PIVOT IRRIGATOR MONITOR AND CONTROLLER

Installation Work Instruction – Valley CAMS PRO Panel

The irrigator monitor is installed into the switching box at the outermost set of wheels of a pivot irrigator. It provides the following functions:

- GPS position of the outer tower, with 10 minute updates.
- Indications of operation, by sensing power to the forward and reverse lines of the irrigator.
- The ability to remotely stop the irrigator by opening the safety circuit momentarily.
- The ability to send text message alarms in the event that the irrigator has stopped unintentionally.

This irrigator monitor is connected to the irrigator's high-voltage AC electrical lines, so the irrigator must be isolated from the electrical grid before starting installation work. The installation involves working and heights and with electricity. Subsequently this work must be performed by a suitably qualified individual.

Additionally for the control of the irrigator, a second device can be installed in the cabinet at the center of the irrigator. This device interfaces with the Valley CAMs Pro panel to provide the following functions from the AGWAN app:

- Forward/Reverse control
- Wet/Dry Control
- Start/Stop Control
- Water pressure status (dry or irrigator pressurized)

Outer Node:

A summarized account of a typical installation for the outer node is as follows:

1. Isolate the irrigator from all power sources and confirm lines at the outer most switching box are deenergized.
2. Remove the neutral to safety jumper wire at the outer most switching box.

3. Connect the irrigator monitor's white wire to the neutral connection on the irrigator, purple wire to the forward line and pink wire to the reverse line. It is not necessary to connect to the safety circuit for stopping the irrigator, as this function is performed by the AGWAN controller at the center of the irrigator.
4. Reinstall the switching box cover and verify the main switch at this box (if equipped) is back in the "on" position.
5. Power up the irrigator and start the irrigator walking to verify that the device is correctly transmitting data to the gateway/base station by checking the status on the app.

A more detailed procedure is as follows:

1. Isolate Electrical Sources: De-energize the irrigator at the main master switch, then disconnect the irrigator from the mains supply to ensure it is physically isolated.
2. At the irrigator's main terminal strip, verify the color code of the wires for neutral, safety, forward and reverse. NOTE: As the irrigators are typically made in the USA, they do not follow Australian electrical code colour schemes. The color coding of the wires provided with the irrigator monitor match that of Reinke irrigators. The irrigator panel may also have been retrofitted to another irrigator type, so the understanding the neutral/forward/reverse color coding specific to the particular irrigator is critical.
3. Remove the outer tower switching enclosure and verify the system is de-energized utilizing a multi-meter between the forward and reverse lines and the ground or neutral circuits.
4. Find a suitable location in the enclosure to place the irrigator monitor using the supplied adhesive backing, allowing adequate clearance to re-install the enclosure cover. Ensure the surface is clean before applying the adhesive. If there is no room to install the device within the enclosure, then a separate mounting bracket can be requested.

Remove the jumper between the neutral and the safety circuit

5. Install the irrigator monitor's white wire to the neutral on the terminal strip
6. Install the irrigator monitor's purple wire to the forward AC line on the terminal strip.
7. Install the irrigator monitor's pink wire to the reverse AC line on the terminal strip.
8. Once the installation is complete, double check the security of all wires.
9. Ensure the transmitter's antenna is pointing upwards.
10. Re-install the enclosure and close the terminal strip switch if one is present.
11. If the remote stop or stop on track feature is to be used when the irrigator is operating in WET mode, this should only be utilized if the irrigator is equipped with a Nelson Valve or similar to shut the water off to the irrigator.
12. Removal of the device is essentially the reverse of the installation, with the most critical step being re-installing the jumper wire between the safety circuit and the neutral line. Without this circuit being closed, the irrigator will not function.
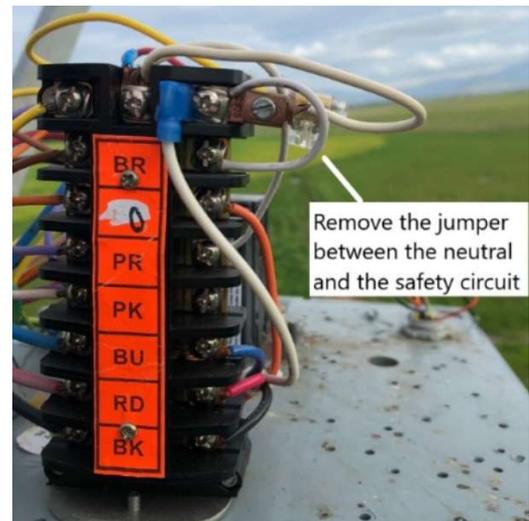
Inner Node:

The installation procedure for the center node is as follows:

1. Confirm the irrigator is still isolated from all electrical power sources.
2. Install the 110VAC to 12VDC power supply on the existing DIN rail. Beside this, install the Controller LoRaWAN device. Add additional DIN rail length if required.
3. On the top right of the main Valley relay board there is a terminal strip that needs to be interfaced. This is performed using the provided 5.08mm Pluggable Terminal Block Sockets. These will not be inserted into the board until the wires have been stripped and terminated, as access to the screw terminals is not possible with the wires in the board.
4. Measure, cut and strip and terminate the supplied wires as defined in the drawing below. Ensure wire terminations are correctly torqued.

Valley CAMS Pro Panel AGWAN Controller Wiring Layout
Dashed black lines represent white wire colour
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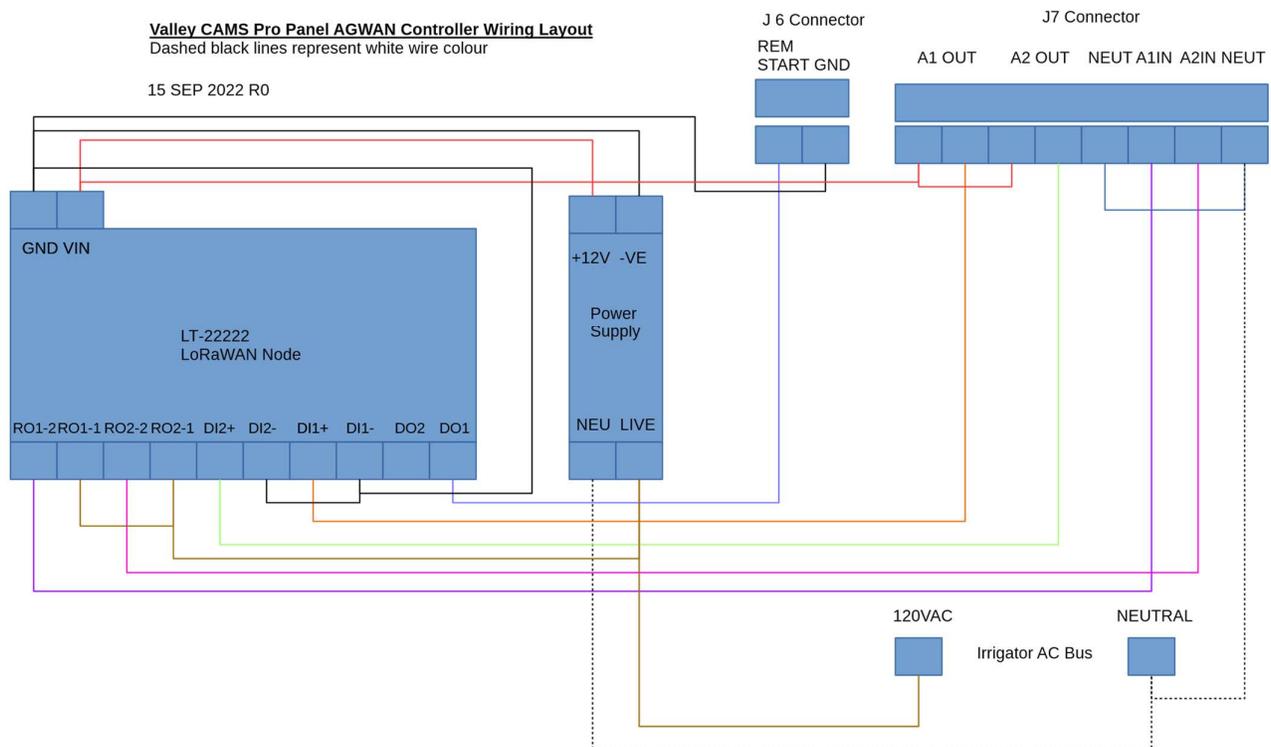
5. Drill a hole at the base of the panel using a step drill of adequate diameter to install the supplied cable gland, through which the supplied SMA coaxial cable will be run.
6. Install the magnetic base antenna at the top of the cable cabinet, approximately 50mm in from the cabinet edge. Run the coaxial cable along the structural members behind the cabinet and secure with zip ties.
7. Run the SMA connector through the cable gland and tighten. Connect the SMA connector to the LoRaWAN control node.
8. Double check all wring matches the schematic above. Ensure all wires are neatly arranged and zip tie as necessary.

9. Close the cabinet and power up the irrigator. The node should register within one minute of operation, which can be viewed by looking in the AGWAN app for the "Last Update" time for the device.
10. The Valley CAMS Pro controller now needs to be programmed in order to enable its inputs and outputs to communicate with the LoRaWAN transmitter.

The required programs by program number may be seen below:

1. PROGRAM > CREATE NEW > 6 OTHER > 2 MODULE > 20 > ENTER > 1 (ON) > REVERSE > ENTER > 2 (NEXT STEP) > 6 OTHER > 2 MODULE > 20 > ENTER > 0 (OFF) > FORWARD > PROGRAM > 1 > ENTER > ENTER (PROGRAM FINISHED) > 2 (SAVE PROGRAM AND RUN) > 1 (THE PROGRAM NUMBER) > ENTER.
2. PROGRAM > CREATE NEW > 6 OTHER > 2 MODULE > 19 > ENTER > 1 (ON) > WATER ON > ENTER > 2 (NEXT STEP) > 6 OTHER > 2 MODULE > 19 > ENTER > 0 (OFF) > WATER OFF > PROGRAM > 2 > ENTER > ENTER (PROGRAM FINISHED) > 2 (SAVE PROGRAM AND RUN) > 2 (THE PROGRAM NUMBER) > ENTER.
3. PROGRAM > CREATE NEW > 6 OTHER > 1 ANALOG > 3 > ENTER > 1216 (MILIVOLTS) > ENTER > 1 (HIGHER) > OPTIONS > 2 (AUX2) > 1 (ON) > PROGRAM > 3 > ENTER > ENTER > 1 (PROGRAM FINISHED) > 2 (SAVE PROGRAM AND RUN) > 3 > ENTER.
4. PROGRAM > CREATE NEW > 6 OTHER > 1 ANALOG > 3 > ENTER > 1216 (MILIVOLTS) > ENTER > 0 (LOWER) > OPTIONS > 2 (AUX2) > 0 (OFF) > PROGRAM > 4 > ENTER > ENTER > 1 (PROGRAM FINISHED) > 2 (SAVE PROGRAM AND RUN) > 4 > ENTER.
5. **PROGRAM > CREATE NEW > 5 (FOR/REV) > FORWARD> OPTIONS > AUXOUT1 ON > PROGRAM > 5 > ENTER > ENTER > 1 (PROGRAM FINISHED) > 2 (SAVE PROGRAM AND RUN) > 5 > ENTER.**
6. **PROGRAM > CREATE NEW > 5 (FOR/REV) > REVERSE > OPTIONS > AUXOUT1 OFF > PROGRAM > 5 > ENTER > ENTER > 1 (PROGRAM FINISHED) > 2 (SAVE PROGRAM AND RUN) > 5 > ENTER.**

Sections in bold are parts of the process that have not yet been verified and may require slight modification in the field.

A final summary of the programs should look like the following:

1. STEP 1 AT: MODULE 20 ON, REVERSE
   STEP 2 AT: MODULE 20 OFF, FORWARD
   RUN PROGRAM 1
2. STEP 1 AT: MODULE 19 ON, WATER ON
   STEP 2 AT: MODULE 19 OFF, WATER OFF
   RUN PROGRAM 2
3. STEP 1 AT: ANALOG 3 HIGHER THAN 1216,
   AUXOUT2 ON, RUN PROGRAM 3
4. STEP 1 AT: ANALOG 3 LOWER THAN 1216,
   AUXOUT2 OFF, RUN PROGRAM 4
5. STEP 1 AT: FORWARD, AUXOUT1 ON,
   RUN PROGRAM 5
6. STEP 1 AT: REVERSE, AUXOUT1 OFF,
   RUN PROGRAM 6,

Operational Verification:

The operator should now be able to control the remote functions for forward/revers wet/dry and start/stop remotely. This should be verified using the app (app.agwan.com.au) before leaving the site.

Figure 1: A correctly installed AGWAN Irrigator Monitor in a Reinke irrigator.

Troubleshooting

- Unknown irrigator fault: The irrigator monitor is designed in a manner where it fails in the "closed" state, and thus should have no impact on the operation of the irrigator. As the device interfaces the safety circuit, there is however the risk that the device is for some reason holding the safety circuit open, preventing the irrigator from operating. This is most commonly caused by either a loose connection, or an overvoltage/current event (lightning strike) that has destroyed the internals of the device. The fastest way to diagnose such situation is to remove the device and re-install the jumper wire between the neutral and safety circuits on the terminal strip. Alternatively if the ability to monitor the irrigator is desired, without the risk of impacting the safety circuit, then simply the

neutral, forward and reverse wires are connected, but not the brown safety wire. This will enable all functions of the irrigator monitor, except the ability to remotely stop the irrigator.

- Failure of device to check in:
  - o Transmission strength: In most lightly undulating farmland with tree rows, a 5km transmission range from the base station can be expected. If an irrigator drops into a valley or there is a data transmission collision, a data packet may be lost. This is not an unusual occurrence or reason for alarm, as in most situations a subsequent transmission will get through with the distress message if the irrigator has unintentionally stopped at that location. If these missed transmissions are commonplace, then options can be investigated to improve the transmission capability of the device or the gateway. The irrigator monitor uses SMA female bulkhead coaxial connectors that allows the use of an SMA male extension cable to a higher gain omnidirectional antenna. Such an antenna should be optimized for 915Mhz and should ideally be a dipole antenna with a 6dB gain. Keep any coaxial runs to this antenna a short as possible to minimize signal strength loss. If this doesn't rectify the issue, then check the quality of the base station/gateway installation. Again, antenna coax runs should be kept as short as possible, and the antenna should be at a point to obtain clear line of sight coverage to all devices.
  - o Device Not Configured: AGWAN devices are shipped as standard pre-configured to not only the AGWAN network, but also to the specific irrigator/site they are intended to be installed. If for some reason a device has not been configured properly, it may not be appearing on your device list. In this situation, contact AGWAN support on +61 (0) 352940829 or at infor@agwan.com.au for assistance and be ready to quote the 16 digit unique identifier (DEV EUI) published on the site of the device.
  - o Battery Not Inserted: If the device is not checking-in on the app, it may be that it is not receiving power, or the internal 14500 Lithium 3.7V rechargeable battery has not been inserted correctly. Although this battery has the same form factor as typical AA alkaline batteries, it is a different chemistry with a much higher voltage. **The irrigator monitor will not work with AA Alkaline batteries**! The battery is charged every time the irrigator is walking in forward or reverse, so that it has power available if the irrigator stops so that it can make a distress transmission.
  - o Incorrect wiring: Check the wiring is as per the guidance (you need to identify at least the forward, reverse, and neutral AC lines), keeping in mind that there is no standardization in wire color coding between irrigator manufacturers.
  - o Remote Stop Faulty: If the remote stop function on the app is selected, but the irrigator only stops momentarily before restarting, then the auto restart function on the irrigator is set for longer than desired. The auto restart functions are typically set on an irrigator so that if there is a power flash of less than one minute, the irrigator will restart without assistance. The irrigator monitor is designed to open this circuit for 65 seconds when the remote stop function is selected on the app, so this automatic restart time must be less than this for it to work effectively. Consult the owner's manual for the particular irrigator to determine how to re-adjust the auto restart time.