

Resource Management Specifications

1.0 FIELD EQUIPMENT

1.1 Automatic Controller

- A. Controller(s) shall be the Calsense model CS3000 irrigation controller as indicated on the drawings, and shall be installed per manufacturer's specifications, as shown on the drawings, and as specified herein.
- B. The irrigation controller shall have a 10-year, limited warranty.
- C. The irrigation controller shall have a large 5.7 inch backlit, ¼ VGA, LCD, sunlight readable display where information can be viewed on the same screen, and with a scrolling side menu design that makes programming intuitive and easy to follow.
- D. The controller shall be available in multiple station counts including 8, 16, 24, 32, 40 or 48 stations. If less than 48 stations are purchased initially, additional stations can be added at any time in the field using 8-station kits.
- E. The controller shall support up to 128-stations when using 2-Wire. This can be either 128, 2-Wire stations or a combination of up to 48 conventional-wired stations plus 80, 2-Wire stations.
- F. Controller software upgrades shall occur via the internet transparently and at no charge.
- G. The controller shall have unlimited programs known as Station Groups which can water individually or concurrently to maximize irrigation system capacity and reduce watering time.
- H. The controller shall have the ability to assign landscape details as plant material, head type, soil type and exposure to each Station Group to simplify programming of stations with similar characteristics. Each group shall include a variety of other settings including irrigation schedule, percent adjust factor, line-fill times and on-at-a time rules.
- I. The controller shall support up to four mainlines simultaneously for managing flow.
- J. The controller shall support up to 12 points of connection shared among controllers.
- K. The controller shall support up to 3 flow sensors and 3 master valves in a by-pass configuration so as to accurately measure and read the overall range of station flow rates from the lowest flowing station in GPM to the highest flowing station in GPM, using the 2-Wire option and the 2-Wire, POC decoders for all 3 flow devices and master valves.
- L. The controller shall automatically calculate cycle and soak scheduling to water each station for a fixed cycle time and allow the water to soak in between cycles, maximizing infiltration and minimizing runoff.
- M. The controller shall have a water budget feature that displays monthly water volume allotments in either HCF or gallons for each of the 12 calendar months labeled as January thru December. This monthly guideline shall be calculated three ways, either directly entered, calculated by the controller using a yearly budget and dividing that out to the 12 months proportionately using built-in historical ET, or by calculating the monthly numbers using total square footage and a user selected percent of historical ET.
- N. The water budget shall be available per POC controlled and programmed for either every month or every other month pre-programmed as date ranges. If the expected water use

for the period exceeds the water volume budget, the user shall be notified with an alarm before the period ends so changes to the program can be made. The controller shall not terminate irrigation automatically in this process, or if selected as an option, the controller shall proactively and automatically decrease the scheduled irrigation for each station group using the percent reduction programmed, when approaching the set water budget limit with notification of said action.

- O. The controller shall have a wide range of water reports and diagnostics available directly at the controller and shall include:
 - A summary of all usage for each irrigation mainline
 - Usage for each point of connection connected to the mainline
 - Station-by-station usage
 - A complete station-by-station history which includes the date and start time of each cycle, programmed minutes, programmed inches, number of cycles, actual flow rate, expected flow rate, and any alerts or issues that occurred during irrigation.
 - Unscheduled water usage and non-controller water usage including quick coupler use and bleeding valves manually
- P. The irrigation controller shall have three separate mainline break settings available for proper flow detection of catastrophic issues without interfering with standard irrigation practices and shall be programmed for 1.) 'during irrigation', 2.) 'master valve override' functions, and 3) 'all other times'
- Q. The controller shall have flow management capability as a standard feature whereas the controller shall learn each station's expected GPM flow rate automatically at night over several irrigations, and use the mainline GPM capacity programmed, to operate up to six (6) valves at the same time to shorten the water window.
- R. The controller shall have the ability to accommodate multiple types of irrigation schedules including irrigating even days, odd days, prescribed days of the week, and interval scheduling ranging from every other day up to every four weeks.
- S. Several controllers, up to twelve shall be able to share one or multiple points of connection with multiple flow sensors and master valves. This option shall allow several controllers without the use of a central control computer to share the irrigation programs and flow information for:
 1. Monitoring of system flows.
 2. Shortening water windows by maximizing the number of valves on without exceeding system flow capacity.
 3. Turning OFF valves with excessive flow rates due to broken lateral lines.
 4. Tracking water usage and comparing to a water budget.
 5. Eliminating relays when sharing pumps and master valves.
- T. When more than one controller is sharing one or multiple points of connection and the controllers are communicating to each other through hardwire or radio, the data shall be distributed as changes occur making the data available from any controller on the *FLOWSENSE™* chain so that the user shall be able to view and program a controller's information from any other controller in the group.
- U. The controller shall provide permanent memory stores of all controller programming and setup data, including date and time, in non-erasable memory.
- V. The controller shall have the ability to create and program an unlimited number of manual programs which allow the user to schedule stations to run for a preset time, up to 6 – times per day, for hydro-seeding, new planting and fertilization scheduling.
- W. Electrical alerts, such as short circuits and no currents, shall be standard to help the user troubleshoot field wiring and solenoid problems.

- X. The irrigation controller shall provide an optional lights feature to be used to operate up to four light, gate or water feature relays.

1.2 Wall Mount Installation

- A. The wall-mounted gray box shall be a completely assembled unit, pre-mounted with the designated controller. The box shall be constructed of weather- and vandal-resistant stainless steel.
- B. The wall mount unit shall come complete with transient and lightning protection board and factory-labeled terminals.
- C. The transient protection board shall be pre-mounted in the wall mount unit and shall support field replaceable modules which include terminal strips for the connection of irrigation field wires, 2-Wire cable, and weather monitoring devices such as an ET gage, Tipping Rain Bucket, and Wind gage.
- D. The wall mount unit shall feature a security-tight locking mechanism, louvered vents, with splash guards, and bee/wasp screens.
- E. All wall mount units shall come with a 10-year limited warranty and shall be fully UL-approved.

1.3 Pedestal Enclosure

- A. The enclosure shall be of a vandal and weather resistant nature manufactured entirely of 304-grade stainless steel, and the top shall be 12 gauge and the body 14 gauge. The main housing shall be louvered upper and lower body to allow for cross flow ventilation. A stainless steel backboard shall be provided for the purpose of mounting electronic and various other types of equipment. The stainless steel backboard shall be mounted on four stainless steel bolts that will allow for easy removal of the backboard.
- B. The 38-inch height with flip top shall provide easy access for programming from a standing position under normal installations.
- C. The pre-assembled vandal resistant enclosure factory pre-assembled and supplied by controller manufacturer shall come complete with 24 VAC lightning and surge protection and all terminals shall be factory labeled. The pre-assembled enclosure shall come provided with an On/Off switch to isolate the controller along with a GFI receptacle. Specific radio antenna(s) shall be pre-mounted and connected on enclosure. The enclosure shall include 2-7/8", 1-1/2" thick, 6-pin cylinder, die-cast steel padlock with unique shackles design.
- D. Factory pre-assembled enclosure with controller shall carry a full UL listing.
- E. Controller manufacturer shall offer a double-wide, pre-assembled vandal resistant enclosure, 38-inch height with flip top for two controller placements side by side. All necessary wiring between the two controllers in order to share central communications and/or flow and weather data shall be pre-wired by manufacturer for easy installation.
- F. The factory pre-assembled enclosures shall carry a ten (10) year limited warranty.

1.4 Grounding

- A. Grounding shall consist of one 5/8-inch x 8-foot copper rod installed per irrigation controller and where multiple controllers *are not* connected to the same ground rod.
- B. The top of each rod shall be installed inside a 10-inch round valve box, with the rod installed as close as practical to the controller. If a pedestal enclosure is used, the ground

rod may be installed through the pedestal base. Under no circumstances shall the rods be shortened.

- C. A #6 AWG solid copper wire shall be used to connect from the ground lug of the transient protection board to the copper rod. Brass clamps specifically designed to secure the copper wire to the grounding rod shall be used. There shall be no kinks or sharp bends in the wire.
- D. Each wire may be wrapped around the rod and brazed in place as an alternative to clamping. Braze the wire to the rod for at least one circumference of the rod.

1.5 2-Wire Path & Decoders

- A. The 2-Wire option shall provide support for up to one-hundred and twenty-eight (128); 2-Wire stations connected to a single controller and shall provide support for up to 6 points of connection (POC's).
- B. The 2-Wire cable shall either be Paige P7354D or Regency's Hunter® Decoder cable with a maximum length of 7,000 ft.
- C. A ground rod, 5/8 inch x 8-ft solid copper shall be required every 300-feet along the 2-Wire path as well as a single ground rod at the end of the cable run.
- D. The station decoder shall be a 2-station decoder and shall be able to operate up to 2-solenoids using unique colored wires for each.
- E. A single controller shall be able to operate up to 70, 2-station decoders and it shall be intended that all wire runs between valves and 2-Wire decoders shall be direct pulls and have no splices except at the decoder location.
- F. All electrical connections must be waterproof and moisture-resistant and shall be done with 3M™ Scotchcast™ 3570G Connector Sealing Packs.
- G. The 2-Wire decoders shall use #14 AWG direct burial wires to connect to remote control valves and the maximum wire run between the decoder and the valve shall be 100-feet.
- H. The POC decoder shall operate a single master valve and flow meter (model FM). A single controller shall be able to operate up to six POC decoders with a maximum of 12-POC's in a chain, controllers using *FLOWSENSE*™ technology.
- I. The maximum wire run between the POC decoder and flow meter shall be 20-feet while the maximum wire run between the decoder and the master valve shall be 100-feet.

1.6 Weather Monitoring

- A. The manufacturer of the central control system shall provide real-time ET and rain data using multiple, state-of-the-art, high resolution numerical weather data provided by NOAA, all without subscription charges. Unlike other services which use only ground-level weather stations, the NOAA-modeled data shall allow weather to be triangulated to each customer's unique latitude, longitude and elevation, ensuring accuracy even within localized microclimates. ET shall be calculated using the latest FAO Penman-Monteith method which shall use solar radiation, temperature, wind speed, relative humidity and other input parameters.
- B. The controller shall be able to interface with an on-site ET gage able to measure daily localized, evapo-transpiration and log the amount of inches lost each day without the use of a central computer.

- C. The ET measuring device shall be powered by the selected field controller. ET is measured directly in 0.01" increments and pulses from the gage are sent directly to the field controller.
- D. The controller shall be able to store and display daily, on-site ET in a 28-day table which is updated every 24 hours.
- E. The user shall be able to view over 100 selections of built-in historical ET tables or program monthly historical ET data for a given area directly, to be used as a backup for that night's calculation in case the ET gage malfunctioned or the real-time value sent normally through the Internet failed.
- F. The user shall be able to cap the amount of daily ET used by the controller for that night's calculation by selecting a percent of historical ET for the given area to be used instead of the actual ET received.
- G. The irrigation controller shall have the capability to calculate station run times using the average of the last 7 days of ET instead of using a single ET value to calculate the next scheduled, station run times.
- H. The controller shall be able to interface directly with a Tipping Rain Bucket and shall accurately measure rainfall in 0.01" increments by means of a tipping and emptying device mounted below the center of the collection dish.
- I. The rain-measuring device shall be wired using the 25-feet of 2-conductor cable supplied with the Tipping Rain Bucket to the selected field controller. The controller shall have a weather option able to interface with the device. The cable shall be installed in conduit and the connections are to be made at a terminal strip inside the enclosure. Maximum length of cable run shall be 1000 feet using Paige P7171D communication cable when necessary. 18-gauge multi-conductor irrigation wire in conduit may be used for runs under 100-feet. Runs shall be direct pulls without splices.
- J. The irrigation controller shall provide the following programming parameters for rain:
 - Stop Irrigation after x.xx inches
 - Maximum Rain in One Hour is x.xx inches
 - Maximum Rain in 24 Hours is x.xx inches
- K. Wind speed shall be monitored by the irrigation controller with the weather option interface and the wind gage installed. The controller shall pause irrigation once the wind speed exceeds a user-set limit. As wind subsides, the controller shall resume irrigation where it left off. Winds from 0-to 135-MPH shall be accurately read. Data from one wind gage shall be shared amongst a group of controllers making up a *FLOWSENSE™* chain.
- L. The wind gage device shall be wired using the 60-feet of 2-conductor cable supplied with the device to the selected field controller. The cable shall be installed in conduit and the connections are to be made at a terminal strip inside the enclosure. Maximum length of cable run shall be 1000 feet using Paige P7171D communication cable when necessary. 18-gauge multi-conductor irrigation wire in conduit may be used for runs under 100-feet. Runs shall be direct pulls without splices.

1.7 Flow Monitoring

- A. The flow sensor used shall be supplied by the same manufacturer as the irrigation controller.
- B. The flow sensor shall be wired back to the irrigation controller using two #14 AWG wires, one red, and one black in 1" PVC conduit to connect to the irrigation controller. The maximum wire run between flow meter and controller shall be 2000 ft. The flow meter

shall send low voltage digital pulses back to the controller and therefore all electrical connections must be waterproof and be resistant to any moisture entry.

- C. It is intended that all wire runs between the controller and flow meter shall be direct pulls and have no splices. If wire splices are unavoidable, they must be installed in a valve box with Spears DS-100 connectors with Spears sealant or 3M Scotchlok No. 3570 connector sealing pack used.
- D. Each flow sensor shall have the following characteristics:
 - 1. Housing to be a Sch 80 polyvinyl chloride tee or bronze tee
 - 2. Have a pulsing output that operates at 9VDC and a pulse rate that is proportionate to the GPM
 - 3. Fully compatible with the internal interface at each field controller
 - 4. Powered by the controller
 - 5. Replaceable metering insert
 - 6. Shall feature a six-bladed design with a proprietary, non-magnetic sensing mechanism
- E. The irrigation controller shall include native support for Bermad 900-M Reed Switch and Netafim Pulse Reed Switch series hydrometers. Allowable hydrometer sizes shall range from 1.5" to 10". Reed Switches that are supported include 1-pulse per 1-gallon and 1-pulse per 10-gallon switches. Currently only one hydrometer mentioned shall be able to interface with the controller.

2.0 Central Control Communication Options

- A. The field controller(s) shall be capable of utilizing a single mode or a combination of communication modes such as 3.5G cellular radio, Ethernet, wireless Ethernet, 450-470MHz Local Radio, point-to-point Spread Spectrum radio, and hardwire communication cable for central control of irrigation via cloud-based, Command Center Online web software.
- B. The controller shall be able to utilize a wireless, 3.5G cellular radio in remote areas where an Ethernet or WiFi connection is not possible for direct communication back to a desktop, tablet, or laptop computer via the Internet. Service plans for single and multiple controllers utilizing a 3.5G cellular modem shall be available through the manufacturer as 1-year or 5-year plan.
- C. The controller shall be able to utilize an Ethernet communication, CAT5 or CAT6 cable path as part of a district's or campus network system. An Ethernet (RJ45) connection shall be supplied at the controller location, with the network set to have access to this connection. IP reservations with DHCP are preferred along with the hard coded MAC address from the Ethernet device supplied. The secondary preference shall be a static IP address with additional programming requirements. The controller shall utilize an existing WiFi, wireless Ethernet network on a school campus or facility city project. IP reservations with DHCP are preferred along with the hard coded MAC address from the Ethernet device supplied.
- D. The controller shall be able to utilize a short-range, Spread-Spectrum radio to communicate with other controllers in line-of-sight proximity providing a reliable communication link instead of a hardwire communication path when sharing data. The spread-spectrum radio option does not require FCC licensing, and offers a secure error correcting frequency hopping radio link immune to outside interference.

2.1 Command Center Online Web Software

- A. The central control software shall be a cloud-based package designed to provide complete irrigation control through a web application, without the purchase of proprietary software loaded on a dedicated, desktop computer.

- B. The fully-featured web application shall provide communication using a variety of internet-connected options including Ethernet, Wireless Ethernet (WiFi), and 3.5G Cellular Radio.
- C. The web application shall allow the user to monitor and program controllers, as well as run various water usage reports from any internet-connected device including PC's, tablets, and smart phones. Weather data collected from an ET Gage, Tipping Rain Bucket, or *WEATHERSENSE* can be shared to any controller on the system.
- D. Engineered for easy and reliable access, all that is needed to get started using the software shall be a user name and password to obtain data from controllers in the field. Each customer's service shall be unique and password protected so data is secure.
- E. User accounts shall be issued and managed by an administrator account so that only authorized users can access controller information.
- F. The cloud-based software shall include the ability to turn stations On and Off remotely using any internet-connected device including PC's and tablets, and a smart phone app. User shall be able to turn on up to six valves simultaneously and view real-time flow information, details if a mainline break occurs, and real-time weather data when using on-site weather devices such as daily ET and rainfall in inches.
- G. The web software shall allow a customer to create their own custom dashboard as the home page, providing a snapshot of the most important water and labor management graphs and reports depicting easily the most current status of each controller at each specific project location.
- H. System reports shall include complete records of the details for every irrigation cycle, water usage versus water budget amounts, the gallons and percentages of water savings, and what events and changes have occurred at the controller. System administrators shall have management reports listing sites and user for their company.
- I. System requirements shall be a broadband internet connection such as DSL, cable, or mobile broadband.
- J. Supported web browsers shall include:
 - Microsoft Windows Internet Explorer® 8.0 or higher
 - Google® Chrome™ 34 or later
 - Mozilla Firefox™ 28 or higher
 - Apple® Safari™ 5.1.7 or higher

3.0 Warranty, Service & Training

- A. The manufacturer shall provide after-sale support that is a *no charge* service whereas on-going training and education shall be provided by factory direct personnel to the end user(s) at the field controller(s) and using the cloud-based, web software for central control of irrigation.
- B. The central control manufacturer shall warrant to the purchaser of its manufactured products against defects in material and workmanship for a period of ten (10) years from the date of original purchase by the owner.
- C. All peripheral, accessory, and RF equipment such as radio and 3.5G cellular radio modems, ET gages, flow sensors, and rain buckets (but not limited to) and used in conjunction with central irrigation controllers, shall have distinct warranties of their own and should be noted separately from this warranty.