



Toro OSMAC® RDR Field Satellite Normally Open Hydraulic Actuation Models Installation Instructions

Introduction

The OSMAC RDR satellite controller is designed for installation on a substantial concrete foundation with imbedded conduit of various diameters to enable power wires, earth ground wire and hydraulic tubing to be routed into the cabinet for connection. A mounting bolt positioner and basic mounting hardware components are included with each controller. Additional materials required to complete the installation must be obtained separately. A material list can be compiled by reading through the instructions completely prior to starting the installation.

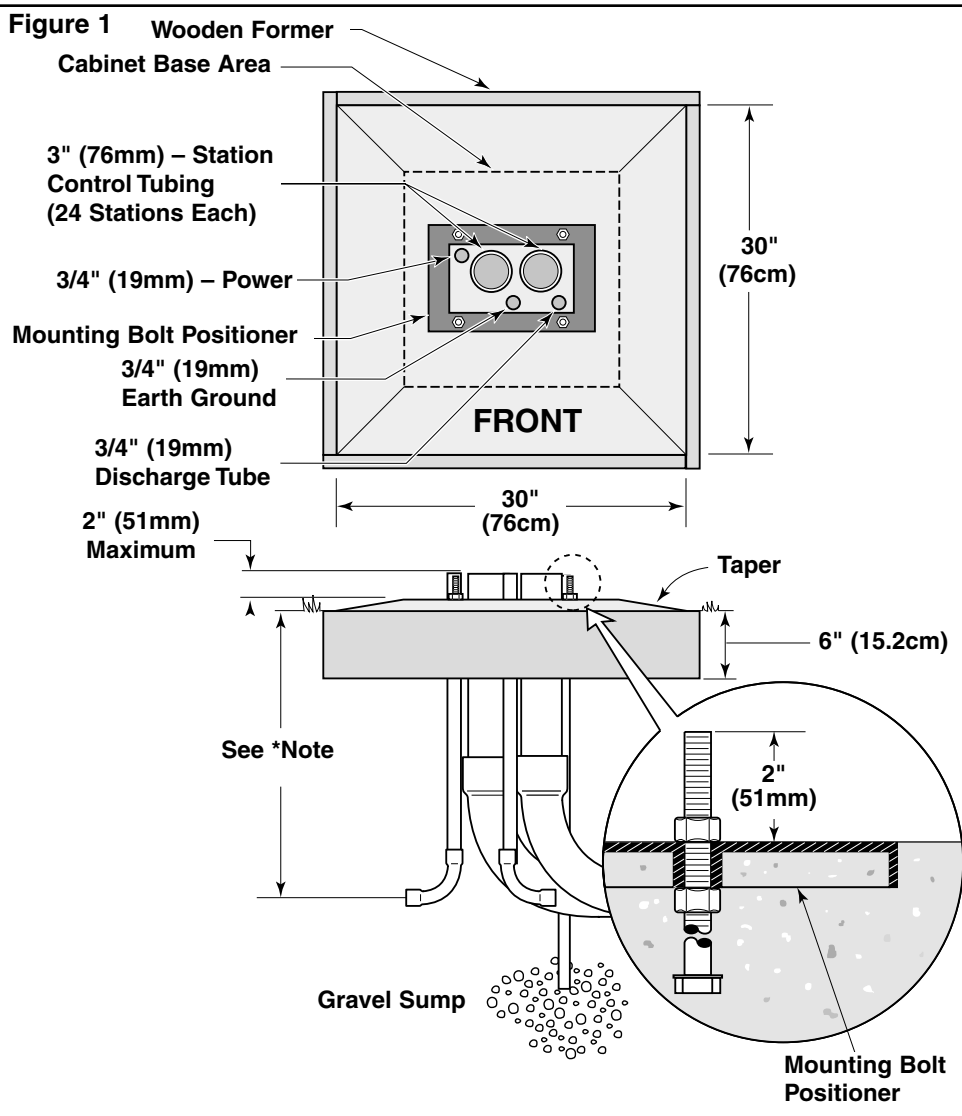
▲ CAUTION: For your protection and the safety of the product end user, comply with all Caution and Warning statements within this document. All installation practices must comply with all applicable national and/or local electrical and construction codes.

Foundation Construction

1. Prepare a hole for the foundation and wiring conduit using the minimum recommended dimensions shown in **Figure 1**.

***Note:** Refer to local electrical codes for required depth of buried wiring.

2. Trench to the foundation site as required for each wiring run.
3. Position straight and sweep elbow conduit sections in foundation hole as shown. Refer to **Figure 1** for recommended conduit size and position. Tape the conduit ends to seal out dirt. Backfill soil to form a 6" (15.2cm) foundation depth. Conduit should not extend more than 2" (51mm) above the finished top surface of the foundation.
4. Prepare the sides of the foundation hole with wood forms.
5. Prepare the mounting bolt positioner with the 5/16 x 4-1/2" bolts and nuts (provided) as shown in **Figure 1**. The threads should extend 2" (51mm) from the top surface of the bolt positioner.
6. Pour concrete into the formed foundation hole. Press the mounting bolt positioner into the concrete until it is **flush and level with the foundation surface** and aligned with the conduit.



7. Finish the concrete with a level flat area of 16" x 16" (41cm x 41cm) for the pedestal base. To prevent pooling at the base of the pedestal, add a slight taper away from the cabinet base contact area. Allow concrete to sufficiently harden before continuing.
8. Remove the hex nuts from the mounting studs. Remove the cabinet cover and doors. Carefully position the controller onto the studs. Install a flat washer and a hex nut on each stud and tighten securely.

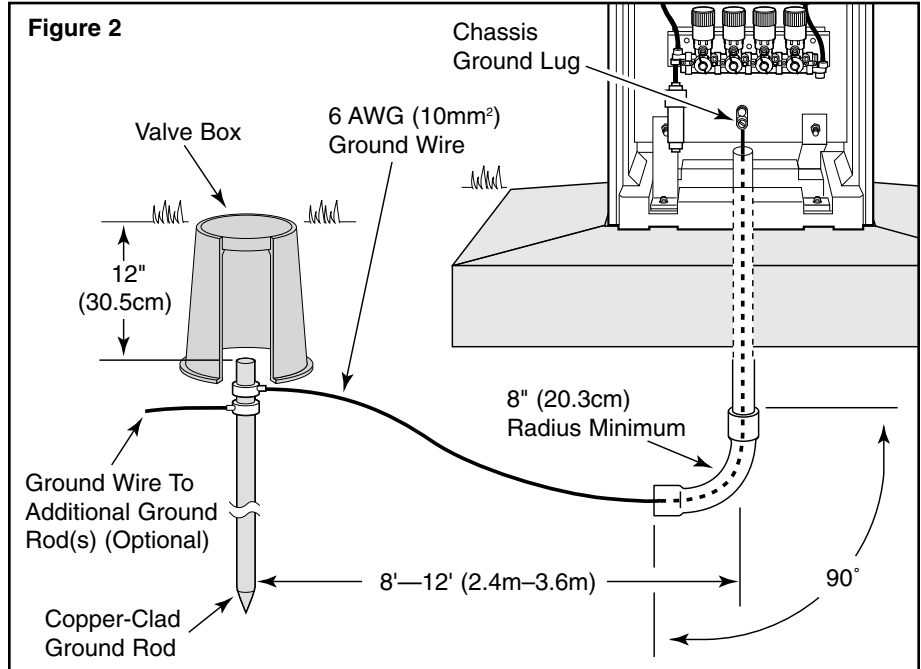
Earth Ground Installation

⚠ Important: The satellite surge protection components cannot properly function unless an efficient pathway to earth ground is provided. The ground path must be as direct as possible, without sharp bends and should have 10 ohms or less resistance (when measured with an earth ground resistance test device). For optimum ground protection, all electrical components throughout the irrigation system should be grounded in a manner which provides the same ground potential.

The following instructions depict one of several recommended grounding methods. Due to variables in soil composition and terrain, the method shown may not be suitable for your installation site. Contact your local Toro distributor for alternate grounding methods and availability of the required earth ground resistance test instrument. Recommended ground testers are: AEMC Instruments, model 3710 clamp-on tester, or Biddle Megger, model 250260 (or equivalent).

Note: Only one earth ground wire connection is required per controller. **Procedure**

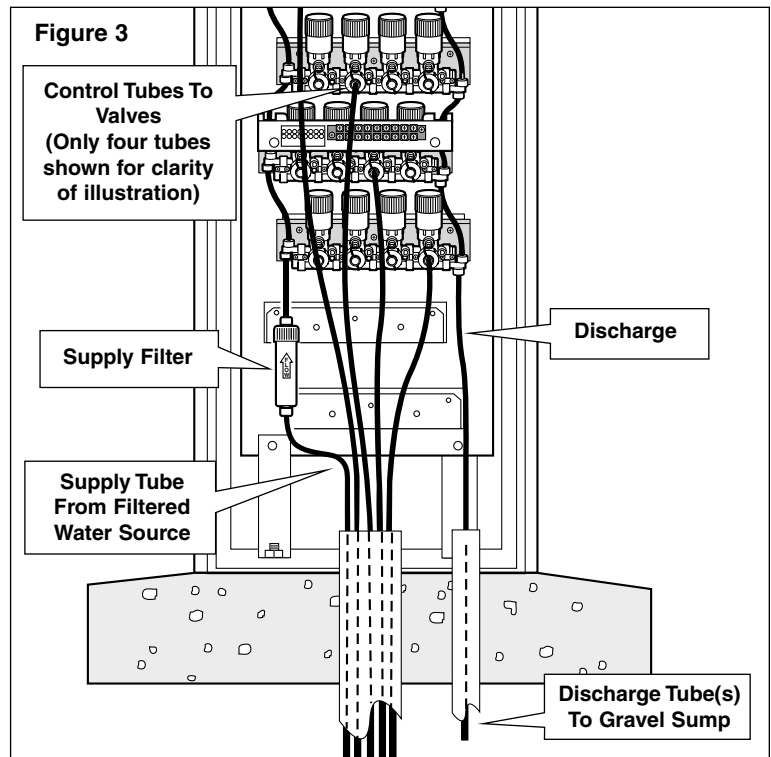
1. Drive a 5/8" (16mm) by 8' (2.5m) copper-clad steel rod into well-moistened soil not less than 8' (2.5m) or more than 12' (3.6m) from the satellite. The top of the ground rod should be 12" (30.5cm) below grade level.
2. Using a 5/8" (16mm) clamp or "Cad weld" fastener, attach a length of 6 AWG (10mm²) solid-core, bare copper wire near the top of the ground rod. Avoiding wire bends of less than 8" (20.3cm) radius, route the wire through the foundation into the controller cabinet. Secure the wire to the large copper ground lug. See **Figure 2**.
3. Ensure the soil surrounding the ground rod remains well moistened at all times. Measure the ground resistance per the instructions provided with the ground test instrument. A reading of 0 ohms is optimum, up to 10 ohms is good and 11–30 ohms is acceptable in most cases. If the resistance exceeds the acceptable limit, an additional ground rod can be installed at a distance equal to twice the buried depth of the first rod (i.e., 16' [4.9m]). Connect the ground rods using 6 AWG (10mm²) bare copper wire and test again. If the ground resistance remains high, contact your local Toro distributor for further assistance and recommendations.



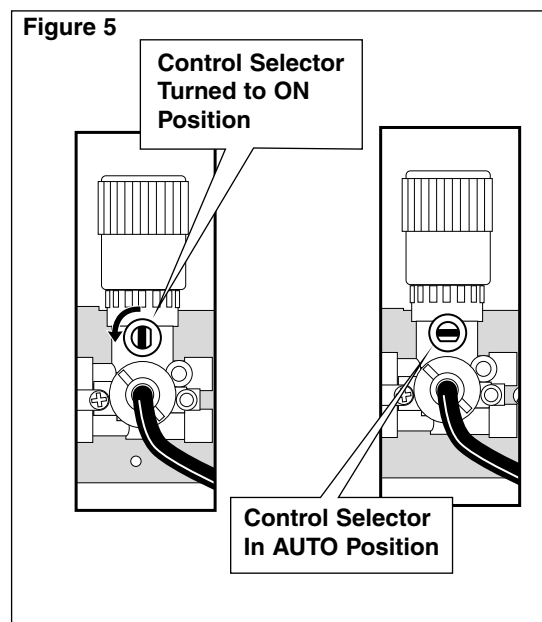
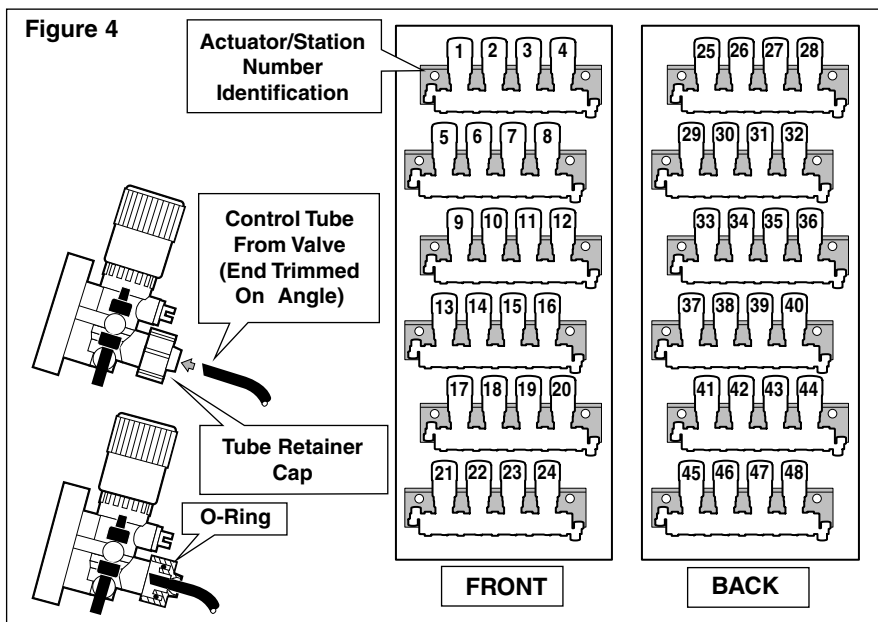
Installing Hydraulic Control Tubing

⚠ Important: To operate properly, the controller must be connected to a filtered (100 mesh or finer) water source which is equal to or greater in pressure than the irrigation water supplied to any valve it controls. If installing a controller with more than 16 stations, multiple supply and discharge lines must be provided.

1. For supply line, route 1/2" (13mm) schedule 40 PVC from pump or main water source to controller location.
2. Using Toro adapter fittings 995-14 and 900-24, connect a length of Toro 1/4" O.D. x 1/8" I.D. control tubing for each supply filter and route into controller through the 3" (75mm) conduit.
3. Remove tube retainer and cap from inlet of supply filter. Slide tube retainer onto supply tube. Push tube onto barbed fitting and secure with tube retainer. Repeat for each filter. See **Figure 3**.
4. Install a separate length of control tubing to barbed fitting of each discharge port and route into gravel drainage sump.
5. Route a separate length of poly tubing from each valve location through 3" (75mm) conduit into controller. Label each tube at both ends with valve location or intended station number.



6. At controller, install each control tube into actuator as follows: Carefully trim end of tube on a slight angle. Insert tube end into tube retainer cap approximately 3/8" (9.5mm). Pull lightly on tube after insertion to ensure proper retention. See **Figure 4**.
Note: Actuator(s) without a control tube connection must have a plug cap installed to prevent supply water from discharging. An O-ring installed in the tube retainer cap (shown in **Figure 4**) must be removed and installed in the plug cap prior to installation. Several plug caps are supplied with the controller. If additional plug caps are required, order part number 89-8205.
7. Pressurize supply line. Flush, pre-fill and connect valve control tubes as follows:
 - Turn all control selectors counterclockwise 1/4 turn to **ON** position. At selected actuator, turn control clockwise 1/4 turn to **AUTO** position; water will begin flowing through control tube. See **Figure 5**.
 - At valve location, allow water to flow from control tube until all air and debris has been purged. Slide tube retainer onto control tube, push tube onto barbed valve fitting and secure with retainer.
 - Turn selected actuator to **ON** position for to stop flow of water from actuator.
 - Repeat procedure for all valves.
 - When all valves have been connected, turn all actuator controls to **AUTO** position.



Control Tube Removal

The control tube cannot be pulled out once it has been inserted. If control tube removal is required, use the following procedure as illustrated in **Figure 6**:

1. Unscrew tube retainer cap (counterclockwise) and remove from actuator assembly.
2. Cut tube on a slight angle leaving a tube remnant approximately 1" (25mm) long remaining in cap.
3. Push tube remnant through cap or grasp remnant with pliers from inside of cap and pull through to remove.
4. Reinstall tube retainer cap and hand-tighten. Reinstall control tube.

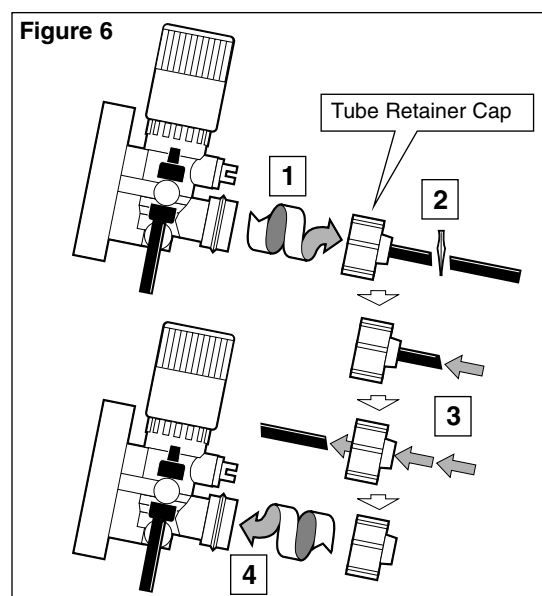
Winterization – Prolonged Shutdown

To prepare the hydraulic system for prolonged shutdown during winter months (if watering is not required), use the following procedure:

1. Turn off system supply water.
2. Remove supply filter cap to relieve inlet water pressure, then reinstall.
3. Turn all control selectors to the **ON** position.

⚠ Important: Prior to restarting system, ensure all actuator control selectors are in the **AUTO** position.

Connecting Power and Equipment Ground Wires



WARNING:



AC Power wiring must be installed and connected by qualified personnel only.
All electrical components and installation procedures must comply with all applicable local and national codes. Some codes may require a means of disconnection from AC power source, installed in the fixed wiring, having a contact separation of at least 0.120" (3mm) in the line and neutral poles. Ensure the AC power source is OFF prior to connecting to the controller.

⚠ CAUTION: When installing multiple controllers, polarity of the Line and Neutral connections must be properly maintained throughout the irrigation system. Reversed polarity may cause damaging potentials to exist at one or more controller locations.

1. Place the controller's main power switch in the OFF position. See **Figure 3**.
2. Position the input voltage select switch to the 115V or 230V position as required.
3. Remove the power supply cover located in back of the RDR unit.
4. Connect the provided 3/4" (19mm) electrical conduit in the satellite to the 3/4" (19mm) electrical conduit installed in the foundation.
5. Route three insulated solid copper wires from the power source, through the conduit, and into the controller power supply.

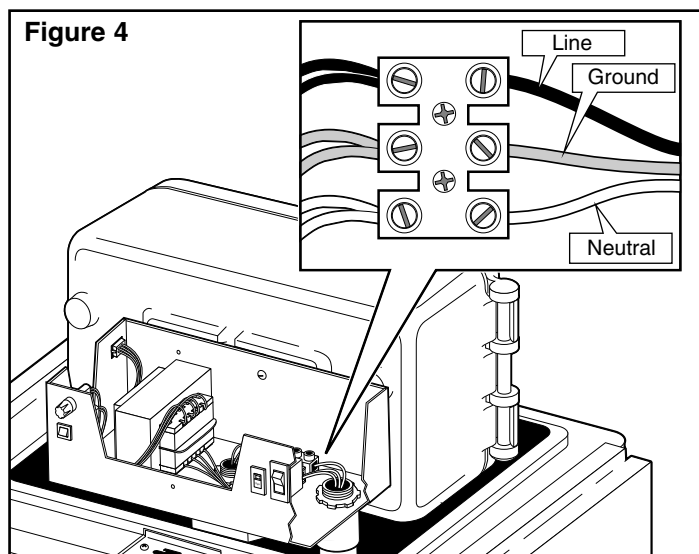
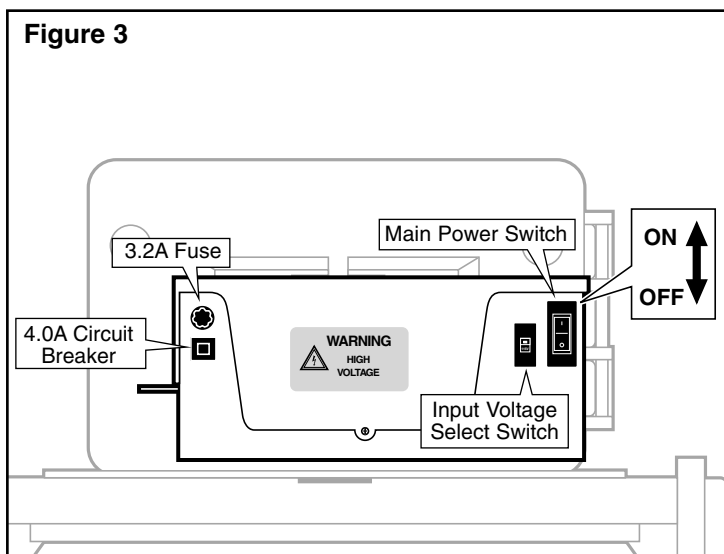


Table 1 – Power Wire Connection

AC Service Type	Line	Equipment Ground	Neutral
115 V a.c. (Domestic)	Hot (Black)	Green	Neutral (White)
230 V a.c. (3-Phase)	Hot (Black)	Green/Yellow	Hot (Blue or Red)

6. Reference **Table 1** for the appropriate power connection. Secure the wires to the terminal block as indicated in **Figure 4**.
7. Reinstall the power supply cover.
8. Apply power to the controller.

Selecting the Narrow-band Decoder Radio Frequency

Note: Wide-band radio models only – Install the wide band frequency module into the RDR unit at this time. Refer to Installation Instruction (form number 371-0002) provided with the frequency module for proper installation procedure.

The narrow-band satellite frequency decoder module provides four preprogrammed frequencies, one of which is selected for use by the placement of a movable jumper located on the module board as shown in **Figure 8**.

The pre-programmed frequencies are as follows:

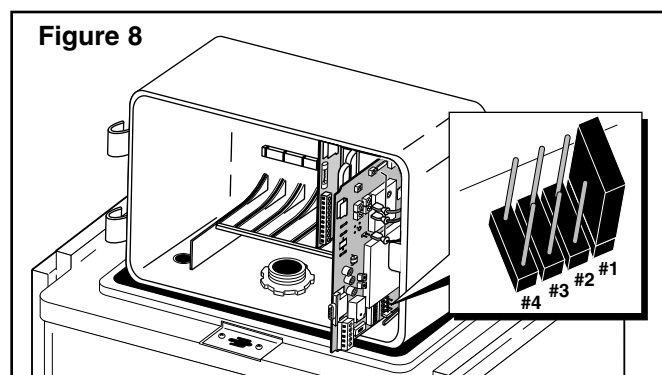
Channel 1=462.2125 Mhz

Channel 2=462.4375 Mhz

Channel 3=467.2125 Mhz

Channel 4=467.4375 Mhz

Note: The decoder module utilizes a programmable frequency synthesizer which enables each of the preprogrammed frequencies to be changed as needed for the irrigation site conditions. Contact your local Toro distributor for additional information regarding frequency reprogramming.



⚠ Important: The base station transmitter, hand-held radio and frequency decoder module must be set to the same frequency to enable communication.

Assigning the Satellite Address Number

Each satellite requires a 3-digit address number to enable communication with the central controller and/or a hand-held radio. The address numbers range from 1 (001) through 255 and are selected using an array of eight DIP switches located on the frequency decoder module assembly. See **Figure 9**. In the down position, the switch is Off (open) and represents a value of 0 (zero). In the up position, the switch is On (closed) and represents one of the following binary numbers: 1, 2, 4, 8, 16, 32, 64 and 128.

The **wide-band** DIP switch array is configured as follows:

Sw 1 = 128 Sw 2 = 64 Sw 3 = 32 Sw 4 = 16
Sw 5 = 8 Sw 6 = 4 Sw 7 = 2 Sw 8 = 1

The **narrow-band** DIP switch array is configured as follows:

Sw 1 = 1 Sw 2 = 2 Sw 3 = 4 Sw 4 = 8
Sw 5 = 16 Sw 6 = 32 Sw 7 = 64 Sw 8 = 128

To set the satellite address number, place the switch or combination of switches to the On position which provides the numerical equivalent of the desired address number.

Example for wide-band radio: To set satellite address number 50 (050), start with all eight DIP switches in the Off (open) position, then close switch numbers 3, 4 and 7; i.e., $32 \text{ (Sw 3)} + 16 \text{ (Sw 4)} + 2 \text{ (Sw 7)} = 50$. See switch address code matrix in **Table 2**.

Example for narrow-band radio: To set satellite address number 50 (050), start with all eight DIP switches in the Off (open) position, then close switch numbers 2, 5 and 6; i.e., $2 \text{ (Sw 2)} + 16 \text{ (Sw 5)} + 32 \text{ (Sw 6)} = 50$. See switch address code matrix in **Table 2**.

Note: The narrow band satellite utilizes a built-in antenna located on the frequency module assembly. If site conditions are such that an alternate antenna is required, the optional antenna adapter kit (P/N 102-1204) is required.

Terminal Board Fuse Replacement

⚠ CAUTION: For continued protection against risk of fire, replace the fuse with the same type and rating only.

Each RDR eight-output terminal board is equipped with a 4.0A slow-blow fuse to protect the unit from damage due to excessive current draw. Before replacing the fuse, check for the probable cause, such as a malfunctioning solenoid or loose wire connection and take corrective action. Replace the fuse as follows:

1. Disconnect the primary power source to the satellite.
2. Partially slide the terminal board out to access the fuse.
3. Carefully remove the blown fuse from its retaining clip.
4. Install a 4.0A slow-blow fuse into the retaining clip.
5. Reinstall power and test for proper operation.

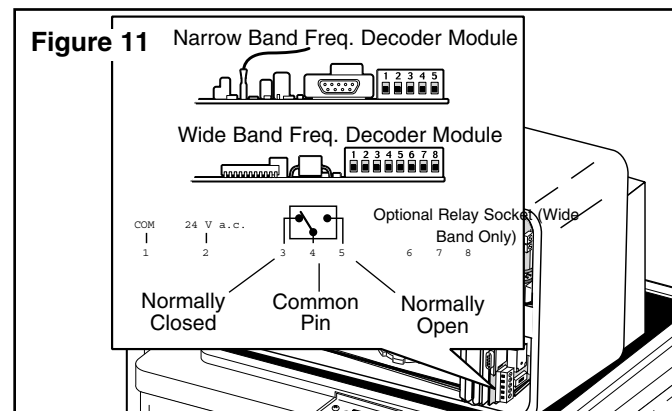
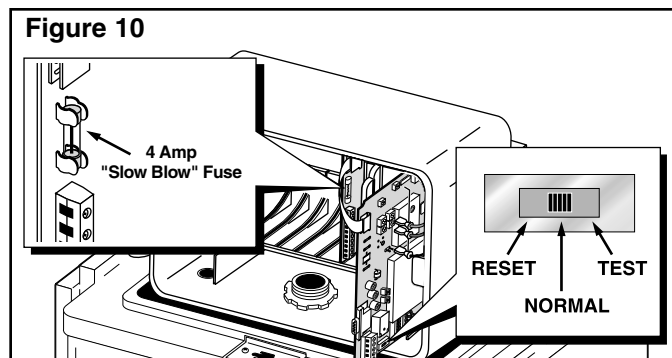
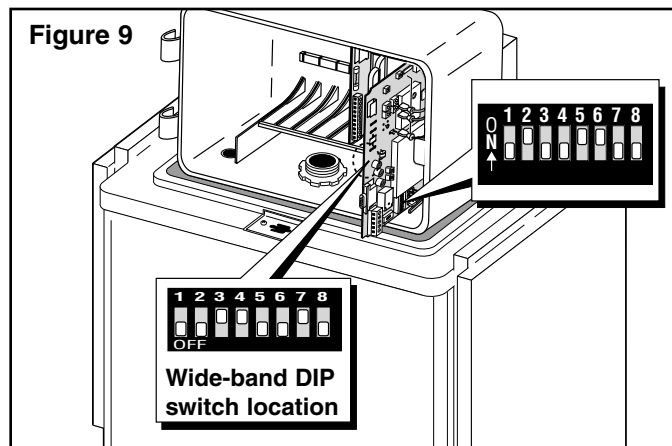
Performing a Control Circuit Self Test(Narrow-band only)

A self-test feature is provided to check the functionality of various key satellite control circuits. The test is initiated by positioning the **TEST/RESET** switch, located on the frequency decoder module, to the **TEST** position as shown in **Figure 10**. Testing will begin immediately. The test will repeat continuously until the **TEST/RESET** switch is positioned to the center (normal operation) position.

Note: The **RESET** position resets the frequency decoder microprocessor to factory defaults. To take affect, the satellite must be powered up with the switch in the **RESET** position. The switch should be placed in the **NORMAL** position after 15 seconds of operation.

Remote Relay Function And Connection

The frequency decoder module is equipped with a 5A relay which is provided for use in irrigation sites that have two different irrigation systems. Command codes are provided which enable the relay to energized, deenergized and disabled to prevent inadvertant operation. See **Table 2** for specific command codes. See **Figure 11** for terminal locations.



Satellite Operations Using a Hand-Held Radio

Satellite operations can be initiated in the field using a hand-held radio keypad. All operation commands must begin with the following keypad sequence: *9 followed by the 3-digit satellite address number. The command code is then entered, followed by additional digits which represent selected stations and/or run time values. All station numbers from 1–9 must be entered with a preceding 0; i.e., station 1 is entered as 01. Refer to **Table 2** for command codes and operation descriptions

Example: Confirm communication to the satellite by issuing a manual station start command as follows: Press *9, the 3-digit satellite address code, command code 7521 and 01 (station 1). Visually check for sprinkler operation. To step forward through the stations, press *1; to step back through the stations, press *2. To terminate the test, use command code 7520.

Table 2 – Hand-held Radio Command Codes

Command Code	Operation Description
8008	Configures stations as switches. Stations can be specified individually and in combination with a range of stations; e.g., 8008 01 12 50 – 60 configures stations 1, 12 and 50 through 60 as switches. Note: Only a single dash is used when entering a range of stations.
8009	Configures stations for irrigation. Stations can be specified individually and in combination with a range of stations; e.g., 8009 01 20 45 – 48 configures stations 1, 20 and 45 through 48 for irrigation.
8011	Resets EPROM to factory defaults.
7510	Turns off individual stations; e.g., 7510 01 02 40 turns off stations 1, 2 and 40.
7511	Turns on individual stations; e.g., 7511 01 02 40 turns on stations 1, 2 and 40.
7512	Syringes individual stations for a predetermined number of 30-second intervals (already defined in the satellite); e.g., 7512 01 02 turns on stations 1 and 2 for 30-second intervals.
7513	Disables individual stations; e.g., 7513 01 03 disables stations 1 and 3. After this command, on and off commands will be ignored for stations 1 and 3 until the stations are re-enabled. (See 7514.)
7514	Enables individual stations; e.g., 7514 01 03 enable stations 1 and 3.
7515	Sequentially syringes a specified station number range; e.g., 7515 10 20 will syringe stations 10 through 20 sequentially.
7516	Sequentially syringes individual stations; e.g., 7516 10 11 will syringe stations 10 and 11. Note: Multiple syringe groups can also be run (base station command only - not applicable to hand-held radio). Enter two dashes between stations to designate separate syringe groups; e.g., 7516 10 11 - - 22 24 26 28 will run two syringes at the same time. First on stations 10 and 11, followed by stations 22, 24, 26 and 28.
7517	Turns on individuals stations for a specified number of hours, minutes and seconds; e.g., 7517 01 30 00 23 24 25 turns stations 23, 24 and 25 on for 1 hour, 30 minutes and no seconds.
7518	Turns on individual stations for a specified number of minutes; e.g., 7518 10 23 24 25 turns on stations 23, 24 and 25 for 10 minutes.
7520	Turns off a sequential station run operation (initiated by command code 7521).
7521	Turns on a sequential station run operation; e.g., 7521 01 turns on station 1. To step forward through the stations, press *1; to step back through the stations, press *2.
7524	Turns on individual stations as switches; i.e., does not simultaneously energize the pump. Note: Will not turn off the pump if already running. E.g., 7524 25 35 45 turns on stations 25, 35 and 45 without energizing the pump.
7525	Turns on individual stations as switches for a time given in minutes; i.e., does not simultaneously energize the pump in this command string, the run time is entered first, followed by the station numbers; e.g., 7525 25 05 42 turns on stations 5 and 45 for 25 minutes without energizing the pump.
7526	Turns on individual stations as switches for the time given in hours, minutes and seconds. In this command string, the run time is entered first, followed by the station numbers; e.g., 7526 02 30 45 25 26 27 turns on stations 25, 26 and 27 for 2 hours, 30 minutes and 45 seconds.
7540	Turns off all stations (this satellite only).
7543	Disables all stations in all satellites (rain shutdown). Note: Satellite address code 256 is used with 7543 or 7544 command codes. The stations will not respond to any further commands until enabled.

Table 2 – Hand-held Radio Command Codes (continued)

Command Code	Operation Description
7544	Enables operation of all stations in all satellites. See Note for command code 7543.
7546	Sequentially syringes all stations for a set length of time; e.g., 7546 turns on all stations for the predetermined number of 30 second intervals as defined in the syringe time.
7800	Disable the remote relay on the frequency decoder module.
7801	Enable the remote relay on the frequency decoder module.
7810	Turns off the remote relay on the decoder module. Resumes function to the satellite unit.
7811	Turns on the remote relay on the decoder module. Disables function to the satellite unit.
8000	Disables pump start.
8001	Enables pump start to be assigned to a station; e.g., 8001 48 assigns pump start to station 48.
8003 00	Disables operation and turns off all stations in the satellite with sequential shutdown.
8003 01	Enables operation of all stations in the satellite.
8004	Changes the password; e.g., 8004 7531 6108 will change the factory default password (7531) to 6108.
8006 01	Sets the syringe time in 30-second intervals; e.g., 8006 01 0100 (without a password) or 8006 pppp 01 0100 (with a password) sets the syringe time to 100 intervals (50 minutes). The number of intervals must be given as four digits with leading zeros but can be no greater than 0255.
8006 02	Sets the time-out limit in 30-minute intervals. This must be specified using four digits with leading zeros and no greater value than 0255; e.g., 8006 02 0060 (without a password) or 8006 pppp 02 0060 (with a password) sets the time-out limit to 30 hours.
8006 03	Enables/disables the password. Use 8007 03 01 to enable password protection or 8007 03 00 to cancel password protection.

Specifications

Line Voltage: 115/230 V a.c. 50/60 Hz (switchable),
130 VA (100W)

Current Draw (no load): 0.07A @ 115V, 60 Hz,
0.09A @ 230V, 50 Hz

Current Draw (maximum load): 0.76A @ 115V, 60 Hz,
0.41A @ 230V, 50 Hz

Secondary Voltage Output: 24 V a.c., 50/60 Hz,
3.0A (72 VA)

Maximum Load Per Station Output:
0.75A (18 VA)

Maximum Load Per Pump/Master Valve Output:
0.75A (18 VA)

Maximum Total Load: 3.0A (72 VA)

Hardware Features

Plastic: 44 1/2" x 16" x 15" (113.0 cm x 40.6 cm x 38.1 cm)
Top Locking Cover

Fuses and Circuit Breakers

Power Supply:

- 1.5A On/Off Switch/Circuit Breaker – Main Power Input
- 3.2A Fuse (Slow-Blow) – Field Output
- 4.0A Fuse (Slow Blow) – Station Output Module
- 4.0A Circuit Breaker – Control Functions

Electromagnetic Compatibility

Domestic: This equipment has been tested and found to comply with the limits for a FCC Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. The equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to the radio communications. Operation in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

International: This is a CISPR 22 Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

Table 3 – Satellite Address DIP Switch Matrix

☒=On ☐=Off WB=Wide Band NB=Narrow Band

WB	8	7	6	5	4	3	2	1
NB	1	2	3	4	5	6	7	8
001	•							
002		•						
003	•	•						
004			•					
005	•		•					
006		•	•					
007	•	•	•					
008				•				
009	•			•				
010		•						
011	•	•		•				
012			•	•				
013	•		•	•				
014		•	•	•				
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044			•	•		•		
045	•		•	•		•		
046		•	•	•		•		
047	•	•	•	•		•		
048					•	•		
049	•				•	•		
050		•			•	•		
051	•	•			•	•		

WB	8	7	6	5	4	3	2	1
NB	1	2	3	4	5	6	7	8
052			•		•	•		
053	•		•		•	•		
054		•	•		•	•		
055	•	•	•		•	•		
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WB	8	7	6	5	4	3	2	1
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126		•	•	•	•	•	•	
127	•	•	•	•	•	•	•	
128							•	
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147	•	•			•		•	
148			•		•		•	
149	•	•	•		•		•	
150		•	•		•		•	
151	•	•	•		•		•	
152				•	•		•	
153	•			•	•		•	

WB	8	7	6	5	4	3	2	1
NB	1	2	3	4	5	6	7	8
154		•		•	•			•
155	•	•		•	•			•
156			•	•	•			•
157	•		•	•	•			•
158		•	•	•	•			•
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160						•	•	
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162		•				•	•	
163		•				•	•	
164			•			•	•	
165	•		•			•	•	
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167	•	•	•			•	•	
168				•		•	•	
169	•			•		•	•	
170		•		•		•	•	
171	•	•		•		•	•	
172			•	•		•	•	
173	•		•	•		•	•	
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175	•	•	•	•		•	•	
176					•	•	•	
177	•				•	•	•	
178		•			•	•	•	
179	•	•			•	•	•	
180			•		•	•	•	
181	•		•		•	•	•	
182		•	•		•	•	•	
183	•	•	•		•	•	•	
184				•	•	•	•	
185	•			•	•	•	•	
186		•		•	•	•	•	
187	•	•		•	•	•	•	
188			•	•	•	•	•	
189	•		•	•	•	•	•	
190		•	•	•	•	•	•	
191	•	•	•	•	•	•	•	
192						•	•	
193	•					•	•	
194		•				•	•	
195						•	•	
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200				•		•	•	
201	•		•			•	•	
202		•	•			•	•	
203	•	•	•			•	•	
204			•			•	•	

WB	8	7	6	5	4	3	2	1
NB	1	2	3	4	5	6	7	8
205	•		•	•			•	•
206		•	•	•			•	•
207	•	•	•	•			•	•
208					•		•	•
209	•						•	•
210		•			•		•	•
211	•	•			•		•	•
212			•		•		•	•
213	•		•		•		•	•
214		•	•		•		•	•
215	•	•	•		•		•	•
216				•	•		•	•
217	•			•	•		•	•
218			•	•	•		•	•
219	•	•	•	•	•		•	•