**Golf Training Program**

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**Genesis System**

**GF Controllers (1994 – 1998)**

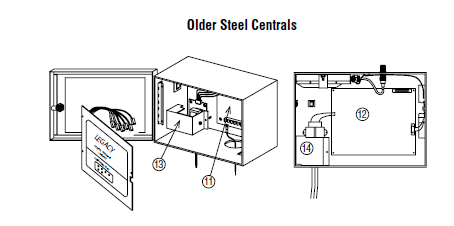
* Next generation from COPS.
* Added radio communications
* Firmware versions in the 2.XX range
* Large, 10” x 16” facepak, exposed circuit board.
* Available in 8,12,16, 18, 20, 24, 28, 30, 32, 36, 42 and 51 station sizes
* Manual station size configuration on the circuit board of the facepak using jumpers on JP4, JP5 and JP6 as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **Size** | **JP4** | **JP5** | **JP6** |
| 8 | Open | Close | Open |
| 12 | Close | Close | Open |
| 16 | Close | Open | Close |
| 18 | Open | Close | Close |
| 20 | Close | Open | Open |
| 24 | Close | Close | Open |
| 28 | Close | Open | Close |
| 30 | Open | Close | Close |
| 32 | Close | Open | Open |
| 36 | Open | Close | Open |
| 42 | Close | Close | Open |
| 51 | Close | Close | Close |

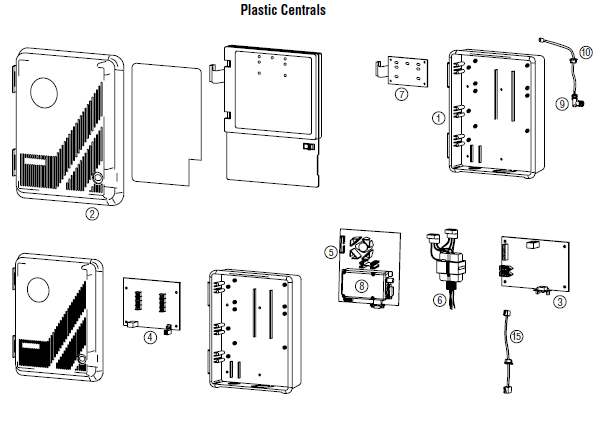
* Triacs and station screws are on the same boards
* If more than 30 stations are used, the upper output board must be a 31 station and then use a ribbon cable to connect the lower boards.
* If either output board fails, it could affect the operation of the other board, indicated by controller reporting size “0” or “253”
* A 31 station upper could be made into a 30 by using a jumper wire (usually 18 ga stranded wire, cut to 3” long, NOT STRIPPED) and bridging pins 1 and 4 of the ribbon cable location on the upper board (pin 1 is the first on the left, and then count to the 4th going right). This is a band aid to keep some stations watering if the lower board is determined to be bad.
* Original radio versions were Wide band, and used a crystal type radio (nicknamed the Maxon Humpback). The radio comm board for these types of devices is not compatible with digital radios we offer today. Both must be replaced. A kit is available for these 2 items.
* Radio Controllers were easily identified in the field by their coffee warmer style antenna which was attached to the lid of the controller. The antenna connected to the radio inside the controller via RG58 cabling with BNC connectors to the radio module.
* The controller footprint is approximately 18” square, and the lids were specific to the communication type, one for hardwire, one for radio.
* Hardwire communication boards are the same as used in newer controllers, not Pilot.
* Transformers have harnesses for communication and station power integral to the assembly. Different part numbers were used for 110V and 220V.
* Transformer assemblies have 2 separate transformers, one for station operation with higher current, and the other for communications. One could get damaged and leave the other functional. There was a pop out circuit breaker on the part of the transformer that could be reset if a surge caused it to activate, and this was on the underside of the exposed part of the unit. Over time, this would accumulate dust and moisture which would cause the controller to go to sleep when it got hot. A protective membrane was used when this was discovered to help protect the contacts from getting this debris and moisture inside them.
* No factory parts are available for this series of controllers anymore, but can be repaired or replaced by Boardtronics, in CA.
* For hardwire systems that use maintenance radio, the radio is installed at the central and then commands are received there and sent down the comm wire. Genesis software must be launched on the PC, and the PC must remain on to achieve this.
* GCBL comm wire is used, the same as used in today’s product. Two twisted pairs of wires black/red and blue/orange. The black/red pair is for the transmit side, and blue/orange for the receive. Black and blue wires are the positive signal wires, and red and orange are the circuit completers. Knowing this, if a black or blue wire is determined to be shorted to ground, or broken, then sometimes the red or orange can be used in their place to fix comm issues.
* GCBL cannot be spliced between controllers. There must be a continuous wire from central to controller, or controller to controller. If a change in direction is required, it must be made on the field side of a comm board at a controller location. This is because the signal is amplified as it leaves a controller, thus allowing the spec of 10,000’ between controllers to be achieved.
* Programming is very simple, and flows from left to right on the keypad. There are 5 Program groups (think of as areas on GC – greens, tees, fairways, roughs, ????). Each program group has 4 independent Start Times within them. Thus giving a total of 20 programs. Water days are by numbers only, not Day of Week. So if a weekly schedule was required, there must be a 7-day schedule present, and the first day of that schedule determined (either Sunday or Monday, customer choice). Then each day is counted from that point for Yes or No irrigation.
* The maximum schedule length was 31 days.
* To access the address function on the keypad, the Program button must be selected once to display ‘Option #00’, then pressing ‘Enter’. The address can then be set, along with some other default settings like MR runtime, Pump Use, and Default Program use.
* The Default program was a feature that would automatically irrigate all the stations present starting at 10 pm, and with a runtime of 10 minutes. These times are not available to be changed, and are hard programmed in the firmware. This feature is useful if the facepak should get its programming wiped out by a Cold Start having occurred due to lightning, or power outage and losing its memory. Often causes irrigation at wrong times if Time of day is reset.

**Older Centrals**

* Original interface was hard wire only, and had 3 field leg terminals.



* Then came a radio version, which only talked to the satellites, and if maintenance radio was required, another radio box was needed to achieve this. This was referred to as ‘Radio Radio’.
* Then came dedicated radio and hard wire interfaces, without the need for radio radio. This was when StraightTalk was introduced. Not very many sold, and even less still out there today.
* Hardwire and radio interfaces came in plastic cases at this time. Radio had 1 box installed, and hard wire had 2 boxes, one inside the office area connecting to the PC, the other was connected via an Ethernet type cable and could be mounted outside the office for easy connection to the GCBL.



* The inner panels of the plastic style interfaces have diagnostic LED’s to indicate if communication is occurring, and also if 110V power is on. There is no power switch in either of these styles, so the plug would need to be removed from the wall or a circuit breaker turned off to replace boards.
* For hardwire versions with MR, the radio was installed on the back side of the inner panel, and there was a ribbon cable to provide the connection to the main board. If the radio got damaged, it was possible to place the jumper across the pins near to where the ribbon cable connects, which would allow the course to still send programs via the GCBL, but bypass the MR until repaired.
* The HW version was very prone to lightning strikes, and was shipped with a Surge protected power strip in the later days to help with this problem. Also, the number of comm paths was reduced to 2 in the outside box. Even so, 2 GCBL cables could be connected to one output if required (to replace the original 3 path metal box).
* Connection for all the older interfaces to the PC was made using an RS232 connection (serial port).
* Communication speeds for both hardwire and radio (all versions) are at 1200 baud rate.
* One common troubleshooting that we had to do was to verify the comm port on the PC was working, which either had to be done with a loop back tester, or using Hyper Terminal from windows.
* The Central package would feature a roof mount antenna if the course was radio controlled or featured a maintenance radio option in hardwired versions. This antenna was referred to as an RA5M mast style antenna. It was an Omni directional antenna which listened on a 360 degree plain. This antenna was supplied with an RG8-50ft cable. These antenna cables were required to be grounded to the earth with a Polyphaser arrestor supplied with them.
* In certain installations another antenna may be visible on the course called an RA6F Yagi antenna. The RA6F antenna is a directional antenna and focused its listening and transmitting energy in the specific direction it was pointed. These were used when the site survey required the need. These also featured the RG8-50 ft. cable.

**GFC Controllers**

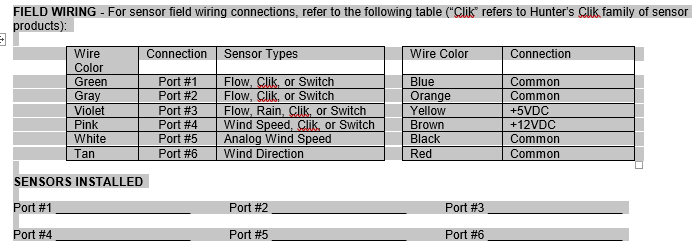
* Started production in 1998.
* StraightTalk introduced for radio versions, allowing the use of Maintenance Radio (TRNR) without the need for a central.
* Improvements included separating triac boards and station screws into 2 different boards for easier servicing (TB10, and LPB10). Station sizes were also changed to be in increments of 10, up to a 60 station maximum.
* Smaller facepak, only 8” x 8” square. The early versions still had exposed circuit boards for the keypad. Firmware versions begin with a 3.XX
* Automatic station size detection, using a jumper on the triac board in the last board installed. The last board (bottom of the rack) would have the jumper across the pins, whereas the other boards above it would have the jumper open. The station size jumper has been changed from the pin cover style to a “dummy plug” resembling the same connector the ribbon cables use. It still resides in the last triac installed.
* If a controller displays “Size = 0” this usually indicates a damaged Triac board. To diagnose disconnect all Triac boards then one at a time reconnect (starting with the first or upper board) The jumper needs to be on the last Triac board only. Repeat this process until the board/s that cause the “Size = 0” are located. **Power must be turned off when connecting/disconnecting cables etc.**
* The cabinet stayed the same from the GF series controllers, but had new parts inside to allow the triac boards and lightning protection boards to be mounted on plastic racks. The triacs are tool less servicing, meaning they snap in and out of the rack.
* Because of the new facepak design and shape, a kit was made that included a new style facepak and metal template that could be used to replace the larger GF style facepaks for those customers that required new parts. The power supply board is mounted under the template plate for older style GF kits. Important to know this because the fuse is located here.
* 1998 was also the year that Hunter purchased the golf products from Buckner, and became Hunter Golf. Engineering began designing a plastic pedestal almost immediately, which came to market in 2001. This cabinet featured double doors that were hinged, and a common mid plane that the boards mounted to. This mid plane could accommodate both decoder and conventional components.
* This plastic version of pedestal was modular, and snapped together for assembly. There was also a wall mount version of the plastic.
* A new stainless pedestal was then created by 2003, which had a wider footprint than the GF, and could accommodate the mid plane of the plastic version.
* Programming of the facepak got a little easier, as the Options function was given its own button location, not hidden like in the GF series. But the principal of operation was the same as the GF, with the logic going from left to right.
* The transformer went through some design changes also, changing from the 2 switch type (one for all power, the other for isolating the 24V test post) to a single switch type, and electronics were created to isolate the high current surge from the test post to the electronics.
* Like the GF series facepaks, the new versions of facepaks used the Hertz from the power supply (50 or 60) to keep accurate time (up to version 3.14 when electronics were added to eliminate the use of Hertz). This was good so long as the hertz didn’t fluctuate too much. There is a dip switch block on the side of the facepak to select the 50 or 60 hertz operation. This block also includes the options to select conventional or decoder operation, or if the facepak is being used as a GF upgrade version so that it can recognize the odd sized controllers other than multiples of 10. There is a label close to the switch block on the underside of the flange to help with the settings.
* If the conventional/decoder switch is in the wrong position versus the controller it is installed in, it could cause the number of stations that can run simultaneously to be reduced. This would be true if the facepak was installed in a decoder controller, and the switch is in the conventional position. Only 3 stations could be turned on, instead of 6.
* There is still a bug in the firmware, which will NEVER get fixed. This bug shows up when a customer runs a program from the keypad in Semi-Auto mode, and lets the program finish until timed out. What happens is the firmware still thinks the program is running, and will not start the next scheduled program at its programmed start time. The way to diagnose this problem is to have the customer (or you) look at the facepak display, and if it shows only hours and minutes, instead of hours/minutes/seconds, then the firmware is locked up. To fix it, either press the Off key to the right of the display, and see if the seconds show back up, or cycle the power to the controller if they don’t.

**TriSend Interface**

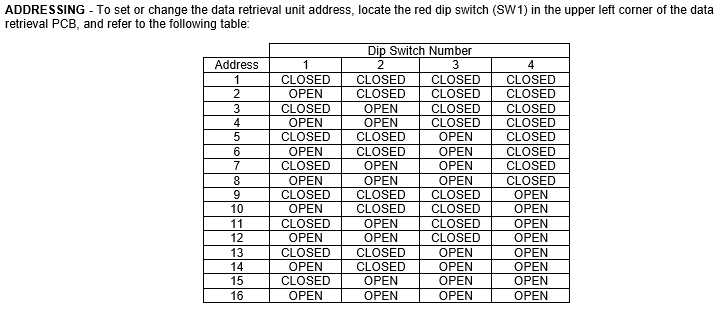
* Introduced in 2001.
* Replaces ALL older central versions, going back to Buckner models also.
* Last firmware version in production was 1.2. The original version, 1.0, required the user to set dip switches on the main CPU board for either Genesis or VSX operation, also if radio or hardwire communications. Version 1.2 did not require this, as it automatically detected what software was being used, and the dip switches were used for setting an address for MR functions.
* The interface was shipped as a hardwire comm unit as default, and if radio was required, it was either ordered from the factory with it installed, or could be added later as a kit.
* The TriSend could also be used with an analog telephone line for remote applications also. After dialing in, it would then use radio or HW for communications. Radio brands that can be used for the system are the Maxon SD-125, the SD-225 (replaced the 125) and the ME D250. They can be mixed on a golf system between controllers and interface.
* The main CPU board has 2 micro switches on it, one is located towards the LED’s on the top side of the board, and the other is lower and more central. They are labeled. The one by the LED’s is for testing radio operation, and will key the radio to produce a test tone on the TRNR. The lower one is a reset button, which will erase the onboard memory of the interface. This is used when a version 1.0 board was being used for Genesis, and then the customer upgraded to VSX and Surveyor.
* To reset the onboard memory, turn the power switch on the transformer off, press and hold the reset button, turn the power back on, and KEEP HOLDING the reset switch for up to 10 seconds. There are no indicators that the memory has been wiped. The first time a communication is performed from the software, the database is re-built in the memory.
* Connection to the PC was still using an RS232 cable and serial port. With later PC’s, only specific USB to serial adaptors could be used, which include the one the FSM team uses from DigiKey.
* Genesis can only be installed on PC’s with Windows XP or earlier (95, 98, 2000). Version 3.1.26 was the last version of software produced.

**Data Retrieval Units**

* Used the same cabinetry as the interface, so there are either plastic boxes or the TriSend metal box versions, but the boards are the same in either.
* Can use either HW or radio communications.
* Have separate communication protocols than controllers, using the same wire or radio. What this means is you could have a situation where the DR unit is communicating, but the controllers are not.
* Typically, was installed at the pump station, especially if flow was to be used.
* Can accept a variety of sensors – flow (x3, or x2 if a rain bucket was to be used, GENDATFL), rain bucket (Davis Instruments, GENDATRC), anemometers (x2, which were Davis Instruments digital (GENDATAN), or Young analog), or a plain switch closure device (like a float switch for water level control or Clik sensor).
* The anemometer connections allowed for wind speed and direction, which would be configured on a separate port.
* The CPU board has a pigtail with several wires in it, and these would get connected to the sensors as a ‘+’ and ‘-‘ or ‘Common’ wire. Any of the Common wires could be used for the ‘-‘ side, but there were specific instructions for which ones to use included in the kit.



* It is possible to have up to 16 Data Retrieval units installed on a system, and each one requires dip swtch settings to configure the address.



* Data Retrieval units are NOT weather stations. They only react to a sensor condition and perform a system shutdown or pause, depending on the configuration. They do not calculate ET. It is possible to configure partial shutdowns in the software so that golf courses that have more than 18 holes, or cover a large acreage, can shut down only part of the course. An example would be where the wind speed and direction would cause sprinklers to throw into a housing development in a certain area of the course, so the controller in that area could be told to suspend irrigation if the condition exists.
* In Genesis, the Data Retrieval unit would become the master clock once configured, without a choice. Normally, a controller would be used for a master clock. So if a data retrieval is removed from a Genesis system, a master clock must be selected again in a controller. This is important as DR units would accidentally be created, and then the master clock would disappear and cause faults in the software.
* A Master clock was used to compare the PC information with the filed controllers, including time and schedule information. If they were not in sync, then the software would ask which one should be used, the field or the central.

**Surveyor/VSX System**

**VSX Controllers**

* Introduced in 2001.
* Designed to be used with several software platforms.
* Enhanced the number of programs from 20 in Genesis, to 64. Each program contains up to 30 lines of Events (this is where ‘Events’ came into existence).
* Introduced the use of ‘Blocks’, which are groups of stations (up to 8), that can be operated simultaneously.
* Events in a program would run sequentially, from 1 to 30, but each event could be either a station or a block, and could be used in any order.
* Increased the number of cycles a program could be repeated from 9 to 15.
* Continued the use of infinite cycles (‘0’ option) from Genesis, where an end time must be used to stop irrigation. Used mostly during the grow in of a newly grassed golf course to keep the seed or stolon’s damp. A program could be set to start in the morning, and end at sunset so that a nightly irrigation could take place also.
* The facepak has 2 memory allocations, versus only 1 in Genesis. This allows for FCP (Field Controller Programs) and hydraulically balanced programs from the central (System) to be stored side by side and not interfere with each other.
* A new feature, ‘Presets’ was introduced in the VSX which would allow the user to create a program without a start time, and use it for maintenance purposes. This program could only be started from the keypad or MR. Mainly used for fertilizations, over seeds, blow outs, or any other situation where the user needs to run the same schedule for different reasons throughout the season.
* Presets and Programs would share the total memory count of 64 programs, and are indicated as to how many are used when the command is selected. For example, if the Program key is pressed, the first display will show the number of programs created, and how many are available. If the Preset button is pressed, it will display similar information.
* The last version of firmware for the VSX was 1.04\*. The first was 0.94. The firmware chip inside the plastic housing is not soldered onto the PCB, so it can be changed in the field.
* All of the other hardware components of a VSX controller are the same as a Genesis controller. This allowed for easy upgrades in the field, as the customer only needed to purchase facepaks and software to upgrade. Even a GF controller could be upgraded to VSX and Surveyor software.
* The VSX also allowed the entry of program names through the keypad, using the alpha-numeric buttons similar to an old cell phone would have for texts. Program names were limited to 12 characters, including spaces, and could not begin with a space. This was a common mistake that would not allow programs to be sent from the central to the controller. Names could be entered at the central also, and transmitted to the facepak, or they could be retrieved.
* Security was also added to the feature list, and a user could set a PIN number to prevent changes being made. The back door to get out of this is to enter the following sequence of keys within 2 seconds of each other:
  + Clear (button on keypad)
  + 6, 6, 7, 4, 6, 0 (spells ‘No pin’ on keypad), or 6,6,7,4,6,7 (spells ‘No pins’ on keypad). This was firmware specific, so try both in the event you need to.
  + Enter
* Another feature added was the use of FCP Auto Inhibit. This command, if activated, would not allow ANY FCP programs to operate automatically. This was to ensure that manual programs would not run at the same time as hydraulic programs created by the central. When an event based program was sent by the central, this mode would be set automatically. If the user sent out FCP programs from the central, this mode would be de-activated.
* Days to water in a schedule could now be set to day of the week, or to use a daily schedule like Genesis. If Day of Week was selected, the user would toggle the day to upper or lower case letters to designate water or no water.
* Next and Back buttons were also added to help navigate the display or menu options.

**TriSend for VSX/Surveyor**

* Same as for Genesis. When an upgrade was sold, the user would need to clear the TriSend memory of Genesis controllers, and allow Surveyor to re-populate the data with VSX.
* Maintenance radio commands for hardwire systems would follow the VSX rules of operation.

**AGCHUB for AGC controller operation**

* When the ACC controller was introduced, Surveyor software was modified to include the use of an AGC controller (identical to an ACC, except for the sticker on the facepak).
* In order to communicate to the AGC clocks, a new set of communication protocols was made, and therefore required a new interface to be made. It is almost identical to the TriSend unit, except for the firmware in the CPU chip.
* It was also made to be a USB connection instead of serial port, to accommodate the faster baud rate of 4800.
* If a radio system was required, the radio used was the same as that for an ACC, either the Maxon SD-174 or the ME D350.
* All other features of the AGCHUB are the same as that for TriSend.
* The PC required FTDI drivers to be able to connect the Hub.
* If the AGCHUB was damaged, and an IMMS-CCC was available, this could be used as the interface for hardwire systems until the Hub was repaired.
* There were issues with the drivers maintaining connection to the PC , similar to the issues discovered in the IMMS CCC USB version, and if this is found to be an issue, the main CPU board of the interface must be replaced with the newer version of electronics.

**Data Retrieval for Surveyor**

* The Data retrieval unit can only work in systems that contain VSX controllers. Systems that were AGC could not use the DR unit.
* All the features are the same for Surveyor as they were for Genesis.

**Pilot System**

**Pilot FC**

* Introduced in 2010.
* Created by a collaboration of FSM, Engineering, and Product Manager input.
* Designed from the ground up to be service friendly, having more emphasis in design looking at diagnostics than function. Uses only a #2 Philips screwdriver for servicing which is included in the pedestal.
* Largest conventional station capacity on the market at 80. 40 stations each on 2 sides of the controller.
* Kept with the 10 station increments like Genesis/VSX, but made the horizontally accessible rather than vertically like before. This allows the user to move station wires without having to possibly make a splice or pigtail on the station wire.
* Uses the same transformer as the ACC, at 4A. This allows 18 stations to be turned on simultaneously (there is actually a 1 second delay between stations to allow for inrush current to dissipate, and prevents water hammer. The same delay occurs on station shutdown also.)
* Because 64 programs in the VSX were hardly ever used to capacity, the Pilot only has 32 ‘Schedules’, and each schedule has 64 lines (events) of programming information.
* Block programming was kept, and increased to 10 stations per block over the VSX, which has 8.
* Schedules operate the same way as the VSX did, where the event lines will commence sequentially, but each line or event can be a block or station, and now delays were added.
* Communications were enhanced to include the ability to mix and match types of communication within a system. The inclusion of Spread Spectrum radio also occurred. Hardwire systems now have the ability to split the GCBL at a controller location, and go in different directions. Hardwire systems can now have an option to ‘jump’ via radio to cross over difficult terrain or obstacles, like roads or canyons, and then switch back to hardwire.
* Communication checks can be performed from controller to controller, or controller to FI. This is essentially a Ping test like the ACC. The results are enhanced to show the strength of communications, and an RSSI indicator is available when using radio systems. A value below 30% will give intermittent comm.
* All firmware in each module installed can be updated using an SD card and easily emailed files.
* Facepak programming information can also be retrieved into a laptop via USB A-B cable and having the Pilot software installed on it. The USB port is next to the SD card slot, with a black dust cover over it.
* The doors for the front and back of the controller are double vented so that the internal temperature of the pedestal has a 30-40-degree F lower value.
* The lower mounting holes are designed to fit over Toro, Rainbird, Signature (or John Deere), and Genesis/VSX bolt patterns.
* The junction box where the main power is connected, has a unique feature that allows the use of a 1 ½ ” conduit male adaptor to be screwed into a conduit nut without the need for special tools. 110V or 220V operation is selectable by a switch on the junction box. Also, a 2A fast blow fuse is located here.
* Dust covers are provided in the accessory box that is inside the holder of the front door. These are for comm port bays that are not being used to keep out dust and some moisture.
* Output modules are made with blue plastic, and comm modules are made with green plastic for easy identification. They cannot be installed in the wrong location either.
* There are a few cable harness assemblies to connect the facepak to the midplane, and again for the midplane to the back plane, and some smaller ones for common terminal connections. These are all 16 AWG stranded wires, which can be easily repaired if chewed by a rodent, unlike a ribbon cable as used in older models.
* All station modules come with toggle switches as a default option for manual irrigation.
* Each station output is 0.96 A.
* There is no station level current monitoring in the modules. If the output value exceeds 0.96A, then it will not turn on.
* There are diagnostic LED’s on each station, which will flash or stay solid depending on operation or failure.
* If a station is turned on via a switch, the maximum runtime will be 30 minutes if left to run accidently. Also, the station will still run in its scheduled program in the On position (basically goes into a ‘virtual’ auto position.)
* Incoming power wires use the International color coding scheme of brown (hot, or black wire in the US), blue (neutral or white wire), and green/yellow striped for earth ground (bare copper or green).

**Pilot DH**

* Introduced at the same time as the FC.
* Has a maximum station size of 999. This is achieved by 4 decoder modules, 250 each, except for the last which is 249.
* Programming is identical to the FC, and all irrigation related features are the same.
* Each module has its own power supply, and can operate up to 30 stations per module. The output for the power supplies is 40V, either at 50/60 Hz or 1.2 Hz for decoder operation. This is selectable through the facepak, using the Test mode. The 50/60 Hz operation is for using a clamp on amp tester to find wire issues.
* When an SD card is used to update the decoder module, the latest decoder firmware is also installed into the module. This can then be sent from the Hub to the decoders simultaneously, versus using the ICD HP and going one by one to each decoder. It takes about 45 minutes for a fully populated hub.
* The facepak for the hub also has programming ports to address decoders if an ICD HP is not available.
* Functions of the ICD HP can be performed from the facepak, such as Decoder Status and Decoder Info. The milliamp draw for each module can be viewed at the facepak also.
* Pilot decoders draw 1 mA for each decoder, regardless of model. Except for the Surge Decoders, which draw nothing.
* The red and blue connections on the decoder module are protected from incoming surge by a separate 20A automotive fuse on each color.
* 110V or 220V operation is automatically selected by the power supplies so there is no switch to set like the FC.
* The DH uses a 5A fast blow glass fuse for incoming power supply protection.
* Incoming power wires use the International color coding scheme of brown (hot, or black wire in the US), blue (neutral or white wire), and green/yellow striped for earth ground (bare copper or green).

**Pilot FI Interface**

* Introduced in 2010, along with the FC and DH.
* In learning from the older interfaces, this was designed with an LCD display to provide the ability to diagnose communication issues easier.
* Connects to the PC via USB cable, and uses FTDI drivers as with other interfaces. When connected to a PC, a visual indication is displayed in the LCD as a check mark. When no connection to the PC is made or is lost, then the display changes to an ‘!’.
* If a connection to the internet is not available on site, the FTDI drivers will not load when plugged into the PC. In this scenario, there are 2 options – a0 load the FTDI drivers with the USB cable unplugged, and then re-connect the cable (windows should show Device is detected), or b0 connect an ICD HP via the USB cable for it, and then the drivers will load from it. Then the FI can be connected to the PC, and the check mark should appear.
* There are only 2 comm module slots in the FI, the left being for hardwire or LF modules, and the right being for UHF radio.
* The SD card slot for updating firmware is located in the UHF radio module bay, and the radio must be removed to install the card. Once installed, the radio module must be replaced before the update begins to include it in the firmware list.
* The incoming power is provided via a PC power cord, and is auto sensing for voltage. An International adaptor is included with each FI to accommodate other countries.
* Comm checks can be initiated from the FI to controllers, and field tests can be monitored from the FI if there are controller to controller tests being performed.
* There is the possibility that Ethernet will be included in the unit for the future, which will allow remote placement of the FI on a site and the use of LAN to connect to it.

**TRNR Maintenance radios**

* The Kenwood TK 370 model radio was the first version used when the switch to synthesized radios was made.
* Has the ability to store 121 channels.
* Requires software and cable to program, and the cable was a serial type connection.
* Had a feature called ‘Store and Send’, where the user could type in the command he wanted to use, and look at it in the LCD display before pressing the talk key to send it.
* After a few years of this radio, Kenwood stopped producing it and replaced it with the TK 3170.
* Initial radios of the 3170 also had the store and send feature, but Kenwood found that something in their firmware would cause the battery to discharge prematurely, so they changed firmware and this feature was lost.
* It is possible to re-flash the radio back to older firmware for Store and Send, but if this is required, the customer MUST be warned that their battery life will be shortened. Refer to the Work Instructions document contained on the Training flash drive for further information. The hex file must be present when this procedure is started.
* The 3170 is a shorter, stouter radio than the 370. The battery life varies, due to the fact that Hunter production buys batteries separately than the radios, and it has been discovered that some batteries do not have a long life. If a customer has battery issues, make arrangements to get them new ones. There is not a separate part number for the battery, so the Product Manager must be involved to get them for you.