

PILOT® NETWORK

System Design Guide

Hunter®



TAKE CONTROL OF IRRIGATION

With the Pilot Network

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Pilot Network



The Pilot Network refers to the entire Hunter Golf irrigation control system, including the Pilot Command Center, Field Interface, Field Controllers, and Integrated Hubs. The Pilot Command Center consists of the central computer and software necessary to manage golf course irrigation.

The software will arrive already loaded on a dedicated compact computer along with the latest Windows® operating system. All necessary supporting utilities and drivers are also preloaded. An internet connection is required to obtain remote technical support from Hunter and accept Pilot Command Center Software (CCS) updates. A clean, climate-controlled indoor environment is required to ensure reliable operation of the central computer.



Field Interface

Indoor, wall-mounted device that links the central computer to the field via long-range communication options.



Field Controller

Conventionally wired Field Controller, up to 80-station capacity, that stores and operates irrigation.



Integrated Hub

Two-wire Integrated Hub, up to 999-station capacity, for total control of Pilot Two-Way Modules.

ThinkVision is a trademark of Lenovo in the United States, other countries, or both. Windows is a trademark of Microsoft Corporation in the United States and/or other countries.

Pilot Field Interface

The computer is connected to an indoor, wall-mounted Pilot Field Interface via USB connection. The Field Interface takes the local output from the computer and communicates this information over long distances to the controllers or Integrated Hubs that are connected to the irrigation valves.

The Field Interface comes with 8' (2.5 m) of USB cable. It's designed to operate within close range of the central computer. The Field Interface has its own screen and user interface. These features are only used during setup and diagnostics; they are not used for irrigation control functions.

An Field Interface is always required to link the central computer to the Field Controllers or Integrated Hubs. Most systems require just one Field Interface. To reach the controllers or Integrated Hubs, the Field Interface may be loaded with up to two types of communications:

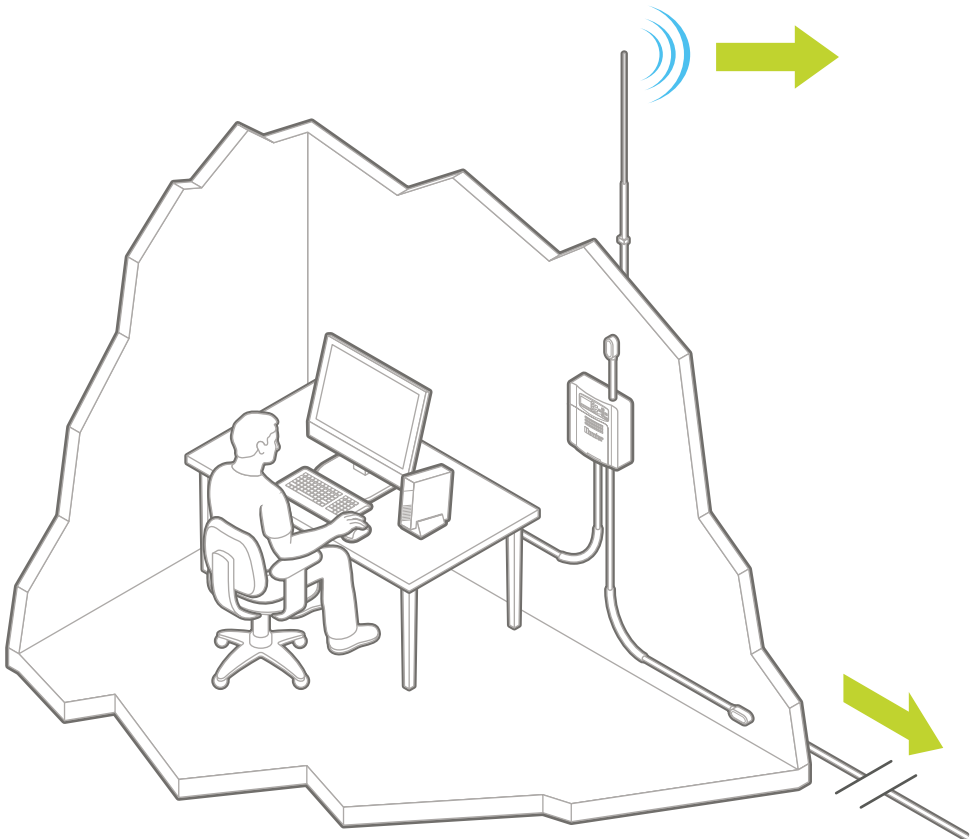
- Hardwire cable
- Narrowband (UHF) radio

Field Interfaces are available as complete, pretested units. See the following chart for configurations:

PILOT-FI SPECIFICATION BUILDER		
Model	Standard Features	Options
PILOT-FI	Plastic, wall-mounted, indoor enclosure	HWR = Hardwire communications UHF = UHF radio communications



Examples:
 PILOT-FI-HWR = Field Interface with hardwire communications
 PILOT-FI-UHF = Field Interface with UHF radio communications



Pilot Field Controllers and Integrated Hubs

Pilot Field Controllers (for conventionally wired systems) and Integrated Hubs (for two-wire systems) may be located virtually anywhere within the setting. They are equipped with the communication modules required to interact with the Field Interface (and the Pilot Command Center Software).



Pilot Field Controllers: Conventional solenoid wiring with an individual wire running to each valve.



Pilot Integrated Hubs: Two-wire control with one or more pairs of wires running through the project and a two-way module spliced in wherever valve control is needed.



For two-wire installations, Hunter offers a two-way module option on Total-Top-Serviceable (TTS) golf rotors.

<https://hunter.info/pilotdecoder>

Conventional Systems

For conventionally wired systems, choose the Pilot Field Controller. The Field Controller is installed in a weatherproof, outdoor plastic pedestal. It contains all the power, communications, and output modules needed to operate the desired number of valves, or valve-in-head rotors, via individual wires. Field Controllers are available in 10-station increments, up to 80 stations maximum per controller.

Pilot Field Controllers are ordered as complete factory-tested packages, with all communications and station output modules preinstalled. The modular communications and outputs may be replaced or expanded after initial installation. See the chart below for configurations.

Conventionally wired installations may require several Field Controllers to successfully operate different areas within the Pilot Network.

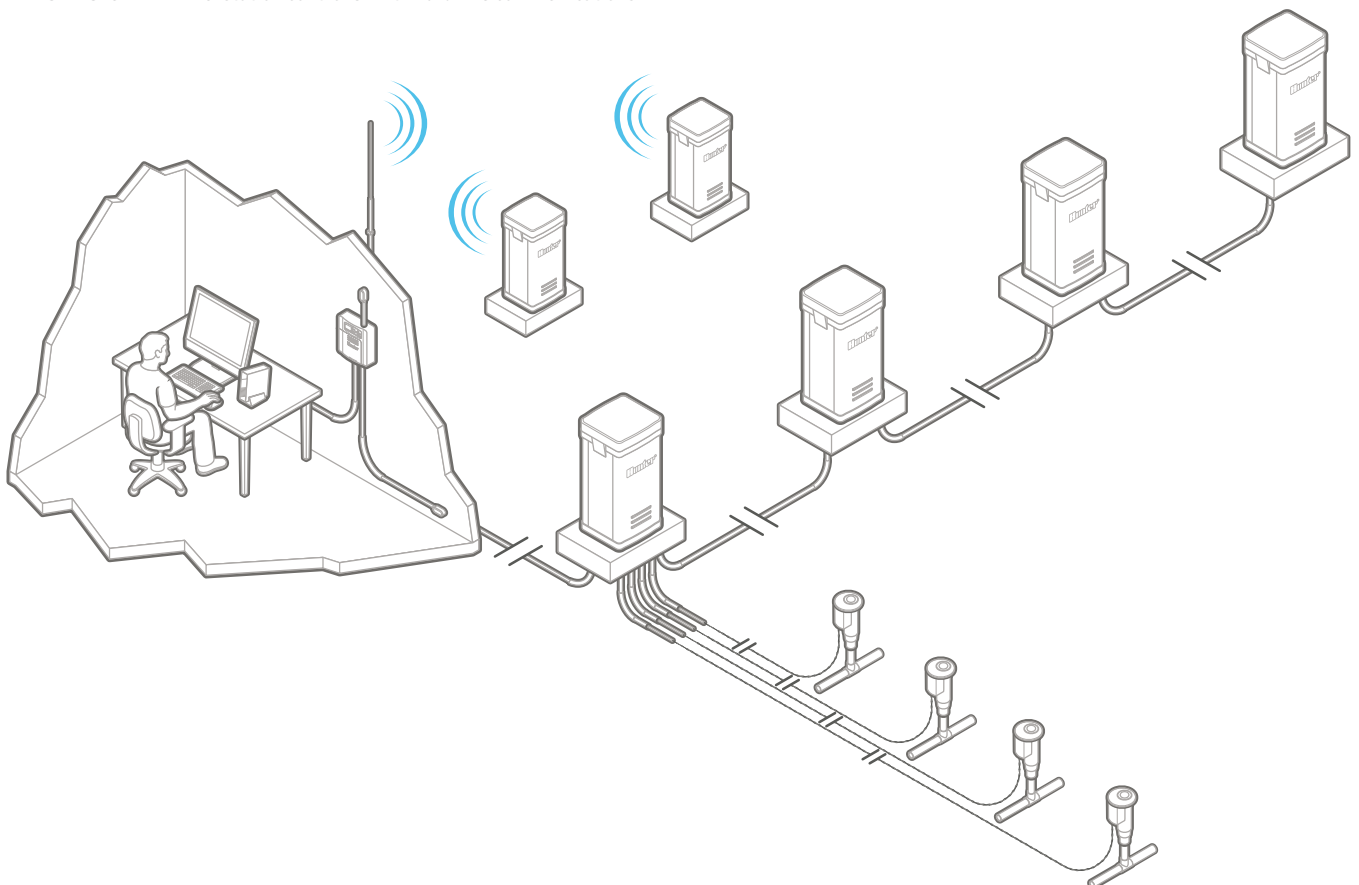
Pilot Field Controllers have their own user interface, or dashboard, and they are fully programmable without a central computer. For flexibility during course construction or maintenance, they do not have to be linked to a central computer to conduct irrigation. However, for maximum performance, installing and linking Field Controllers to the central computer allows you to schedule multiple controllers, balance irrigation for optimum flow management and energy savings, and much more.

PILOT FIELD CONTROLLER SPECIFICATION BUILDER

Model	Standard Features	Options
PILOT-FC20 = 20-station controller	(blank) = Plastic pedestal (gray) 120/230 VAC, 50/60 Hz dual-voltage transformer	S = Standalone field controller with no central communications HWR = Hardwire communications UHF = UHF radio communications UHFA = UHF radio communications (Australia)
PILOT-FC30 = 30-station controller		
PILOT-FC40 = 40-station controller		
PILOT-FC50 = 50-station controller		
PILOT-FC60 = 60-station controller		
PILOT-FC70 = 70-station controller		
PILOT-FC80 = 80-station controller		

Examples:

- PILOT-FC40-S** = 40-station, standalone controller with no central communications
- PILOT-FC70-HWR** = 70-station controller with hardwire communications



Integrated Hub Systems

For management of two-wire irrigation systems, choose Pilot Integrated Hubs. Integrated Hubs are also known as PILOT-DH Controllers. Each Integrated Hub is installed in a plastic pedestal, similar in appearance to the Field Controller. One Integrated Hub can operate up to 999 two-wire Pilot Two-Way Modules. Two-way module systems generally require fewer Integrated Hubs (often just one) compared to the number of Field Controllers needed on conventional installations, but multiple Integrated Hubs can be installed to operate virtually any two-way design. A hybrid system of Field Controllers and Integrated Hubs is another option.

Each Integrated Hub is supplied as a complete unit. All desired communications and output modules are preinstalled and tested at the factory.

Integrated Hubs have their own user interface, or dashboard. They are fully programmable without a central computer. They do not require a computer to irrigate. However, installing Integrated Hubs with a central computer allows you to schedule large numbers of two-way modules, balance irrigation for optimum flow management and energy savings, and much more. For convenience during course construction or retrofitting, start with a standalone Integrated Hub and add the central computer at a later time.

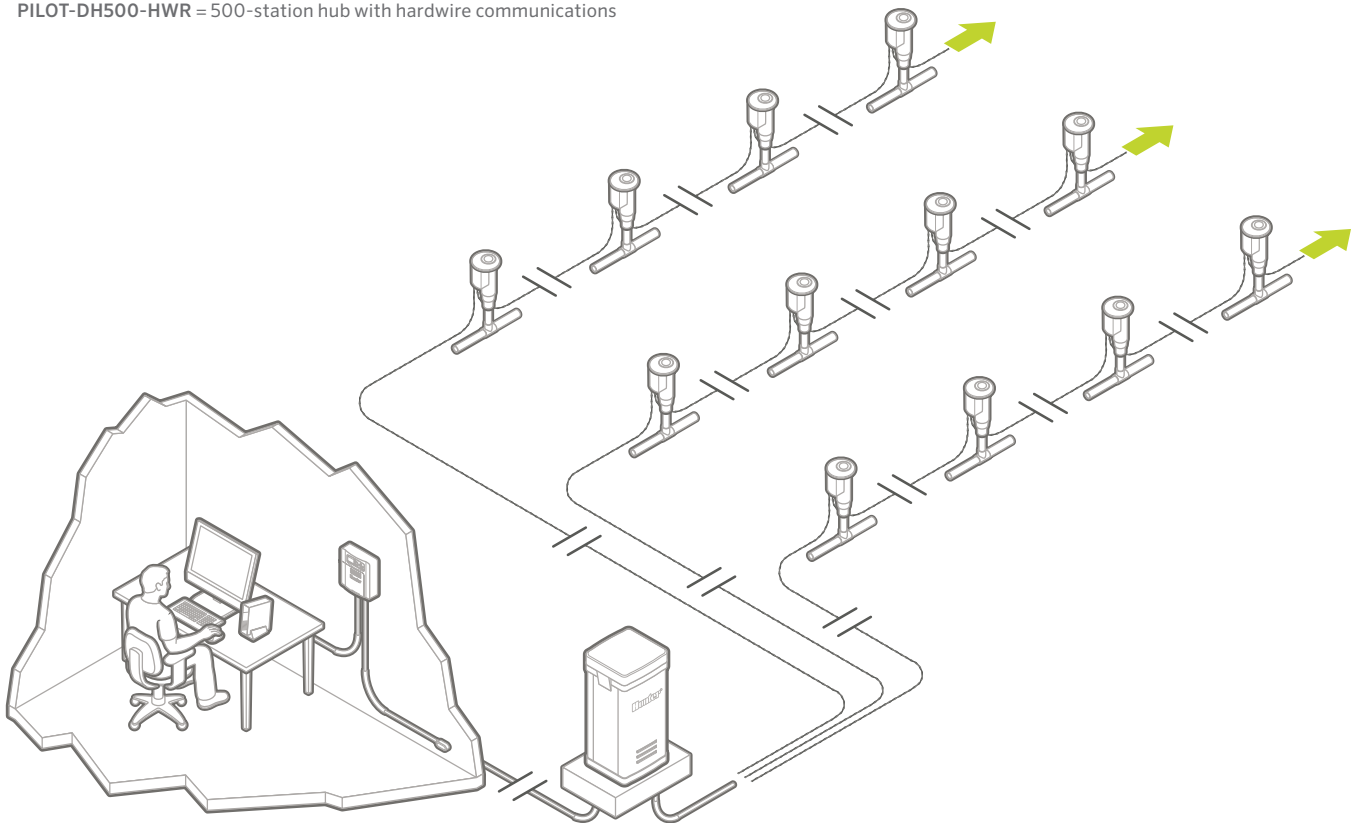
The Pilot Integrated Hub is available in 250-station increments, up to 999 stations maximum per Integrated Hub. See the following chart for configuration options.

PILOT INTEGRATED HUB SPECIFICATION BUILDER

Model	Standard Features	Options
PILOT-DH250 = 250-station hub	(blank) = Plastic pedestal (gray)	S = Standalone hub with no central communications HWR = Hardwire communications UHF = UHF radio communications
PILOT-DH500 = 500-station hub		
PILOT-DH750 = 750-station hub		
PILOT-DH999 = 999-station hub		

Examples:

- PILOT-DH250-S** = 250-station, standalone hub with no central communications
- PILOT-DH500-HWR** = 500-station hub with hardwire communications



MultiTalk™ Technology

With proprietary MultiTalk Technology, the Pilot Network provides more flexibility than any other system in the industry. MultiTalk capabilities include utilizing:

- Multiple wire methods by combining Integrated Hubs and Field Controllers on the same system.
- Multiple communication technologies by switching between wireless and hardwired communication on the same system.
- Multiple remote-control options with the handheld StraightTalk™ Maintenance Radio and free PilotFCP Utility Program, which allows you to schedule basic programs remotely from a computer or tablet.
- Multiple frequencies in wireless modules to repeat the signal and forward communications to controllers in remote locations on the course.

This flexibility is especially valuable for phased renovation projects where sections of the golf course are upgraded over time according to site needs.

Communication Options

There are two main types of communication options to connect the central computer and Field Interface to controllers and Integrated Hubs throughout the setting.

- Hardwired communications offer reliable, secure communications with in-ground cable.
- Wireless communications offer trenchless connections and reduce the chances of system damage due to lightning.

Wireless communications require a site survey in advance to determine antenna selection and placement. Not all terrain is suitable for wireless connection.

Hardwired Communications

In a hardwired system, physical wiring links each controller or Integrated Hub to the Field Interface. A Pilot Network may be wired from the Field Interface to the first controller, from there to the next controller, and so on to connect all controllers.

A single run of hardwire cable to the field is referred to as a “leg” of communications. Some systems may require more than one leg. Legs can be split at communication modules only to go in multiple directions.

Hunter supplies GCBL cable for these connections. GCBL conveys 20 mA loop communications from the Field Interface to the controllers. Each controller is connected to the next by a single run of cable. The cable does not need to be looped back to the Field Interface. The wiring just stops at the last controller in any particular run of cable.

PILOT-DH INTEGRATED HUB POWER			
Type	Distance	Module	Requirements
Hardwire cable	10,000' (3,000 m) between each device	PILOT-HWR	GCBL communications cable
Narrowband radio	2 mi (3.5 km)	PILOT-MOD-UHF	UHF antenna, government license

Hardwire Communication Module

Any device (Field Interface, Field Controller, or Integrated Hub) that will communicate via hardwire cable requires a PILOT-HWR Hardwire Communication Module. At least one PILOT-HWR must be installed in the Field Interface to connect to Integrated Hubs or controllers via GCBL. Install at least one PILOT-HWR in each additional device that will be part of the communications link.

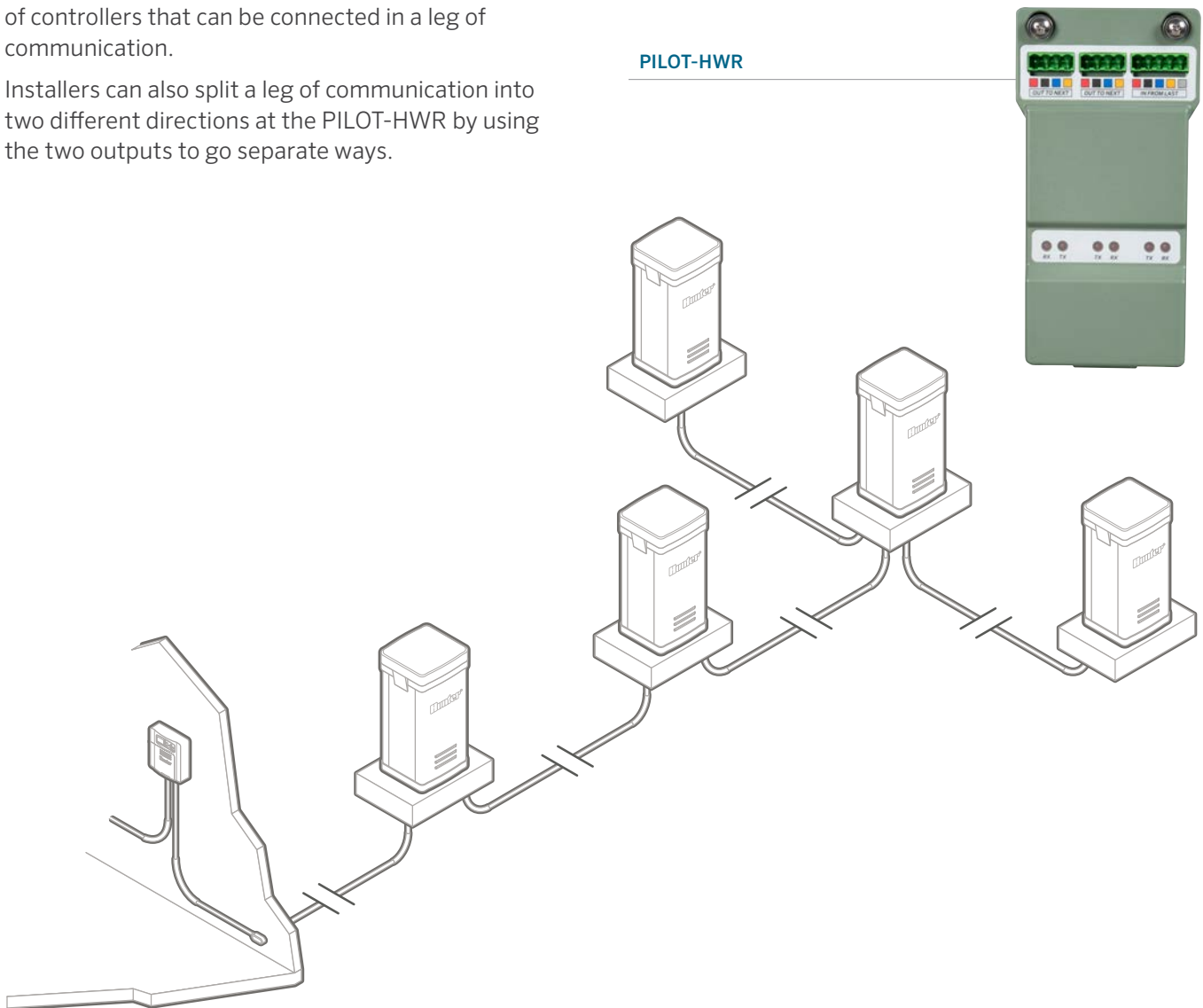
Each PILOT-HWR has an input for hardwire from a preceding device. Each PILOT-HWR can support up to two outputs to the field to continue on to other devices. There is no practical limit to the number of controllers that can be connected in a leg of communication.

Installers can also split a leg of communication into two different directions at the PILOT-HWR by using the two outputs to go separate ways.

Never T-splice GCBL cable in the middle of the cable run. Splitting the wire into multiple legs will divide the communication signal strength, causing communication failures. This is a violation of the signal specification. Hardwire runs may only be split at the PILOT-HWR communication module in a controller.

To allow more than two output paths, it is possible to have more than one PILOT-HWR in a device. A controller with two PILOT-HWR modules could accept one input and split the signal into four separate outputs at any given controller.

PILOT-HWR



GCBL Hardwire Cable Specifications

- **Outer jacket:** Direct-burial rated, sunlight- and water-resistant black polyethylene
- **Four conductors:** Two twisted pairs, 18 AWG (0.823 mm²) stranded wire with PVC insulation
- **Color-coded:** Pair 1: red/black; Pair 2: blue/orange
- **Drain wire:** 1 bare 20 AWG (0.518 mm²) tinned copper wire for connection to earth ground (one end only)
- **Shield:** 0.00235" (0.05969 mm) aluminum and Mylar® tape, helically applied

GCBL cable is priced by the foot (3' = 1 m). Up to 4,000' (1,220 m) can be loaded on a single spool.

GCBL Splices

GCBL may run up to 10,000' (3 km) between each device. GCBL may be end-spliced to extend a cable run according to the following guidelines:

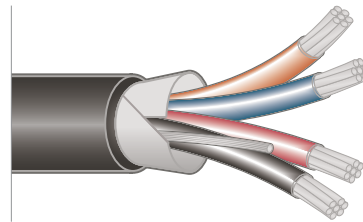
- Make all end splices in a valve box.
- Use high-quality waterproof connectors to join each conductor individually, including the silver drain wire, for a total of five connections.
- Leave adequate slack and strain relief at the splice to prevent stress on the connections due to frost or soil expansion.

Earth-Grounding Cable

Every run of GCBL cable should have one end (not both) of the silver drain wire connected to the earth-grounding terminal of the HWR module. The Field Interface or controller must be thoroughly earth-grounded to ground hardware, as specified in their respective installation instructions.

The silver drain wire should be connected to the fifth terminal on the hardwire module, on the incoming side only (see device manual for earth-grounding specifications). The purpose of earth-grounding the silver wire is to make the foil shield effective regarding noise and surge suppression.

Note: To prevent a differential between two earth-ground points, only one end of each GCBL run should be grounded.



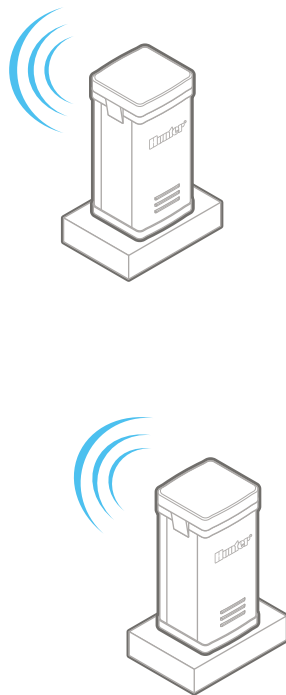
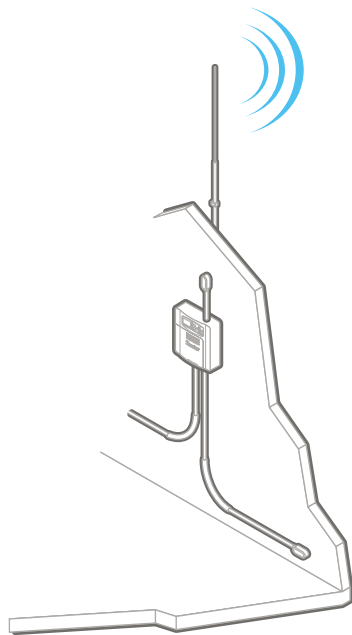
Narrowband (UHF/VHF) Radio Communications

Narrowband radios use modern wireless radios to communicate. These radios require a government license to operate in almost every country in the world. They offer significant flexibility and reduced cost in system design, when and where they are practical.

Pilot radios are “narrowband,” which means they conform to modern 12.5 kHz bandwidth regulations. Pilot radios are available in various frequency ranges. Their effective range is approximately 2 mi (3.5 km), depending on terrain conditions. Buildings and hills may significantly reduce this coverage.

NARROWBAND RADIO SPECIFICATION

Frequency range	450 to 470 MHz (primary); 400 to 440 MHz and 150 to 174 MHz available for select markets
Bandwidth	12.5 kHz
Output power	2 W, default setting (1 to 5 W with extended lead times)
Antenna connection	Female BNC



Narrowband Radio Modules

Any Field Interface, Field Controller, or Integrated Hub that will use narrowband radio communications requires a PILOT-MOD-UHF Communication Module and an appropriate antenna.

To connect to Integrated Hubs or controllers via radio, at least one PILOT-MOD-UHF plus an antenna must be installed in the Field Interface. One PILOT-MOD-UHF and an antenna must also be installed in each additional Field Controller or Integrated Hub that will be part of the communications network.

Narrowband radio systems normally broadcast from and to the Field Interface to all controllers in the system individually. The signals are not relayed from one controller to the next. The Field Interface talks directly to each radio controller in turn.

PILOT-MOD-UHF



Site Surveys and Antenna Options

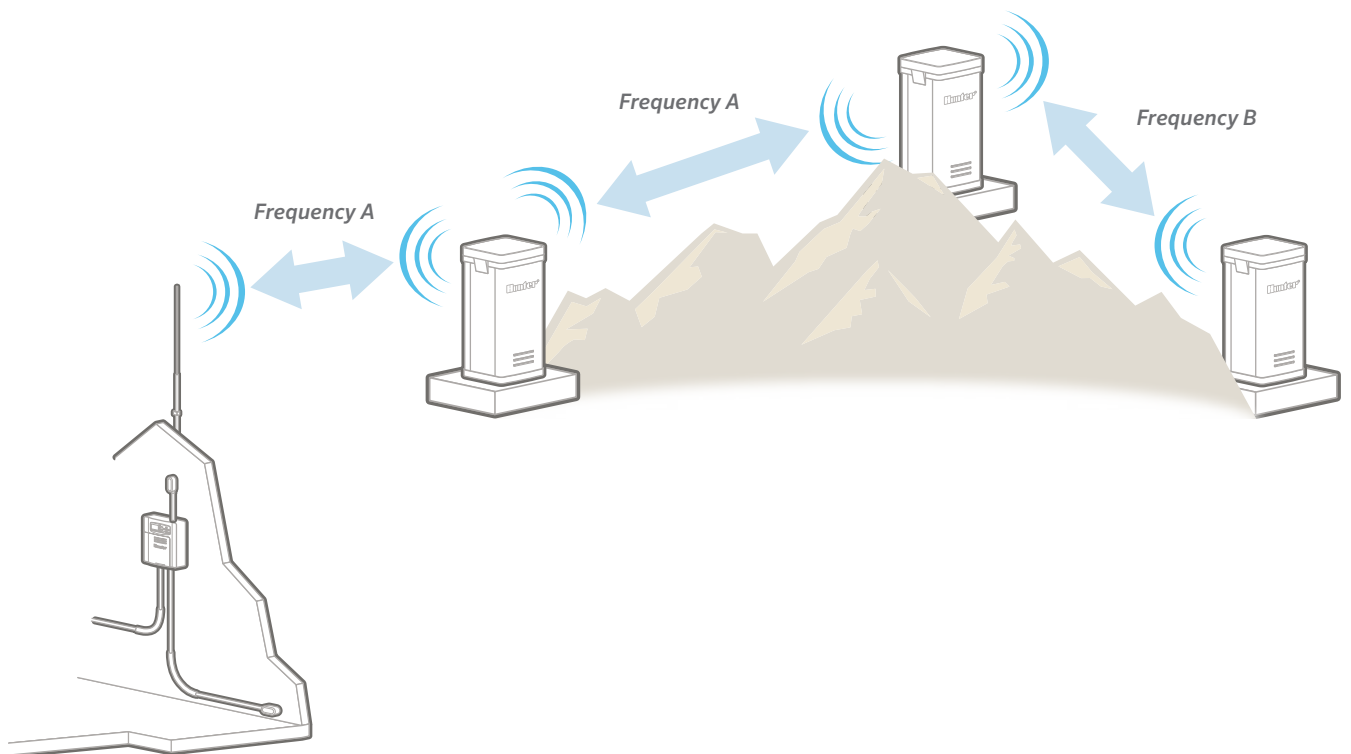
All radio installations require a site survey in advance of actual installation. This is performed by a qualified technician at the actual site. The site survey determines which locations are suitable and which antennas are required. Hunter offers several types of narrowband UHF antennas for golf project installations.

Hunter antenna options are available in the 450 to 470 MHz range. Equivalents in other frequency ranges (for appropriate international markets) are available through local professional radio dealers. It is always the designer’s responsibility to understand local regulations and licensing requirements for radio installations.

Utilizing Multiple Frequencies

With MultiTalk Technology, multiple frequencies can be used to relay the signal to remote locations on the course. In the example below, Frequency A is used to communicate from the Pilot Field Interface to the first two controllers. A second UHF communication module, programmed with Frequency B, is installed in the second controller. It forwards the signal to the third controller behind the hill that’s blocked from receiving Frequency A. This flexibility improves performance and makes future expansion easier.

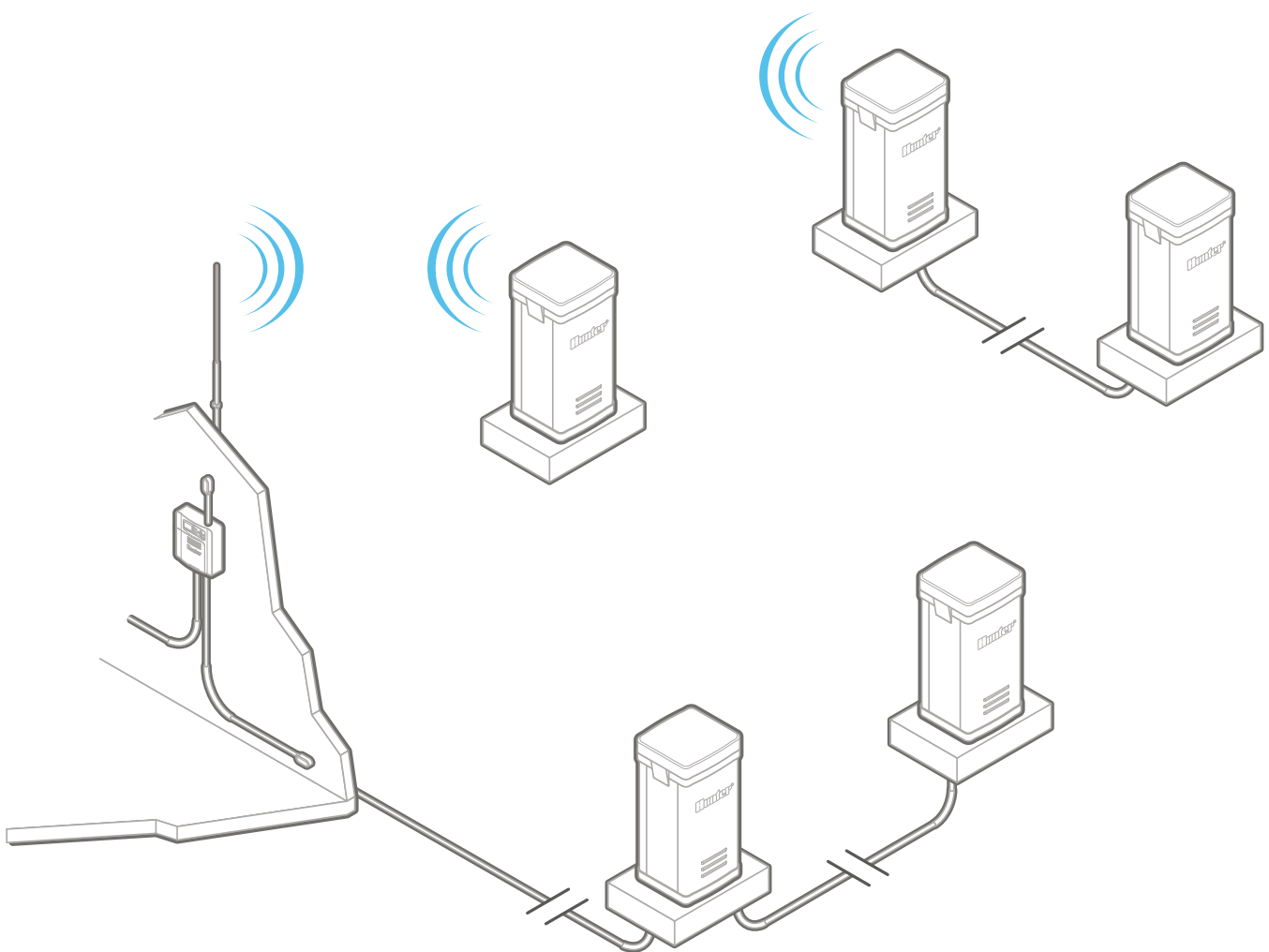
PILOT INTEGRATED HUB POWER			
Type	Model	Description	Requirements
Field Interface base antenna	RA5M	5' (1.5 m) fiberglass mast, omnidirectional	RG850NFNF or custom length of 50 Ω antenna cable
Pedestal lid antennas	IMMS-ANT2	Stealth lid-mounted internal antenna	N/A (antenna, cable, mounting plate included in part)
Specialty long range	RA3F, RA6F	Yagi directional antenna	RG850NFNF or custom length of 50 Ω antenna cable



Hardwire and Radio Combination

Radio may be combined with hardwired communications in certain installations. The Field Interface has two communication slots. To operate different areas, the Field Interface can accommodate both hardwire (PILOT-HWR) and radio (PILOT-MOD-UHF).

Systems may be hardwired up to a certain point. Then radio can be added to move past a fixed obstacle such as a lake or road. This technique may only be used up to two times per hardwired leg. It requires PILOT-MOD-UHF modules and antennas in the controllers using the radio link. The Field Interface would not require a radio and antenna in this configuration.

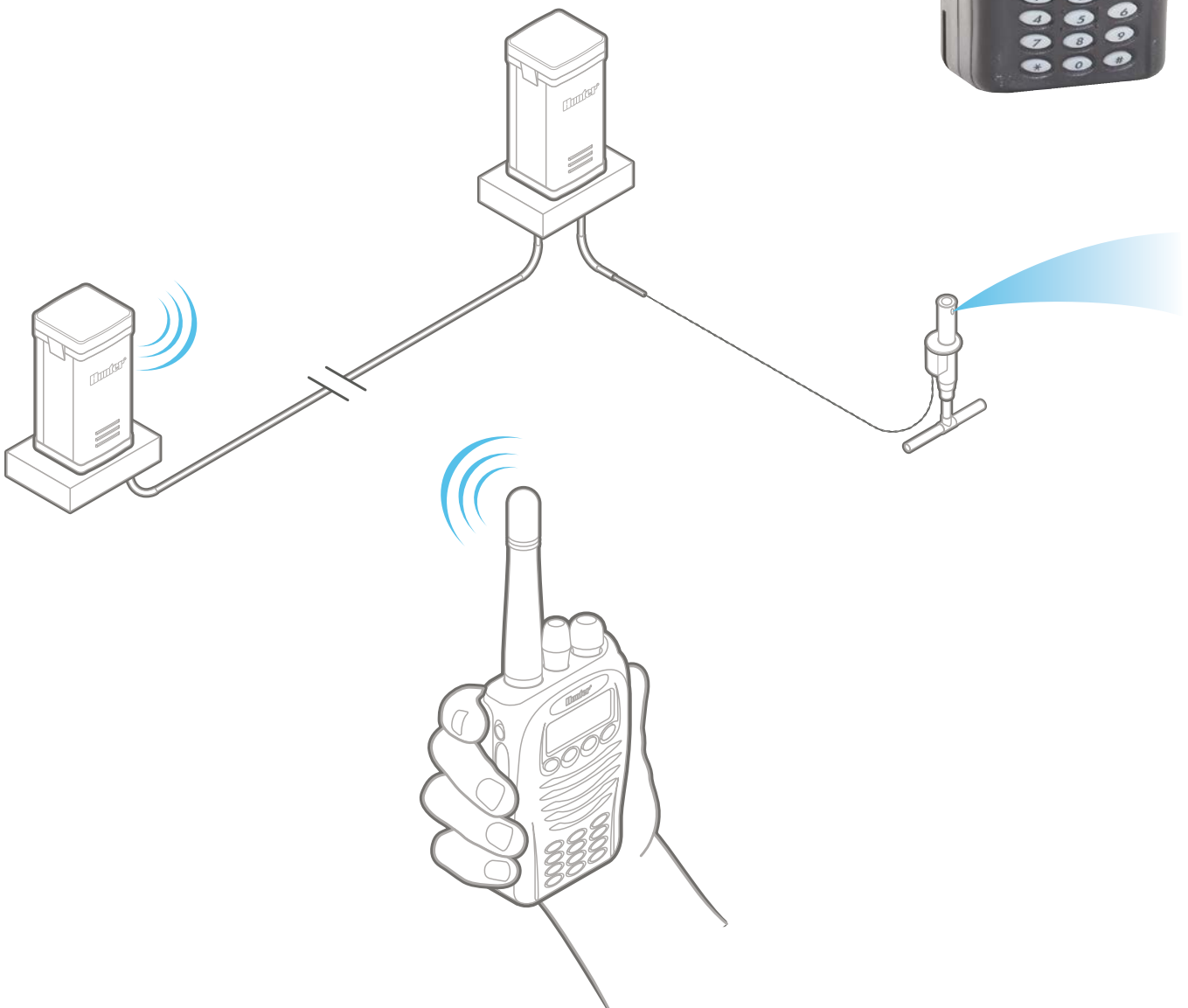


Maintenance Radio Remote Control

All Hunter Pilot Network systems can use Maintenance Radio remote control with legally licensed UHF radios (Hunter model TRNR, specify frequency). Controllers with PILOT-MOD-UHF radio communications can be addressed directly with StraightTalk™ Technology. No additional steps are required.

Controllers with PILOT-HWR hardwired communications may be addressed via any radio-equipped Field Interface or controller. At least one device in the system must have a legally licensed narrowband radio (PILOT-MOD-UHF) for Maintenance Radio to be used. The Maintenance Radio remote can then address any other controller in the system.

TRNR

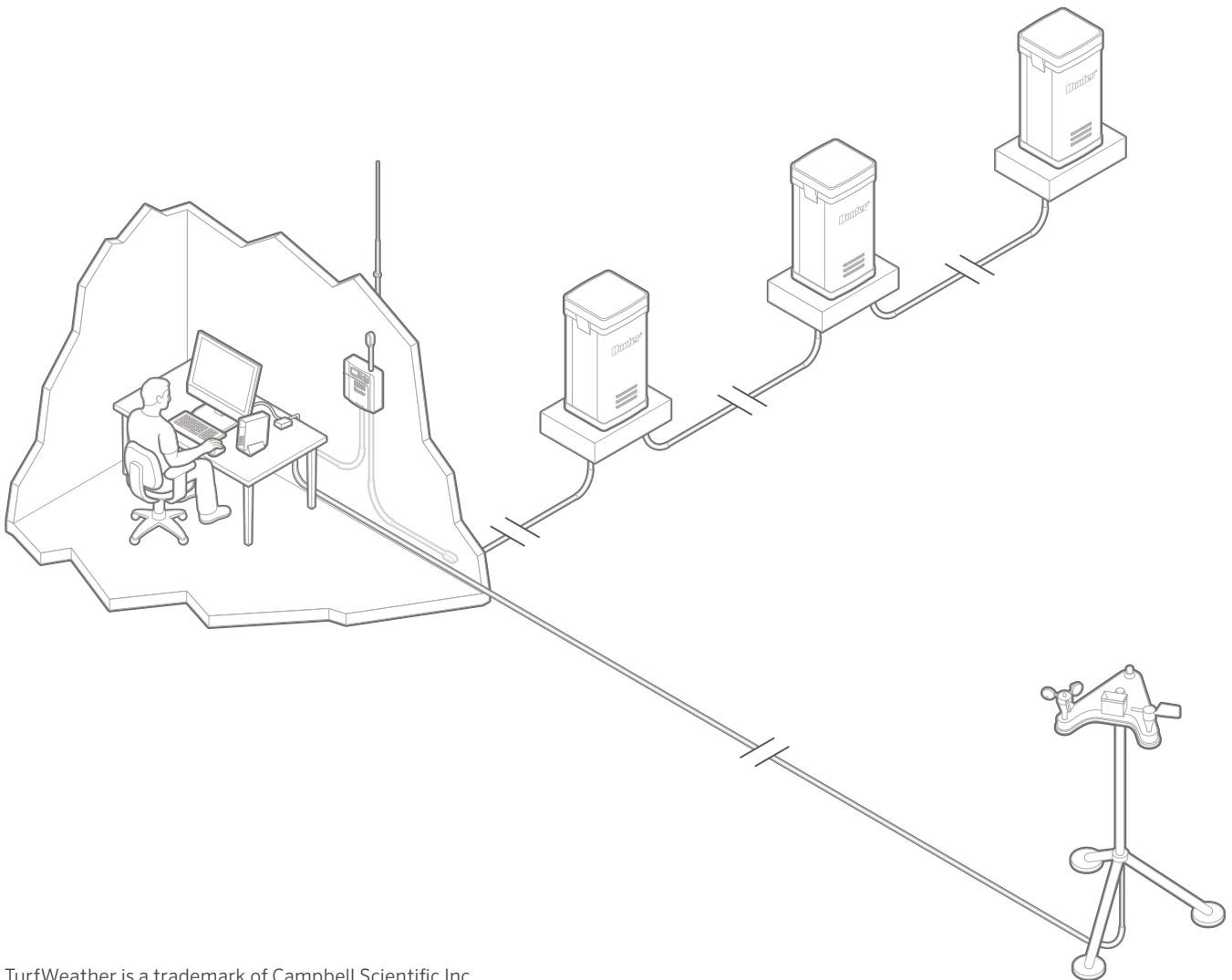


Weather Stations

Pilot Network systems may be equipped with sophisticated TurfWeather® stations that can connect independently to the Pilot Command Center computer.

Hardwire TurfWeather communications with the same type of GCBL cable used for Pilot hardwire. They may never be included in a Pilot hardwire run, however. They require a dedicated GCBL connection of their own to the central computer up to 10,000' (3,000 m).

TurfWeather stations may also be connected with license-free, spread-spectrum communication options. These communications are also separate from Pilot spread-spectrum configurations, and they are not connected via the Field Interface. The spread spectrum option would have a dedicated receiver at the Command Center with its own antenna. There is also a solar power option for TurfWeather stations.



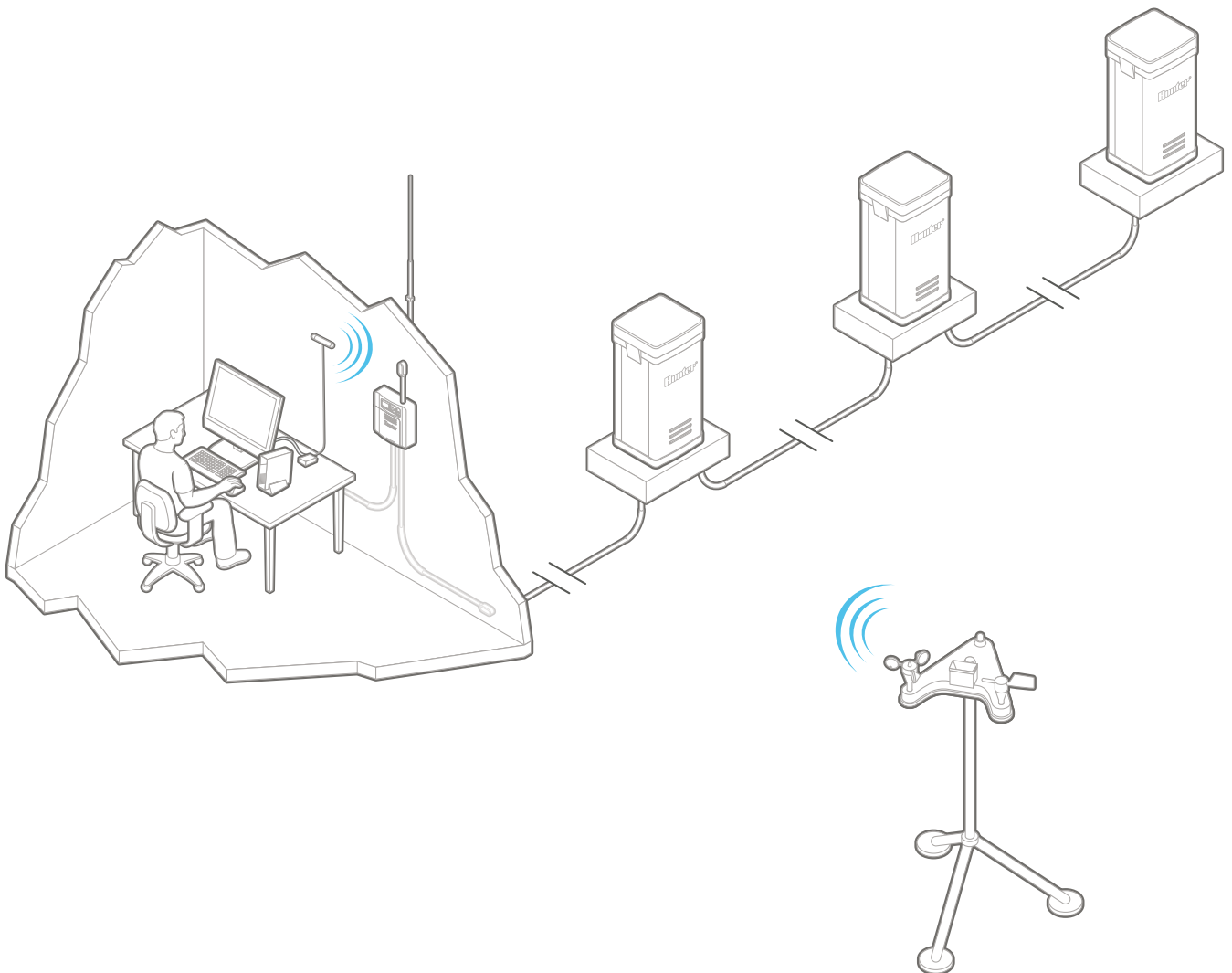
TurfWeather is a trademark of Campbell Scientific Inc.

Wireless Weather Stations

WEATHER STATIONS

Model*	Description
TWHW	TurfWeather with AC adapter and wired communications (GCBL cable required)
TW24	TurfWeather with AC adapter and 2.4 GHz wireless communications
TW916	TurfWeather with AC adapter and 916 MHz wireless communications
TW922A	TurfWeather with AC adapter and 922 MHz wireless communications
TWSUN	Solar power kit for any TurfWeather package

*Note: Complete package includes Hunter TurfWeather software.



Hunter®

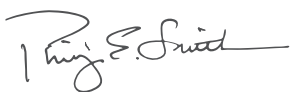
Golf Irrigation

Hunter has been on the leading edge of golf course irrigation for more than three decades. We build performance, reliability, and serviceability into every product. From our industry-best rotors to our robust Pilot® irrigation control system, we take pride in providing golf experts and professionals with the tools and support they need to conceptualize, create, and manage world-class golf courses.

Learn more at hunterindustries.com/golf.

Website hunterindustries.com | **Customer Support** 1-800-383-4747 | **Technical Service** 1-800-733-2823

Helping our customers succeed is what drives us. While our passion for innovation and engineering is built into everything we do, it is our commitment to exceptional support that we hope will keep you in the Hunter family of customers for years to come.



Gene Smith, President, Landscape Irrigation and Outdoor Lighting