to the above wire sizing chart, if the chart recommends 14 AWG (2.5 mm^2) wire path and the initial run of wire between the Interface and the first ICM on the wire path is greater than 2,500 feet (750m) then the initial length of wire (from interface to the first ICM) should be upsized by one additional wire size to 12 AWG (4.0mm^2). This is only necessary when 14 AWG (2.5 mm^2) is the recommended wire size. If the chart recommends 12 AWG (4.0 mm^2) based on number of units and total length of run of the wire path, then additional upsizing in a long initial run of wire is not necessary.

Wire Design Examples

Example 1 – An installation requires 300 ICMs on a single wire path and the Trunk wire length will be up to 10,000 feet (3,000 meters). Utilizing the sizing chart the Trunk wire should use 14 AWG (2.5 mm^2) MAXI wire for the installation. Although there are multiple branches off the main Trunk wire, these are not part of the calculation when determining the size of the Trunk wire. Each branch will also be 14 AWG (2.5 mm^2) wire.

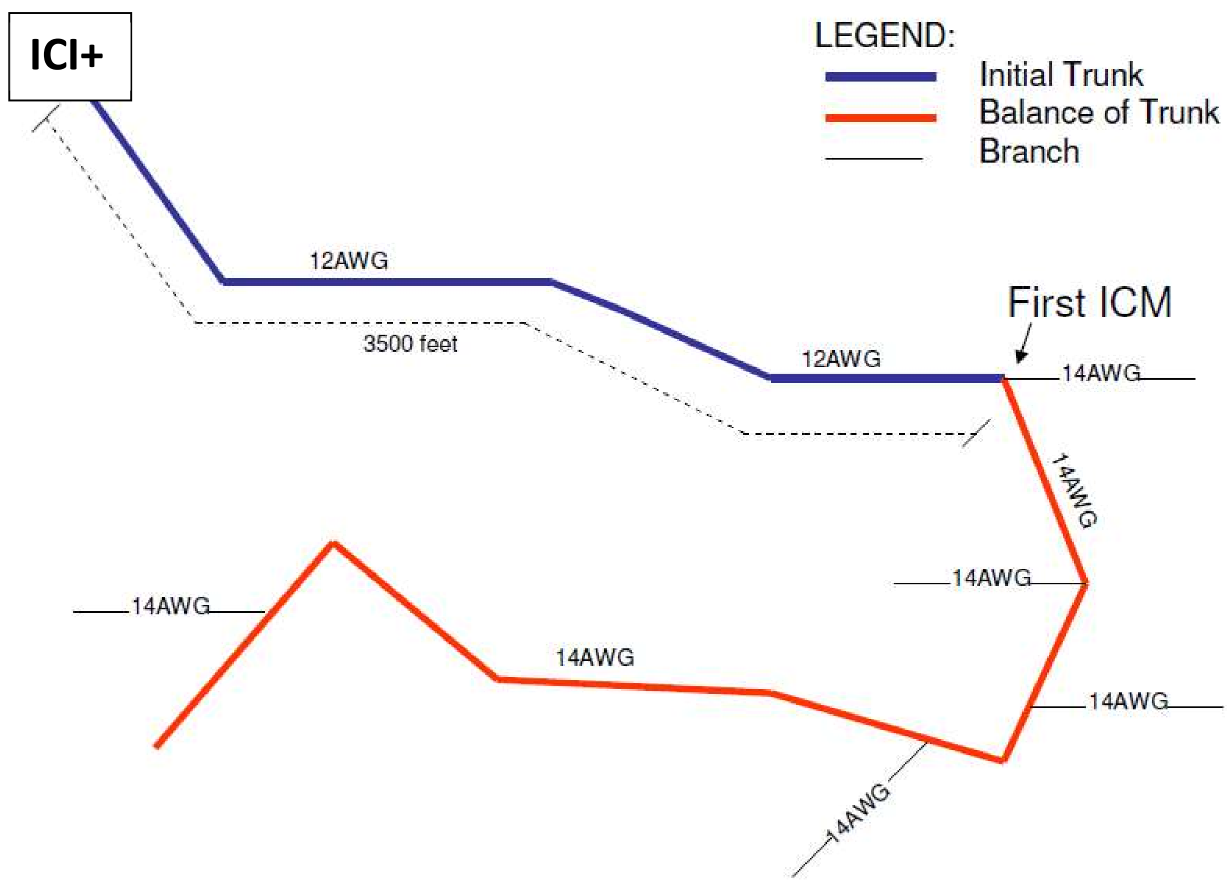


Example 2 – An installation requires 500 ICMs on a single wire path and the Trunk wire length will be up to 9,000 feet (2,700 meters). Utilizing the sizing chart the Trunk wire should be designed using 12 AWG (4.0 mm^2) wire. NOTE: 12 AWG (4.0 mm^2) wire will be used for the Trunk wire only. 14 AWG (2.5 mm^2) wire can be used for all branch lines if each branch does not exceed 25% of the total Trunk wire length. In this example, any branch that is less than 2250 feet (685 meters), 25% of the Trunk wire length, can be installed with 14 AWG (2.5 mm^2) wire.



Example 3 – An installation requires 400 ICMs on a wire path and the trunk wire length will be up to 8,000 feet (2,439 meters). The length of run from the ICI+ to the first ICM on the wire path is 3,500 feet (1,067 meters). Utilizing the sizing chart the Trunk wire should use 14 AWG (2.5 mm^2) MAXI wire for the installation. As the initial 3,500 feet (1,067 meters) is greater than 2,500 feet it requires an increase in wire size to 12 AWG (4.0mm^2). The initial 3,500 feet (1,067 meters) of Trunk wire should be sized at 12 AWG (4.0mm^2) from the ICI+ to the first ICM. After the first ICM, the Trunk wire can continue at 14 AWG (2.5mm^2).

Although there are multiple branches off the main Trunk wire, these are not part of the calculation when determining the size of the Trunk wire. Each branch will also be 14 AWG (2.5 mm^2).



Non-Rain Bird Wire Path Devices

Third-party fuse or switch devices are available in the market that offer the ability to isolate portions of a wire path for troubleshooting purposes. These fuse/switch devices are designed for **DECODER** type control systems to facilitate troubleshooting when a wire path has lost communication due to a shorted decoder. However, this type of failure is extremely rare in IC System because the ICM is designed to remove itself from the wire path when damaged and not impact communication on the rest of the wire path. For this reason, Rain Bird strongly discourages the use of third-party switches on the IC System. Third-party fuse/switch devices are an unnecessary extra device on the wire path with the potential to become a failure point. Such devices may also prevent the Rain Bird central control software and IC System diagnostics from properly identifying and locating field issues.

Grounding

Proper grounding is very important for the IC system. Grounding is accomplished through use of the following components:

1. Central control equipment (Central computer and Interface(s)) use MAXI™ Surge Protectors (MSP-1's) installed on a MAXI Grounding Plate (MGP-1) on each wire path, which isolate the central control equipment from the field.
    a. Remote located interfaces also require the above-mentioned grounding equipment.
    b. Note: Each MGP-1 mounts two MSP-1s.
2. In field isolated grounding points utilize ICSD surge devices which are installed on the wire path. These isolate sections of the wire path to create containment zones for surge energy to shunt to ground.
3. The ICM has built in surge protection standard (20 kV).

For a more detailed view of Rain Bird Grounding philosophy please review the "Surge Protection & Grounding Recommendations for Rain Bird Golf Control Systems" document available from the specifier portal on the Rain Bird Golf website.

Grounding Requirements – Interface Location

Grounding for the central control system should be installed as closely as possible to the location for the central control computer and interface. This "central grounding grid" should consist of MAXI™ Surge Protectors (MSP-1) for each wire path installed on MAXI Grounding Plates (MGP-1) as required. The MGP should then be connected/bonded to ground rods or plates. For locations where the interface is "remotely located" the interface should also have a localized grounding grid.

The central grounding grid should reach an earth ground resistance of 10 Ohms (10 Ω) or less for proper surge protection, 5 ohms or less of ground resistance is preferable. At the ICI+, for a long run (greater than

500 feet or 150 meters) at the beginning of the wire path, the MSP should be installed at the interface and an ICSD installed just prior to the first ICM on the wire path.

Grounding Requirements – Field Locations

The purpose of field surge devices is to "contain" and drain surge energy during an event, so that any damage caused by the surge will be limited by an ICSD located on either side of the event. Successful containment is dependent upon proper ICSD location and effective grounding where the desired Ohms resistance level is achieved.

An ICSD should be located every 15 ICMs or every 500 feet (150 meters), whichever condition is reached first. This is a guideline for design purposes and designers should try to stay as close to these guidelines as possible. However, in the example of a herringbone system with 4 stations per pipe lateral, an ICSD could be installed every fourth lateral (therefore every 16th station) as a normal design practice.

Important! During long runs of wire where there are no ICMs, an ICSD is <u>not</u> required every 500 feet (150 meters).

For example, if there is a wire length of 2,000 feet (609 meters) between ICMs on a wire path, one ISCD should be installed immediately after the last ICM prior to the empty length and one just prior to the next ICM. ICSDs are not required at 500-foot (150 meter) intervals on the intermediate 2,000 foot (609 meter) run of wire.

The IC System must have grounding throughout the wire path to give transient surges the opportunity to exit the wire path. The following requirements must be followed to properly ground the IC System:

1. Each ICSD must have an earth ground resistance of less than 50 ohms and be no more than 500 feet (150 meters) or 15 ICMs from the next ICSD.
2. ICSDs can be located either next to a valve-in-head rotor or in-line valve, whenever possible ICSDs should be installed in a valve box. The ICSD must be accessible for maintenance. A ground rod, plate, or any combination of the two should be used to reach an earth ground reading of 50 ohms or less.
3. The primary objective of grounding is to achieve the desired earth ground reading for the rods or plates regardless of which method is used. Rain Bird has had good success with ground rods when soil conditions allow them to be driven completely into the soil profile. An 8-foot (2.4 m) rod will help distribute a surge into lower layers of the soil profile, away from the soil surface and equipment. If required, rods can be coupled together; or a second rod outside the sphere of influence of the first rod may be successful.
4. ICSDs should be located at dead ends on long wire runs, approaching 500 feet (150m.) Short wire runs do not require ICSDs at dead ends. Herringbone pipe layouts do not require ICSDs at the end of each herringbone lateral.

5. Although not required, an optional shielding wire can also be utilized to improve the grounding of the system. If used, the shielding wire should be a 10 AWG (6 mm^2) bare copper wire that connects to each of the grounding rods or plates in the system. The purpose of the shielding wire is to provide shielding for the MAXI wire path by attracting surges to the shielding wire. The addition of a shielding wire does not change or reduce the requirement of achieving 50 ohms or less resistance at each ICSD grounding point without the shielding wire connected. Rain Bird believes the decision to use a shielding wire on a project should be based on the localized conditions at the project and is not specific to a control system type or manufacturer type. A course would have a shielding wire regardless of control system, or it does not. It should be the decision of the irrigation designer.

NOTE: If a shielding wire is used, the ground rods or plates should be tested independently, prior to connecting the shielding wire to the rods or plates. This will ensure that the rods or plates provide a good earth ground at the ICSD. A measurement with the shield connected does not give a true reading of the individual/local ground location at the ICSD and will give a reading that is considerably lower than the actual grounding at that location.

Types of Pipe Networks

The IC System works equally well with "herringbone" or "sub-loop lateral" pipe network designs. Rain Bird looks to the irrigation designer to select the best pipe network layout for the irrigation system design and then apply the IC System wire path on that layout. Each type of pipe network design offers different advantages depending upon the location and size of the irrigation system. There is no preference for the IC System wire path.

Looping Communication Wire

The IC System communication wire **must NOT** be looped. Dead ends are required to maintain system diagnostic capabilities. While the system will function with looped communication wire, troubleshooting will be more difficult, so looping is not recommended.

Combining Wire Paths at the Interface

While a single IC wire path can handle 750 ICMs when sized according to the design guide table, there are times when it may make sense to bring separate "wire paths" (with fewer ICMs) directly back to the interface. When combining two or more distinct wire paths into a single output terminal at the ICI+, it is <u>not necessary</u> to calculate the total length of <u>all</u> the wire paths combined when calculating Trunk wire size. Each distinct path is viewed separately as a Trunk and not a Branch. Therefore, size each of the Trunk wire paths separately, considering the number of ICMs and length of that path to calculate the wire size. **NOTE: The combined number of ICMs on a single terminal output still cannot exceed 750 ICMs.**

Remotely Locating Integrated Control Interfaces (ICI+)

Rain Bird strongly recommends directly connecting the interface whenever practical, however when conditions prevent this a remote located interface can be used. Designers may wish to consider remotely locating the Integrated Control Interface (ICI+) in the field to reduce long wire runs or address localized conditions. For example, the central control computer can be located at the maintenance building and the ICI+ can be remotely located in a pump station, clubhouse or other secure, weatherproof location that is more conveniently located to the golf course irrigation system.

All Rain Bird interfaces, including remotely located interfaces, are always online and maintain continuous real-time two-way communication between the central and each interface. The central does not download programs to remote interfaces. This ensures that all Rain Bird central control software advanced technologies remain active and operational with all devices attached to the control system. For example, dynamic flow management is always active on all stations regardless of whether the interface is local or remotely located. Water-saving products like RainWatch™ devices are always online and active. There are no limitations with the remotely located interfaces compared to systems where the interface is located at the irrigation computer.

900MHz Spread Spectrum Radios:

An MRLK (Maxi Remote Location Kit) should be used to provide 900MHz wireless radio communication between the central control computer and the remotely located ICI+. The MRLK includes two radios that operate in the 902-928MHz range and automatically hop between frequencies to avoid interference. The MRLK is currently compatible with an IC System ONLY and is not compatible with IFX-hybrid configurations.

Please note the following:

1. A MRLK kit is required for each remotely located ICI+.
2. A site survey should be completed by the authorized Rain Bird golf distributor or manufacturer to ensure that the system will communicate between the desired points. A repeater may be required to ensure good quality communication.
3. 900MHz radios are NOT approved for use in some countries. This should be verified prior to completing the irrigation design.
4. Remotely located interfaces require a UPS device, just as if they were located with the central control computer. The APC model Smart-UPS 1500 is the approved device.

Please contact your distributor or Rain Bird representative to verify the above information and obtain more details about the use of MRLK900 kits to remotely locate an ICI+ on your project.