**CITY OF GREELEY IRRIGATION CONTROLLER SPECIFICATION**

**Baseline Specification**

All irrigation controllers and online web management platform will be as manufactured by Baseline Control Systems. Controllers will be Base Station 3200 painted steel wall mounts and/or stainless-steel pedestals.

**BaseManager Online Management System**

Real-time internet connectivity that works on any web enabled device. With the ability to run any number of controllers across two controller platforms, using one interface.

Map-based user interface utilizing Bing maps with interactive map icons, giving the user the ability to turn zones on and off with user defined runtime, learn flow on a single station, chart zone activity, view what programs the zone is in and its associated runtime, test electrical circuit providing an AC voltage at the solenoid, amp draw, voltage drop reading along the two-wire path, and custom notes. Ability to geo locate zones, master valves, moisture sensors, flow meters, hydrometers, event switches, temperature sensors, and custom markers on map interface through mobile access. Interactive map icons must be color coded with 11 different colors displaying current status of that device. Colors for zone icon activity status and program status must transcend the entire control platform from controller face plate, to mobile phone access, internet and or self-hosted management platform. System can be configured to send alerts and messages via text message and email.

All sensor status and activity must be available in all access points from controller, to mobile phone, and web platform access. System must be able to interface with a rain switch in a manner that allows for user defined start, stop and pause conditions. Weather Access and weather-based schedules programmed on a by zone basis in watering schedule, with the ability to combine timed runtimes, weather-based runtimes and soil moisture-based runtimes in the same program. Allowing for a combination of weather-based or soil moisture activated runtimes on the same zones, depending on specific needs.

Allow the ability to customize zone names, sensor names, and program names and populate those customized descriptions throughout the entire platform from controller face plate, to mobile phone access, internet and or self-hosted management platform.

Requires the ability to manage controller access between users, giving users access to specific controllers, while other users have access to the same controllers or different controllers.

Basemanager must be available as a cloud-based service provided by Baseline Systems, as a subscription- based access platform or a self-hosted server or virtual machine server-based platform.

Minimum security protocol requirements: AES256-bit encryption along with the TLS1.2 protocol.

**Baseline Communication Methods**

All controllers must have the capability of utilizing all of the following methods of communication. Cellular (minimum of 4G), Ethernet, 900Mhz Ethernet Radio, Wi-Fi, and Two-Wire as a true two-way communication path. Must have the ability to connect to the online central without the use of a cellular modem device. Also, must be able to utilize 900Mhz Ethernet radio to connect multiple controllers to the internet through a single controller Ethernet and/or Cellular access point. Controller supports up to 8 available addresses for TCP/IP-based connections. These addresses are used to connect the following performance components: Flow station, SubStation, and Munro Pump Station.

**Baseline Controller and Two-Wire Specification**

Wall mount controllers will be in powder coated steel or 304 grade stainless steel cabinets. Pedestal mount controllers will be in 304 grade stainless steel flip top pedestals mounts. Wall mount controller dimensions are: 15.5” x 12.38” x 6.4”, 16-gauge powder coated steel or stainless steel. Pedestal mount enclosure dimensions are: 17.38” x 36.25” x 12.63” 16-gauge stainless steel. Controller display will meet the following minimum requirements: Built in full color display with High contrast 3.5-inch TFT LCD screen, resolution is 320x240 at 65,536 colors, screen brightness of 200 lumens for easy viewing in direct sunlight. Controllers must have a built in Ethernet port and be capable of running two-wire and conventional wire out of the same controller. With a zone count of up to 200 stations per controller in any combination of conventional and decoder stations, not exceeding the 200 stations. Controllers must utilize true two-way communication on the two-wire path. Controller is capable of operating non-irrigation zones with ease. Controller allows for operation of 15 concurrent zones and a up to 99 concurrent zones through the use of SubStations. Allows for the ability to back up and restore all programming and historical data with any USB flash drive. Controller will store all program and history information in its non-volatile memory. Controller will allow for the establishment of 3 levels of 4-digit PIN password protection: operator, programmer, and administrator.

Programming Features are as follows: All controllers must provide up to 99 automatic programs, with 8 programmable start times, allowing 1-15 concurrent zone to operate in each program, as long as it does not exceed the hydraulic and electrical limitations of the system. Controller will be able to utilize weather-based schedules, moisture sensor-based schedules and traditional runtime-based schedules, and will allow for all three of these methods to be utilized in the same program. Other programming features must include: Water source prioritization, program prioritization, and intelligent water rationing. The controller allows a program to be started by the following options: Start time, moisture percent, temperature value, event switch contacts open or closed, pressure sensor readings.

Each controller must be able to read and manage up to8 master valves and 8 flow sensors and utilize pressure readings to stabilize flow. Every controller will have the ability to monitor up to 25 soil moisture sensors. Pressure sensors can be used to create start, stop or pause conditions based on a user defined pressure reading. Controller will search for and identify all devices connected to the two-wire path and lists them according to device type and serial number.

Messaging and Alerts: Provides real-time soil moisture measurements and watering feedback to the user, alerts and alarms are self-diagnosed and displayed on the screen. Displays on-screen historical-run-time chart that includes time watered for the last 6 days of program, and a historical water use chart showing actual water used for the last 6 days by flow meter. Displays a 6-day scalable soil moisture history graph with integrated run-time bar chart. Displays high flow alerts, low flow alerts, pause messages and conditions, rain delays, wire faults, and other operating conditions.

Decoders will have built in diagnostic LED indicator lights that tell you at a glance the device is working. Two-wire must utilize true two-way communication on the two-wire path. Requires smart two-way communication allowing you to assign any decoder to a zone or function from the controller after the decoder has been installed in the field. Multi-station decoders can be assigned any station number in any order.

Available devices for two-wire include but are not limited to the following: Single station decoder, two station decoder, four station decoder, master valve decoder, dc latching decoder, event decoder, pump start switching decoder, flow decoder, pause decoder and coach’s button, and pressure sensor decoder. Controller must be able to identify every two-wire device connected to the two-wire path and must be able to list them in the controller. Controller is capable of re-addressing any station decoder to a new station number while leaving it installed in the field, by re-assigning the devices serial number to a new station number.

All decoders will be fully sealed, submersion-proof, and approved for direct bury, and will carry a standard 5-year warranty out of the box.

Acceptable wire and wire connectors for two-wire path: Paige P7072D or Regency 14/2 and 12/2 Maxi Wire, connectors will be DBR/Y-6. Other wire and wire connectors may be approved as an equal but must be submitted to owner prior to installation, and owner makes all final decisions on all specifications.

**Controller and Two-Wire Path Grounding and Surge Protection Specification**

All installations should conform to manufacturer’s instructions and must meet or exceed the American Society of Irrigation Consultants (ASIC) Earth Grounding Electronic Equipment in Irrigation Systems–Guidelines (htp://www.asic.org).

Grounding Electrodes In all cases where it does not conflict with appropriate grounding grid design for the site in question, grounding electrodes (such as rods or plates) referred to in this specification must conform to the following standards.

Grounding Rods:

* All grounding rods must be bare copper of 5/8” diameter or greater and a minimum of 8’ length or longer.
* Grounding rods must be located at a minimum distance to assure that the two-wire path is outside of the electrode sphere of influence for the grounding rod. For an 8’ grounding rod, this means that the grounding rod must be connected at least 8’ away from the two-wire path, at a right angle to the two-wire path. See the BL-LA01 Surge Arrestor Installation Guide for details on connecting the grounding rod to the device or surge arrestor.
* Install all grounding rods in a 10-inch round valve box to facilitate the use of a clamp-on ground resistance tester. If you use a smaller box, you will not be able to clamp the tester around the ground rod or the conductor.
* Drive grounding rods into the ground to a minimum of 8’ in a vertical or oblique position. The angle of the rod relative to the vertical must be no more than 45°.

Grounding Plates:

* All grounding plates must be a minimum of 5 square feet, as outlined in ASIC Earth Grounding Electronic Equipment in Irrigation Systems–Guidelines.
* Grounding plates must be located a distance equal to the diagonal measurement (the distance from one corner of the grounding plate to the opposite corner) of the grounding plate from the two-wire path. The longest side of the grounding plate must run parallel to the two-wire path.
* Install grounding plates in a horizontal position a minimum of 30” below ground level and below the frost line. Position the plate flat at the bottom of the trench.

Consult the ASIC Earth Grounding Electronic Equipment in Irrigation Systems–Guidelines for correct minimum recommended distances for different grounding rod or grounding plate sizes and grounding grid designs.

Connections to Grounding Rods & Plates:

All connections to grounding rods/plates must conform to ASIC Earth Grounding Electronic Equipment in Irrigation Systems–Guidelines and must consist of either a CADWELD type or screw clamp type of connection. CADWELD or equivalent connections are preferred. All clamps must be suitable for direct burial or exothermic weld. The resistance reading on this connection should be less than 1milliohm.

Any wire extensions required to connect from a grounding rod to a surge arrestor or enclosure ground lug must be 6-gauge bare copper wire and must not have any sharp bends, coils, or kinks. Wire extensions connected to surge arrestors must use a split bolt connector, CADWELD connector, or screw clamp connector where the bare copper ground wire meets the green grounding wire from the surge arrestor.

Never use solder to make connections in the grounding system because it will melt during a lightning discharge.

Grounding Options:

While the best option for grounding irrigation equipment is a direct physical connection to the earth, there are times when this is impossible or impractical. The following options are available for special cases. All other requirements in Baseline’s Grounding Specifications apply.

* Controller Enclosure: When direct physical connection to the earth is not possible, the irrigation controller’s enclosure ground can be connected to the building ground. However, DO NOT connect the two-wire surge arrestor ground to the building ground. The ground on an electrical receptacle (outlet) is not allowed, and is not sufficient.
* Irrigation System on a Green Roof or Green Wall: When grounding the irrigation system on a green roof or green wall, the irrigation controller’s enclosure ground can be connected to the building ground, and it is acceptable to connect the green wire from each surge arrestor to the building system ground.

Two-wire Grounding with Surge Arrestors:

The surge arrestor is a critical part of the surge protection scheme for the two-wire path. Surge arrestors attach directly to the two-wire path and help dissipate electricity generated by nearby lightning strikes and other electromagnetic events. While two-wire components have optical isolators and other surge arresting features, the surge arrestor provides an extra measure of protection.

IMPORTANT: Surge arrestors are required for proper operation and for warranty coverage.

Installation of Surge Arrestors:

* Connects directly to the red and black wires
* Attaches to grounding rod via the green wire
* Install in a valve box
* Surge arrestors must be connected to bare copper ground wires using split bolt connectors, CADWELD connectors, or screw clamp connectors suitable for direct burial (no wire nuts of any kind are supported for grounding wires).

Two-Wire Grounding Installation:

Two-wire supports a large number and variety of wiring configurations. As more wires are connected to a piece of electronic equipment, more lightning energy enters the equipment, and a more substantial grounding grid must be used. Consult the Baseline Two-Wire Specification for more details. The two-wire must have properly installed surge arrestors as outlined in the Baseline Surge Arrestor Install Guide and elsewhere in this document. Surge arrestors must be installed as outlined below:

* The first surge arrestor on the two-wire path must be within 25’ of the controller. This grounding point must be separate from the irrigation controller’s enclosure grounding point.
* Place a surge arrestor every 600’ on the two-wire path. Each surge arrestor protects a 300-foot radius of the two-wire path.
* In lightning prone regions, consider grounding every 300’ rather than going out to the maximum distance.
* There must be a surge arrestor at the end of the two-wire that is the maximum distance from the controller or if looped at the point of maximum distance from the controller.
* Any branch of the two-wire that exceeds 50’ must have a surge arrestor at the end.
* On an uninterrupted run of more than 600’, it is acceptable to have a surge arrestor at each end. Note: On any wire run with no splices, do not cut the wire to install a surge arrestor, just place one at the end.

Controllers in Steel Wall Mount Enclosures:

The following applies to all controllers, controller extensions, add on components, in steel wall mount enclosures. If the controller is on or within an existing building, the unit must be grounded as outlined below: The ground lug, located in the interior in the lower right region of the enclosure, must be connected directly to the building ground using a bare copper wire of 6 AWG or larger, as outlined in article 250 of the National Electric Code (NEC), so that a single point of connection with the building ground is achieved. If the controller is mounted at a remote location more than 25’ away from the building or grounded AC power source, the unit must be grounded as outlined below: A bare copper grounding wire of 6 AWG or larger must be connected from the ground lug to an appropriate grounding rod as outlined in the previous sections of this document.

Controllers in Stainless Steel Enclosures:

If the controller is within 25’ of an existing building, and is connected to the AC power system within that building, the unit must be grounded as outlined below: The ground lug, located in the interior on the back panel in the lower-left corner under the AC power box in the pedestal enclosure, must be connected directly to the building ground using a bare copper wire of 6 AWG or larger, as outlined in article 250 of the National Electric Code (NEC), so that a single point of connection with the building ground is achieved. If the controller is mounted at a remote location more than 25’ away from a building or grounded AC power source, the unit must be grounded as outlined below: A bare copper grounding wire of 6 AWG or larger must be connected from the ground lug to an appropriate grounding rod as outlined in the previous sections, and in conformance with the ASIC Earth Grounding Electronic Equipment in Irrigation Systems– Guidelines.

IMPORTANT: All clamps used to connect the 6 AWG wire to the grounding electrode must be suitable for direct burial or exothermic weld.

**Baseline Extended Ten Warranty**

All Baseline manufacturer specifications must be adhered to including all grounding specifications for the controller and or the two-wire path. Once the controller has been installed the contractor is required to have Authorized Baseline Technical Service Representative perform the Baseline Extended Warranty testing. All equipment must meet or exceed the testing standards set forth by Baseline Systems. Controllers must be grounded to 10 ohms or less. After you have installed your grounding system on the two-wire path, Baseline requires that you measure the ground resistance in order to prove that each grounding point meets Baseline's specifications. Resistance readings of 5 to 10 ohms are desirable, and a reading of no more than 25 ohms is required. An Authorized BaselineTechnical Service Representative will measure the ground resistance and will perform all other necessary testing, inspections and will submit all paperwork to Baseline for approval.

The Baseline Extended Ten Year Warranty Testing should be specified as follows:

AUTHORIZED BASELINE EXTENDED WARRANTY CERTIFICATION TECHNICIAN TO PERFORM GROUNDING OHMS TEST AT CONTROLLERS AND ALONG TWO-WIRE PATH GROUNDING RODS. CONTROLLERS MUST BE GROUNDEDTO 10 OHMS OR LESS, AND TWO-WIRE GROUNDING RODS (5-10 OHMS DESIRABLE) MUST BE 25 OHMS OR LESS. INCLUDES ALL FIELD INSPECTIONS AND SUBMISSION TO BASELINE FOR APPROVAL.

Important: Consult Baseline’s Two-Wire Technical Specification and the Surge Arrestor & Grounding Specification for details on surge protection installation. Failure to install surge protection hardware to specification will void surge protection coverage under this warranty.

THIS WARRANTY IS LIMITED SOLELY TO BASELINE EQUIPMENT, AND DOES NOT WARRANT AGAINST DAMAGE CAUSED BY LIGHTNING OR OTHER POWER SURGES TO NON-BASELINE EQUIPMENT, WIRING, LANDSCAPE, OR FACILITIES. THIS WARRANTY DOES NOT COVER ANY EFFECTS TO LANDSCAPE OR PROPERTY DUE TO BASELINE EQUIPMENT’S OPERATION OR FAILURE TO OPERATE FOLLOWING A SURGE OR LIGHTNING STRIKE, NOR DOES IT COVER LABOR COSTS ASSOCIATED WITH TROUBLESHOOTING OR REPAIRS.