RAIN BIRD®

Integrated Sensor System™ (ISS)

Installation, Programming & Operation Guide

ISDL-2400
Wireless Data Logger

RAIN BIRD®

Symbols

NOTE: Symbol alerts the user to important operating, functionality, installation or maintenance instructions.

WARNING: Symbol alerts the user to the presence of electricity or electromagnetic energy which may constitute a risk of electric shock, radiation exposure or other hazard.

CAUTION: Symbol alerts the user to important instructions or conditions that could seriously affect irrigation effectivity or device operation.

DIAL: Symbol alerts user of requirement to turn the dial on the device to an appropriate setting in order to follow subsequent instructions.

REPEAT: Symbol indicates that a repetition of previous steps or actions may be required in order to continue or complete the process of programming the device.

Regulatory Information

Note to Users in the United States:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If the equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Note to Users in Canada:

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

The internal wireless radio complies with RSS 210 and RSS GEN of Industry Canada.

Disposal of Electronic Waste

This symbol indicates that it is your responsibility to dispose of waste equipment (including batteries) by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your waste disposal service or the shop where you purchased the product.

For technical assistance contact Rain Bird at 1-800-247-3782
Visit us on the web at www.rainbird.com

Contents

Introduction & Overview

Welcome to Rain Bird®

Thank you for purchasing your new state-of-the-art Rain Bird Integrated Sensor System™ (ISS).

For over seven decades Rain Bird has led the irrigation industry in meeting water management needs by providing the highest quality products and services available.

Integrated Sensor System™ (ISS)

Description, Features and Benefits

Rain Bird's Integrated Sensor System (ISS) is a turf management and irrigation control system designed for large sites such as golf courses with diverse landscaped environs. The ISS has a variety of features to efficiently manage turf conditions and irrigation requirements, including:

- State-of-the-art hardware technology to monitor soil conditions at numerous locations on site, then collect and transmit the data to a Central Control computer workstation for analysis.

- Soil Manager™ software analyzes data to determine optimum watering requirements that match specific target conditions across the site.

- Battery powered system components allow ultimate flexibility for soil monitoring, data collection and transmission from any location on the site.

Sensors buried at numerous locations monitor soil conditions in real-time to provide absolute readings of soil moisture, temperature and salinity. The following information is measured at each soil sensor:

- Moisture (measured as percentage of Volumetric Water Content) indicates amount of water present in soil, and accounts for factors such as soil compaction and type.

- Temperature (measured in Celsius or Fahrenheit) measures the current soil temperature to determine a variety of conditions such as potential heat stress and optimum seed germination.

- Salinity (measured in deciSiemens per meter (dS/m)) reflects salt content levels present in the soil. High concentrations of salt can interfere with a plants ability to absorb water, and may eventually become toxic.

System Overview

4 The **Network Antenna** receives the soil data and relays it to the **Wireless Gateway** router.

3 **Wireless Repeaters** transmit the data to a **Network Antenna**.

2 **Wireless Data Loggers** record and transmit soil data over a **Wireless Mesh Network**.

5 The **Wireless Gateway** routes the soil data to a central workstation.

6 **Soil Manager** software at the central workstation receives and analyzes the soil data. Irrigation adjustments are made based on the real time soil data.

1 **Soil Sensors** provide real-time soil data (moisture, temperature and salinity levels) at various locations on the irrigation site.

Figure 1 - ISS System Overview

System Components

Soil Sensors

Soil Sensors provide real-time soil data (moisture, temperature and salinity levels) at various locations on the irrigation site.

The soil sensor is a small, durable, lightweight sensor that is buried in the soil at various locations, providing accurate readings of soil conditions. The sensors do not require calibration and provide accurate readings immediately after installation. Sensors connect to an ISDL-2400 Data Logger using a three-conductor AWG-18 gauge irrigation cable.

- The maximum cable length between sensor and Data Logger is 300 feet.

- The ISS manages a maximum of 198 soil sensors.

- Each ISDL-2400 supports up to 18 soil sensors.

! NOTE: Only Rain Bird approved sensors can be used with ISS.

Figure 2 - Rain Bird TSM-3 (Type 3) Soil Sensor

Coaxial Impedance Dielectric type of sensor.

ISDL-2400 Wireless Data Logger

Wireless Data Loggers record and transmit soil data over a Wireless Network.

The ISDL-2400 Wireless Data Logger collects data from soil sensors and transmits it over the wireless network to the Central Control Software workstation. The ISDL-2400 communicates with the software automatically at regular user-defined intervals, or can operate in a stand-alone mode to provide instant, real-time soil readings from the sensors. Each ISDL-2400 supports up to 18 soil sensors on two channels (nine sensors per channel).

Controls and Indicators

Key operational features of the ISDL-2400:

1 Programming Dial- Used for selecting programming functions.

2 LCD Display with backlight button- Displays system status information and programming commands.

3 Programming Buttons- Press buttons to enter and change program information.
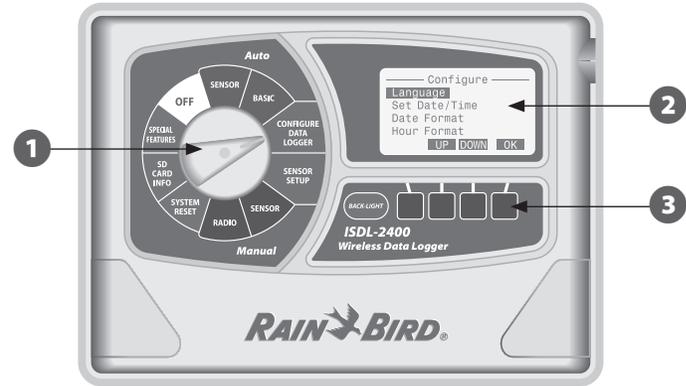
Figure 3 - ISDL-2400 Wireless Data Logger

ISR-2400 Wireless Repeater

Wireless Repeaters receive and transmit soil data over the network to a Network Antenna.

The ISR-2400 Wireless Repeater receives and transmits data between ISDL-2400 Data Loggers, other ISR-2400 Wireless Repeaters, and the network antenna. A series of ISR-2400 Repeaters are required to form the wireless network.

- The ISS supports a maximum of 40 Wireless Repeaters over the entire network.

- A maximum of 7 hops allowed from end-node to Wireless ISG-2400 Gateway router.

- Unobstructed line of sight range is at least 800 yards.

- One Wireless Repeater can receive sensor data from a maximum of 8 Data Loggers.

Controls and Indicators

Key operational features of the ISR-2400:

1 LCD Display with backlight button- Displays system status information and programming commands.

**2** Programming Buttons- Press buttons to enter and change program information.

Figure 4 - ISR-2400 Wireless Repeater

Wireless Network

A Network Antenna receives data over the Wireless Network and relays it through the ISG-2400 Gateway to a computer workstation for use by the Soil Manager Central Control Software.

ISS uses wireless mesh network technology to route data between system components. Mesh networking extends wireless range by transmitting data from node to node (ISR-2400 to ISR-2400) until the data reaches the ISG-2400 Gateway router. Reliability is increased by the ability of the network to "self-heal"; if the connection between any two nodes (ISR-2400) is lost, an alternate path is created to restore the network provided other wireless Repeaters are within range. The use of Direct Sequence Spread Spectrum (DSSS) radios reduces risks of wireless interference and ensures reliable communication.

ISG-2400 Gateway
Wireless Gateway Router

The Wireless ISG-2400 Gateway router provides the interface between the wireless mesh network and the Central Control Software. The Gateway communicates with the network of ISDL-2400 Data Loggers and ISR-2400 Repeaters through a roof-mounted radio antenna and routes data to and from the Soil Manager on the central workstation via a USB cable.

Figure 5 - ISG-2400 Gateway

Network Antenna

A radio antenna mounted on a rooftop (or a location that provides adequate reception) is utilized to provide wireless network communication to the ISG-2400. The antenna and the Wireless Gateway are physically connected using a coaxial cable.

Soil Manager™ Software

NOTE: Soil Manager software is not included with the ISS hardware and must be purchased separately.

Soil Manager is the software application installed at the central workstation (standard PC or laptop) that provides monitoring and control of the ISS. Soil Manager displays soil data from every individual sensor in the system and recommends water budgets based on soil conditions. The Soil Manager interfaces with irrigation software (Cirrus family) to adjust station run times based on soil conditions.

Programming the ISDL-2400 Data Logger

Programming Overview

During normal operation, the IDSL-2400 Wireless Data Logger communicates automatically over the wireless network with the Central Control Software. There may also be times when system settings or configuration changes have to be made locally at the Data Logger. The programming dial on the front panel provides access to a variety of programming functions, such as setting date and time, configuring sensors, or upgrading firmware.
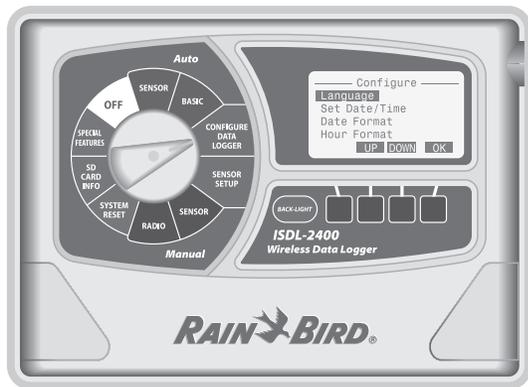
The ISDL-2400 operates normally with the dial in the Auto Sensor or Auto Basic position. Data consisting of soil measurements from the sensors and system status information (such as radio MAC address, battery voltage and wireless link quality) are sent to the Central Control Software (Soil Manager) at regular intervals.

When the dial is in any other switch position, radio communication with the network continues but current real-time sensor data is not sent to the Soil Manager. After completing any programming function, the dial should be set to Auto Sensor or Auto Basic to ensure proper system operation. The ISDL-2400 also consumes less power when set to an Auto position. Alerts are generated at the Soil Manager when the ISDL-2400 is not in an Auto position.

⚠ **NOTE:** If the ISDL-2400 is not powered on, open the front panel. Set the internal power switch to ON and close the front cover. The "Please wait while the SD card is scanned…" screen is briefly displayed. After 60 seconds the LCD goes into a "sleep" mode to conserve battery power- press any button to see the display. After 10 seconds the backlight feature disappears.

Auto Sensor

This position displays the latest sensor data while keeping the ISDL-2400 in the network.
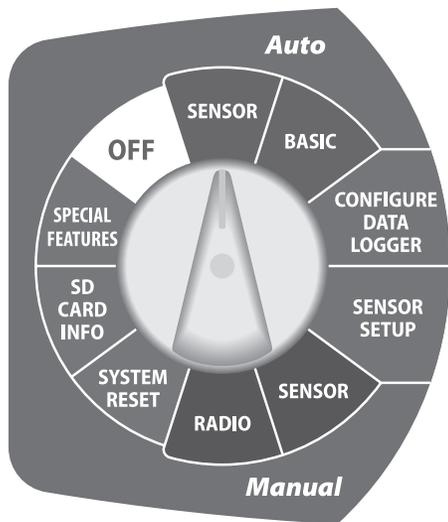
Sensor Addresses

The assigned address for each selected sensor (1-9 for Ch 1, a-i for Ch 2) is displayed.

Sensor Types

The supported sensor type is displayed.

! NOTE: A sensor error code will display if a sensor is not working properly. Troubleshooting procedures for sensor error codes can be found in the Appendix section, page 89.

Soil Data

Last measured moisture, temperature and salinity levels are displayed for each sensor.

Last Reading

The elapsed time since the last sensor reading is displayed.

Next Reading

The time remaining until the next sensor reading is displayed.

Turn the dial to Auto SENSOR

1 The Auto Sensor screen appears.

```
┌──── Auto Sensor ────┐
Sensor 1  Type 1
 63.8 °F      Last 00:09:35
 18.3 %M      Next 00:05:25
 0.21 dS/m
                 << >>
```
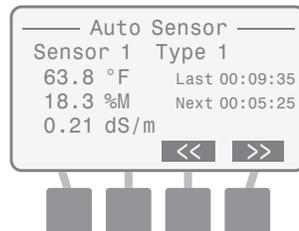
2 Press the << or >> button to view the status of other installed sensors.

```
┌──── Auto Sensor ────┐
Sensor 2  Type 1
 63.8 °F      Last 00:09:35
 18.3 %M      Next 00:05:25
 0.21 dS/m
                 << >>
```
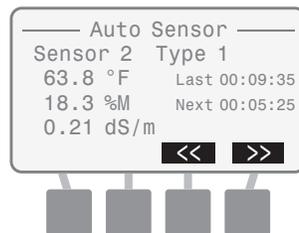
! NOTE: If no sensors are detected the "No sensors installed" message is displayed.

Auto Basic

This position displays basic system information while keeping the ISDL-2400 in Auto mode.
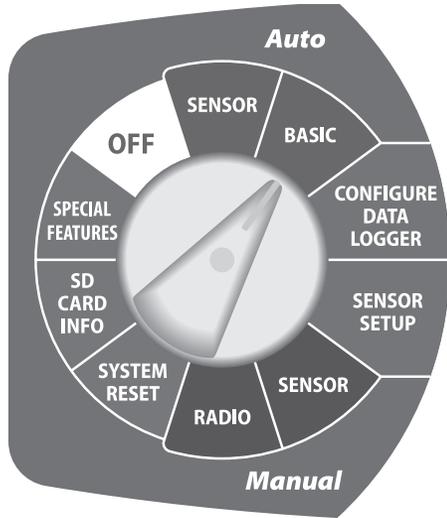
Current Date and Time

The current date and time is displayed.

Installed Sensors

The total number of sensors connected to the ISDL-2400 is displayed.

Battery Level (Vbat)

Battery life of the power supply is displayed as LOW, MED, or HIGH.

Link Status

The received radio signal strength of the wireless network link is displayed as LOW, MED, or HIGH.

Last Sync

The elapsed time since the last Soil Manager network update is displayed.

Radio Status

The current status of the radio is displayed as Awake, Sleep, or Setup.

! NOTE: Details on Radio Modes can be found in the Appendix section, page 85.

Turn the dial to Auto BASIC

1 The Auto Basic screen appears. System Status information is displayed.

```
——— Auto Basic ———
09/23/2010  03:28:45
 1 sensors installed
Vbat:HIGH  Link:HIGH
Last SYNC: 01:39:35
Radio Status:  Awake
```
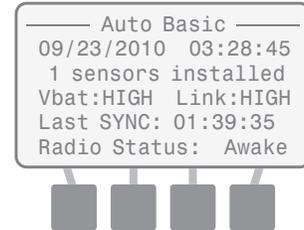
Configure Data Logger

This position provides the capability to manually change system settings.
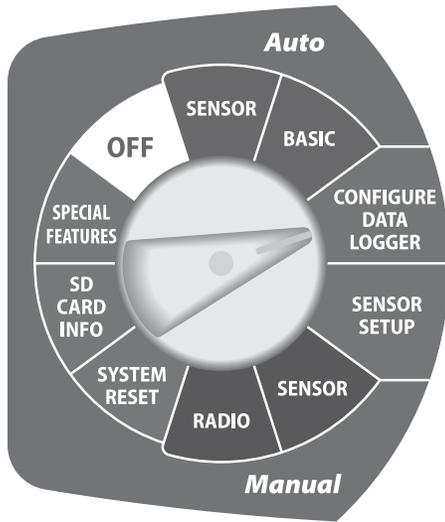
Language

Eight different languages are available.

- English
- Spanish
- French
- German
- Italian
- Portuguese
- Chinese
- Swedish

Set Date/Time

Used to manually enter system date and time.

⚠ NOTE: If the internal power switch is turned off, the system date and time are NOT saved. Date and time can be re-entered manually, but it is recommended to let the Soil Manager update the values automatically during the next network sync.

Date Format

Three different date formats are available.

- MM/DD/YYYY
- DD/MM/YYYY
- YYYY/MM/DD

Hour Format

Two different hour formats are available.

- 24 Hour (24H)
- 12 Hour (12H)

Temperature Units

Two different temperature units are available.

- Celsius (°C)
- Fahrenheit (°F)

Sample Rate

The sample rate determines how often the ISDL-2400 records soil data from the sensors. When the radio is on, the sample rate of 2-120 minutes is controlled by the Soil Manager. If communication with the network is lost, the sampling rate reverts to the factory default of 15 minutes.

⚠ **NOTE:** The sample rate will need to be manually reset if the radio is off or network communication is lost.

Upgrade Firmware

The firmware for the ISDL-2400 can be updated using a standard SD card. This action does not affect system status settings or sensor configuration.

Select Language

Seven different languages are available.

➤ **Turn the dial to CONFIGURE DATA LOGGER**

1 The Configure screen appears. Press the UP or DOWN button to select Language; then press OK.

```
─────── Configure ───────
 Language
 Set Date/Time
 Date Format
 Hour Format
         UP  DOWN   OK
```

2 The Select Language screen appears. Press the UP or DOWN button to select the desired language; then press OK.

```
─── Select Language ───
 English
 Spanish
 French
 German
              UP  DOWN    OK
```
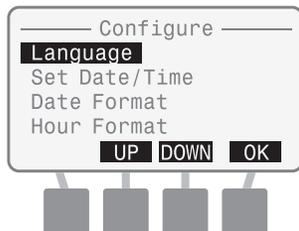
➤ **When finished, turn the dial to Auto (SENSOR or BASIC)**

Set Date/Time

Used to manually enter system date and time. When connected and synced to the network, the date and time will be updated by the Soil Manager.:

Turn the dial to CONFIGURE DATA LOGGER

1 The Configure screen appears. Press the UP or DOWN button to select Set Date/Time; then press OK.

```
————— Configure —————
 Language
 Set Date/Time
 Date Format
 Hour Format
          UP  DOWN   OK
```

2 The Set Date/Time screen appears with the month selected. Press the + or buttons to set the current month; then press NEXT.
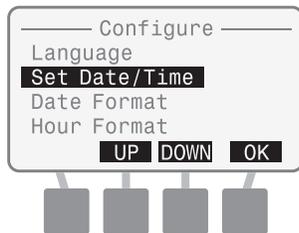
```
———— Set Date/Time ————

  09/01/2009  00:00
  MM/DD/YYYY  HH:MM
 DONE    +    —    NEXT
```
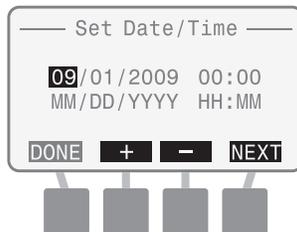
3 Day is selected. Press the + or buttons to set current day; then press NEXT.
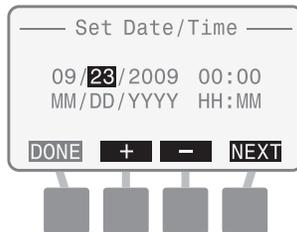
```
———— Set Date/Time ————

  09/23/2009  00:00
  MM/DD/YYYY  HH:MM
 DONE    +    —    NEXT
```

4 Year is selected. Press the + or buttons to set the current year; then press NEXT.

```
———— Set Date/Time ————

  09/23/2010  00:00
  MM/DD/YYYY  HH:MM
 DONE    +    —    NEXT
```

5 Hour is selected. Press the + or buttons to set the current hour; then press NEXT.

```
———— Set Date/Time ————

  09/23/2010  07:00
  MM/DD/YYYY  HH:MM
 DONE    +    —    NEXT
```

6 Minute is selected. Press the + or buttons to set the current minute; then press DONE.

```
──── Set Date/Time ────

  09/23/2010  07:45
  MM/DD/YYYY  HH:MM

 DONE    +    −    NEXT
```
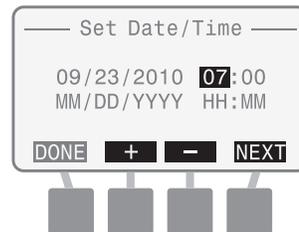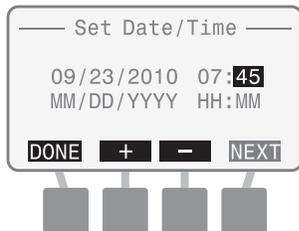
When finished, turn the dial to Auto (SENSOR or BASIC)

Select Date Format

Three different date formats are available:

- MM/DD/YYYY
- DD/MM/YYYY
- YYYY/MM/DD

Turn the dial to CONFIGURE DATA LOGGER

1 The Configure screen appears. Press the UP or DOWN button to select Date Format; then press OK.

```
────── Configure ──────
 Language
 Set Date/Time
 Date Format
 Hour Format
          UP  DOWN   OK
```
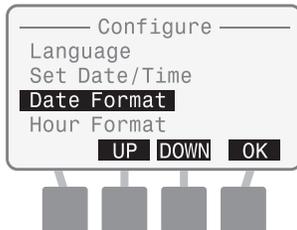
2 The Date Format screen appears. Press the UP or DOWN button to select the desired date format; then press OK.

```
──── Date Format ────
 MM/DD/YYYY
 DD/MM/YYYY
 YYYY/MM/DD

       UP  DOWN   OK
```
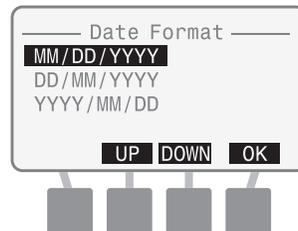
When finished, turn the dial to Auto (SENSOR or BASIC)

Select Hour Format

Two different hour formats are available:

- 24 Hour (24H)
- 12 Hour (12H)

Turn the dial to CONFIGURE DATA LOGGER

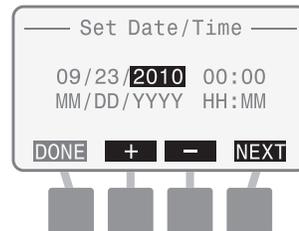**1** The Configure screen appears. Press the UP or DOWN button to select Hour Format; then press OK.

```
───── Configure ─────
Language
Set Date/Time
Date Format
Hour Format
        UP  DOWN   OK
```

2 The Hour Format screen appears. Press the UP or DOWN button to select 24 Hour or 12 Hour; then press OK.

```
───── Hour Format ─────
24 Hour
12 Hour


        UP  DOWN   OK
```
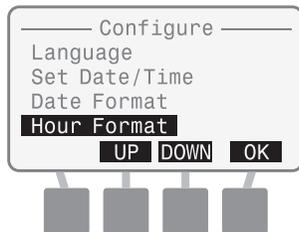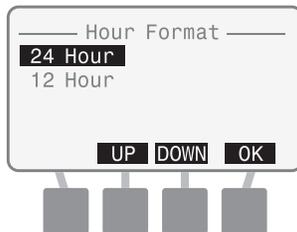
When finished, turn the dial to Auto (SENSOR or BASIC)

Select Temperature Units

Two different temperature units are available:

- Celsius (°C)
- Fahrenheit (°F)

Turn the dial to CONFIGURE DATA LOGGER

1 The Configure screen appears. Press the UP or DOWN button to select Temperature Units; then press OK.

```
───── Configure ─────
Set Date/Time
Date Format
Hour Format
Temperature Units
        UP  DOWN   OK
```
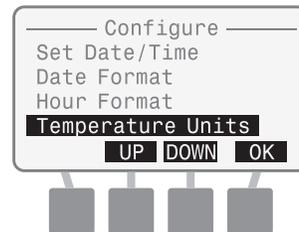
❷ The Temperature Units screen appears. Press the UP or DOWN button to select Degrees C or Degrees F; then press OK.

```
— Temperature Units —
 Degrees C
 Degrees F


       UP  DOWN   OK
```
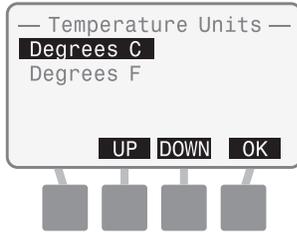
When finished, turn the dial to Auto (SENSOR or BASIC)

Set Sample Rate

The sample rate determines how often the sensors measure soil conditions.

! **NOTE:** The sample rate will need to be manually set if the radio is off or network communication is lost.

Turn the dial to CONFIGURE DATA LOGGER

❶ The Configure screen appears. Press the UP or DOWN button to select Sample Rate; then press OK.

```
———— Configure ————
 Date Format
 Hour Format
 Temperature Units
 Sample Rate
         UP  DOWN   OK
```
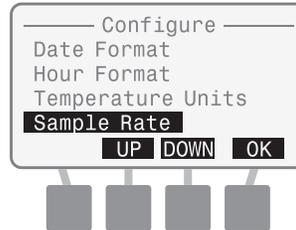
❷ The Set Sample Period screen appears with minutes selected. Press the + or buttons to set the desired sample period; then press DONE.

```
— Set Sample Period —

      0015 Minutes


       +   —    DONE
```
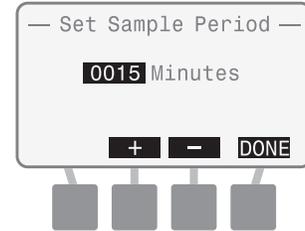
When finished, turn the dial to Auto (SENSOR or BASIC)

Upgrade Firmware

The ISDL-2400 firmware can be updated using a standard SD card.

! NOTE: To begin firmware upgrade, insert an SD card with the new firmware. SD card replacement procedures can be found in the Appendix section, page 87.

⟳ Turn the dial to CONFIGURE DATA LOGGER

1 The Configure screen appears. Press the UP or DOWN button to select Upgrade Firmware; then press OK.

```
───── Configure ─────
Hour Format
 Temperature Units
 Sample Rate
Upgrade Firmware
       UP  DOWN   OK
```
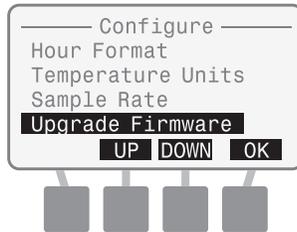
2 The Update Firmware screen appears. The "Confirm firmware update..." message is displayed. Press the 2 and 4 buttons together for 3 seconds to initiate the update.

```
─── Update Firmware ───
 Confirm firmware
 update by pressing 2
 and 4 simultaneously
BACK   2    3    4
```
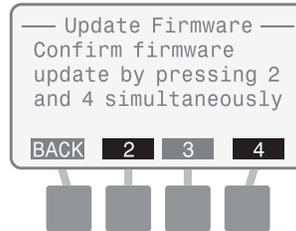
3 The Update Firmware message displays "Checking SD card…"

```
─── Update Firmware ───

  Checking SD card...

BACK   2    3    4
```
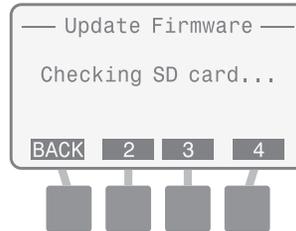
! NOTE: If the SD card cannot be read, "Firmware update file not found" is displayed.

4 When the update is found, the Rain Bird Bootloader screen is displayed. An updating firmware status bar indicates the update progress.

```
      Rain Bird
      ISDL-2400
   Bootloader 1.02
   DO NOT POWER OFF
  Updating firmware
```
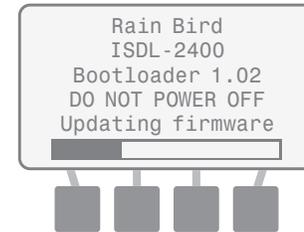
! NOTE: Do not change the dial position or turn off power to the ISDL-2400 when updating firmware.

5 When completed, the Rain Bird splash screen is briefly displayed before a return to the Configure screen.
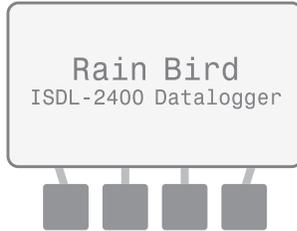
```
     Rain Bird
 ISDL-2400 Datalogger
```

NOTE: An alternate procedure to upgrade the firmware is to turn off the power switch inside the ISDL, turn the dial to Configure Data Logger, insert the SD card with the new firmware file, and turn the power switch back on. The ISDL will start Step 3 and Step 4 automatically.

When finished, turn the dial to Auto (SENSOR or BASIC)

Sensor Setup

Provides the capability to configure each sensor connected to the ISDL-2400. A total of 18 sensors can be processed, using two channels with a maximum of 9 sensors assigned to each channel.
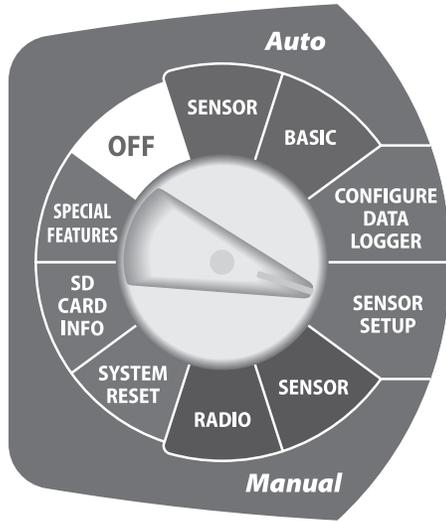
Add Ch 1 or Ch 2 (Sensors)

The ISDL-2400 checks the sensor type of a new sensor and assigns an available address (1-9 for Ch 1, a-i for Ch 2) selected by the user. A new sensor must have an address of "0" to receive a new channel assignment.

> **!** **NOTE:** The default address of a sensor from the manufacturer is 0.

Remove (Sensor)

The ISDL-2400 removes the address of a selected sensor from the Data Logger database and the removed address is made available to new sensors.

Query Channel (Sensor Address)

This function provides the address of one individual sensor connected to the selected channel- only one sensor can be physically connected to the channel during a Query or no address of any sensor will be displayed. The RESET button is used to change the address of a sensor to "0".

Scan Sensors

The channel and address of all connected sensors are detected and displayed.

> **!** **NOTE:** All connected sensors must have a unique address. The Scan Sensor function will not work correctly if there are connected sensors with the same address.

Add Sensor (Ch 1 or Ch 2)

The ISDL-2400 checks the sensor type of a new sensor and assigns an available address.

! **NOTE:** During an ISS installation, it is recommended to perform a Query on the channel before adding a sensor to verify the sensor is properly addressed.

◉ **Turn the dial to SENSOR SETUP**

① The Sensor Setup screen appears. Press the UP or DOWN button to select Add Ch 1 (or Ch 2); then press OK.

```
┌──── Sensor Setup ────┐
│ Add Ch 1             │
│ Add Ch 2             │
│ Remove               │
│ Query Ch 1           │
│        UP DOWN   OK  │
└──────────────────────┘
```
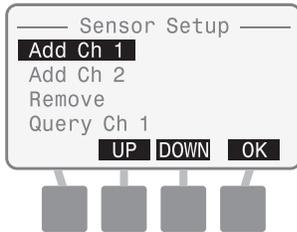
② The Add Sensor screen appears. Press the UP or DOWN button to select an available slot; then press OK.

```
┌───── Add Sensor ─────┐
│ Ch 1, Slot 1         │
│ Ch 1, Slot 2         │
│ Ch 1, Slot 3         │
│ Ch 1, Slot 4         │
│ BACK  UP DOWN   OK   │
└──────────────────────┘
```
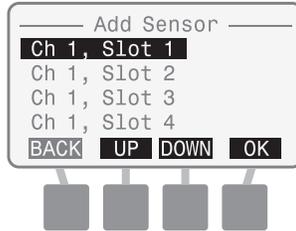
③ The Add Sensor screen displays "Adding Sensor" and "Checking Sensor", while searching for the new sensor.

```
┌───── Add Sensor ─────┐
│                      │
│ Adding sensor [1]    │
│                      │
│ BACK                 │
└──────────────────────┘
```
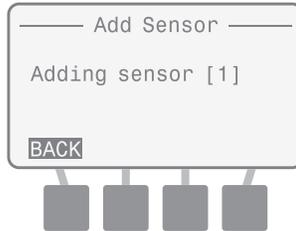
! **NOTE:** If no new sensor is detected, the "No new sensor found" message is displayed.

④ When completed, the Add Sensor screen displays the slot number and sensor type for the new sensor.

```
┌───── Add Sensor ─────┐
│                      │
│ Added sensor [1]     │
│ Sensor type 1        │
│ BACK                 │
└──────────────────────┘
```
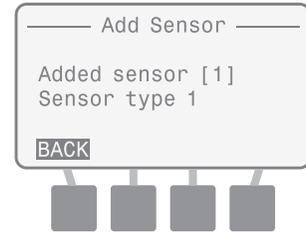
◉ **When finished, turn the dial to Auto (SENSOR or BASIC)**

Remove Sensor

The ISDL-2400 removes the address of a selected sensor from the Data Logger database and the removed address is made available to new sensors.

! NOTE: A sensor should remain connected to the ISDL when removing an address. The sensor can be disconnected when Remove Sensor is complete.

⊃ Turn the dial to SENSOR SETUP

1 The Sensor Setup screen appears. Press the UP or DOWN button to select Remove; then press OK.

```
——— Sensor Setup ———
Add Ch 1
Add Ch 2
Remove
Query Ch 1
         UP  DOWN   OK
```
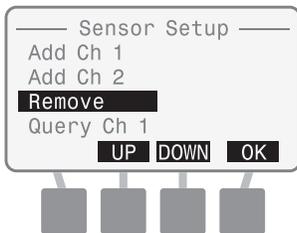
2 The Remove Sensor screen appears with a list (channel and slot) of every currently installed sensor. Press the UP or DOWN button to select desired sensor/slot to remove; then press OK.

```
——— Remove Sensor ———
Ch 1, Slot 1
Ch 2, Slot a


BACK   UP  DOWN    OK
```
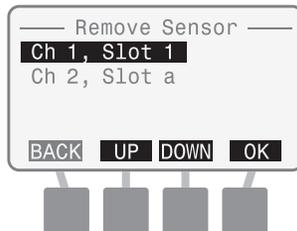
3 When completed, the "Sensor Removed" message is displayed.

```
——— Remove Sensor ———

Sensor [1] removed


BACK
```
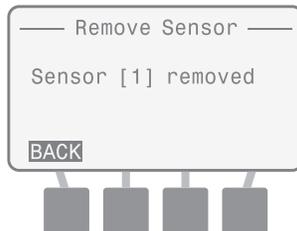
⊃ When finished, turn the dial to Auto (SENSOR or BASIC)

Query Sensor (Ch 1 or Ch 2)

This function provides the address of one individual sensor connected to the selected channel, and can reset the address of the sensor to 0. If more than one sensor is connected to the channel, no addresses will be displayed.

Turn the dial to SENSOR SETUP

**1** The Sensor Setup screen appears. Press the UP or DOWN button to select Query Ch 1 (or Ch 2); then press OK.

```
—— Sensor Setup ——
Add Ch 1
Add Ch 2
Remove
Query Ch 1
        UP  DOWN  OK
```
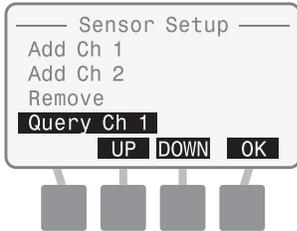
2 The Query Channel 1 (or 2) screen appears and "Only one sensor can be connected..." is displayed.

```
— Query Channel 1 —
Only one sensor can
be connected to the
channel during query.
BACK        RESET RETRY
```
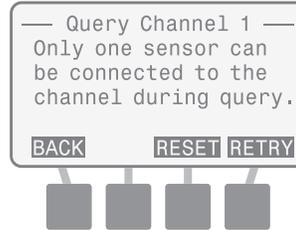
3 "Scanning" is displayed while performing the query.

```
— Query Channel 1 —

Scanning...

BACK        RESET RETRY
```
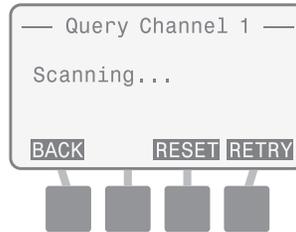
! **NOTE:** If no sensor is found, the "No sensor detected" message is displayed.

4 When completed, the "Found sensor [#]" message displays the address of the sensor.

```
— Query Channel 1 —

Found sensor [1]

BACK        RESET RETRY
```
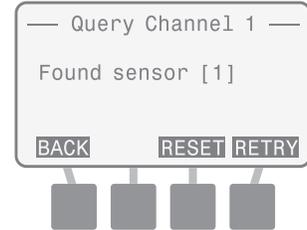
⟳ Press RETRY to run the Query again if desired.

! **NOTE:** The RESET button can be pressed to change the sensor address back to "0". This should always be pressed when installing a new sensor on the ISDL to verify the address is 0.

When finished, turn the dial to Auto (SENSOR or BASIC)

Sensor Scan (Detect)

The channel and address of all connected sensors are detected and displayed.

⮕ **Turn the dial to SENSOR SETUP**

1 The Sensor Setup screen appears. Press the UP or DOWN button to select Scan Sensors; then press OK.

```
───── Sensor Setup ─────
Remove
Query Ch 1
Query Ch 2
Scan Sensors
         UP  DOWN   OK
```
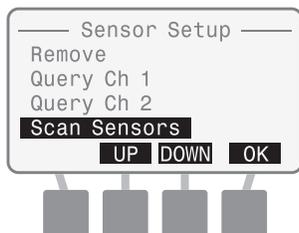
2 The Sensor Scan screen appears and begins scanning.

```
────── Sensor Scan ──────
0 Sensors detected
Scanning [1]
_ _ _ _ _ _ _ _ _ _
_ _ _ _ _ _ _ _ _ _
BACK              RETRY
```
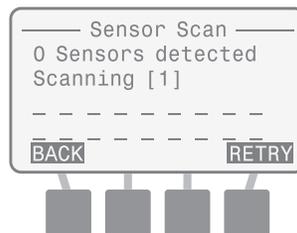
3 When complete, the number of installed sensors and the assigned channel/slot for each detected sensor is displayed.

```
────── Sensor Scan ──────
6 Sensors detected
Sensor addresses are
1 2 3 _ _ _ _ _ _ _
a b c _ _ _ _ _ _ _
BACK              RETRY
```
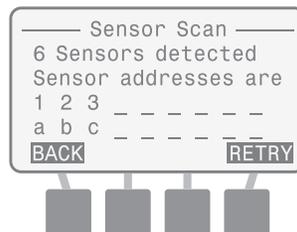
🔄 Press RETRY to run the Scan again if desired.

⮕ **When finished, turn the dial to Auto (SENSOR or BASIC)**

this page intentionally left blank

Manual Sensor

This position provides the last soil data reading of a selected sensor. A current sensor reading can be forced and displayed. A sensor error code is shown if the ISDL-2400 is unable to read a selected sensor.
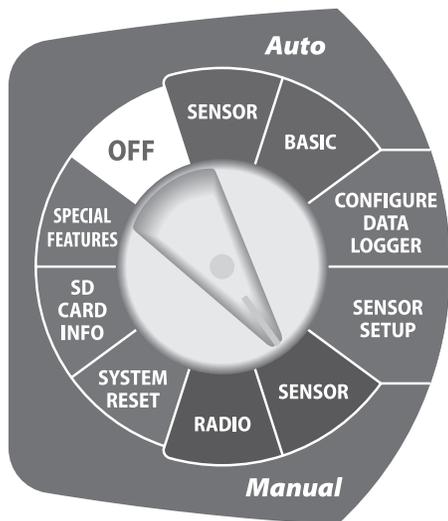
Sensor Addresses

The assigned address for each selected sensor is displayed: 1-9 for Ch 1 and a-i for Ch 2.

Sensor Types

The specific type of supported sensor is displayed.

> ⚠ **NOTE:** Troubleshooting procedures for sensor error codes can be found in the Appendix section, page 89.

Soil Data

Last measured moisture, temperature and salinity levels are displayed for each sensor.

Last Reading

The elapsed time since the last sensor reading is displayed.

Next Reading

The time remaining until the next scheduled sensor reading is displayed.

Manual Sensor Reading

This position provides the last soil data reading of a selected sensor. A current sensor reading can be forced and displayed.

▶ **Turn the dial to MANUAL SENSOR**

1 The Manual Sensor screen appears.

```
 ── Manual Sensor ──
 Sensor 1    Type 3
  63.8 °F     Last 00:09:35
  18.3 %M     Next 00:05:25
  0.21 dS/m
 READ          <<   >>
```
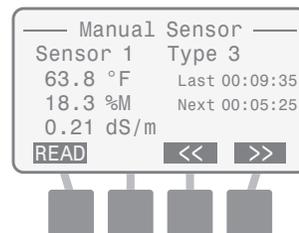
> ⚠ **NOTE:** If no sensors are installed, the "No sensors installed" message is displayed.

2 Press the << or >> button to view other installed sensors.

```
────  Manual Sensor  ────
Sensor 2  Type 3
 63.8 °F      Last 00:09:35
18.3 %M       Next 00:05:25
0.21 dS/
READ          <<   >>
```
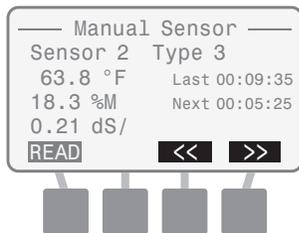
3 Press the READ button to force a current reading of all installed sensors.

```
────  Manual Sensor  ────
Sensor 2  Type 3
 63.8 °F      Last 00:09:35
18.3 %M       Next 00:05:25
0.21 dS/
READ          <<   >>
```
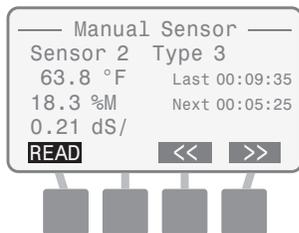
4 The screen shows "Reading" while taking new soil measurements.

```
────  Manual Sensor  ────
Sensor 2  Type 3
 63.8 °F      Last 00:09:35
18.3 %M       Next 00:05:25
0.21 dS/      Reading 2
READ          <<   >>
```
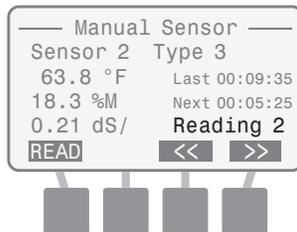
5 New soil measurements for the selected sensor are displayed. Press the << or >> button to view other installed sensors.

```
────  Manual Sensor  ────
Sensor 2  Type 3
 64.5 °F      Last 00:00:01
18.0 %M       Next 00:14:59
0.2 dS/m
READ          <<   >>
```
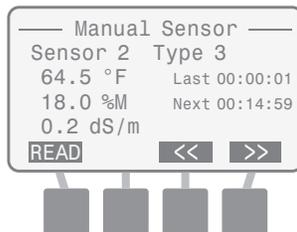
When finished, turn the dial to Auto (SENSOR or BASIC)

Manual Radio

This position displays radio status and can force the radio into Awake mode.
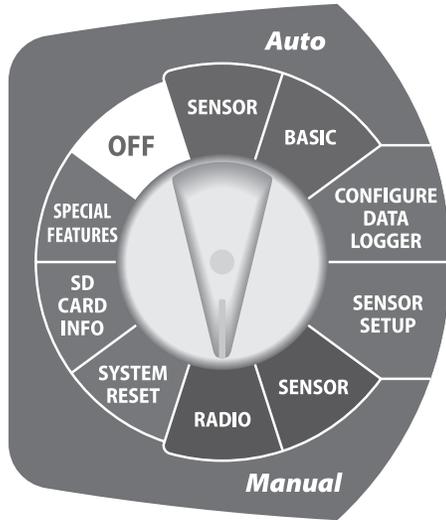
Radio Status

The current status of the radio is displayed as Awake, Sleep, or Setup.

> **! NOTE:** Details on Radio Modes can be found in the Appendix section, page 85.

Last Wake

The elapsed time since the last mode change from Sleep to Awake is displayed.

Next Wake

The time remaining until the next scheduled Wake is displayed.

Last SYNC

The elapsed time since the last sync command from the Soil Manager is displayed.

Link Status

The received radio signal strength of the wireless network link is displayed.

> **! NOTE:** Details on signal strength values (measured using dBm units in a negative scale) can be found in the Appendix section, page 85.

Table 1 - RSSI Values

Value	Relative Strength
-92 to -85	Low
-85 to -80	Medium
Above -80	High

Manual Radio Wake

This position displays radio status and information and can force the radio into Awake mode.

Turn the dial to MANUAL RADIO

1 The Manual Radio screen appears.

```
———— Manual Radio ————
Radio Status:  Awake
Last Wake: 00:00:41
Next Wake: 00:00:53
Last SYNC: 01:39:35
Link: HIGH        WAKE
```
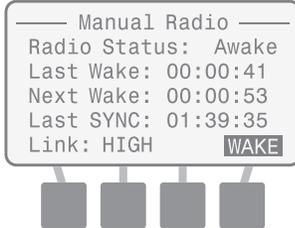
2 If the Radio Status is SLEEP, press the WAKE button to change the status of the radio to Awake.

```
———— Manual Radio ————
Radio Status:  Awake
Last Wake: 00:00:41
Next Wake: 00:00:53
Last SYNC: 01:39:35
Link: HIGH        WAKE
```
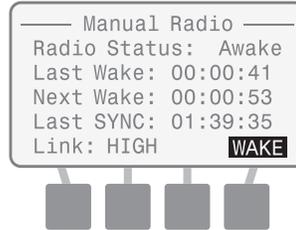
NOTE: Radio will wake for approximately 20-30 seconds, then return to the normal wake/sleep cycle that is set using the Soil Manager.

When finished, turn the dial to Auto (SENSOR or BASIC)

System Reset

This position performs a system reset or returns all settings to the default factory values.
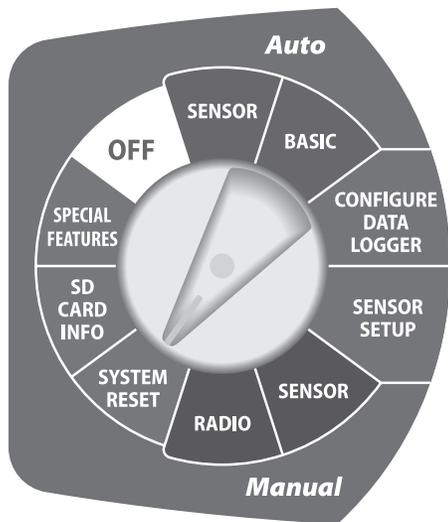
Reset

This function resets the microprocessor without affecting system settings (such as date, time, or sampling rate) or sensor channel addresses.

Factory Defaults

This function resets all system settings (except date and time) to default factory values.

⚠ **NOTE:** After the Factory Default function is performed, all sensors are un-installed from the data logger. Each connected sensor keeps its last assigned address, but "no sensors installed" would be displayed on the Auto Sensor, Auto Basic and Manual Sensor screens. Use the Scan Sensors function from the Sensor Setup menu to reinstall every sensor.

Reset

This function will not change system settings or sensor addresses.

⊳ **Turn the dial to SYSTEM RESET**

1 The System Reset screen appears. Press the UP or DOWN button to select Reset; then press OK.

```
┌─── System Reset ───┐
│ Reset               │
│ Factory Defaults    │
│                     │
│        UP  DOWN  OK │
└─────────────────────┘
```
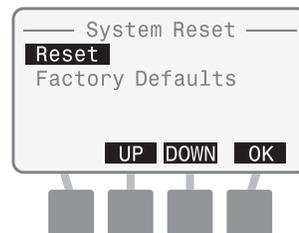
2 The "Please wait while the SD card is scanned" message is briefly displayed.

```
Please wait while the
SD card is scanned...
```
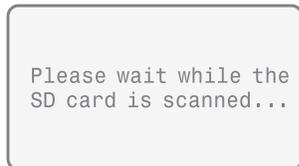
When completed, the System Reset screens displays again.

When finished, turn the dial to Auto (SENSOR or BASIC)

Factory Defaults

This function resets all system settings (except date and time) to default factory values.

Turn the dial to SYSTEM RESET

1 The System Reset screen appears. Press the UP or DOWN button to select Factory Defaults; then press OK.

```
——— System Reset ———
Reset
Factory Defaults

           UP  DOWN   OK
```
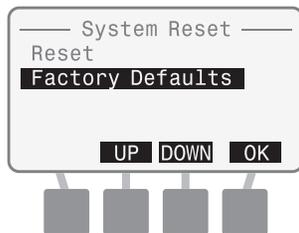
2 The "Restoring Factory Defaults" message is briefly displayed before a return to the System Reset main screen.

```
——— System Reset ———

Restoring Factory
Defaults

BACK
```
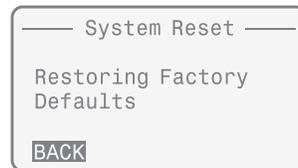
When finished, turn the dial to Auto (SENSOR or BASIC)

SD Card Info

This position displays information about an installed SD Card.

⚠ **NOTE:** SD Card Replacement procedures can be found in the Appendix section, page 87.
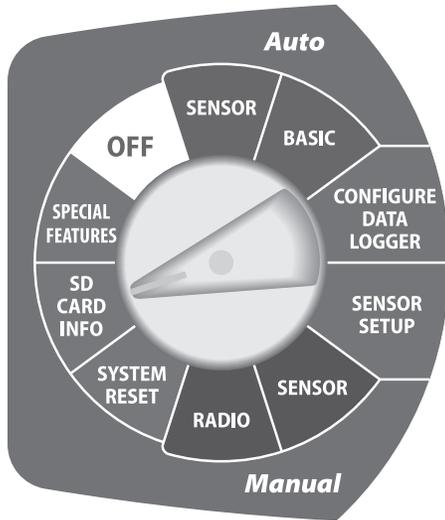
Card Status

Either "Card ready" or "Card not ready" is displayed.

Card Capacity

The capacity of the installed SD card is displayed in MB (megabytes).

Card Free Space

The amount of available space on the installed SD card is displayed in MB (megabytes).

⚠ **NOTE:** The amount of available space may not be accurately displayed if the SD card has been used in other digital media, such as a digital camera or music player. An SD card reader and personal computer can be used to check the free space.

Check SD Card Status

This position displays information about an installed SD Card.

▶ **Turn the dial to SD CARD INFO**

1 The SD Card Status screen appears, and the status, capacity and free space on the SD card is displayed.

```
 ─── SD Card Status ───
 Card Ready

            3965 MB card
            3948 MB free
```
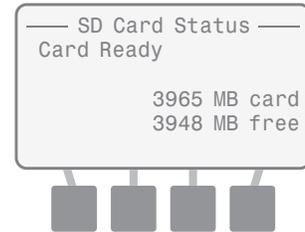
▶ **When finished, turn the dial to Auto (SENSOR or BASIC)**

Special Features

This option provides detailed system information and diagnostic tests to the advanced user. A password is required to run the diagnostic tests. (The password is 4-1-3-2.)
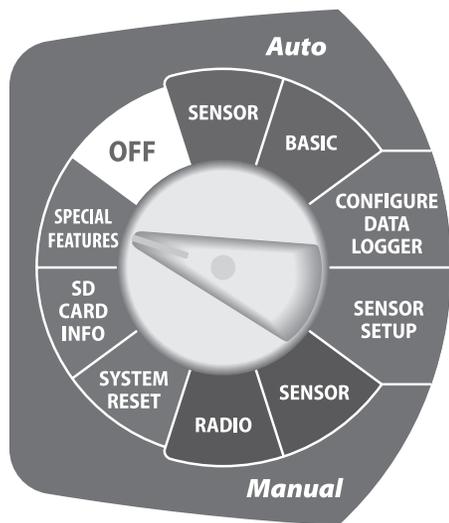
ISDL Version

Displays the current firmware version installed on the ISDL-2400.

Radio Version

Displays the current radio module version installed on the ISDL-2400.

Node (MAC Address)

Displays the radio MAC address of the ISDL-2400.

Host (MAC Address)

Displays the radio MAC address of the Gateway router being used by the ISS. (The factory default address is 0.)

Diagnostic Tests

The following diagnostic tests are available:

Diagnostic 1

Tests and displays Radio Status, RSSI value, battery level and packet efficiency. The Radio mode can be changed from Sleep to Awake.

Diagnostic 2

Displays Radio Status, elapsed time since last Wake, time until next Wake, and the elapsed time since the Last Sync from the Soil Manager. The Radio mode can be changed from Sleep to Awake.

Diagnostic 3

Performs a manufacturing functional test that displays the status of various ISDL-2400 hardware components.

⚠ **NOTE**: Diagnostic Test Result information can be found in the Appendix section, page 90.

Run Diagnostic Test 1

Tests and displays Radio Status, RSSI value, battery level and packet efficiency.

Turn the dial to SPECIAL FEATURES

1 The Features screen appears. Press and hold the second and third buttons until the Diagnostic screen appears.

```
────── Features ──────
ISDL Version 1.0
Radio Version: 804B
Node 13A200 403B6CE2
Host 13A200 4033F656
     DIAGNOSTIC
```

2 The "Enter Password" message is displayed. Enter 4132.

```
────── Diagnostic ──────

Enter password

  1     2     3     4
```

3 If the correct password is not entered after 10 seconds, "Invalid password or timeout" is displayed. Press RETRY.

```
────── Diagnostic ──────

Invalid password
or password timeout

              RETRY EXIT
```

4 The Diagnostic 1 screen and test results are displayed.

```
───── Diagnostic 1 ─────
Radio Status:  Awake
RSSI:  -78 dBm  HIGH
Battery: 4.89    MED
Packet:  0.0%
EXIT WAKE  <<   >>
```
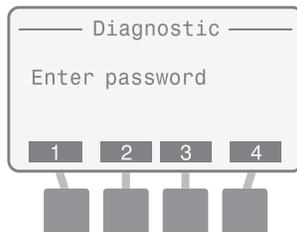
! **NOTE:** If necessary, press WAKE to change the radio status from Sleep to Awake. The radio will wake for approximately 20-30 seconds, then return to the normal wake/sleep cycle.

When finished, turn the dial to Auto (SENSOR or BASIC)

Run Diagnostic Test 2

Displays Radio Status, elapsed time since last Wake, time until next Wake, and the elapsed time since the Last Sync from the Soil Manager.

Turn the dial to SPECIAL FEATURES

1 The Features screen appears. Press and hold the second and third buttons until the Diagnostic screen appears.

```
——— Features ———
ISDL Version 1.0
Radio Version: 804B
Node 13A200 403B6CE2
Host 13A200 4033F656
     DIAGNOSTIC
```

2 The "Enter Password" message is displayed. Enter 4132.

```
——— Diagnostic ———

Enter password


  1    2    3    4
```

3 If the correct password is not entered after 10 seconds, "Invalid password or timeout" is displayed. Press RETRY.

```
——— Diagnostic ———

Invalid password
or password timeout

          RETRY  EXIT
```

4 The Diagnostic 1 screen appears; press the >> button.

```
——— Diagnostic 1 ———
Radio Status:  Awake
RSSI:  -78 dBm  HIGH
Battery: 4.89   MED
Packet:  0.0%
EXIT WAKE  <<   >>
```

5 The Diagnostic 2 screen and test results are displayed.

```
——— Diagnostic 2 ———
Radio Status:  Awake
Last Wake: 00:00:41
Next Wake: 00:00:53
Last SYNC: 01:39:35
EXIT  OFF   <<   >>
```
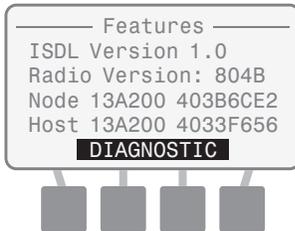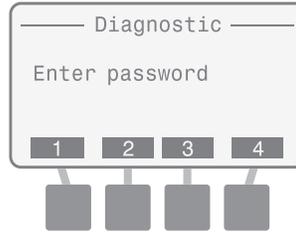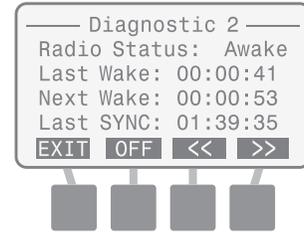
! **NOTE:** If required, press OFF or ON to cycle power to the radio.

When finished, turn the dial to Auto (SENSOR or BASIC)

Run Diagnostic Test 3

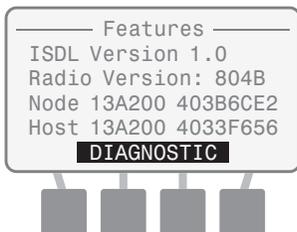*Performs a manufacturing functional test that displays the status of various ISDL-2400 hardware components.*

⚠ **NOTE:** Only one sensor should be connected to each channel when performing this test.

➤ **Turn the dial to SPECIAL FEATURES**

1 The Features screen appears. Press and hold the second and third buttons until the Diagnostic screen appears.
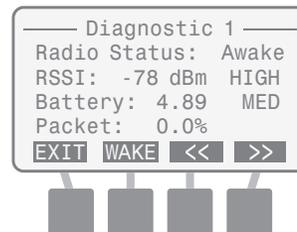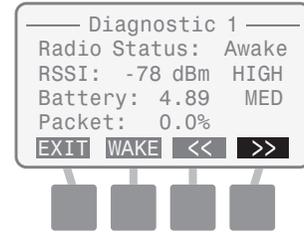
```
——— Features ———
ISDL Version 1.0
Radio Version: 804B
Node 13A200 403B6CE2
Host 13A200 4033F656
     DIAGNOSTIC
```

2 The "Enter Password" message is displayed. Enter 4132.

```
——— Diagnostic ———

Enter password


  1     2     3     4
```

3 If the correct password is not entered after 10 seconds, "Invalid password or timeout" is displayed. Press RETRY.

```
——— Diagnostic ———

Invalid password
or password timeout

            RETRY  EXIT
```

4 The Diagnostic 1 screen appears; press the >> button twice.

```
——— Diagnostic 1 ———
Radio Status:  Awake
RSSI:  -78 dBm  HIGH
Battery: 4.89   MED
Packet:  0.0%
EXIT  WAKE  <<   >>
```
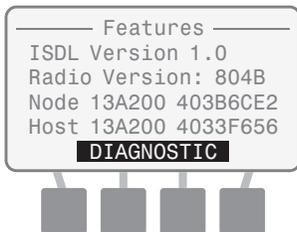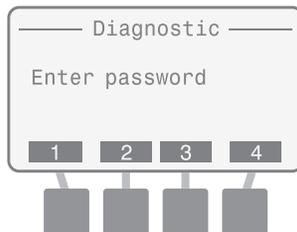
5 The Diagnostic 3 screen appears. "Press M-TEST key to start manufacturing functional test" is displayed. Press M-TEST.
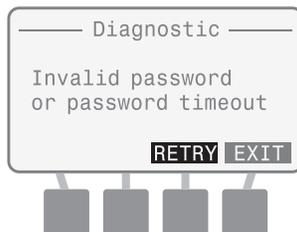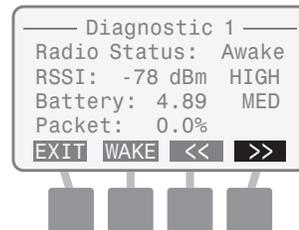
```
——— Diagnostic 3 ———
Press M-TEST key to
Start manufacturing
functional test

EXIT  M-TEST  <<   >>
```
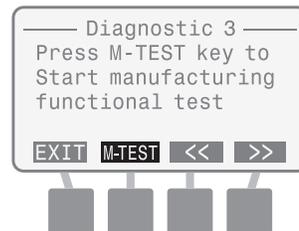
6 "Testing" message is displayed while conducting the test.
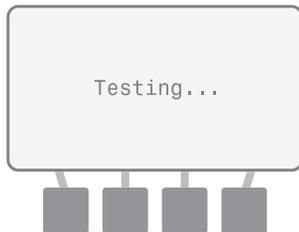
```
     Testing...
```

7 When complete, the MFG TEST RESULTS screen appears.

```
 —— MFG TEST RESULTS ——
 Vbat: 4.88            OK
 Xbee: 804B Awake ---  OK
 SDHC: Card Ready      OK
 CH 1: Sensor 3  2mA   OK
 CH 2: NO SENSOR     FAIL
 EXIT              RETRY
```
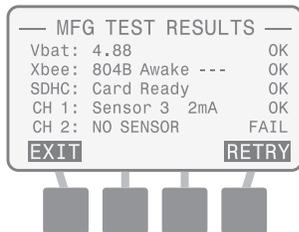
↻ Press RETRY to conduct the test again if desired.

When finished, turn the dial to Auto (SENSOR or BASIC)

Off Position

This position sets the ISDL-2400 into low power mode and keeps the internal clock and microprocessor running. Sensor readings and radio communications are terminated.
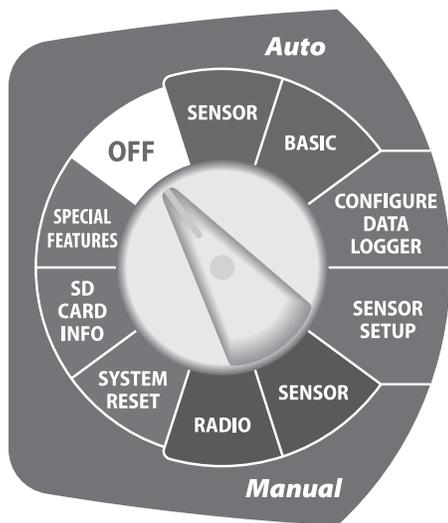
Programming the ISR-2400 Repeater

Programming Overview

The ISR-2400 Wireless Repeater automatically communicates with the Central Control Software during normal operation, but there may be times when system setting or configuration changes have to be made locally. The LCD on the front panel provides access to a variety of programming functions, such as setting date and time or upgrading firmware.

NOTE: If the ISR-2400 is not powered on, open the front panel. Set the internal power switch to ON and close the front cover. The Rain Bird splash screen is briefly displayed. After 60 seconds the LCD goes into a "sleep" mode to conserve battery power- press any button to see the display. After 10 seconds the backlight feature disappears.

Home Screen

The Home screen displays basic system information.

Current Date and Time

The current date and time is displayed.

Battery Level (Vbat)

The battery life of the power supply is displayed as LOW, MED, or HIGH.

Link Status

The received radio signal strength of the wireless network link is displayed.

> **!** **NOTE:** Details on signal strength values (measured using dBm units in a negative scale) can be found in the Appendix section, page 85.

Table 2 - RSSI Values

Value	Relative Strength
-92 to -85	Low
-85 to -80	Medium
Above -80	High

Last Sync

The elapsed time since the last Soil Manager network update is displayed.

Radio Status

The current status of the radio is displayed as Awake, Sleep, or Setup.

> **!** **NOTE:** Details on Radio Modes can be found in the Appendix section, page 85.

Menu

Press MENU to view the Menu screen.

Wake

Press WAKE to change the radio status from Sleep to Awake.

> **!** **NOTE:** The radio will be in set up mode immediately after the unit is powered on and the radio prepares to listen to network commands.

```
─────── Home ───────
09/23/2010  03:28:45
Vbat:HIGH  Link:HIGH
Last SYNC: 01:39:35
Radio Status:  Awake
MENU  WAKE
```
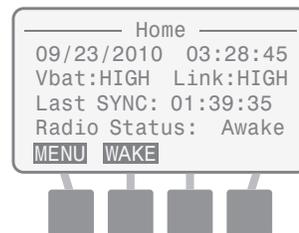
Menu Screen

The Menu screen is used to configure system settings, view radio status, view SD card information, conduct range tests, or perform diagnostic tests.

Home

Press HOME to return to the Home screen.

Programming Buttons

Use the UP, DOWN, and OK buttons to make programming selections.

Menu Options

Lists the available programming options for system configuration and monitoring.

```
┌──────── Menu ────────┐
│ Home                 │
│ Configuration        │
│ Manual Radio         │
│ System Reset         │
│ HOME   UP  DOWN   OK │
└──────────────────────┘
```
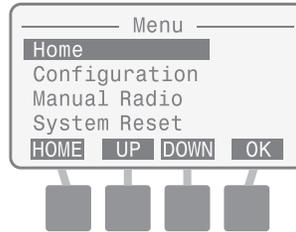
Configuration

This option provides the capability to manually change system settings.

Language

Eight different languages are available.

- English
- Spanish
- French
- German
- Italian
- Portuguese
- Chinese
- Swedish

Set Date/Time

Used to manually enter system date and time.

! NOTE: If the internal power switch is turned off, the system date and time are NOT saved. Date and time can be re-entered manually, but it is recommended to let the Soil Manager update the values automatically during the next network sync.

Date Format

Three different date formats are available.

- MM/DD/YYYY
- DD/MM/YYYY
- YYYY/MM/DD

Hour Format

Two different hour formats are available.

- 24 Hour (24H)
- 12 Hour (12H)

Upgrade Firmware

The firmware for the ISR-2400 can be updated using a standard SD card. This action does not affect system status settings or sensor configuration.

Select Language

Seven different languages are available.

1 On the Home screen, press the MENU button.
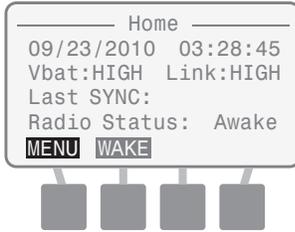
```
———————— Home ————————
09/23/2010  03:28:45
Vbat:HIGH  Link:HIGH
Last SYNC:
Radio Status:  Awake
MENU  WAKE
```

2 The Menu screen appears. Press the UP or DOWN button to select Configuration; then press OK.

```
———————— Menu ————————
Home
Configuration
Manual Radio
System Reset
HOME  UP  DOWN  OK
```

3 The Configure screen appears. Press the UP or DOWN button to select Language; then press OK.

```
————————— Configure —————————
Language
Set Date/Time
Date Format
Hour Format
BACK  UP  DOWN  OK
```
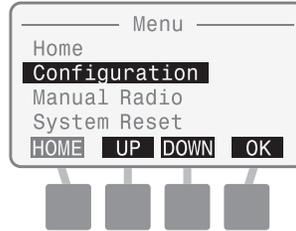
4 The Select Language screen appears. Press the UP or DOWN button to select the desired language; then press OK.
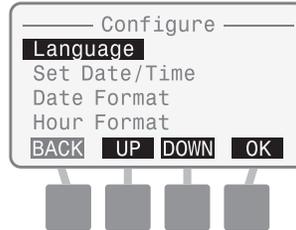
```
——— Select Language ———
English
Spanish
French
German
        UP  DOWN  OK
```
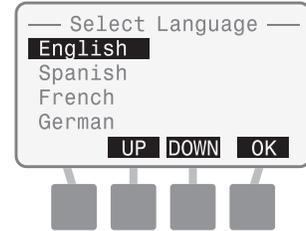
Set Date/Time

Used to manually enter system date and time. When connected to the network, the date and time will be updated by the Soil Manager

1 On the Home screen, press the MENU button.
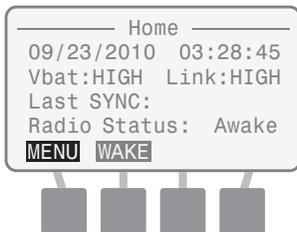
```
┌──────── Home ────────┐
│ 09/23/2010  03:28:45 │
│ Vbat:HIGH  Link:HIGH │
│ Last SYNC:           │
│ Radio Status:  Awake │
│ MENU  WAKE           │
└──────────────────────┘
```

2 The Menu screen appears. Press the UP or DOWN button to select Configuration; then press OK.

```
┌──────── Menu ────────┐
│ Home                 │
│ Configuration        │
│ Manual Radio         │
│ System Reset         │
│ HOME   UP  DOWN   OK │
└──────────────────────┘
```

3 The Configure screen appears. Press the UP or DOWN button to select Set Date/Time; then press OK.

```
┌────── Configure ──────┐
│ Language              │
│ Set Date/Time         │
│ Date Format           │
│ Hour Format           │
│ BACK   UP  DOWN   OK  │
└───────────────────────┘
```
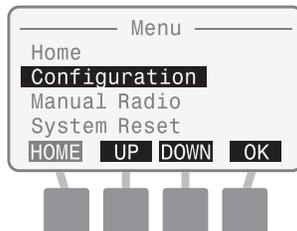
4 The Set Date/Time screen appears with the month selected. Press the + or - button to set the current month; then press NEXT.
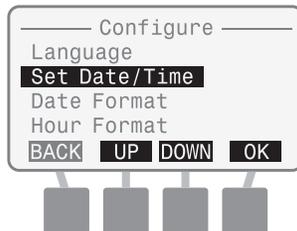
```
┌───── Set Date/Time ─────┐
│                         │
│  09/01/2009  00:00      │
│  MM/DD/YYYY  HH:MM      │
│                         │
│ DONE   +    ─    NEXT   │
└─────────────────────────┘
```
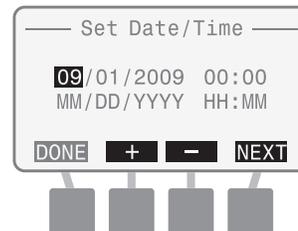
5 Day is selected. Press the + or - button to set the current day; then press NEXT.
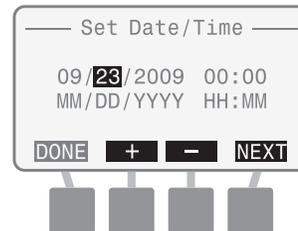
```
┌───── Set Date/Time ─────┐
│                         │
│  09/23/2009  00:00      │
│  MM/DD/YYYY  HH:MM      │
│                         │
│ DONE   +    ─    NEXT   │
└─────────────────────────┘
```

6 Year is selected. Press the + or -
button to set the current year;
then press NEXT.

```
───── Set Date/Time ─────

  09/23/2010  00:00
  MM/DD/YYYY  HH:MM

 DONE    +    −    NEXT
```

8 Minute is selected. Press the +
or - button to set the current
minute; then press DONE.

```
───── Set Date/Time ─────

  09/23/2010  07:45
  MM/DD/YYYY  HH:MM

 DONE    +    −    NEXT
```
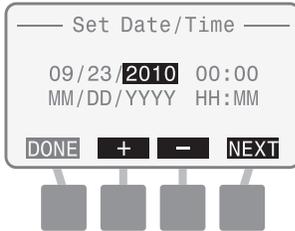
7 Hour is selected. Press the + or
- button to set the current hour;
then press NEXT.
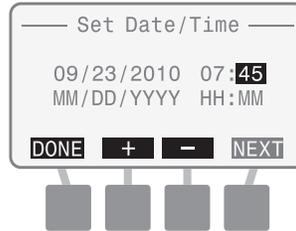
```
───── Set Date/Time ─────

  09/23/2010  07:00
  MM/DD/YYYY  HH:MM

 DONE    +    −    NEXT
```
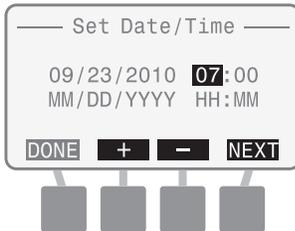
Select Date Format

Three different date formats are available:

- MM/DD/YYYY
- DD/MM/YYYY
- YYYY/MM/DD

1 On the Home screen, press the MENU button.
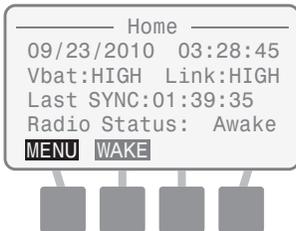
```
───── Home ─────
09/23/2010  03:28:45
Vbat:HIGH  Link:HIGH
Last SYNC:01:39:35
Radio Status:  Awake
MENU  WAKE
```

2 The Menu screen appears. Press the UP or DOWN button to select Configuration; then press OK.

```
───── Menu ─────
Home
Configuration
Manual Radio
System Reset
HOME   UP  DOWN   OK
```

3 The Configure screen appears. Press the UP or DOWN button to select Date Format; then press OK.
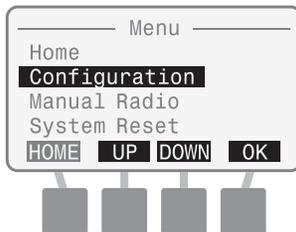
```
───── Configure ─────
Language
Set Date/Time
Date Format
Hour Format
BACK   UP  DOWN   OK
```
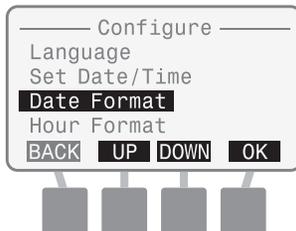
4 The Date Format screen appears. Press the UP or DOWN button to select the desired format; then press OK.

```
───── Date Format ─────
MM/DD/YYYY
DD/MM/YYYY
YYYY/MM/DD

        UP  DOWN   OK
```
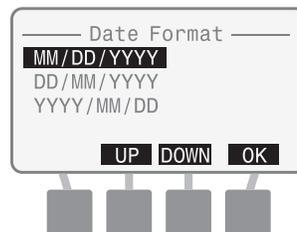
Select Hour Format

Two different hour formats are available:

- 24 Hour (24H)
- 12 Hour (12H)

1 On the Home screen, press the MENU button.
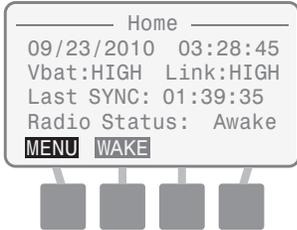
```
 ——————— Home ———————
 09/23/2010  03:28:45
 Vbat:HIGH  Link:HIGH
 Last SYNC: 01:39:35
 Radio Status:  Awake
 MENU  WAKE
```

2 The Menu screen appears. Press the UP or DOWN button to select Configuration; then press OK.

```
 ——————— Menu ———————
 Home
 Configuration
 Manual Radio
 System Reset
 HOME   UP  DOWN   OK
```

3 The Configure screen appears. Press the UP or DOWN button to select Hour Format; then press OK.

```
 ——————— Configure ———————
 Language
 Set Date/Time
 Date Format
 Hour Format
 BACK   UP  DOWN   OK
```
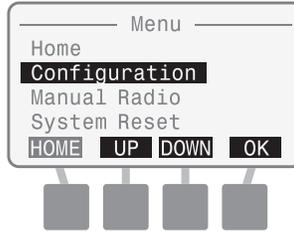
4 The Hour Format screen appears. Press the UP or DOWN button to select 24 Hour or 12 Hour; then press OK.
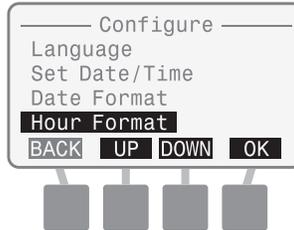
```
 ——————— Hour Format ———————
 24 Hour
 12 Hour


          UP  DOWN   OK
```
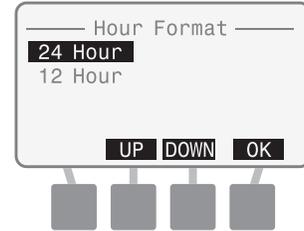
Upgrade Firmware

The ISR-2400 firmware can be updated using a standard SD card.

! **NOTE:** To begin firmware upgrade, insert an SD card with the new firmware. SD card Replacement procedures can be found in the Appendix section, page 87.

1 On the Home screen, press the MENU button.
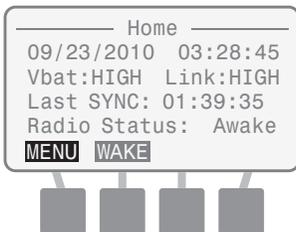
```
———— Home ————
09/23/2010  03:28:45
Vbat:HIGH  Link:HIGH
Last SYNC: 01:39:35
Radio Status:  Awake
MENU  WAKE
```

2 The Menu screen appears. Press the UP or DOWN button to select Configuration; then press OK.

```
———— Menu ————
Home
Configuration
Manual Radio
System Reset
HOME   UP  DOWN   OK
```

3 The Configure screen appears. Press the UP or DOWN button to select Upgrade Firmware; then press OK.
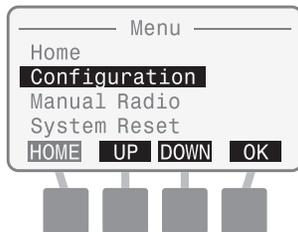
```
———— Configure ————
Set DateTime
Date Format
Hour Format
Upgrade Firmware
BACK   UP  DOWN   OK
```
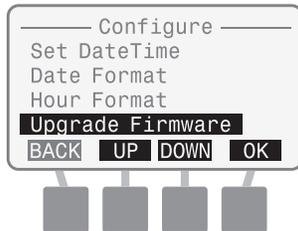
4 The Update Firmware screen appears. The "Confirm firmware update..." message is displayed. Press the 2 and 4 buttons for 3 seconds to initiate upgrade.

```
—— Update Firmware ——
Confirm firmware
update by pressing 2
and 4 simultaneously

DONE   2    3     4
```
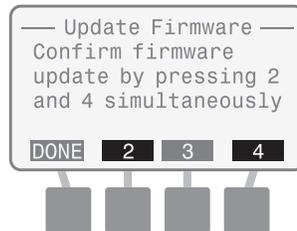
5 The Update Firmware screen displays "Checking SD card…"

```
—— Update Firmware ——

Checking SD card...


BACK   2    3     4
```
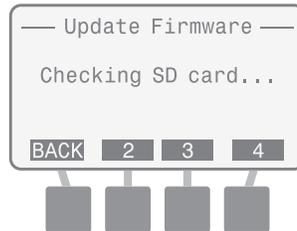
NOTE: If the SD card cannot be read, "Firmware update file not found" message is displayed.

6 If the update is found, the Rain Bird Bootloader screen is displayed. An updating firmware status bar indicates the update progress.

```
        Rain Bird
     ISR-2400 Repeater
      Bootloader 1.02
      DO NOT POWER OFF
     Updating firmware
```
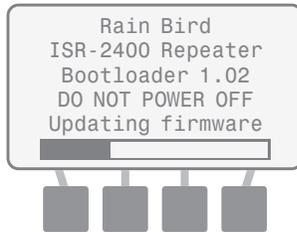
NOTE: Do not turn off power to the ISR-2400 when updating firmware.

7 When completed, the Rain Bird splash screen is briefly displayed before a return to the Update Firmware screen.
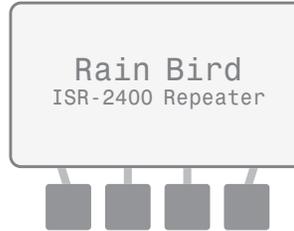
```
        Rain Bird
     ISR-2400 Repeater
```

NOTE: An alternate procedure to upgrade the firmware is to turn off the power switch inside the ISDL, turn the dial to Configure Data Logger, insert the SD card with the new firmware file, and turn the power switch back on. The ISDL will start Step 3 and Step 4 automatically.

Manual Radio

This option displays radio status, controls power to the radio, and forces the radio into Awake mode.

Radio Status

The current status of the radio is displayed as Awake, Sleep, or Setup.

! **NOTE:** Details on Radio Modes can be found in the Appendix section, page 85.

Last Wake

The elapsed time since the last mode change from Sleep to Awake is displayed.

Next Wake

The time remaining until the next scheduled Wake is displayed.

Last SYNC

The elapsed time since the last Soil Manager update is displayed.

ON/OFF

Toggles between ON and OFF, depending on the power status of the radio module.

Wake

Press WAKE to change the radio status from Sleep to Awake.

Home

Press HOME to return to the Home screen.

Manual Radio Wake

This option displays radio status, controls power to the radio, and can force the radio into Awake mode.

1 On the Home screen, press the MENU button.

```
┌──────── Home ────────┐
│ 09/23/2010  03:28:45 │
│ Vbat:HIGH  Link:HIGH │
│ Last SYNC: 01:39:35  │
│ Radio Status:  Awake │
│ MENU  WAKE           │
└──────────────────────┘
```
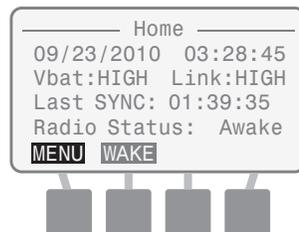
2 The Menu screen appears. Press the UP or DOWN button to select Manual Radio; then press OK.
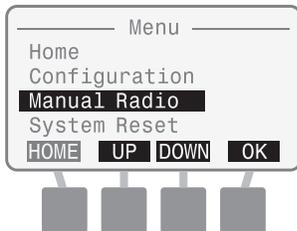
```
┌──────── Menu ────────┐
│ Home                  │
│ Configuration         │
│ Manual Radio          │
│ System Reset          │
│ HOME   UP  DOWN   OK  │
└───────────────────────┘
```

3 The Manual Radio screen appears.

```
┌──── Manual Radio ────┐
│ Status:     Awake     │
│ Last Wake: 00:00:41   │
│ Next Wake: 00:00:53   │
│ Last SYNC: 01:39:35   │
│        OFF  WAKE  HOME │
└───────────────────────┘
```
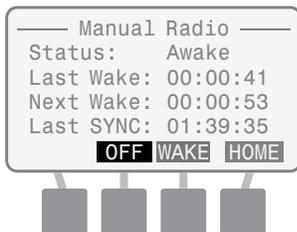
! **NOTE:** If required, press OFF or ON to cycle power to the radio.

4 Press WAKE to change the radio status from Sleep to Awake.

```
┌──── Manual Radio ────┐
│ Status:     Sleep     │
│ Last Wake: 00:00:41   │
│ Next Wake: 00:00:53   │
│ Last SYNC: 01:39:35   │
│        OFF  WAKE  HOME │
└───────────────────────┘
```
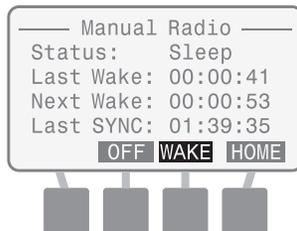
! **NOTE:** The radio will wake for approximately 20-30 seconds, then return to the normal wake/sleep cycle.

System Reset

This option performs a system reset or returns system settings to the default factory values.

Reset

This function resets the microprocessor without affecting system settings (such as date, time, or date format).

Factory Defaults

This function resets all system settings (except date and time) to default factory values.

Reset

This function will not change system settings.

1 On the Home screen, press the MENU button.
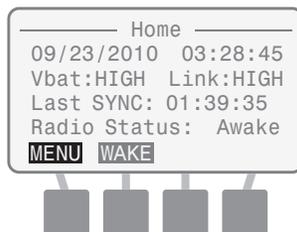
```
┌──── Home ────┐
│ 09/23/2010  03:28:45 │
│ Vbat:HIGH  Link:HIGH │
│ Last SYNC: 01:39:35  │
│ Radio Status:  Awake │
│ MENU  WAKE           │
└──────────────────────┘
```

2 The Menu screen appears. Press the UP or DOWN button to select System Reset; then press OK.

```
┌──── Menu ────┐
│ Home                 │
│ Configuration        │
│ Manual Radio         │
│ System Reset         │
│ HOME  UP  DOWN  OK   │
└──────────────────────┘
```

3 The System Reset screen appears. Press the UP or DOWN button to select Reset; then press OK.

```
┌── System Reset ──┐
│ Reset                │
│ Factory Defaults     │
│                      │
│                      │
│ BACK  UP  DOWN  OK   │
└──────────────────────┘
```

4 When completed, the Rain Bird splash screen is briefly displayed before a return to the Home screen.

```
     Rain Bird
  ISR-2400 Repeater
```
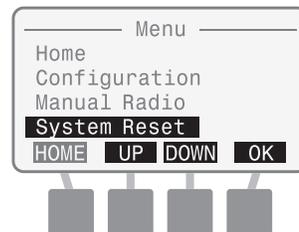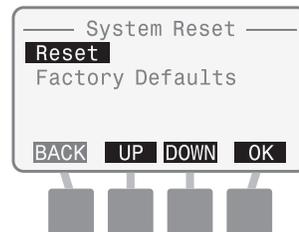
Factory Defaults

This function resets all system settings (except date and time) to default factory values.

1 On the Home screen, press the MENU button.
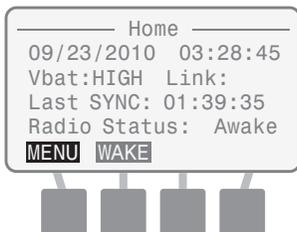
```
┌──── Home ────┐
09/23/2010  03:28:45
Vbat:HIGH  Link:
Last SYNC: 01:39:35
Radio Status:  Awake
MENU  WAKE
```

2 The Menu screen appears. Press the UP or DOWN button to select System Reset; then press OK.

```
┌──── Menu ────┐
Home
Configuration
Manual Radio
System Reset
HOME   UP DOWN   OK
```

3 The System Reset screen appears. Press the UP or DOWN button to select Factory Defaults; then press OK.

```
┌──── System Reset ────┐
Reset
Factory Defaults


        UP DOWN   OK
```

4 The "Restoring Factory Defaults" message is briefly displayed.

```
┌──── System Reset ────┐

Restoring Factory
Defaults

BACK
```
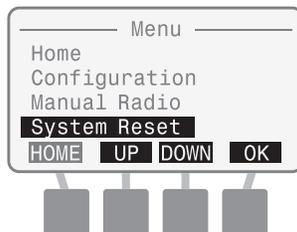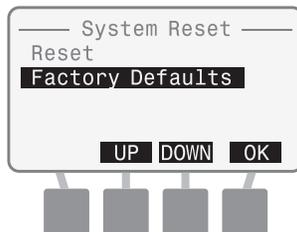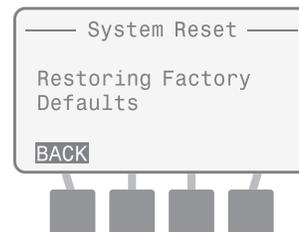
SD Card Info

This option displays information about an installed SD Card.

Card Status

Either "Card ready" or "Card not ready" is displayed.

Card Capacity

The capacity of the installed SD card is displayed in MB (megabytes).

Card Free Space

The amount of available space on the installed SD card is displayed in MB (megabytes).

! **NOTE:** The amount of available space may not be accurately displayed if the SD card has been used in other digital media, such as a digital camera or music player. An SD card reader and personal computer can be used to check the free space.

Check SD Card Status

This option displays information about an installed SD Card.

1 On the Home screen, press the MENU button.

```
──── Home ────
09/23/2010  03:28:45
Vbat:HIGH  Link:HIGH
Last SYNC: 01:39:35
Radio Status:  Awake
MENU  WAKE
```
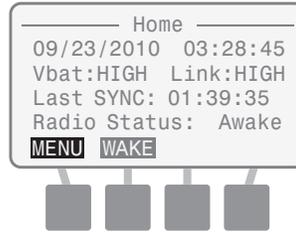
2 The Menu screen appears. Press the UP or DOWN button to select SD Card Information; then press OK.

```
──── Menu ────
Configuration
Manual Radio
System Reset
SD Card Information
HOME  UP  DOWN  OK
```
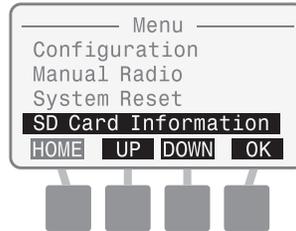
3 The SD Card Status screen appears. Status, capacity and free space are displayed.

```
── SD Card Status ──
Card Ready

         3965 MB card
         3948 MB free
BACK              HOME
```
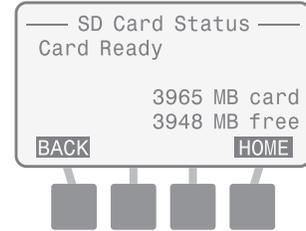
Range Test

This option provides radio range tests that are used during ISS installation or network troubleshooting. Range test procedures are found on pages 66-69 in the Installation section of this manual.

> ⚠ **NOTE**: Do not conduct range tests when the mesh network is operating. This feature is intended for installation or troubleshooting purposes only. Turn off the mesh network if conducting troubleshooting by placing the dials on the ISDL and ISR in the OFF position, or by powering the units off.
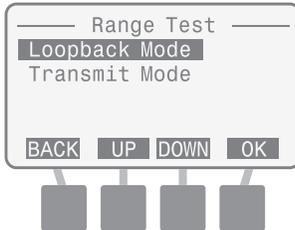
```
─────  Range Test  ─────
Loopback Mode
Transmit Mode


BACK   UP  DOWN   OK
```

Special Features

This option provides detailed system information and diagnostic tests to the advanced user. A password is required to run the diagnostic tests. (The password is 4-1-3-2.)

ISR Version

Displays the current firmware version installed on the ISR-2400.

Radio Version

Displays the current radio module version installed on the ISR-2400.

Node (MAC Address)

Displays the radio MAC address of the ISR-2400.

Host (MAC Address)

Displays the radio MAC address of the Gateway router being used by the ISS. (The factory default address is 0.)

```
———— Features ————
ISR Version 1.0
Radio Version: 804B
Node 13A200 403B6CE2
Host 000000 00000000
BACK  DIAGNOSTIC  HOME
```

Diagnostic Tests

The following diagnostic tests are available:

Diagnostic 1

Tests and displays Radio Status, RSSI value, battery level and packet efficiency. The Radio mode can be changed from Sleep to Awake.

Diagnostic 2

Displays Radio Status, elapsed time since last Wake, time until next Wake, and the elapsed time since the Last Sync from the Soil Manager. The Radio mode can be changed from Sleep to Awake.

Diagnostic 3

Performs a manufacturing functional test that displays the status of various ISR-2400 hardware components.

> **!** **NOTE**: Diagnostic Test Results information can be found in the Appendix section, page 90.

Run Diagnostic Test 1

Tests and displays Radio Status, RSSI value, battery level and packet efficiency.

1 On the Home screen, press the MENU button.

```
——— Home ———
09/23/2010  03:28:45
Vbat:HIGH  Link:HIGH
Last SYNC:01:39:35
Radio Status:  Awake
MENU  WAKE
```

2 The Menu screen appears. Press the UP or DOWN button to select Special Features; then press OK.

```
——— Menu ———
System Reset
SD Card Information
Range Test
Special Features
HOME  UP DOWN  OK
```

3 The Features screen appears. Press and hold the second and third buttons until the Diagnostic screen appears.

```
——— Features ———
ISR Version 1.0
Radio Version: 804B
Node 13A200 403B6CE2
Host 13A200 4033F656
BACK  DIAGNOSTIC  HOME
```

4 The "Enter Password" message is displayed. Enter 4132.

```
——— Diagnostic ———

Enter password


1    2    3    4
```

5 If the correct password is not entered after 10 seconds, "Invalid password or timeout" is displayed. Press RETRY.

```
——— Diagnostic ———

Invalid password
or password timeout

RETRY EXIT
```

6 The Diagnostic 1 screen and test results are displayed.

```
──── Diagnostic 1 ────
Radio Status:  Awake
RSSI:  -78 dBm  HIGH
Battery: 4.89    MED
Packet:  0.0%
EXIT WAKE  <<   >>
```

NOTE: If necessary, press WAKE to change the radio status from Sleep to Awake.

Run Diagnostic Test 2

Displays Radio Status, elapsed time since last Wake, time until next Wake, and the elapsed time since the Last Sync from the Soil Manager.

1 On the Home screen, press the MENU button.

```
———— Home ————
09/23/2010  03:28:45
Vbat:HIGH  Link:HIGH
Last SYNC:01:39:35
Radio Status:  Awake
MENU  WAKE
```

2 The Menu screen appears. Press the UP or DOWN button to select Special Features; then press OK.

```
———— Menu ————
System Reset
SD Card Information
Range Test
Special Features
HOME   UP  DOWN   OK
```

3 The Features screen appears. Press and hold the second and third buttons until the Diagnostic screen appears.
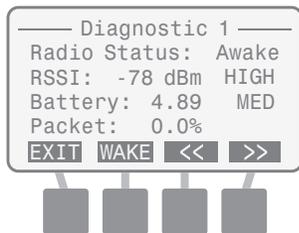
```
———— Features ————
ISR Version 1.0
Radio Version: 804B
Node 13A200 403B6CE2
Host 13A200 4033F656
BACK  DIAGNOSTIC  HOME
```

4 The "Enter Password" message is displayed. Enter 4132.

```
———— Diagnostic ————

Enter password


  1     2     3     4
```

5 If the correct password is not entered after 10 seconds, "Invalid password or timeout" is displayed. Press RETRY.

```
———— Diagnostic ————

Invalid password
or password timeout

          RETRY EXIT
```

6 The Diagnostic 1 screen appears; press the >> button.

```
——— Diagnostic 1 ———
Radio Status:  Awake
RSSI:  -78 dBm  HIGH
Battery: 4.89   MED
Packet:  0.0%
EXIT WAKE  <<   >>
```

7 The Diagnostic 2 screen and test results are displayed.

```
——— Diagnostic 2 ———
Radio Status:  Awake
Last Wake: 00:00:41
Next Wake: 00:00:53
Last SYNC: 01:39:35
EXIT WAKE  <<   >>
```

! **NOTE:** If necessary, press WAKE to change the radio status from Sleep to Awake.

Run Diagnostic Test 3

Performs a manufacturing functional test that displays the status of various ISR-2400 hardware components.

1 On the Home screen, press the MENU button.
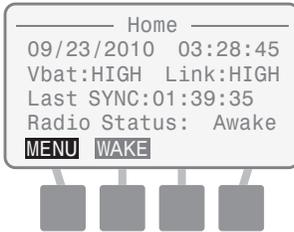
```
┌───── Home ─────┐
│ 09/23/2010  03:28:45 │
│ Vbat:HIGH  Link:HIGH │
│ Last SYNC:01:39:35   │
│ Radio Status:  Awake │
│ MENU  WAKE           │
└──────────────────────┘
```

2 The Menu screen appears. Press the UP or DOWN button to select Special Features; then press OK.

```
┌───── Menu ─────┐
│ System Reset        │
│ SD Card Information │
│ Range Test          │
│ Special Features    │
│ HOME  UP DOWN  OK   │
└─────────────────────┘
```
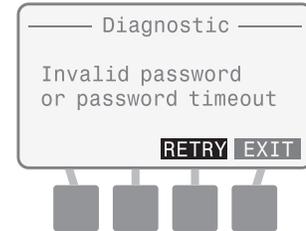
3 The Features screen appears. Press and hold the second and third buttons until the Diagnostic screen appears.

```
┌───── Features ─────┐
│ ISR Version 1.0         │
│ Radio Version: 804B     │
│ Node 13A200 403B6CE2    │
│ Host 13A200 4033F656    │
│ BACK  DIAGNOSTIC  HOME  │
└─────────────────────────┘
```

4 The "Enter Password" message is displayed. Enter 4132.

```
┌───── Diagnostic ─────┐
│ Enter password          │
│                         │
│  1    2    3    4       │
└─────────────────────────┘
```

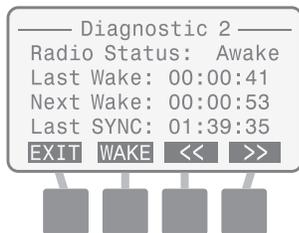**5** If the correct password is not entered after 10 seconds, "Invalid password or timeout" is displayed. Press RETRY.

```
┌───── Diagnostic ─────┐
│ Invalid password        │
│ or password timeout     │
│            RETRY  EXIT  │
└─────────────────────────┘
```

6 The Diagnostic 1 screen appears; press the >> button twice.

```
———— Diagnostic 1 ————
Radio Status:  Awake
RSSI:  -78 dBm  HIGH
Battery: 4.89   MED
Packet:  0.0%
EXIT WAKE  <<   >>
```
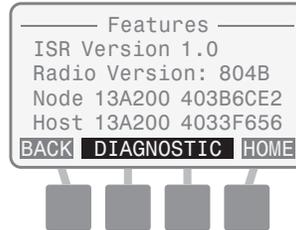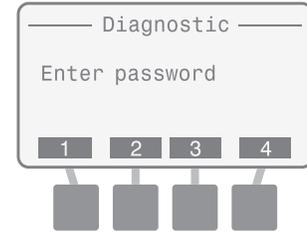
7 The Diagnostic 3 screen appears. "Press M-TEST key to Start manufacturing functional test" is displayed. Press M-TEST.

```
———— Diagnostic 3 ————
Press M-TEST key to
Start manufacturing
functional test

EXIT M-TEST  <<   >>
```
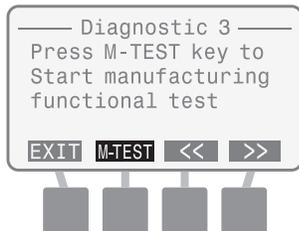
8 "Testing..." is displayed while conducting the test.
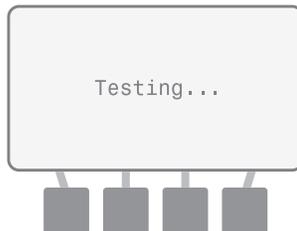
```
Testing...
```

9 When complete, the MFG TEST RESULTS screen appears.

```
———— MFG TEST RESULTS ————
Vbat: 4.88              OK
Xbee: 804B Awake ---    OK
SDHC: Card Ready        OK

EXIT                  RETRY
```
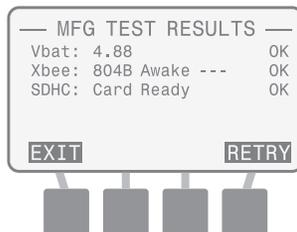
↻ Press RETRY to conduct the test again if desired.

this page intentionally left blank

Installation

Overview

This section provides instructions for installing the Rain Bird Integrated Sensor System (ISS) hardware.

Installation Checklist

When installing the ISS for the first time, it is recommended that the Installation Checklist be used as a step-by-step guide to the installation process. For your convenience a check-off box is provided for each step.

❑ Conduct Site Survey

❑ Gather Required Tools

❑ Sensor Installation

❑ Data Logger and Repeater Installation

❑ Network Hardware Installation

❑ Software Installation (not covered in this manual)

Conduct Site Survey

A site survey is required prior to installing the ISS. The site survey will help determine the number of Soil Sensors, Data Loggers and Repeaters that are necessary for installation site coverage.

Locations

Using a scaled map of the golf course or irrigation site, mark the potential locations for each network device (ISDL-2400, ISR-2400, and antenna) that will ensure optimum wireless communication. Figure 6 shows an example site survey location map.

⚠ **NOTE**: The unobstructed line of sight wireless range between units is guaranteed to be at least 800 yards, but factors such as changes in vegetation coverage through the seasons, tree and leaf growth, and new construction projects may affect wireless ranges.

General Considerations

- To take advantage of mesh networking, each Data Logger should be installed within wireless range of at least two other Repeaters to establish an alternate signal path.
- Each Repeater should be installed within range of at least two other Repeaters.

- The Gateway antenna should be within range of at least two Repeaters.
- Produce a map of the wireless network to determine the total number of network devices that will be required for installation and for future reference.
- Failure to conduct a site survey may lead to poor network communication.

Data Logger Considerations

- The maximum cable length between the furthest sensor on either wire path and the ISDL-2400 should not exceed 300 feet.
- Each wire path from the ISDL-2400 has a capacity of up to 8 sensors.

Repeater Considerations

- One ISR-2400 can receive data from multiple ISDL's, provided they are within wireless range.
- A maximum of 7 hops are allowed between the farthest unit (ISDL-2400 or ISR-2400) in the network and the radio antenna.

Once a preliminary map has been created, range tests need to be conducted in the field to verify wireless ranges between components. See the Wireless Network Range Test section for instructions.
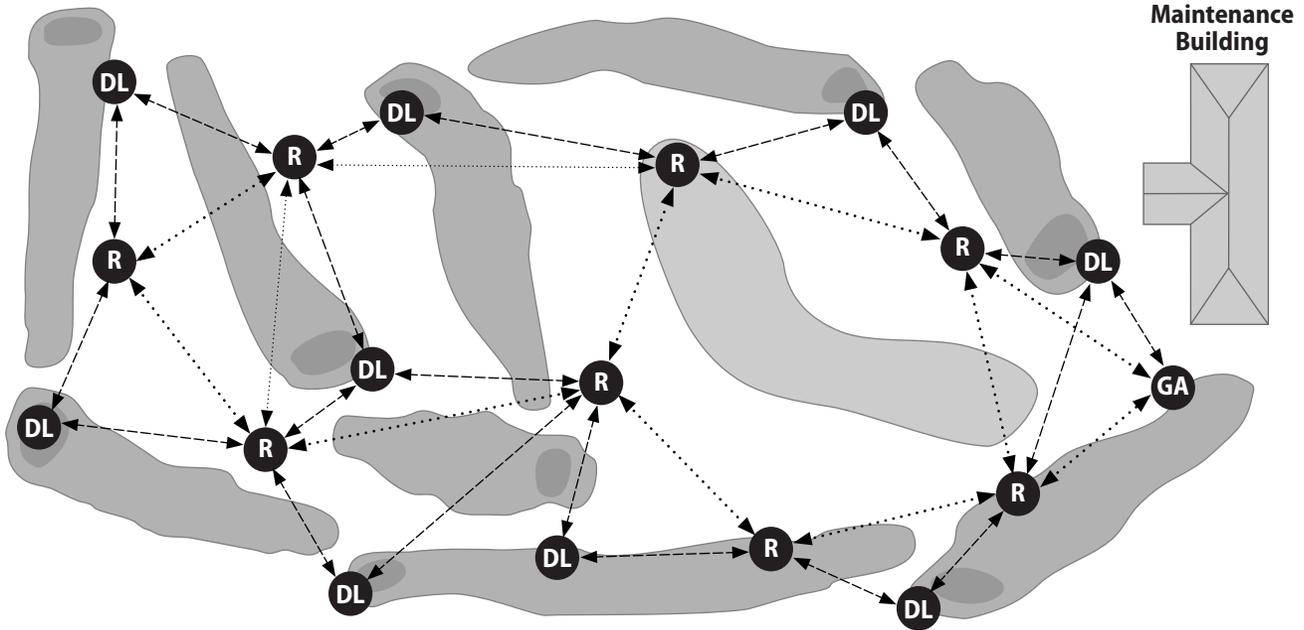
Figure 6 - Site Survey Location Example

Maintenance Building

Key

GA Antenna

DL Data Logger

R Repeater

! **NOTE:** Each data logger must be in direct range of at least two repeaters, or one repeater and the Gateway antenna, to ensure reliable network communication.

Integrated Sensor System (**65**)

Wireless Network Range Test

This procedure is used to verify the proposed locations of the system components on the Site Survey. The range tests confirm all units will be within wireless range before installation.

Items Required

❑ The Site Survey map

❑ Two ISR-2400 Wireless Repeaters

❑ A handheld GPS locator (optional)

❑ Handheld radios or cell phones for communication between testers

Conduct range tests in between every proposed unit location on the Site Survey for each ISDL-2400 and ISR-2400 pair, and also for each ISR-2400-ISR-2400 pair. Verify at least two ISR-2400's are within range of the radio antenna. Use the Site Survey map and the GPS locator to pinpoint proposed unit locations. The locations can be adjusted based on the range tests for efficient system operation.

! **NOTE:** Two ISR-2400 Repeaters must be used to verify every proposed location. It is important that the height of the repeaters while conducting the test matches the height of the units when installed.

Conduct Range Test

1 Power on ISR #1 at the first proposed location, 5 feet above ground.

2 On the Home screen, press the MENU button.

```
┌────── Home ──────┐
│09/23/2010  03:28:45│
│Vbat:HIGH  Link:    │
│Last SYNC:          │
│Radio Status:  Awake│
│ MENU  WAKE         │
└────────────────────┘
```

3 The Menu screen appears. Press the UP or DOWN button to select Range Test; press OK.

```
┌────── Menu ──────┐
│ Manual Radio       │
│ System Reset       │
│ SD Card Information │
│ Range Test         │
│ HOME  UP  DOWN  OK │
└────────────────────┘
```
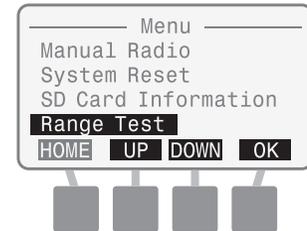
4 The Range Test screen appears. Press the UP or DOWN button to highlight Loopback Mode; do not press OK.

```
┌──── Range Test ────┐
│ Loopback Mode      │
│ Transmit Mode      │
│                    │
│ BACK  UP  DOWN  OK │
└────────────────────┘
```
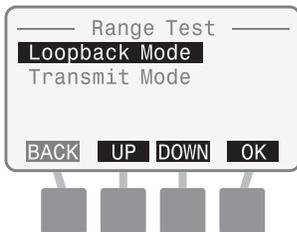
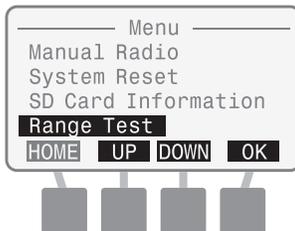**5** Power on ISR #2 at the second proposed location, 5 feet above ground.

6 On the Home screen, press the MENU button.
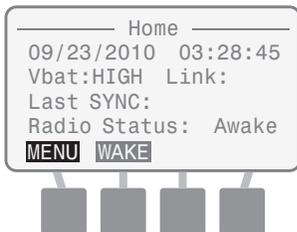
```
┌──────── Home ────────┐
│ 09/23/2010  03:28:45 │
│ Vbat:HIGH  Link:     │
│ Last SYNC:           │
│ Radio Status:  Awake │
│ MENU  WAKE           │
└──────────────────────┘
```

7 The Menu screen appears. Press the UP or DOWN button to select Range Test; press OK.

```
┌──────── Menu ────────┐
│ Manual Radio         │
│ System Reset         │
│ SD Card Information   │
│ Range Test           │
│ HOME  UP  DOWN   OK  │
└──────────────────────┘
```

8 The Range Test screen appears. Press the UP or DOWN button to highlight Transmit Mode; do not press OK.

```
┌──── Range Test ────┐
│ Loopback Mode      │
│ Transmit Mode      │
│                    │
│ BACK  UP  DOWN  OK │
└────────────────────┘
```
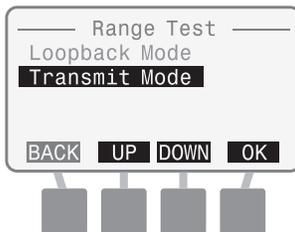
9 Each tester should now press OK to start the range test at the same time.

! **NOTE:** The radio status on each ISR will display "Setup" for a few seconds, then "Awake" when the test begins.

10 On ISR #1, the Range Test Loopback Mode screen is displayed. (ISR #1 is now ready to receive and re-transmit data packets from ISR #2.)

```
┌──── Range Test ────┐
│ Loopback Mode      │
│ Radio Status:  Setup│
│ RSSI: --- dBm      │
│ Packet Count:    0 │
│ BACK     CLEAR HOME│
└────────────────────┘
```
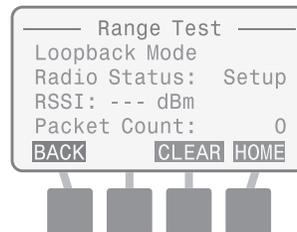
11 On ISR #2, the Range Test Transmit Mode screen is displayed.

```
┌──── Range Test ────┐
 Transmit Mode
 Radio Status:  Setup
 RSSI: --- dBm
 Rx/Tx:   0/        0
 BACK        CLEAR HOME
└────────────────────┘
```
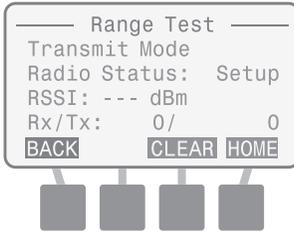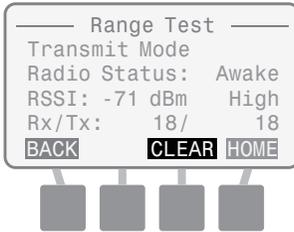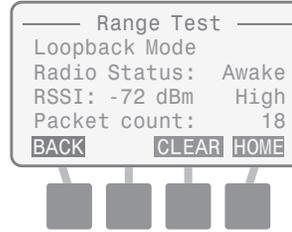
12 When the test begins and data packets are transmitted and received back from ISR #1, the following screen is displayed on ISR #2.

```
┌──── Range Test ────┐
 Transmit Mode
 Radio Status:  Awake
 RSSI: -71 dBm   High
 Rx/Tx:   18/      18
 BACK        CLEAR HOME
└────────────────────┘
```

13 The following screen is now displayed on ISR #1.

```
┌──── Range Test ────┐
 Loopback Mode
 Radio Status:  Awake
 RSSI: -72 dBm   High
 Packet count:     18
 BACK        CLEAR HOME
└────────────────────┘
```

14 Observe RSSI and RX/TX values at ISR #2 and see Tables 1 and 2 for acceptable values.

! **NOTE:** Acceptable RSSI values are based on ISR #2 only.

15 Repeaters can be moved closer and farther apart to finalize the proposed locations on the Site Survey map.

Potential values for RSSI (Received Signal Strength Indicator) and RX/TX (received packets/transmitted packets) are shown in the following tables.

! **NOTE:** Acceptable values are an RSSI signal higher than -85 dBm and an RX/TX value above 90%.

Table 3 - Signal Strength

RSSI Value (dBm)	Relative Strength
-92 to -85	Low
-85 to -80	Medium
Above -80	High

Table 4 - Packet Ratio

RX/TX Value (%)	Acceptable
90-100	Yes
0-90	No

! **NOTE:** The RX/TX value is displayed on the LCD as a ratio of packets received to packets transmitted. For example, if 10/10 is displayed, then 10 packets were received out of 10 packets transmitted for a percentage of 100%. If 5/10 is displayed, then only 5 packets were received out of 10 packets transmitted for a percentage of 50%.

Installation Tools Required

Before beginning installation, gather together the following tools and materials.

Required tools common to each type of install:

1. Lineman's Pliers
2. Tape Measure
3. Wire Stripper/Cutter
4. Marker

Required tools and materials to install sensors:

5. Spade or any cable pulling equipment (Sod cutter with mole kit, vibratory plough, etc.)
6. Three-conductor AWG-18 gauge irrigation cable
7. Rain Bird DB-series Wire Connectors
8. Valve Boxes (6")

Required tools and materials to install data loggers or repeaters:

9. Phillips slot-head screwdrivers (#1, #2, & #3 tip)
10. Torpedo Level
11. Electric Drill
12. Tie Straps

Additional materials required to install data loggers:

13. 3/4" flexible conduit
14. 3/4" metal strap (for flexible conduit)
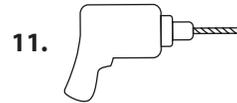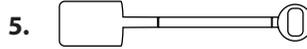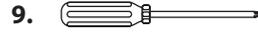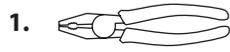15. 3/4" fitting (for flexible conduit)
16. Screws

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

13.

14.

15.

16.

Figure 7 - Installation Tools

Sensor Installation Overview

This section provides the procedures to install the sensors, wire paths, and valve boxes used to connect the sensors to the ISDL-2400 Data Logger.

Sensors

On a map of each green, mark the location of the ISDL-2400 based on the site survey. Determine the exact locations of the sensors that will provide effective soil monitoring coverage.

- Record sensor location to avoid damage when aerifying greens.

- Two sensors per location are recommended; a top sensor to monitor the root zone and a lower sensor to monitor salinity conditions.

! **NOTE:** Sensors must be addressed before installation. Prior to burial, connect each sensor one at a time to the data logger and take a reading to verify operation. These procedures are found in the Programming the ISDL-2400 Data Logger section of the manual.

Wire Paths

One or two wire paths, one for Channel 1 and one for Channel 2, can be installed to accommodate up to 18 sensors (9 per channel). The distance between the ISDL and the furthest sensor cannot exceed 300 feet. Use three-conductor AWG-18 gauge irrigation cable.

Valve Boxes

For future access, it is recommended that valve boxes be used to contain the sensor cable and wire path connections.
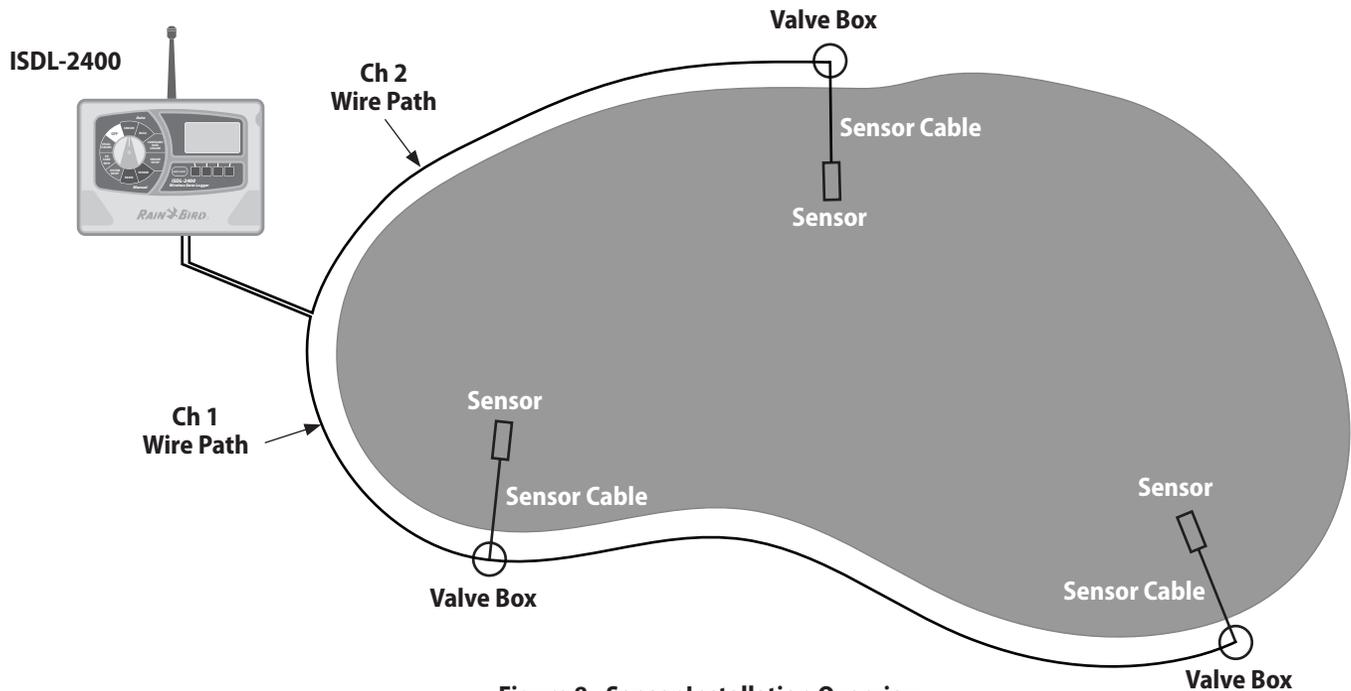
Figure 8 - Sensor Installation Overview

Sensor Installation
TSM-3 (Type 3) Soil Sensors
To Install the Sensors:

1 Using a spade (or other suitable tool), carefully cut and remove turf area where the sensor(s) will be located. Dig sensor holes as deep as the depth of the lower sensor (if two will be used) as shown in Figure 9.

2 Cut trenches for sensor cables, perpendicular to the green edge and running from the sensor hole to 1-2 feet past the edge of the green at valve box location.

! **NOTE:** Sensor cable should be placed deep enough to avoid damage from deep tine aerification.

3 Set sensor(s) into the bottom of the hole and run each sensor cable into the trench and back to valve box location.

4 Push one sensor into the soil at the bottom of the hole. Push the other sensor into the side of the hole at the root zone (typically about 3" below grade).

⚠ **CAUTION:** Be sure to push all four sensor probes completely into the undisturbed soil. Otherwise, air pockets may be created when the hole is filled in that cause inaccurate sensor readings.

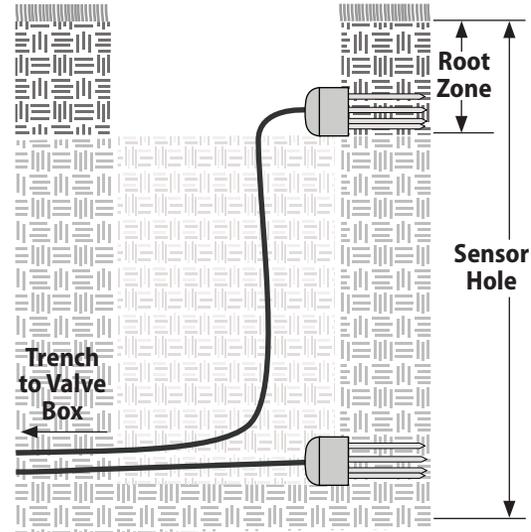**5** Carefully replace soil and turf over the sensor hole and wire path trench.

Figure 9 - Type 3 Sensor Installation

Wire Path Installation

To Install the Wire Path:

1 Using a spade, sod cutter with blade mole kit, or a vibratory plough, lay cable around the green deep enough to avoid damage from aerificaiton as shown in Figure 10. Start at either the data logger or the furthest valve box location.

2 Set the wire into the trench, leaving enough extra wire to make the data logger and valve box connections.

3 Replace the soil and turf carefully over the trenches so that after a short healing period the installation is no longer visible.
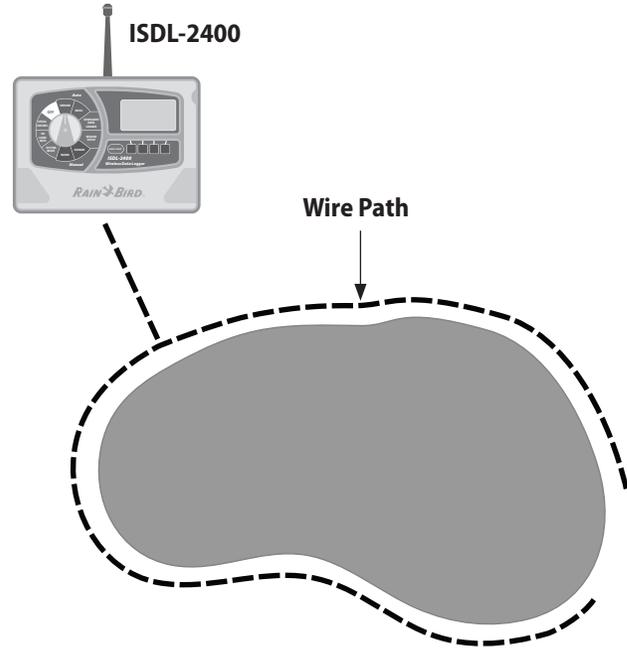
ISDL-2400

Wire Path

Figure 10 - Wire Path Installation

Valve Box Installation

To install the valve boxes:

1 At each valve box, locate and identify the wire path and the sensor cable as shown in Figure 11.

2 Use a wire cutter to cut the wire path, and insert the two ends of the wire path and the end of the sensor cable into the valve box.

3 Using a wire stripper and Rain Bird DB-series wire connectors, connect the sensor cable to the wire path as shown.

Table 5 - Cable Wires

Cable	Data	Power	Ground
Wire Path	Green	Red	White
TMS-3 (Type 3)	Blue	Red	Black

4 Replace the soil and turf carefully around the valve box so that after a short healing period the installation is no longer visible.
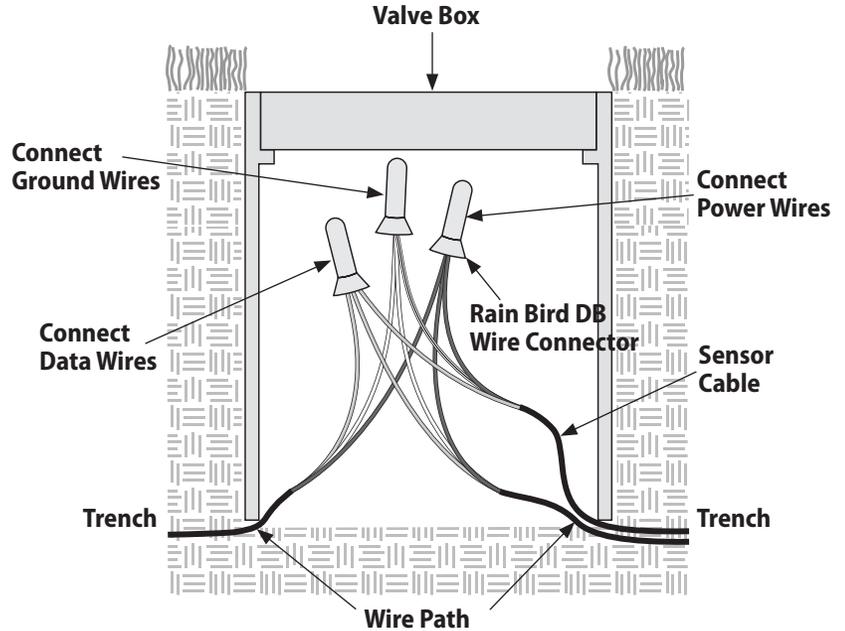

Figure 11 - Valve Box Wiring Diagram

Data Logger and Repeater Installation Overview

This section provides the procedures to install ISDL-2400 Data Loggers and ISR-2400 Repeaters.

Check Box Contents

Components below are included with each ISDL-2400 or ISR-2400 and are required for installation. If anything is missing, please contact your distributor before proceeding.

1. ISDL-2400 or ISR-2400 unit
2. Ribbon Cable
3. Antenna
4. Antenna Rubber O-Ring
5. Machine Screws (4)
6. SD Card (ISDL-2400 only)
7. Keys
8. Mounting Bracket
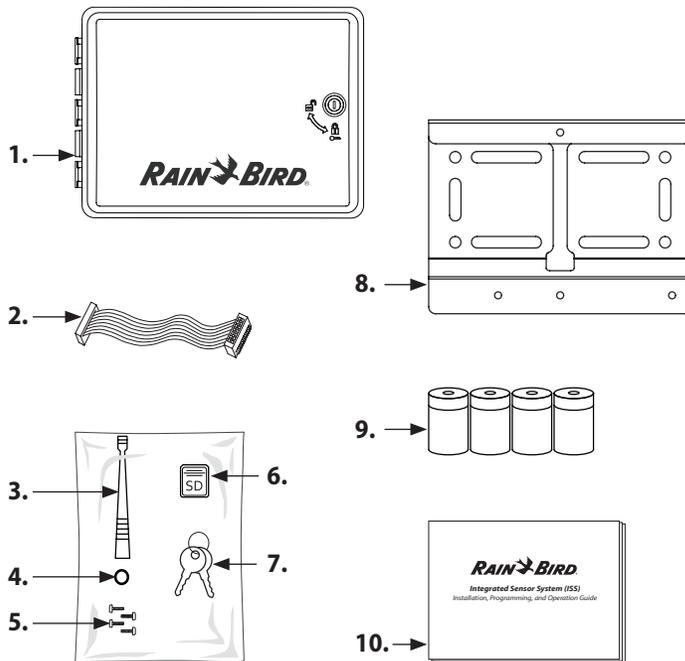9. D-Cell Batteries (4)
10. User's Guide


Figure 12 - Box Contents

Data Logger and Repeater Installation

**To Install the Data Logger or Repeater:**

Determine the exact location of the Data Logger or Repeater based on the site survey. Each unit must be installed on a flat, stable surface such as a 4x4 wooden post or a metal stake (U-bolt would be required).

! **NOTE:** Allow at least 12" of horizontal clearance to the left side of the unit, to allow the hinged door to swing fully open. For ISDL-2400 Data Loggers, leave at least 3" of clearance under the unit for cable conduit.

1 The unit must be mounted at least 5 ft. above grade to ensure wireless network communication.

2 Attach the mounting bracket, using appropriate hardware for the location surface.

3 Insert one of the four provided machine screws into the top hole of the mounting bracket, and tighten until a 1/8" gap remains.

4 Hang the ISDL-2400 or ISR-2400 on the screw using the keyhole slot located on the back of the unit. Make sure the screw is secure in the narrow part of the keyhole slot.

(ISDL Shown)

12in +

3in +

2 **3** Machine Screw

4 Keyhole Slot

1 5ft

Facing View

Side View
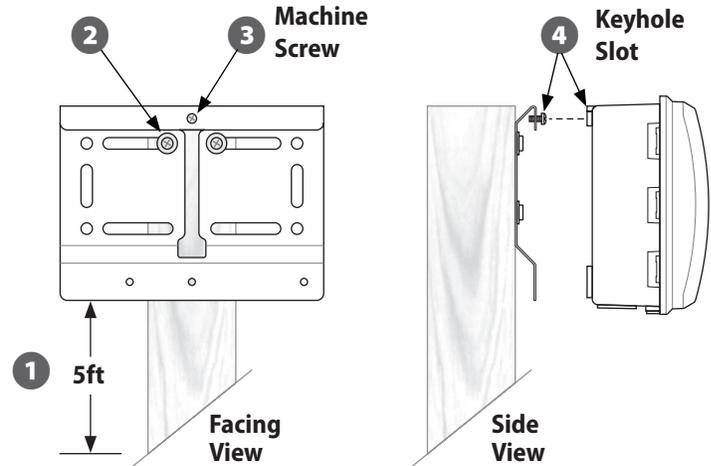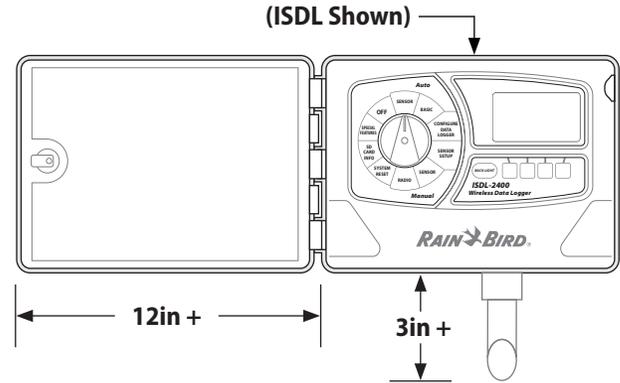
5 If necessary, unlock the door of the unit with the supplied key. Then open the door of the unit and swing it to the left.

6 Open the front panel and swing it open to the left, exposing the interior of the unit.

! **NOTE:** If it makes installation easier, the front door and front panel can be removed and then re-attached when installation is complete.

7 Insert the remaining three machine screws through the mounting holes on the inside of the unit and screw them into the threaded holes in the mounting bracket. Verify that the unit is secure.

8 Install batteries according to procedures described in the Maintenance section of this manual.

4X Batteries

3X Machine Screws
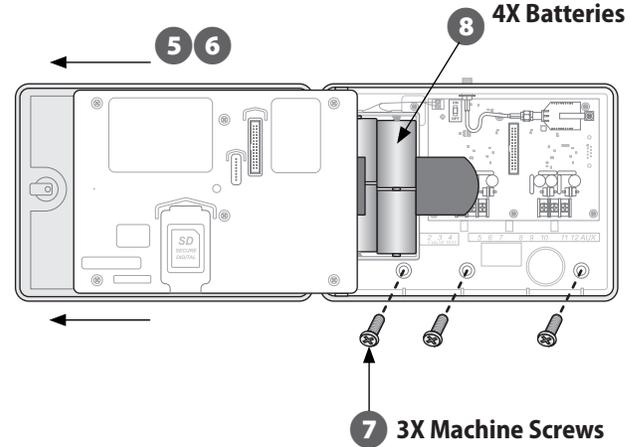
9   Install SD Card according to procedures described in the Maintenance section of this manual.

10   Connect one end of the ribbon cable to the printed circuit board connector and the other end to the connector on the back of the front panel.

⬥ **CAUTION:** When connecting the ribbon cable, observe the keyed orientation of the connector. The red line on the cable should be on the top.

11   Slide the rubber o-ring provided over the brass terminal post on top of the unit, then screw the antenna securely to the post. The connection should be tight.

12   For ISR-2400 Repeater, set the internal ON/OFF switch to the ON position.
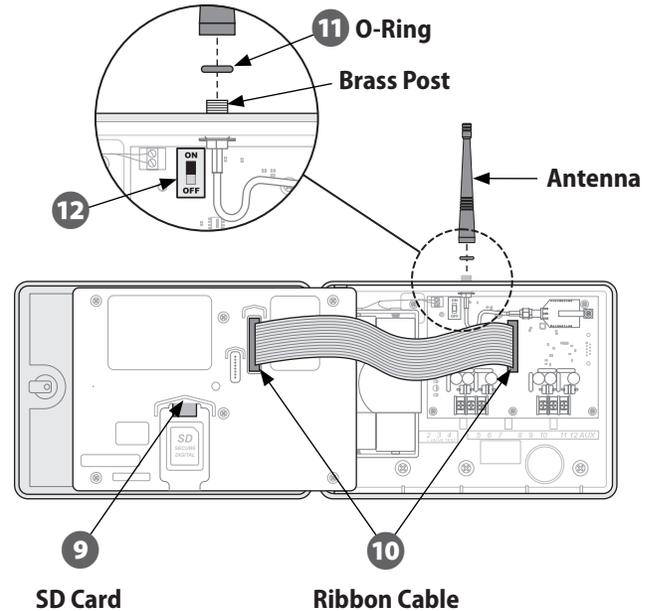
⚠ **NOTE:** For ISDL-2400 Data Logger installation, leave the switch in the OFF position.

Hardware installation for an ISDL Repeater is complete.

13   Configure the Repeater and verify functionality using the Programming the ISR-2400 Repeater section of this manual.

11 O-Ring

Brass Post

Antenna

12

9

SD Card

10

Ribbon Cable

Data Logger installation continued...

! **NOTE:** It is recommended that cable conduit and a conduit fitting be used to protect exposed wires.

14 Install cable conduit and fitting underneath the Data Logger, and route wire paths through the conduit and up through the knock-out hole in the bottom of the ISDL-2400 unit.

15 Connect the wires to the Ch 1 or Ch 2 posts and label each wire clearly for future reference.

16 Set the internal ON/OFF switch to the ON position.

17 Configure the Data Logger and verify functionality using the Programming the ISDL-2400 Data Logger section of this manual.

16

14

15

GND

DATA

PWR

Wire Path to Ch1 (1-9)

Wire Path to Ch2 (a-i)
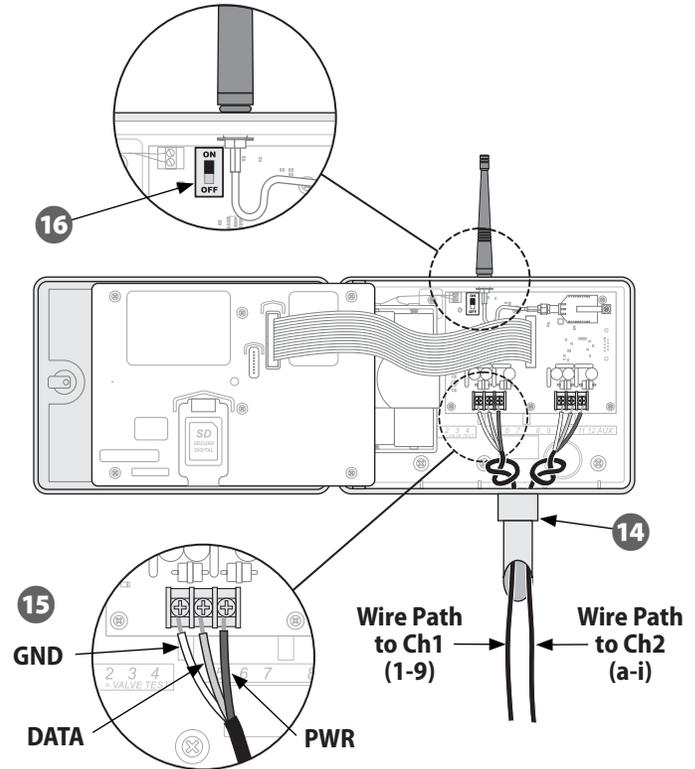
Network Hardware Installation

This section provides the procedures to install the wireless network hardware.

Antenna

Determine an installation site for the antenna to allow maximum wireless network reception. This can be on the roof the building where the central workstation is located, or else another appropriate location.

To Install the Antenna:

- Install the antenna according to the manufacturer's instructions.
- Run the antenna cable from the antenna to the location of the ISG-2400 Wireless Gateway router.
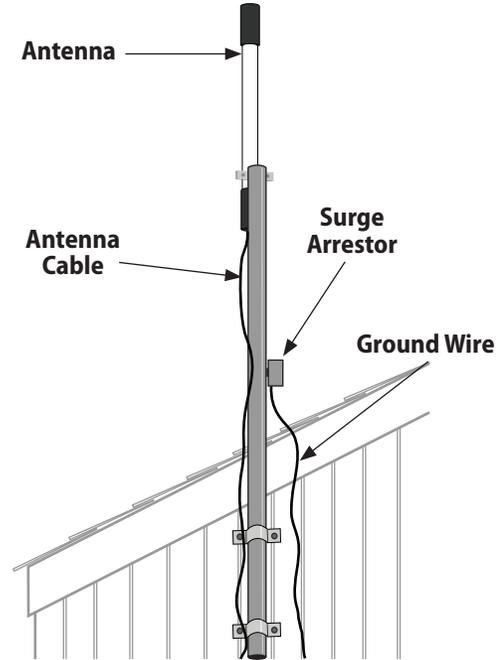
Antenna

Antenna Cable

Surge Arrestor

Ground Wire

Figure 13 - Antenna Installation

ISG-2400 Wireless Gateway

Place (or mount if desired) the ISG-2400 Gateway within USB cable range of the central workstation computer.

> **!** **NOTE:** The ISG-2400 Gateway router MUST be located indoors and away from outside exposure.

To Install the Gateway:

- Connect antenna cable to the XBee Antenna Connector jack on the ISG-2400 Gateway.

- Connect the USB cable to the Gateway and an open USB port on the workstation computer, preferably on the back of the computer to prevent accidental removal.

USB Cable

Antenna Cable

Figure 14 - ISG-2400 Gateway Router Installation

Configuration

The procedures for configuring and operating the Wireless Network for the Integrated Sensor System (ISS) can be found in the Rain Bird Soil Manager Software User's Guide.

this page intentionally left blank

Appendix

Radio Modes

The radio module installed in each ISDL-2400 Wireless Data Logger and ISR-2400 Wireless Repeater operates in three possible modes, indicated on various LCD displays by the Radio Status:

- Awake- the radio is active and able to transmit and receive data.

- Sleep- the radio is inactive when not in use to conserve battery power.

- Setup- the radio briefly enters Setup mode when first powered on or when beginning a range test.

The ISDL-2400 and ISR-2400 radio mode changes from Sleep to Awake at every sampling period. If the unit is part of a network, the sampling period interval and the length of time that the radio mode changes to Awake is controlled at the central workstation by a sync command from the Soil Manager.

Several programming features of the ISDL-2400 and the ISR-2400 provide the ability to force the radio mode to Awake using the WAKE option. If this function is used, the radio will wake up for approximately 30 seconds and attempt to communicate with the wireless network. If unsuccessful, the radio will default to a 2 second Wake/2 second Sleep repeated cycle until communication is reestablished.

RSSI (Received Signal Strength Indicator) is the received radio signal strength from the wireless network, measured in dBm, or the power ratio in decibels.

Table 6 - RSSI Values

Value	Relative Strength
-92 to -85	Low
-85 to -80	Medium
Above -80	High

Maintenance

This section provides instructions to replace the batteries in each unit and to replace or install an SD card.

Battery Replacement

The ISDL-2400 and the ISR-2400 are powered by four D-cell alkaline batteries. The battery levels are displayed at each unit (Vbat) and sent to the central workstation. Estimated minimum battery life is twelve months in 20°C (68°F) environment, assuming 100 readings per day.

To replace the batteries in the ISDL-2400 or the ISR-2400:

1 If necessary, unlock the door of the unit with the supplied key. Then open the door of the unit and swing it to the left.

2 Open the front panel and swing it open to the left, exposing the interior of the unit.

3 Ensure the internal power switch is turned OFF.

4 Remove the Velcro strap from the plastic clip holding the batteries in place.

5 Remove and replace the four D-cell batteries.

6 Slide the Velcro strap back through the plastic clip and secure.

7 Turn the internal power switch to ON.

8 Close the front panel.

9 Verify proper operation of the unit.

10 Close the front cover.

SD Card Replacement

The SD card slot located inside the front panel of the ISDL-2400 is used to provide sensor data storage, and upgrade the firmware on both the ISDL-2400 and ISR-2400 when necessary.

To replace or install an SD card:

1 If necessary, unlock the door of the unit with the supplied key. Then open the door of the unit and swing it to the left.

2 Open the front panel and swing it open to the left, exposing the interior of the unit.

3 To remove an installed card, gently press up on the bottom of the card to release.

4 To replace, slide an SD card up into the slot until it locks into place.

CAUTION: If the SD card is removed during a sensor reading, data may be corrupted. Only remove an SD card in between sampling periods.

Troubleshooting

This section provides help to resolve issues that may arise while operating or installing the ISS™.

General Troubleshooting

Table 7 - General Troubleshooting

Problem	Solution
No display on LCD.	Press backlight button. If display doesn't light up, check batteries.
Unresponsive programming button.	Turn power OFF then back ON.
Sensor cannot be addressed.	Using the QUERY function, see if the address already exists. If not, perform RESET and add new address. If unsuccessful, replace sensor.
Date and time revert to default values.	Manually change date and time using Configure menu or wait for next network sync.
Low RSSI values displayed.	Run diagnostic tests. Verify unit is in range of wireless network.
No RSSI value is displayed.	

Problem	Solution
SD "card not ready" message is displayed.	Verify an SD card is installed properly. (ISDL only)
No sensor readings.	Check sensor setup on the Data Logger, and verify sensor and bus cable connections are correct. Replace sensor if required.
"no sensor installed" message is displayed.	
"no sensor found" message is displayed.	
LCD displays Sensor Error Code.	

Sensor Error Codes

If a sensor error code is displayed after performing the MANUAL SENSOR READ function, use the following procedure to determine the cause of the error.

Follow the steps in the table in order until the error clears or the problem is identified.

Table 8 - Sensor Error Code Procedure

Step	Action
1	If the sensor is not buried in the soil, verify there is no obvious external damage.
2	Verify there is a Rain Bird logo on the sensor; if not, the sensor is not Rain Bird certified and needs to be replaced.
3	Ensure the sensor probes are completely buried in the soil when the MANUAL SENSOR READ is performed, or the sensor will not work properly.
4	Turn the dial to MANUAL SENSOR and press READ; continue with Step 5 if the error does not clear.

Step	Action
5	Check the wiring connections to the terminals inside the ISDL-2400: a) Inspect wires for open and/or short circuits. b) Verify wires are connected to the correct terminal (PWR, GND, DATA) and the correct channel (Ch1 or Ch2). Refer to the diagram on page 81.
6	Check the wiring connections at the DB connectors (inside the valve box): a) Inspect wires for open and/or short circuits. b) Verify wiring connections are correct. Refer to the diagram on page 76.
7	Turn the dial to SENSOR SETUP and select "Scan Sensors". If a sensor address is detected, proceed to step 8. If no address is detected, go to step 9.
8	Select " Remove" to remove the suspect sensor from the data logger. Then select "Add Sensor" to reinstall the sensor. Turn the dial to MANUAL SENSOR and press READ.
9	If the error code persists, record the sensor address, sensor error code, and ISDL node ID. Contact Rain Bird GSP for advanced troubleshooting.

Diagnostic Tests

The following tables list test results that are displayed after running each diagnostic test.

Table 9 - Diagnostic 1 Test Results

Test Result	Expected Value	Details
Radio Status	Awake or Sleep	Shows current radio status
RSSI Value	Above -80	Low: -92 to -85, Medium: -85 to -80, High: Above -80
Battery Level	4-6	LOW, MED, HIGH
Packet Efficiency	90 - 100%	Compares data packets received with data packets transmitted

Table 10 - Diagnostic 2 Test Results

Test Result	Expected Value	Details
Radio Status	Awake or Sleep	Shows current radio status
Last Wake	hr : min : sec	Elapsed time since last wake
Next Wake	hr : min : sec	Time until next wake
Last SYNC	hr : min : sec	Elapsed time since last sync with Soil Manager

Table 11 - Diagnostic 3 Test Results

Test Result	Expected Value	Details
Vbat	4-6	OK/FAIL (Battery voltage indication)
Xbee	8.04 B Awake	OK/FAIL (FAIL indicates possible radio module failure)
SDHC	Card Ready	OK/FAIL (SD card not installed or failed)
CH 1	Sensor [x] 2mA	Only used for engineering testing
CH 2	Sensor [x] 2mA	

Rain Bird Support

Rain Bird Technical Services

(800) RAINBIRD (U.S. and Canada)

Visit us at www.rainbird.com/ISS

List of Figures

List of Tables

this page intentionally left blank

Declaration of Conformity

Application of Council Directives: EMC 2004/108/EC and R&TTE 1999/5/EC

**Standards To Which Conformity Is Declared**

EN61000-6-3: 2006
  EN55022 Radiated Emissions Class B
EN61000-6-1: 2005
  EN61000-4-2
  EN61000-4-3
  EN61000-4-4
  EN61000-4-6
ETSI EN 301 489-1
ETSI EN 301 489-17
  EN61000-4-2
  EN61000-4-3
  EN61000-4-4
  EN61000-4-6

Manufacturer's Name: Rain Bird Corporation
Manufacturer's Address: 9491 Ridgehaven Court
San Diego, CA 92123
Manufacturer's Phone: (626) 812-3400

Equipment Description: Integrated Sensor System™ ISS
Equipment Class: Generic Requirements
Integrated Sensor System contains the following component model numbers:

Model Numbers: Data Logger: ISDL-2400
Repeater: ISR-2400
Soil Sensors: TSM-1/TSM-3

I the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).

Place: San Diego, CA USA

Signature:
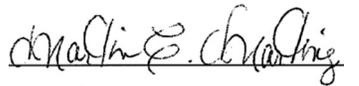
Full Name: Martin C. Martinez
Position: Sustaining Engineering Group Manager

RAIN BIRD.

RAIN BIRD CORPORATION
6991 East Southpoint Road
Tucson, AZ 85756

www.rainbird.com