Students please affix one of your self adhesive identification labels to this space. Do not obscure other parts of this page with the label. If you do not have a self adhesive identification label, please complete the following information. Write your name as it appears on your badge.

Your Name: _____

Participation Number:

Two letter state abbreviation. → | | | | 0 | 3 | | | | 0 | |

State code (0301, 0302, ... to 0350)

Team member number (01, 02, 03, or 04)

Students please do not write or mark within this box.

Judges, after this skill sheet has been scored and double checked, write the total score for this activity in the blank below.

Skill Activity Score: _____

Judges Initials: _____

2014 National Agricultural Technology and Mechanical Systems Career Development Event
Plant Production Systems
Electrical Systems

Situation: You work as an irrigation technician for XYZ Irrigation. Mr. Smith, a customer, has a two-valve residential irrigation system. He left a garbled phone message that one (or both, you really couldn't understand) valves did not come "on" and water as scheduled. You are troubleshooting the irrigation system and have determined there is water to both valves and the receptacle supplying the controller has the correct voltage (120 VAC). You suspect an electrical problem at the controller or in the wires going to the valves. Use the tools, meter, and references at your station to collect the information specified below and identify the specific electrical fault(s). **Do not mark on any reference. You may only disconnect wires at the controller. Do not un-tape any connection. If you cannot distinguish colors, ask a contest official for assistance.**

Directions: Complete each task as described and answer all questions in the manner specified:

1. What color is the insulation on the field wire that goes to both zone valves? _____ **(3 pt.)**
2. Set the controller to cause zone valve 1 (Station 1) to come "ON." Correctly and safely use the meter to measure the AC voltage across the "C" and "1" terminals at the controller. Record this value (with correct unit) below:

   Voltage across "C" and "1" _____ **(3 pts.)**

→ Turn Station 1 "OFF"

3. Set the controller to cause zone valve 2 (Station 2) to come "ON." Correctly and safely use the meter to measure the AC voltage across the "C" and "2" terminals at the controller. Record this value (with correct unit) below:

   Voltage across "C" and "2" _____ **(3 pts.)**

→ Turn Station 2 "OFF"

4. Based on your measurements (2 and 3) above, what is the electrical condition of each pair of terminals?

Terminals "C" to "1":	**OK**	**or**	**DEFECTIVE**	(Circle one)	**(2 pts.)**
Terminals "C" to "2":	**OK**	**or**	**DEFECTIVE**	(Circle one)	**(2 pts.)**

→ Unplug the controller power cord from the receptacle

5. Measure the total resistance in the field wiring and valve solenoid for Zone1. Record this value (with correct unit) below:

   Total resistance for Zone 1: _____ **(3 pts.)**

6. Measure the total resistance in the field wiring and valve solenoid for Zone 2. Record this value (with correct unit) below:

   Total **resistance for Zone 2:** _____ **(3 pts.)**

7. What is your evaluation of each zone? Select one response per zone by circling the letter of your response. **Note: Any circle around more than one letter will be counted as incorrect.**

Zone 1 (Circle only one) - 5 pts.	**Zone 2 (Circle only one) - 5 pts.**
A. The zone is operating correctly - No Fault	A. The zone is operating correctly - No Fault
B. The red wire is cut (open circuit)	B. The red wire is cut (open circuit)
C. The blue wire is cut (open circuit)	C. The blue wire is cut (open circuit)
D. The white wire is cut (open circuit)	D. The white wire is cut (open circuit)
E. There is a "short" between the red and white wires	E. There is a "short" between the red and white wires
F. There is a "short" between the blue and white wires	F. There is a "short" between the blue and white wires
G. There is a "short" between the red, blue, and white wires	G. There is a "short" between the red, blue, and white wires
H. The irrigation controller is malfunctioning	H. The irrigation controller is malfunctioning

Scoring: (Contestants - Do NOT mark below the line.)

Participation (1 pt.) ___1___ pt.

Total points from Skill Sheet: (29 pts.) _____ pts.

Safety (- 3pts/violation) -_____ pts. TOTAL: _____/30 PTS.

XYZ Irrigation
Technician Notes
Irrigation Electrical Troubleshooting

Irrigation electrical systems can be complex, making the job of troubleshooting malfunctioning systems problematic. However, over the years, XYZ Irrigation has found the following basic information extremely helpful in diagnosing electrical faults in irrigation systems.

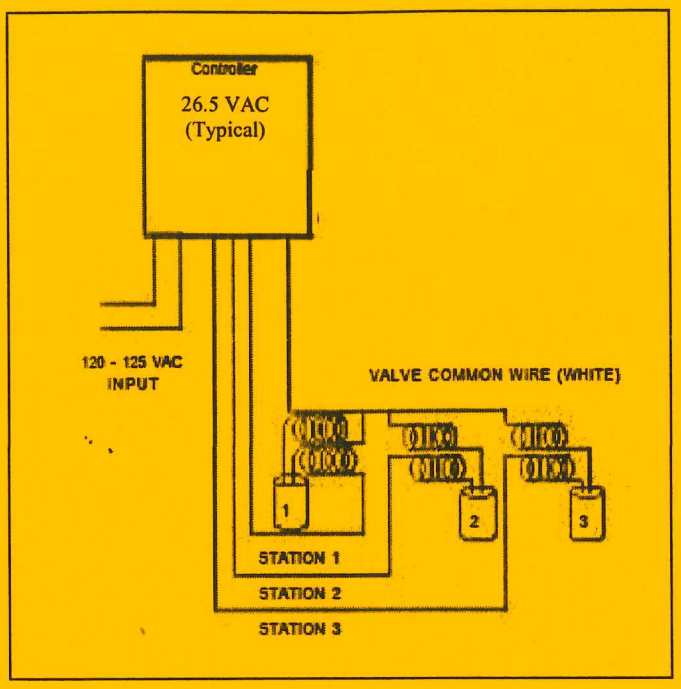

Figure 1. Typical Irrigation Electrical Schematic

Controllers
Most controllers used in residential irrigation systems use a 120 VAC receptacle as the electrical source. A transformer in the controller's electrical plug steps the 120 volt AC electricity down to a nominal voltage of 24 volts AC for use in the irrigation control system. (Note: this 24 V value is a "nominal" voltage; actual AC voltages, measured inside the controller, may be as high as 28-30 volts. This is normal and does not constitute a fault.)

Irrigation controllers vary by manufacturer and model in specific programming and operating characteristics. For troubleshooting purposes, you will often need to manually cause the controller to send current to a zone valve to cause it to come "on" (commonly called "running" the valve or station.) Refer to the controller owner's manual for information on how to do this - commonly the instructions will be found under, "Manually Run a Single Station" or similar heading in the manual. When a station is running, the minimum voltage across the common terminal (often labeled as "C") and the numbered station terminal should be 24 volts AC.

Field Wiring and Valve Solenoid
The wiring between the controller and individual zone valve(s), called the field wiring, and/or the valve solenoid may become damaged, causing the valve(s) not to operate correctly. The best way to check this is with an ohm meter. Unplug the controller and remove the white wire from the common ("C") terminal. Use the ohm meter to determine the resistance of the circuit between the controller and each zone valve. A properly functioning circuit (field wiring plus valve solenoid) should have between 15 and 50 ohms of total resistance. A reading of "0" ohms indicates an electrical short in the field wiring and/or solenoid. (Note: The controller's fuse should be "blown" if there is a direct short in the field wiring - once the short has been eliminated, the fuse will likely need to be replaced.) A reading of "infinite resistance" indicates an open-circuit [cut wire(s)] in the field wiring and/or solenoid. (Note: Different ohm meters indicate "infinite resistance" in different ways. An easy way to tell how your meter does this is to set the meter for resistance, hold the probes so they do not touch each other, and observe the meter reading.)