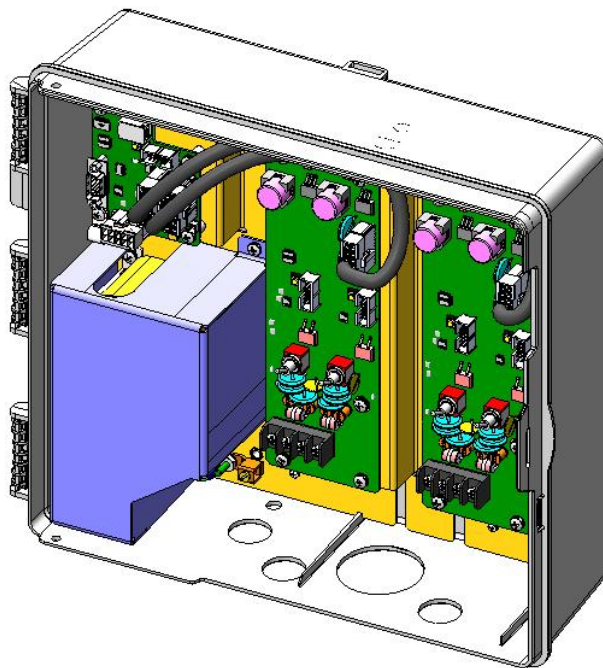




IC System™

Operation and Troubleshooting Guide



July 2009



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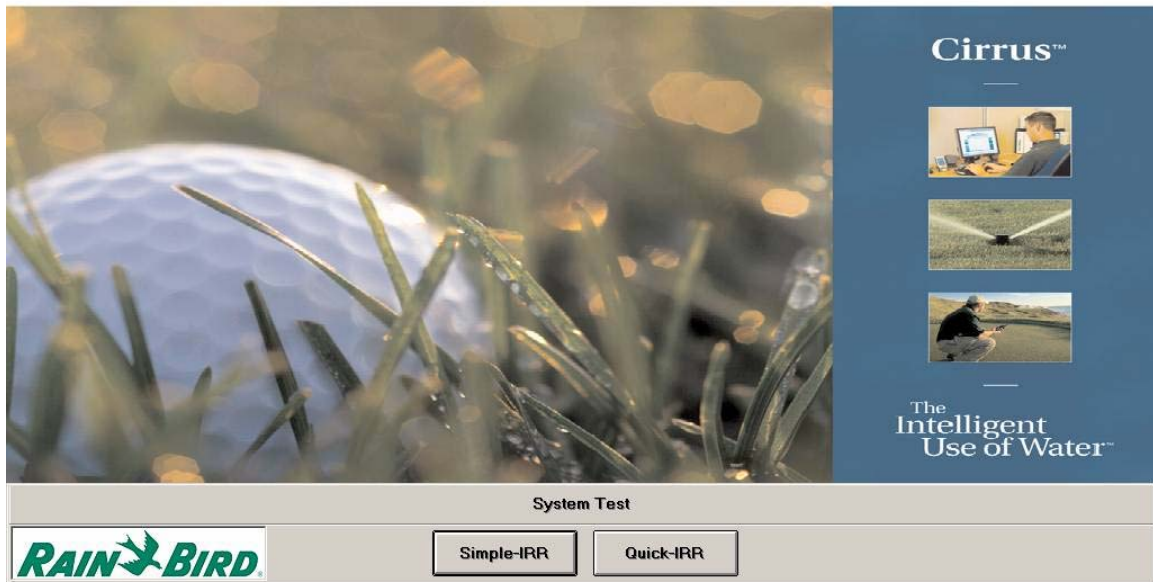
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IC System™

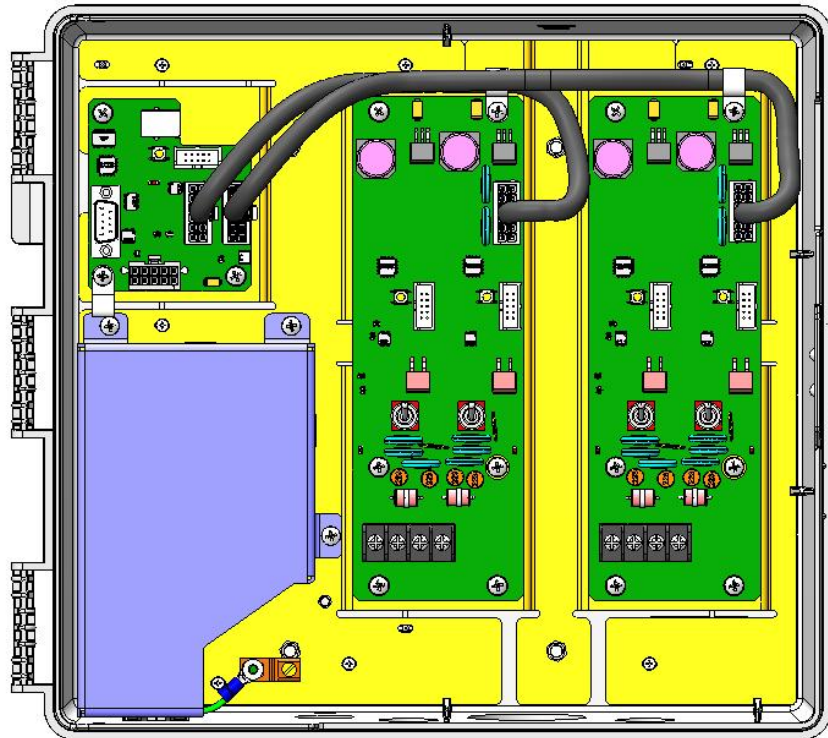
Central Control Software

Cirrus™, Nimbus II™, Stratus II™, Stratus LT™ and GO™ are the Central Software platforms that operate the IC system and allow you to troubleshoot the system. There are many diagnostics features within this software that can help you quickly diagnose where field problems are located in the system.



ICI

The Integrated Control Interface (ICI) is the field interface that accepts commands from the Central Control Software and directs them to the field. The ICI also communicates intelligently with the field in order to update the status back to the Central Control Software.





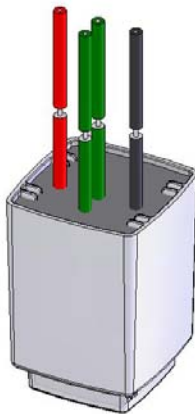
ICM

The Integrated Control Module (ICM) is built into the Rain Bird rotor or Rain Bird electric control valve and communicates directly with the Central Control Software via the ICI to turn rotors and valves on and off throughout the golf course.



ICSD

The Integrated Control Surge Device (ICSD) provides surge protection for the system in case of lightning strikes.



How the system works

There are two addresses associated with each ICM in the system. The first is the Long Address and is the unique number that identifies the ICM. Each ICM has a barcode with the printed Long Address number on the outside of the housing. The Long Address is similar to a phone number for each ICM.



The second address is the Fast Connect Address and is assigned based on the ICM's location in the central control database. This occurs in the background and is how the software communicates with more than one ICM at a time. This is similar to having a speed dial for several phone numbers. The Central Control Software can manage up to 750 ICMs on a single wire path by utilizing this communication scheme. Once the Central Control Software has made contact with the individual ICMs the status will change from "Not Connected" to "Fast Connect."

Troubleshooting Philosophy

The following two steps will allow the user to accurately diagnose any system issues.

1. Use the Central Control Software to diagnose field issues. If used properly, you should be able to pinpoint areas that may be working marginally or not at all.
2. Once field issues have been identified, it is sometimes necessary to go to the field with the suggested tools to further diagnose problem areas.

Information and Tools Needed

The most important information to have is an accurate "as built" or record drawing that shows the ICM long addresses and locations on the site. In addition, the location of the ICSDs and all splices must be recorded on the same record drawing.

The following tools are required for proper troubleshooting:

- AC Current Clamp Multi-Meter



Figure 1 - AMPROBE Model AC50A. Available from GSP (P/N GSP700405) 1-866-GSP-XPRT.

- Alternate meters require current measurement capability with a minimum resolution of 0.01mA.
- Additional ICMs
- Wire Splice Kits and Wire Splicing Tools
- King Safety Wire Stripper
- Standard Wire Strippers (10 – 18 AWG)



Troubleshooting with Central Control Software

The following five steps should be followed to diagnose IC System field issues using the Central Control Software. Each step builds upon the previous step in order to quickly diagnose where the problem may exist. The following sequence is an overview of the troubleshooting steps. A detailed explanation follows:

1. **Verify System Status** – Checking the system status should be the initial step to verify incoming power, system communications, and wire path power.
2. **Review Station Status** – After checking the system status for correct communication to the field, the software can quickly check the status of all the stations in the field. The station status can be viewed in the “Station Detail” window of the Central Control Software. Each station will either be assigned a status of “Not Connected,” “Fast Connect” or “Suspended.” This check determines whether “Fast-Connect” addresses have been assigned to all ICMs. In addition, this check can indicate if a particular ICM has ever communicated with the system since initial installation.
3. **ICM Diagnostics** – This set of tests will refine your search to problem areas by attempting communications with specified ICM wire path groups. A few helpful screens provide a snapshot indicating the health of the ICMs in the system.
4. **ICI Diagnostics** – Utilizing the ICI Diagnostics within the Central Control Software, it is possible to determine whether there may be high current conditions on any of the wire paths. By utilizing the fault finding mode with a clamp meter, direct field shorts can be located.
5. **Individual Station Status** – A number of tests can be performed on the individual ICMs to verify communication and proper operation, including manual operation and feedback.



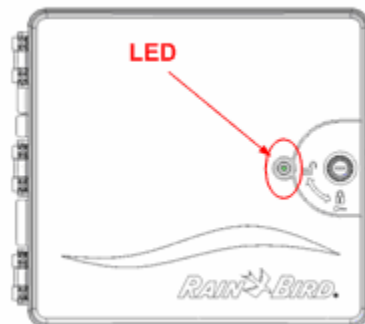
Verify System Status

If a large number (or all) of ICMs in the field have stopped communicating with the central, then you should perform these tests in the following order:

- ICI System Power
- Wire path Power
- Communication from Central Control Software to the ICI Controller.
- Communication from the ICI Controller to each wire path.

System Status - ICI System Power

An LED located on the front cover of the ICI controller will show the status of the power supply in the ICI.



This LED will have three (3) possible conditions:

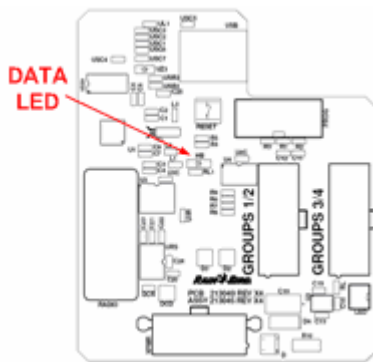
- | | |
|----------|--|
| GREEN | The system is powered and it is communicating with at least one wire path. The LED will remain green as long as ONE path is communicating, even if there are multiple wire paths installed. |
| RED | The system is powered but cannot communicate any of the installed wire paths. |
| No light | If the LED is not illuminated, then check one of the following: <ul style="list-style-type: none">• Verify incoming power supply to the ICI controller. Check power supply, terminal strip or UPS to ensure that the ICI controller is receiving power. If there is no power, re-establish the power supply. |

- Check the Fused Power Entry Module (PEM) to ensure that the rocker switch is ON.
- If both of the above conditions are true, then check the incoming power supply fuse and replace with an equivalent value fuse (1.5 amp slow blow) if blown.

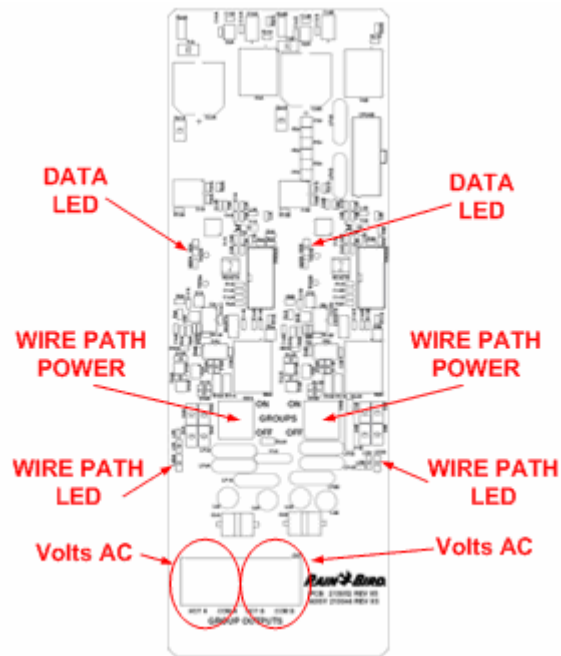


System Status - Wire Path Power

To check the power on the outgoing wire paths, open the ICI front cover to view the boards inside the cabinet. The voltage can be measured between “HOT A” and “COM A” or “HOT B” and “COM B” on the lower terminal blocks. This will verify outgoing voltage on each of the wire paths. The outgoing voltage should be between 25 and 28 volts AC.



CPU Board



Driver Board



Multiple LEDs are located on the boards inside the ICI to observe various communication and power functions.

System Status - Central Software Communications

CPU Board Data LED: To verify communication between the computer and the ICI controller, an LED is located on the CPU board inside the ICI. This LED will flash on and off every time there is communication between the ICI and the Central Control Software. The Central Control Software will communicate at least once per minute to the CPU board although the interval is usually more frequent.

If the LED is not flashing periodically (approximately once a minute) then the following possible conditions may exist and each should be verified.

- The device setting inside the central control software may not have been assigned.
- The USB cable between the ICI controller and the computer may be unplugged or damaged.
- The power supply to the ICI may be disconnected or the fuse is blown.
- The CPU board may be damaged. If all of the above conditions have been verified, consider replacing the CPU board.

If the LED is flashing periodically, continue to the next troubleshooting step below.

System Status - ICI Field Communication

Driver Board Data LEDs will flicker when communicating with the field ICMs. There are two LEDs mounted on each driver board (one per wire path.) If the Driver Board Data LED is on constantly with no flickering then most likely there is a high-current condition in the field which is usually the result of a direct short on the wire path. The Driver Board automatically detects this condition and reduces power to the field. If there is a direct short on the wire path, it is necessary to use a clamp meter to find the excessive current on the shorted wires.

The **Wire Path LED** is a simple indicator of power to the field; The LED should be lit when the switch is in the UP (or ON) position. When the switch is turned off, the LED will slowly grow dim as the field power discharges. This normally occurs within 30 seconds and the LED will go off. If the switch is on, but the light is not lit, there may be a problem with the driver board. Use a voltmeter to determine if there is between 25-28 volts between the two terminals on the driver board. If the LED is off and there is no power, the driver board may be damaged and require repair or replacement.

Troubleshooting ICMs with the central control software:

Overview:

The central control software includes a series of advanced troubleshooting tools that helps to quickly diagnose issues in with the system. The basic troubleshooting procedure should be performed as follows:

1. Run the “Status Poll” to determine if any stations are not responding.
2. If any stations do not respond to the Status Poll, test the ICM with the Long Address Poll and the Fast Connect Poll
3. If neither poll responds, the ICM is either damaged or not connected to the wire path

Station Status

Using the Central Control Software, navigate to the “Station Detail” screen. You will be able to see the following information.

Station ID	Area	Zone	ICM	Address	Status	Signal Strength	Water Flow	Pressure	Temperature	Other
1G1	A	1	2	2372	Fast Connect		1	10		
1G2	A	1	2	2318	Fast Connect		1	10		
1G3	A	1	2	2318	Fast Connect		1	10		
1G4	A	1	2	2376	Fast Connect		1	10		
1G5	A	1	2	237E	Fast Connect		1	10		
1T1	A	1	1	2336	Fast Connect		1	10		
1T2	A	1	1	2263	Fast Connect		1	10		
1T3	A	1	1	21C8	Fast Connect		1	10		
1T4	A	1	1	21D2	Fast Connect		1	10		
1F1	A	1	2	229E	Fast Connect		1	10		
1F2	A	1	2	2291	Fast Connect		1	10		
1F3	A	1	2	2220	Fast Connect		1	10		
1F4	A	1	2	21D1	Fast Connect		1	10		
1F5	A	1	2	21BA	Fast Connect		1	10		
1F6	A	1	2	21B7	Not Connected		1	10		
1F7	A	1	2	223C	Fast Connect		1	10		
1F8	A	1	2	21D3	Fast Connect		1	10		
1F9	A	1	2	21FD	Fast Connect		1	10		
1F10	A	1	2	2311	Fast Connect		1	10		
1F11	A	1	2	2289	Fast Connect		1	10		
1F12	A	1	2	21DF	Fast Connect		1	10		
1F13	A	1	2	222A	Fast Connect		1	10		
1F14	A	1	2	224F	Fast Connect		1	10		
1F15	A	1	2	227D	Fast Connect		1	10		
1F16	A	1	2	2240	Fast Connect		1	10		
1F17	A	1	2	21BE	Fast Connect		1	10		
1F18	A	1	2	2244	Fast Connect		1	10		
1F19	A	1	1	21DC	Fast Connect		1	10		
1F20	A	1	1	223F	Fast Connect		1	10		
1F22	A	1	1	2254	Fast Connect		1	10		
1F23	A	1	1	21E2	Fast Connect		1	10		
1F24	A	1	1	21B3	Fast Connect		1	10		
1F25	A	1	1	21DA	Fast Connect		1	10		
1F29	A	1	1	21B9	Fast Connect		1	10		
1A1	A	1	2	21E8	Fast Connect		1	10		
1A2	A	1	2	21C7	Fast Connect		1	10		



In the connect status column, there are four possible conditions that may indicate the status of the ICM in the field. Initially, prior to programming the Long Address (the address on the label on the ICM) into the software, the stations should show as “not connected.” After programming the Long Address, the following conditions may be shown:

1. **Fast Connect** – When the station shows the status as Fast Connect, the central control has successfully contacted the ICM and assigned a Fast Connect Address to that ICM.
2. **Not Connected** – When the station shows the status as Not Connected, the Central Control has not been able to contact the ICM to assign the Fast Connect Address. Possible conditions could be:
 - No ICM connected to the wire path
 - Incorrect Long Address entered in database
 - Bad wire splice
 - Wire polarity is reversed
 - The wire path has a fault or short.
3. **Suspended** – The Suspended status is an option that is manually assigned by the user. This option may be used when the station information (ie. ICM Long Address) has been assigned but the station is not ready to be used. The Suspended option will stop the Central Control from trying to contact the ICM and program the Fast Connect Address.
4. **Use Long Address** – Use Long Address is only necessary when troubleshooting the system. This option ignores the Fast Connect address. It should only be used if the system is not able to communicate to the ICM using the Fast Connect address. Communicating with the ICM using the Long Address is a slower method of communication. It is not desirable to leave the station in the “Use Long Address” setting.

21FD	Fast Connect	
2311	Fast Connect	
2289	Fast Connect	
21DF	Use Long	▼
222A	Fast Connect	
224F	Not Connected	
227D	Suspended	
2240	Use Long Address	
21BE	Fast Connect	

Software Diagnostics for the ICM

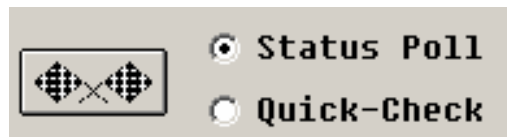
As stated earlier, the following diagnostics help refine your search to address problem areas by attempting communications with specified ICM groups. Two important ICM Diagnostic checks are the Status Poll and the Quick Check.

IMPORTANT NOTE: the Quick Check will physically cause the rotor or valve to activate, which turns on the water, so take this into account before using this method.

ICM Diagnostics - Status Poll

The Status Poll is a quick way to verify communication with every ICM in the field. The Status Poll will communicate to each selected ICM and respond with either a “Pass” or a “Fail.”

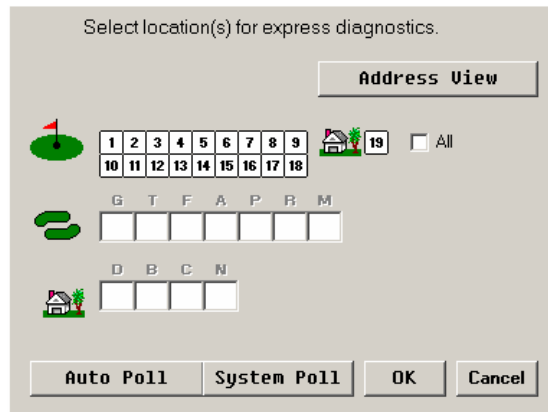
The ICM Diagnostics screen is found in the **Monitor/Log and Course View** tab. Open the window and select “ICM Diagnostics” from the dropdown menu. After navigating to the ICM Diagnostics screen, you will see a selection box at the top of the screen similar to the following figure.



By selecting the **Status Poll** button and then clicking on the start button (the double flags) to the left, the software will bring up a window that will allow you to select how the Status Poll should be performed.

There are a few options that you will want to consider prior to running the Status Poll test.

- Both the **Auto Poll** and **System Poll** perform the **Status Poll** test of the entire system. **System Poll** checks the status of all ICMs on the system when initiated. **Auto Poll** causes the software to automatically perform a Status Poll on the entire system at a desired frequency. If **Auto Poll** is selected, another window will appear to enable you to select the frequency that the Status Poll will be performed.
- **Express Diagnostics** will perform a Status Poll only the desired areas of the course. These are selected with the following window that appears after clicking the button.



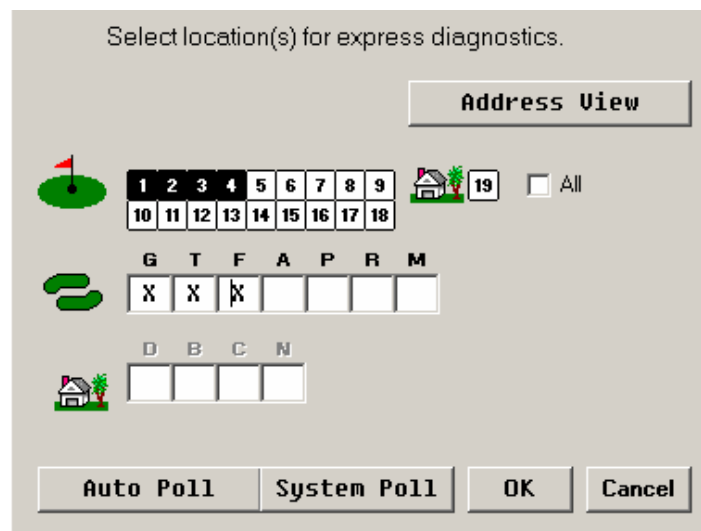
After selecting the desired holes and areas, click on “OK” to activate the test.

The following examples will help to explain the choices available for the Auto Status Poll:

Example 1 – AUTO POLL: You could elect to have the system perform an Auto Status Poll at 2:00pm every day. A quick glance at the “Status Poll” screen will show the health of the system.

Example 2 – STATUS POLL FOR THE ENTIRE COURSE: You want to check the entire installed base of ICMs immediately because you suspect a problem. Simply click on the **System Poll** button and this test will be performed on the entire system. The results will be shown quickly as they are communicated back from the field.

Example 3 – STATUS POLL FOR SELECTED AREAS: To check a particular area of the course, select which hole and area (multiple holes and areas can be selected) then click on the OK button. The system will test the specified areas. This test is known as **Express Diagnostics**.





When the **Status Poll** is activated, the pass/fail status of each station can be followed on the ICM Diagnostics screen.

Monitor/Log and Course data Views

Course 1

Fast Connect Programming

ICM Diagnostics

Status Poll

Quick-Check

Stop Quick-Check

Last Status Poll: 3/11/2009 1:08:00 P

Location	Hole						
	1	2	3	4	5	6	7
Green							
G1	PASS	PASS	PASS	PASS			
G2	PASS	PASS	PASS	PASS			
G3	PASS	PASS	PASS	PASS			
G4	PASS	PASS	PASS	PASS			
G5	PASS	PASS	PASS	PASS			
Tee							
T1	PASS	PASS	PASS	PASS			
T2	PASS	PASS	-	PASS	-		-
T3	PASS	-	-	PASS	-		-
T4	PASS	-	-	-	-		-
T5	-	-	-	-	-		-
T6	-	-	-	-	-		-
T7	-	-	-	-	-		-
T8	-	-	-	-	-		-
T9	-	-	-	-	-		-
Fairway							
F1	PASS	PASS	PASS	PASS			
F2	PASS	PASS	PASS	PASS			
F3	PASS	PASS	PASS	PASS			
F4	PASS	PASS	PASS	PASS			
F5	PASS	PASS	PASS	PASS			
F6		PASS	-	PASS			
F7	PASS	PASS	-	PASS			-

All of the above tests will indicate a green PASS or a red FAIL after they have been completed. The cell will turn yellow as the system is attempting communication with the field ICMs.

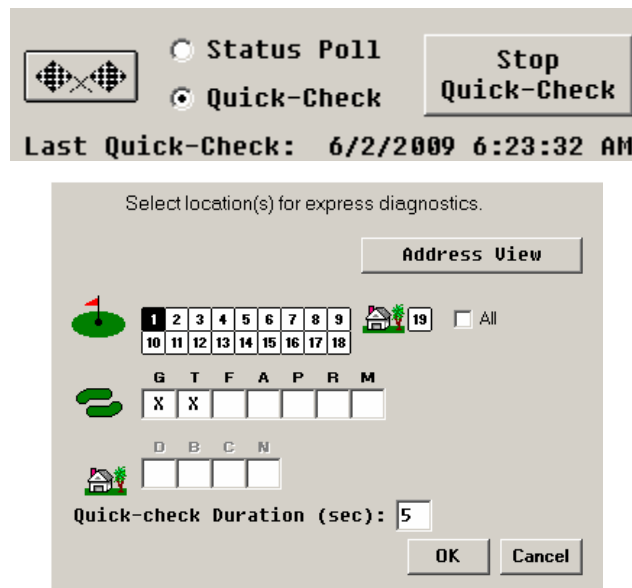
If an ICM station has not accepted the Fast Connect address, the Central Control will not attempt to communicate with it and the station will remain white with neither a green "Pass" nor a red "Fail."

<u>Highlight</u>	<u>Result</u>
GREEN	Pass
RED	Fail
YELLOW	Attempting communication
WHITE	Fast Connect not programmed or accepted.



ICM Diagnostics - Quick Check

NOTE: The Quick Check test enables a very brief mechanical activation at the electric valve or valve-in-head sprinkler. After selecting the Quick-Check radio button and then clicking the “double flags” button to the left of it, you will see the following dialog appear.

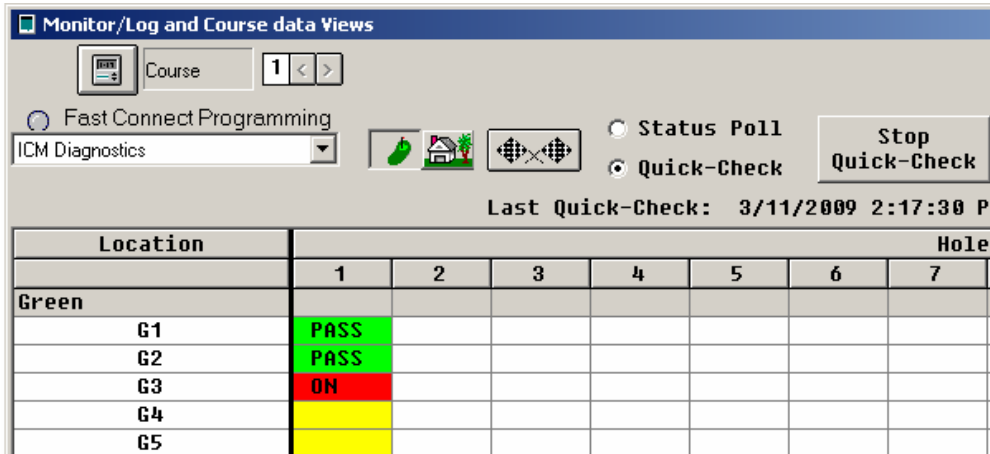


Quick Check is easily performed with this window. The test enables you to specify the hole, area, and duration (in seconds) of the sprinkler operation during the test. After clicking OK, the system will cycle through each station in all of the selected areas. Activation will occur one ICM at a time, stepping through the system from tee to green, hole by hole, and activate each sprinkler for the specified time.

NOTE: When performing the Quick Check test, the system will take approximately 7-10 seconds before activating the first station. This test must be activated from the central control software. It cannot be activated from The FREEDOM System™ or MI Series Mobile Control.

NOTE: Do not activate this test within 30 seconds of scheduled irrigation events.

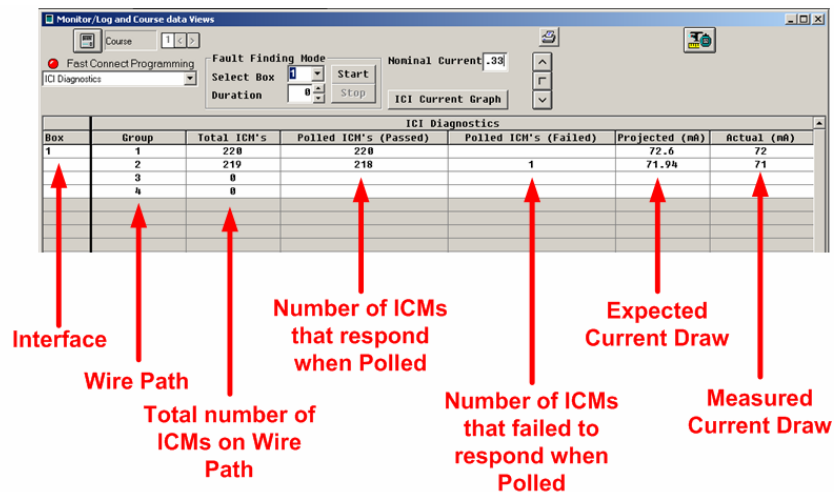
During the Quick Check test you will see something similar to the following window appear on the ICM Diagnostics screen.



At any time during these tests you can stop the Status Poll or Quick-Check by clicking on the Stop Quick-Check button in the upper right of the screen. The text on the button will change based on which test is currently running.

ICI Diagnostics

The ICI Diagnostics are used to determine system health.





NOTE - The ICI diagnostics will not be populated with data until the ICM Diagnostics System Poll test has been completed.

This screen is very useful for troubleshooting possible high current situations that may occur. This screen can also indicate how many ICMs failed during the ICM Diagnostics Poll.

ICI Diagnostics - Nominal Current

The Nominal Current feature assigns a value for each ICM on the wire path. This is used to calculate the projected total current draw (mA) by multiplying the number of polled ICMs with the Nominal Current. The nominal current should be approximately .33 mA per ICM on most systems, but the nominal current will vary slightly based on the length of the wire path. It is recommended to use .33 mA.

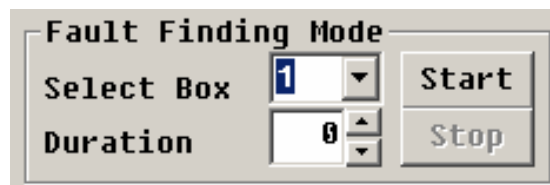
NOTE: The measured current draw in the software may be higher when compared to the value measured with a clamp meter when there are less than 50 ICMs on the wire path.



ICI Diagnostics - Fault Finding Mode

Fault Finding Mode is a tool that can be used to detect field faults when there may be a direct short on the wire path.

Activating the Fault Finding Mode will cause all communications on the selected ICI System to stop, shutting off the irrigation system. The software will then apply a reduced current to the field. A clamp meter can be used to isolate shorts on the wire path while the system is in the Fault Finding Mode.



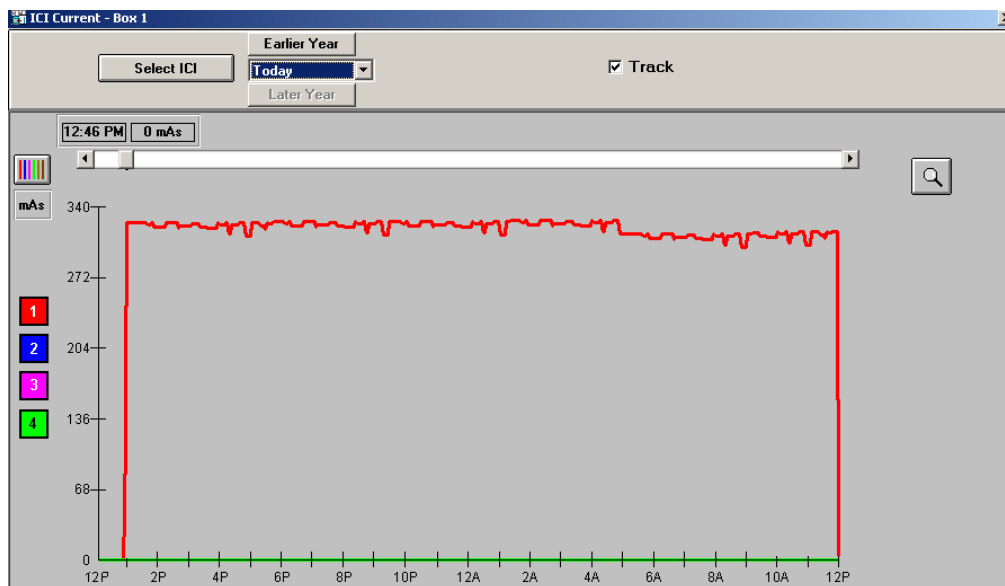


The duration can be specified from 0 to 300 minutes, after this time the Central Control Software will automatically revert back to normal irrigation mode.

NOTE – While this mode is activated, you will notice that the DATA LED’s on the ICI Driver board will be continuously lit. As soon as the fault finding mode is complete, normal LED activity will resume.

ICI Diagnostics - ICI Current Graph

The ICI Current Graph tracks the current draw on each wire path over a specific time period. The ICI Current Graph will show the system health. If a fault or cut wire occurs on the wire path, the graph will show the change in current. This can be very helpful to identify the time the event occurred.

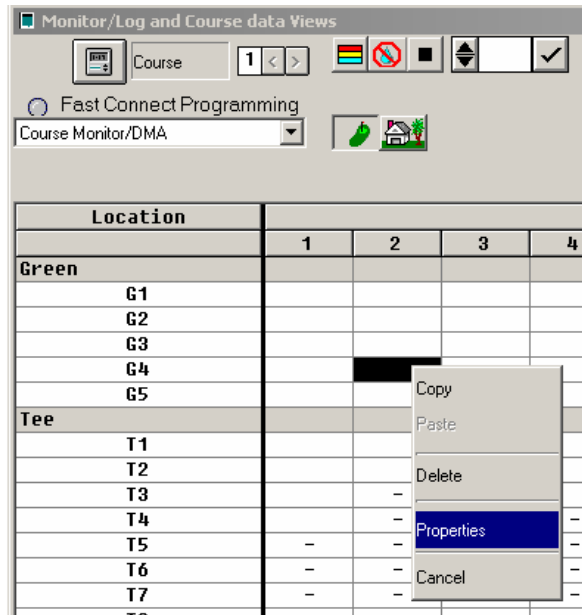


Individual Station Status

After isolating possible faults to a specific location or area, you can use the Individual Station Status to query information on the suspect ICM.



Navigate to the **Course Monitor/DMA** screen. Select the desired station, right-click and select **Properties** on the particular ICM in question. The following figure shows the properties for the ICM on Hole # 2, Green Station # 4.



After selecting the station properties, a window will appear that has several tabs. For troubleshooting purposes, the most valuable tabs will be labeled **Status** or **Voltage**.

NOTE: The voltage tab will appear only when the Password option (4321) has been selected in the Central Control Software. The Password can be found in the “Password” icon on the header tab of the software.

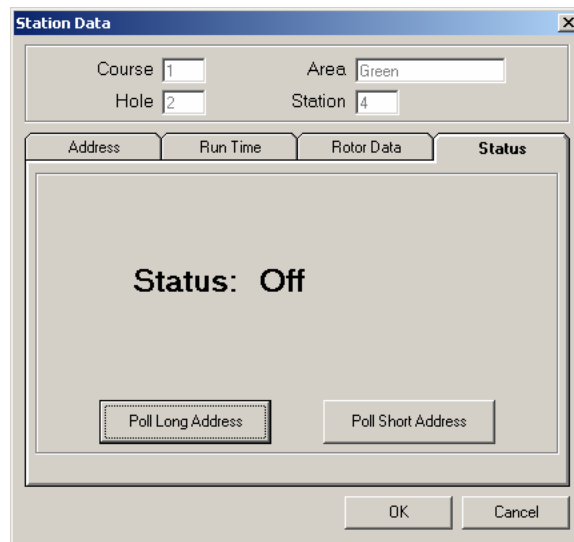
On these tabs you should be able to:

- Poll Long Address
- Poll Fast-Connect Address
- Measure Voltage

There are a number of other things that can be checked, such as the actual Long Address, etc. but we will concentrate on ICM communications for diagnostic purposes.

Individual Station Status - Poll Long Address

By clicking on the Poll Long Address button you will see station will post ON, OFF, or NO ANSWER.



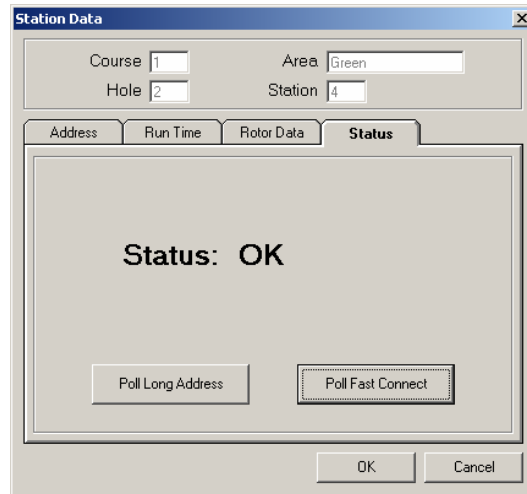
The image shows a software dialog box titled "Station Data". At the top, there are four input fields: "Course" with the value "1", "Area" with the value "Green", "Hole" with the value "2", and "Station" with the value "4". Below these fields is a tabbed interface with four tabs: "Address", "Run Time", "Rotor Data", and "Status". The "Status" tab is currently selected and displays the text "Status: Off". At the bottom of the "Status" tab are two buttons: "Poll Long Address" and "Poll Short Address". At the very bottom of the dialog box are "OK" and "Cancel" buttons.

This method uses the factory programmed address to communicate. If "No Answer" is received, then re-check the Long Address of the ICM with the "as built" installation records.



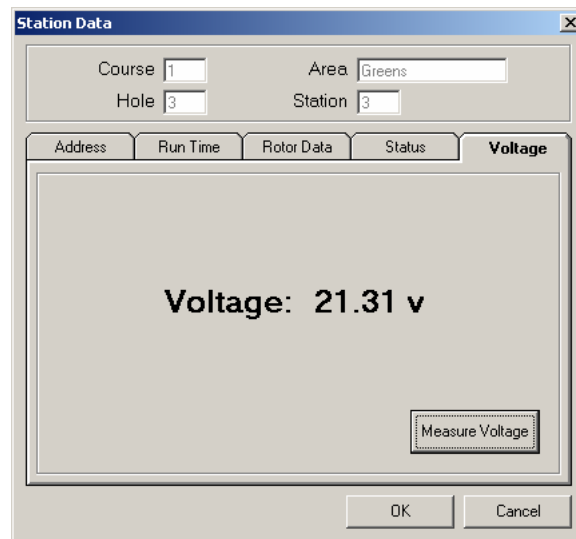
Individual Station Status - Poll Fast-Connect Address

If you click on the Poll Fast Connect Address button, you will see either OK or NO ANSWER as a response.



Individual Station Status - Measure Voltage

The Measure Voltage tab is a very useful feature for identifying poor connections in the field. This measurement is the voltage that the ICM requires in order to turn the valve ON. This reading is an **internal** ICM voltage reading and is not the same RMS voltage reading as would be identified using a multi-meter on the wire path. **The lowest voltage threshold level for turning on the rotor or valve is 20 volts.** If the voltage is below 20 volts, the ICM will not activate the sprinkler even though the ICM is communicating with the central control software.





Example 1 – You have a situation where all of the ICMs on a particular green are not watering and they do not pass the Status Poll test defined above. Utilizing the voltage test would allow you to check the voltage at these ICMs. If the voltage is below 20 volts at the ICM, then you should start at the beginning of the wire path and review the various ICM voltages periodically as you work your way down the wire path spot checking the voltage of each ICM. **When a significant voltage drop is observed compared to the previous ICM voltage measurement this indicates a problem on the wire path. The wire path between these locations should be examined for possible issues that cause the voltage loss. Recent digging or disturbances near the wire path are indicators of possible problem areas.**



Troubleshooting in the Field

Complete Status Poll as described previously to determine if any stations are not responding.

If any stations do not respond to the Status Poll, test the ICM with the Long Address Poll and the Fast Connect Poll. If neither poll responds check the ICM voltage. If there is no response or a low voltage reading, the ICM is either damaged or not connected to the wire path, or the wire path is damaged.

Loss of Communication with an ICM – Possible Broken Wire

If you find that you do not have any communication beyond a certain point in the wire path, use the Status Poll method to determine the location of the last ICM that responds to the Poll.

The Course Log will also show a “0” (Zero) for each ICM past the broken wire.

Utilize the As-built drawings to locate the point just after this problem (which is probably a bad wire splice) and check that area.

Lower than expected Run Times – Possible Poor Splice

If you determine that you have lower than expected run times in the Course Log, a poor splice is possibly the issue.

After using the Status Poll to determine which ICMs have marginal communication, use the Voltage Measurement Tool in the Central Control Software to compare voltages at the ICMs before and after the suspect location.

If the voltage is low after the suspected location is passed on the wire path, check the closest associated splice from the As-built drawings.

Zeros in Course Log – Possible Damaged ICM

If the Course Log shows “0” (Zero minutes) as the reported run times, then you may have a damaged ICM. Zeros in the Course Log means that there is no feedback from the ICM. This could happen for several reasons. To verify whether the ICM is working, perform the following tests:

1. Check the ICM with the Individual Station Status Check. If no response, use the Voltage Check.
2. If there is no response from any test, verify that the database matches the Long Address on the ICM.
3. If none of these steps identifies the issue, the ICM is likely damaged and should be replaced. Once removed, it can be checked inside the building by connecting directly to the ICI.



Damaged ICSD

An ICSD can be sacrificed by a direct lightning strike on the system. If the ICI diagnostics show excess current and all ICMs are operational, the ICSDs should be checked with a Clamp Meter. Any ICSD drawing any current more than 2 mA should be replaced.

Fault to Ground

A Fault to Ground can be caused by a nicked or cut Maxi wire. This nick or cut allows current to travel out of the copper wire to the ground. A Fault to Ground may be observed through excessive current on the wire path and/or low run times in the Course Log from the ICMs on the wire path.

The Fault to Ground can be located through three methods:

1. Voltage Check - Using the voltage check feature in the software, the voltage can be measured in ICMs on the wire path. Anytime there is a significant voltage drop (+1 volt for stations located less than 200 feet or 60 meters from each other) the fault has been passed.
2. Clamp Meter - Use a clamp meter on the physical wire path. If Red and Black do not have equal current, there is a Fault to Ground on the wire with the higher current. Track the fault until the current is even. When the current is even, the fault has been passed.
3. Search – Pick a point half-way down the wire path and take a reading. If the reading is equal on both Red and Black wires, the fault is back towards the Central Control. If the reading is not equal, the fault is out further toward the end of the wire path. Pick the direction of the fault and go halfway toward the central or end and take another reading. If the fault no longer appears, the problem is back toward the central from the reading point. If the imbalance can still be seen with the meter, the fault is further out toward the end of the wire. Keep picking half-way points until you narrow down the location of the fault.

No ICM Communication

Verify if the problem is on the entire wire path or a single portion of the path.

- If a single portion, it is most likely a broken wire or a bad splice
- If the entire wire path, then verify if the ICI is functioning properly.