



MicroMax
Instruments

Interrupters

User Guide

Information in this document is subject to change without notice.

© 1999 - 2019 American Innovations, Ltd. All rights reserved.

American Innovations | www.aiworldwide.com | 12211 Technology Blvd | Austin, TX 78727

Reproduction in any manner whatsoever without the written permission of American Innovations is strictly forbidden.

The American Innovations logo and icon and products are trademarks of American Innovations, Ltd. Other trademarks and trade names may be used in this document to refer to either the entities claiming the marks and names or their products. American Innovations, Ltd. disclaims any proprietary interest in trademarks and trade names other than its own.

Revised May 2019

Contents

Chapter 1: Getting Started	1
Interrupter Overview	1
Relay and Interruption Features	2
Mounting and Power Features	3
Working with Other Brands of Interrupters	3
Supplied Power Cables and GPS Antenna	4
Required Tools and Equipment	6
Optional Hardware and Software	6
Contacting Technical Services	7
Chapter 2: GPS300 Installation	8
Installing the GPS300 Interrupter	8
Determining a Power Source	8
Connecting a Relay	9
Connecting the GPS Antenna	11
Setting Display Contrast	12
Viewing GPS Info	12
Running a Test Program	13
Chapter 3: GPS350 Installation	14
Installing the GPS350 Interrupter	14
Determining a Power Source	15
Connecting the Built-in Relay to a Rectifier	15
Connecting the GPS Antenna	17
Setting Display Contrast	18
Viewing GPS Info	18
Running a Test Program	19
Chapter 4: GPS360 Installation	21
Installing the GPS360 Interrupter	21
GPS360 Power and Battery Information	22
Determining a Power Source	22
Connecting the Built-in Relay to a Rectifier	23
Connecting the GPS Antenna	24
Connecting an External Relay with Line Power	26
Setting Display Contrast	27

Viewing GPS Info	28
Running a Test Program	29

Chapter 5: Interrupter Programming 30

Status Icons	30
Configuring with Unit Keypad	31
Setting Up and Running an Interruption Program	31
Setting Up an Interference Interruption Program	33
Options Features	35
Output Parameters	36
Setting the UTC Offset	37
Using Zero Crossing	38
Resetting to Factory Defaults with Keypad	38
Configuring with Bullhorn Tools	39
Installing Bullhorn Tools	40
Connecting Unit and Starting Bullhorn Tools	40
Configuring the Interrupter	41
Viewing Unit Information	42
Using Saved Templates	42
Setting Up Interruption Options	43
Setting Up Interruption Programs	44
Setting Up an Interference Interruption Program	47
Creating a Settings Template	49
Using Saved Templates	49
Importing a Saved Template	50
Applying a Saved Template	51
Exporting or Deleting Saved Templates	52
Resetting to Factory Defaults with Bullhorn Tools	53
Upgrading Firmware	54
Exiting Bullhorn Tools	54

Appendix A: Factory Defaults Settings 56

Appendix B: Technical Specifications 57

Appendix C: Derating Tables 59

GPS350 Derating Table	59
GPS360 Derating Table	59

Appendix D: Mercury Relay Advisory 61

Appendix E: Regulatory Notices 63

Export Control Classification Number 63

Getting Started

The MicroMax GPS300, GPS350, and GPS360 interrupters are programmable, GPS-synchronized, current interrupters. The information in this guide is intended for authorized service personnel who plan to install and program an interrupter for service.

This section includes the following topics:

- [Interrupter Overview on page 1](#)
- [Supplied Power Cables and GPS Antenna on page 4](#)
- [Required Tools and Equipment on page 6](#)
- [Optional Hardware and Software on page 6](#)
- [Contacting Technical Services on page 7](#)

Interrupter Overview

The MicroMax GPS300, GPS350, and GPS360 interrupters are fully programmable, satellite-synchronized interrupters that are capable of interrupting rectifier, bond, or any other current. Cycles can be programmed using any combination of time intervals between 0.1 seconds and 999.9 seconds (in 0.1 second increments) for "Off" and "On" cycles. The interrupters can store up to 9 interruption programs for later use.



Figure 1-1. MicroMax Interrupters

The MicroMax GPS350 and GPS360 also include a built-in solid state relay (normally closed) that can interrupt either AC or DC, up to 60 A with on/off cycles of less than 4 seconds and 80 A with cycles totaling 4 seconds or longer. The relay can be easily installed without concern for polarity. The GPS360 includes a battery for use without an external power source.

Output parameters are set to accommodate any external relay configuration. Additionally, the menu-driven synchronization configuration allows the interrupter to operate with almost any other brand of GPS synchronized interrupter or data logger. Based on the number of satellites seen and the quality of view, synchronization triggering accuracy is specified to within 1 μ s with any other MicroMax interrupter.

A unique patent-pending *Interference Mode* interruption cycle allows rectifier influence studies with greatly increased productivity and ease of data interpretation. By operating in interference mode, it is possible to determine the influence from each individual rectifier being interrupted and get the instant "Off" and "On" pipe-to-soil potentials, all during a single visit to a test station. The influence from up to 99 rectifiers can be studied simultaneously using *Interference Mode*.

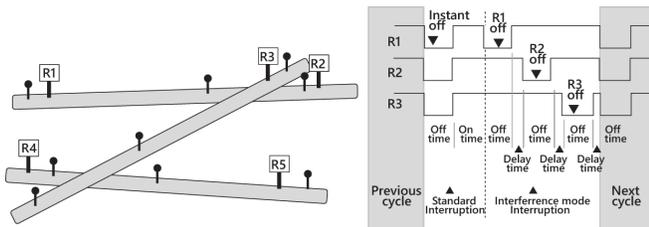


Figure 1-2. Interference Mode Example

The MicroMax interrupters also allow for full cathodic protection (CP) polarization when the interrupter is not in use (rectifier "on" and no interruption).

Relay and Interruption Features

The GPS300, GPS350, and GPS360 interrupters can be connected to almost any external current relay (or multiple relays) using a 12V control. Depending on the configuration, the interrupter supplies up to 500mA (12V) relay control current. As a result, numerous relays can be controlled with one interrupter. This leads to significant cost savings in areas where multiple current sources in a confined area need to be switched. The MicroMax interrupters can be set to accommodate normally open and normally closed relays. There are several relay options for switching either AC or DC at various loads.

The GPS350 and GPS360 include a built-in solid state relay that can interrupt either AC or DC, up to 60 A with on/off cycles of less than 4 seconds and 80 A with cycles totaling 4 seconds or longer. The internal relay can be easily installed without concern for polarity.

The MicroMax interrupter relay and interruption features include:

- The interrupters can drive an external relay of 100 A / 100 V (higher capacities available).
- The interrupters can be connected to any external current relay (or multiple relays). The interrupter supplies up to 500mA.
- **GPS300** can be used with a solid state relay (AC or DC) or mercury relay (AC or DC).

NOTE: For important information about mercury relays, refer to [Mercury Relay Advisory on page 61](#).

- **GPS350** and **GPS360** have a built-in solid state relay that can interrupt either AC or DC, up to 60 A with on/off cycles of less than 4 seconds and 80 A with cycles totaling 4 seconds or longer. The relay is **Normally Closed**.
- The interrupters include the ability to use Zero Crossing to set when timed measurements are taken. Zero Crossing allows you to use the instant when the AC crosses zero instead of using a GPS reading.
- With external relays, user-selectable control of the interrupters output to 0 V or 12 V for "On" or "Off." (Accommodates normally open or normally closed relays.)
- Synchronization can be set on the leading or falling edge of the interruption cycle.
- Interruption continues automatically after power is disrupted.
- Cycle range up to 999.9 seconds in 0.1 second increments.
- Synchronization triggering accuracy is within 1 μ s with any other GPS300 or GPS350 interrupter and collectively is less than 5 μ s after the PPS signal (precise positioning service signal) as provided by the GPS satellite constellation, even when only one satellite is visible.
- The interrupters are fully programmable between the following schedules: continuous, daily, start/stop, and interference. Can store up to nine different interruption programs for later use.

Mounting and Power Features

- **GPS350** and **GPS360** are shipped with factory-installed mounting magnets that can be used to easily attach the interrupter to an available surface.
- **GPS360** includes an internal, rechargeable battery.

NOTE: Be sure to fully charge the battery before field use.

- Interrupters can be powered from either AC or DC, with a wide range of input voltages.

Working with Other Brands of Interrupters

The MicroMax GPS300, GPS350, and GPS360 interrupters will work with most GPS-synchronized interrupters on the market. Most manufacturers use the same principle of calculating interruption synchronization.

Use the following procedure to synchronize a JR-2 interrupter with the MicroMax interrupters. The following procedure uses the optional, JR-2 adapter cable provided by AI.

1. Connect the JR-2 adapter cable to the JR-2 interrupter. Connect the other end of the adapter cable to the relay control output cable provided in the installation kit. Do not connect the banana plugs on the other end of the relay control output cable at this time.
2. Start the interrupter with the following output parameters and interruption settings:
 - **Switch:** Normally Closed (Low output = Off)
 - **Int. Cycle:** OFF/ON
 - **On** = 59.5 **Off** = 0.5
3. After the interrupter has started interruption, use the exact time of the interrupter as a guide when setting the JR-2 interrupter. Set the time ahead on the JR-2 interrupter to allow enough time to finish the procedure.
4. Before the next OFF cycle on the interrupter, connect the banana plugs on the JR-2 adapter cable to the **INPUT** connections on the power / relay assembly cable. Wait until an OFF cycle has executed.

The power cable assembly for the interrupter is typically used for the relay control output cable.
5. The interrupters should now be synchronized (clocks are set at the exact same time), and the interrupter can be set back to the required program.

Supplied Power Cables and GPS Antenna

The following cables are provided in the installation kit with the interrupters. The interrupters consume approximately 120 mA. External relay current consumption is additional, which is typically less than 10 mA for a solid state relay and as high as 400mA for a mechanical mercury relay.

NOTE: Refer to the interrupter's installation chapter for instructions on how to connect the cables.

- **Power Cable and AC/DC Power Input Cable with Alligator Clips**

Specifications for the cables after assembly:

- **INPUT:** 8-42 V AC or 10-60 V DC.
- **OUTPUT:** 10-14 V DC (500 mA maximum).
Red indicates positive (+); black indicates negative (-).

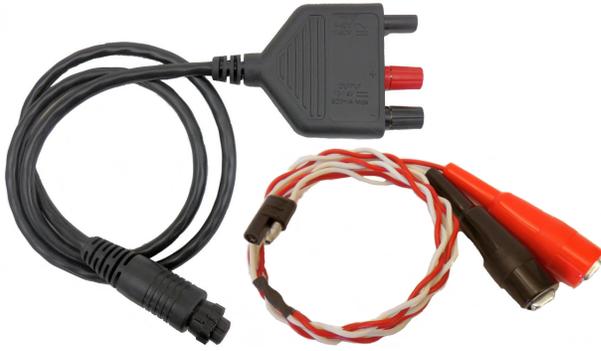


Figure 1-1. Power Cable and AC/DC Power Input Cable with Alligator Clips

- **GPS Antenna:** The GPS antenna should be mounted on a metal surface with a clear view of the sky.



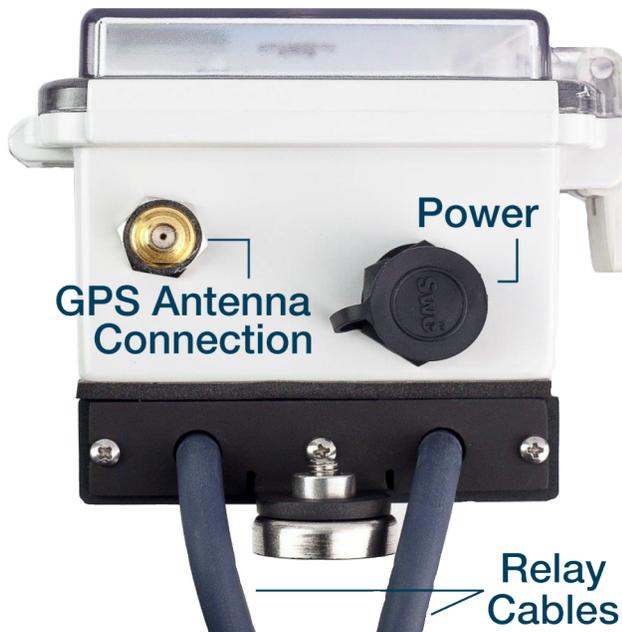
Figure 1-2. GPS Antenna

Below is an example of the connections located on the side of the GPS300.



Figure 1-3. GPS300 Connections

Below is an example of the connections located on the side of the GPS350 and GPS360.

**Figure 1-4. GPS350 and GPS360 Connections and Relay Cables**

Required Tools and Equipment

The following tools and equipment are required for installing and configuring the unit for service:

- Voltmeter
- Hand tools for installing relay

Optional Hardware and Software

MicroMax GPS300, GPS350, and GPS360 interrupters can be programmed through the unit's keyboard (refer to [Configuring with Unit Keypad on page 31](#)). As an alternative method of programming the interrupter, you can also configure the unit with Bullhorn Tools configuration software using a Microsoft Windows-based computer with the following hardware and software specifications:

- Pentium processor or equivalent
- 2 GB RAM (minimum)
- 400 MB free hard drive space (minimum); 1 GB recommended

- Spare USB port
- USB mini-b cable (standard mini USB cable typically used with most digital cameras)
- Microsoft Windows 7 Home Premium, Professional, or Ultimate or later versions
- Bullhorn Tools configuration software (available from [Bullhorn Tools](#) launch page)
- Windows Internet Explorer version 8.0 or higher
- Adobe Reader version 6.0 or higher (available from the [Adobe website](#))

Refer to [Configuring with Bullhorn Tools on page 39](#) for details on configuring with this software.

Contacting Technical Services

AI Technical Support is available to provide assistance with your unit, accept feedback about units, or discuss your organization's training needs. Use the following information to contact AI Technical Support:

Telephone:

1-800-229-3404

Email:

techservices@aiworldwide.com

Address:

American Innovations, Ltd.
Attn: AI Technical Support
12211 Technology Blvd.
Austin, TX 78727

GPS300 Installation

The GPS300 interrupter consumes approximately 120mA. Relay current consumption is additional, which is typically less than 10mA for a solid state relay and could be as high as 400mA for a mechanical mercury relay.

The GPS300 installation process includes the following steps:

- [Installing the GPS300 Interrupter on page 8](#)
- [Setting Display Contrast on page 12](#)
- [Viewing GPS Info on page 12](#)
- [Running a Test Program on page 13](#)

Installing the GPS300 Interrupter

When completing the following procedure, refer to [Supplied Power Cables and GPS Antenna on page 4](#) for input and output voltage specifications.

WARNING: Make sure to follow all precautions when working with the interrupter and high voltage circuits.

WARNING: Do not connect the GPS300 to *primary* power.

The installation process includes the following steps. Refer to the individual sections for each step for the complete instructions.

- [Determining a Power Source on page 8](#)
- [Connecting a Relay on page 9](#)
- [Connecting the GPS Antenna on page 11](#)

Determining a Power Source

Determine how to power the MicroMax interrupter using one of these possible sources:

1. Rectifier - with power turned on to the rectifier, use a voltmeter to locate a power source across two available AC taps. The interrupter requires 8-42 V AC or 10-60 V DC.
2. A 120 V AC convenience outlet to use with the 12 V DC wall adapter.
3. A DC source, such as a 10-60 V DC battery.

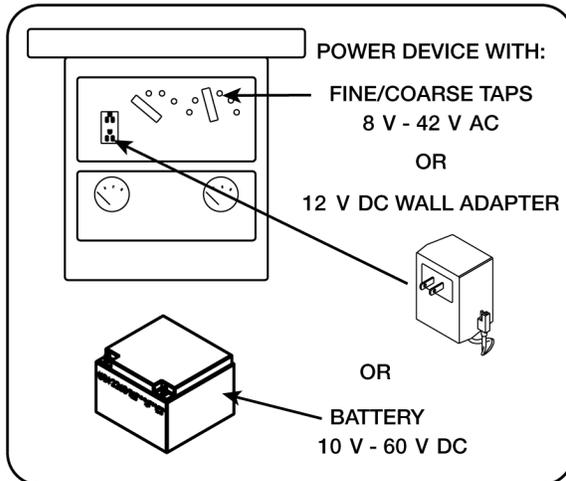


Figure 2-1. Power Source Options

Connecting a Relay

The GPS300 requires an external relay to perform interruptions. The GPS300 can be used with an AC, DC, or mercury relay. Refer to [Mercury Relay Advisory on page 61](#) if working with a mercury relay.

1. Turn **OFF** all power to the rectifier.
2. If a relay is not already installed, install an AC, DC, or mercury relay according to the relay's installation instructions.
3. Connect the GPS300 power cable to the GPS300 interrupter. Line up the notch on the cable to the connection on the interrupter. Twist ring on cable to lock the cable into the connection.



Figure 2-1. Power Cable and GPS300 Connection

4. Connect relay control or coil to the power cable **OUTPUT**. Be sure to observe proper polarity, especially if a flyback diode is present on a mercury relay coil.



Figure 2-2. Power Cable Connections

5. Connect the AC/DC Power Input cable to the power cable's **INPUT** connection.



Figure 2-3. AC/DC Power Input Cable Connected to Twisted Wire Cable

6. Clip the AC/DC Power Input cable's alligator clips to the rectifier Coarse AC taps. Voltage range is 8-42 V AC.

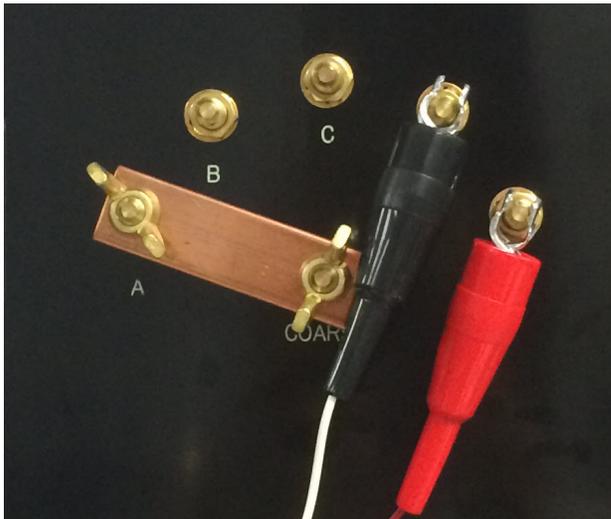


Figure 2-4. Alligator Clips Connected to Rectifier Taps

If you are connecting to a DC power source such as a battery, the power requirement is 10-60 V DC.

Connecting the GPS Antenna

1. Connect the magnetic-mount, GPS antenna to the GPS connector on the GPS300.



Figure 2-1. GPS Antenna Connection

2. Mount the GPS antenna on a metal surface making sure the antenna has a clear view of the sky. If a metal surface is unavailable, glue a flat washer on a suitable surface and then place the GPS antenna on the flat washer.

After applying power to the GPS300 interrupter, unit information briefly appears in the display.

After the initialization process completes, the interrupter displays the main menu. If the main menu does not display (this may take several minutes), make sure the interrupter is not currently running another program. If another program is running, press **PREV** and then **ENTER**.

3. The main menu displays available menu options that you can select. To select a menu option, use the keypad to select the number associated with the menu option. For example, press **1** on the keypad to select the **Interrupt** menu option.

The main menu also displays current time and date and satellite information. For information on the symbols shown on the screens, see [Status Icons on page 30](#).

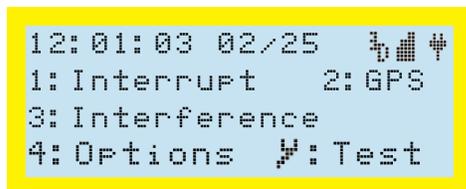


Figure 2-2. Main Menu

Refer to [Interrupter Programming on page 30](#) for more information on configuring the interrupter.

Setting Display Contrast

Use the up  and down  arrow keys on the keypad to adjust the contrast level of the display. Press and hold the up arrow to increase the contrast; press and hold the down arrow to decrease the contrast.

You can adjust the contrast level at any time **except** when the interrupter is running an interruption program.

Viewing GPS Info

The GPS Info screen includes status information for the current number of satellites in view, time zone, antenna, and the current time and date.



Figure 2-1. GPS Info

To display the GPS Info screen, press **2** from the main menu. Press **PREV** to return to the main menu.

The following list describes the type of information shown on the GPS Info screen:

- **15:32:01 02/20/14** — The current time and date. The time is shown in military time (24 hours) and uses the HH:MM:SS format to represent hours, minutes, and seconds. The date is shown in MM/DD/YYYY format to represent the month, day, and year. The plug symbol  indicates that power is present.
- **GPS Antenna OK** — The antenna status. If the antenna is disconnected or loose, the status message **Antenna OPEN** displays. If the antenna is shorted, the status message **Shorted** displays.
- **3D Fix Sats 09/12** — Shows whether a 2D or 3D GPS lock has been obtained and the number of satellites seen by the unit. In this example, **09/12** refers to 9 satellites in view out of 12 possible satellites. A 2D lock requires 3 satellites, while 3D lock requires at least 4 satellites. If the unit sees an insufficient number of satellites, move the antenna until at least a 2D lock (preferably a 3D lock) is achieved.

If no satellites are seen, the message **Acq Sat** appears in the display on the left side. The message **3D Fix** displays when the unit has established communication with at least four

satellites.

- **Current UTC -06** — The Universal Time Constant (UTC) that is used by the GPS system.

IMPORTANT: GPS lock is not needed for the GPS300 to operate. The internal clock updates as soon as the internal GPS locates satellites. For synchronized interruption or interference, make sure the antenna position enables at least a 2D lock.

Running a Test Program

Before programming the interrupter, you can test the interrupter by running a test program.

With the main menu displaying, press  to display and begin the Test Mode. Press **PREV** to cancel the test or when the test is done.

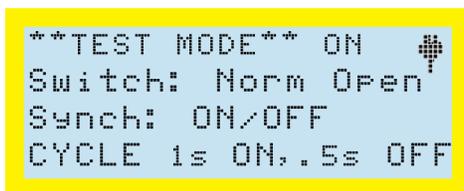


Figure 2-1. Test Mode

The following list describes the type of information shown on the Test Mode screen and that is used for the test:

- **TEST MODE ON/OFF/DONE** — The cycle that the interruption is running during the test. The test runs through an off and on sequence for a few seconds. It will then display **DONE** when it completes the test. The plug symbol ⚡ indicates that power is present.
- **Switch: Norm Open** — Shows whether the relay is normally open or normally closed. The setting is determined by the **Switch** setting in Out Parameters (refer to [Output Parameters on page 36](#)).
- **Synch** — Shows that synchronization begins with On. The setting is determined by the **Int. Cycle** setting in Out Parameters (refer to [Output Parameters on page 36](#)).
- **CYCLE 1s ON, .5s OFF** — The timing of the on and off cycle.

GPS350 Installation

The GPS350 interrupter consumes approximately 120 mA. The built-in solid state relay current consumption is additional 100 V / 80 A max with > 4 s cycle or 100 V / 60 A max with 1 s-4 s cycle. The relay is **normally closed**.

The interrupters are set to use Normally Closed relays by default. If you plan to use a Normally Open relay, configure the interrupter prior to installing it.

The GPS350 installation process includes the following steps:

- [Installing the GPS350 Interrupter on page 14](#)
- [Setting Display Contrast on page 18](#)
- [Viewing GPS Info on page 18](#)
- [Running a Test Program on page 19](#)

Installing the GPS350 Interrupter

When completing the following procedure, refer to [Technical Specifications on page 57](#) for input and output voltage specifications.

WARNING: Make sure to follow all precautions when working with the interrupter and high voltage circuits.

WARNING: Do not connect the MicroMax GPS350 to primary mains power.

Metal relay casing on the GPS350 will get hot. Allow 5 - 10 minutes after interruption stops before handling the unit.

The installation process includes the following steps. Refer to the individual sections for each step for the complete instructions.

- [Determining a Power Source on page 15](#)
- [Connecting the Built-in Relay to a Rectifier on page 15](#) — or connect an external relay
- [Connecting the GPS Antenna on page 17](#)

Determining a Power Source

Determine how to power the MicroMax interrupter using one of these possible sources:

1. Rectifier - with power turned on to the rectifier, use a voltmeter to locate a power source across two available AC taps. The interrupter requires 8-42 V AC or 10-60 V DC.
2. A 120 V AC convenience outlet to use with the 12 V DC wall adapter.
3. A DC source, such as a 10-60 V DC battery.

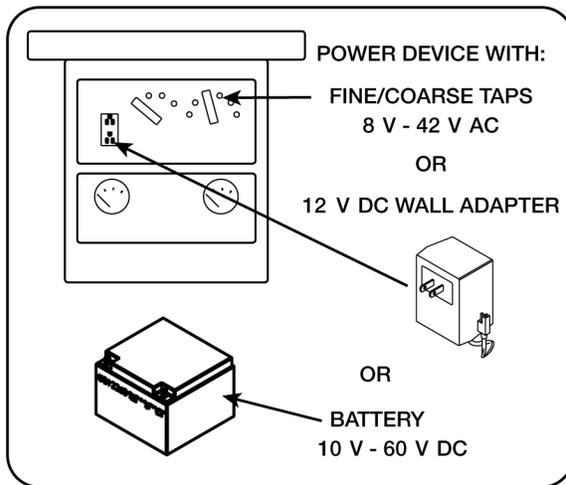


Figure 3-1. Power Source Options

Connecting the Built-in Relay to a Rectifier

The GPS350 includes a built-in relay. You can also connect the GPS350 to an external relay. Refer to [Mercury Relay Advisory on page 61](#) if working with a mercury relay.

1. Turn **OFF** all power to the rectifier.
2. Connect the interrupter's relay cables to the rectifier, depending on what you will be interrupting.

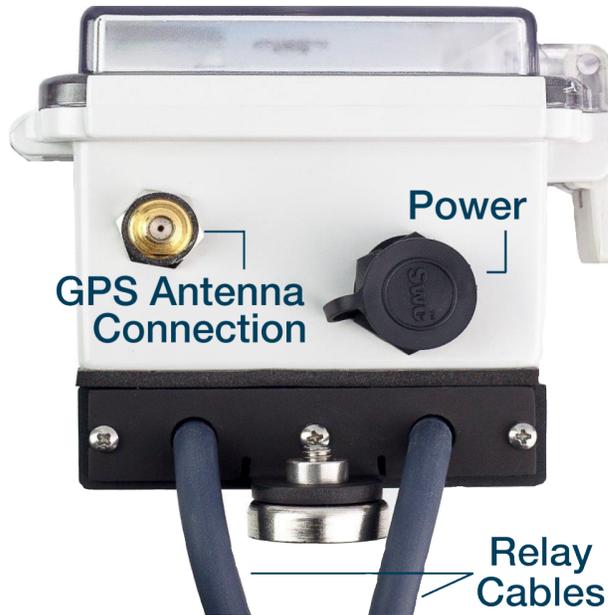


Figure 3-1. Relay Cables

3. If interrupting the **AC power**, remove the tap change bar from the taps and connect both of the interrupter's relay cables to the same tap settings that were connected by the change bar.
4. If interrupting the **DC power**:
 - a. Disconnect DC output cable.
 - b. Connect one of the interrupter's relay cables to the output.
 - c. Slide shrink wrap tube on to the other relay cable.
 - d. Connect the DC output cable to the interrupter's relay cable.
 - e. Wrap relay cables in shrink wrap to prevent shorting the equipment.



Figure 3-2. Relay and DC Output Cable in Shrink Wrap

Connecting the GPS Antenna

1. Connect the magnetic-mount, GPS antenna to the GPS connector on the interrupter.



Figure 3-1. GPS Antenna Connection

2. Mount the GPS antenna on a metal surface making sure the antenna has a clear view of the sky. If a metal surface is unavailable, glue a flat washer on a suitable surface and then place the GPS antenna on the flat washer.

After applying power to the interrupter, unit information briefly appears in the display.

3. After the initialization process completes, the interrupter displays the main menu. If the main menu does not display, make sure the interrupter is not currently running another program. If another program is running, press **PREV** and then **ENTER**.

The main menu displays available menu options that you can select. To select a menu option, use the keypad to select the number associated with the menu option. For example, press **1** on the keypad to select the **Interrupt** menu option.

The main menu also displays current time and date and satellite information. For information on the symbols shown on the screens, refer to [Status Icons on page 30](#).

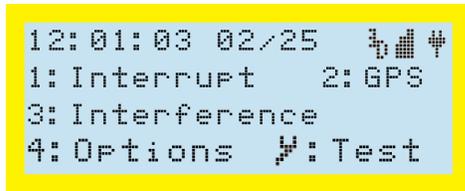


Figure 3-2. Main Menu

Refer to *Interrupter Programming on page 30* for more information on configuring the interrupter.

Setting Display Contrast

Use the up  and down  arrow keys on the keypad to adjust the contrast level of the display. Press and hold the up arrow to increase the contrast; press and hold the down arrow to decrease the contrast.

You can adjust the contrast level at any time **except** when the interrupter is running an interruption program.

Viewing GPS Info

The GPS Info screen includes status information for the current number of satellites in view, time zone, antenna, and the current time and date.

With the main menu displaying, press **2** to display the GPS Info screen. Press **PREV** to return to the main menu.



Figure 3-1. GPS Info

The following list describes the type of information shown on the GPS Info screen:

- **15:32:01 02/20/14** — The current time and date. The time is shown in military time (24 hours) and uses the HH:MM:SS format to represent hours, minutes, and seconds. The date is shown in MM/DD/YYYY format to represent the month, day, and year. The plug symbol  indicates that power is present.
- **GPS Antenna OK** — The antenna status. If the antenna is disconnected or loose, the status message **Antenna OPEN** displays. If the antenna is shorted, the status message **Shorted** displays.

displays.

- **3D Fix Sats 09/12** — Shows whether a 2D or 3D GPS lock has been obtained and the number of satellites seen by the unit. In this example, **09/12** refers to 9 satellites in view out of 12 possible satellites. A 2D lock requires 3 satellites, while 3D lock requires at least 4 satellites. If the unit sees an insufficient number of satellites, move the antenna until at least a 2D lock (preferably a 3D lock) is achieved.

If no satellites are found, the message **Acq Sat** appears in the display on the left side. The message **3D Fix** displays when the unit has established communication with at least four satellites.

- **Current UTC -06** — The Universal Time Constant (UTC) that is used by the GPS system.

IMPORTANT: GPS lock is not needed for the GPS350 to operate. The internal clock updates as soon as the internal GPS locates satellites. For synchronized interruption or interference, make sure the antenna position enables at least a 2D lock.

Running a Test Program

Before programming the interrupter, you can test the interrupter by running a test program.

With the main menu displaying, press  to display and begin the Test Mode. Press **PREV** to cancel the test or when the test is done.

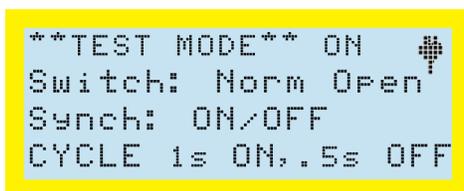


Figure 3-1. Test Mode

The following list describes the type of information shown on the Test Mode screen and that is used for the test:

- **TEST MODE ON/OFF/DONE** — The cycle that the interruption is running during the test. The test runs through an off and on sequence for a few seconds. It will then display **DONE** when it completes the test. The plug symbol  indicates that power is present.
- **Switch: Norm Open** — Shows whether the relay is normally open or normally closed. The setting is determined by the **Switch** setting in Out Parameters (refer to [Output Parameters on page 36](#)).
- **Synch** — Shows that synchronization begins with On. The setting is determined by the **Int.**

Cycle setting in Out Parameters (refer to [Output Parameters on page 36](#)).

- **CYCLE 1s ON, .5s OFF** — The timing of the on and off cycle.

GPS360 Installation

The GPS360 interrupter consumes approximately 120 mA. The built-in solid state relay current consumption is additional 100 V / 80 A max with > 4 s cycle or 100 V / 60 A max with 1 s-4 s cycle. The relay is **normally closed**.

The GPS360 includes a built-in battery that is used to power the unit if an external power source is unavailable.

The interrupters are set to use Normally Closed relays by default. If you plan to use a Normally Open relay, configure the interrupter prior to installing it.

The GPS360 installation process includes the following steps:

- [Installing the GPS360 Interrupter on page 21](#)
- [Setting Display Contrast on page 27](#)
- [Viewing GPS Info on page 28](#)
- [Running a Test Program on page 29](#)

Installing the GPS360 Interrupter

When completing the following procedure, refer to [Technical Specifications on page 57](#) for input and output voltage specifications.

WARNING: Make sure to follow all precautions when working with the interrupter and high voltage circuits.

WARNING: Do not connect the GPS360 to primary mains power.

Metal relay casing on the GPS360 will get hot. Allow 5 - 10 minutes after interruption stops before handling the unit.

The installation process includes the following steps. Refer to the individual sections for each step for the complete instructions.

- [GPS360 Power and Battery Information on page 22](#)
- [Determining a Power Source on page 22](#)
- [Connecting the Built-in Relay to a Rectifier on page 23](#)
- [Connecting the GPS Antenna on page 24](#)
- **Optional** — [Connecting an External Relay with Line Power on page 26](#)

GPS360 Power and Battery Information

The GPS360 includes a battery to power the interrupter as a stand-alone device. The following are considerations when powering the GPS360 with the battery:

1. Fully charge the battery before using. Refer to [Status Icons on page 30](#) for charging and battery icons and descriptions.
2. On power up, the unit will stay on as long as it takes to acquire a GPS signal. Once it acquires a 3D fix, it takes approximately two minutes to synchronize to GPS time and automatically enter the main menu or a previously loaded interruption program.
 - a. The unit will not go to sleep while in this mode, which could potentially drain the battery. The unit must get a GPS lock to enable power save features. You can bypass the GPS screen by pressing **PREV**.
3. The unit will turn off the LCD screen (power save mode) 30 seconds after the last key press. If an interruption program was not selected to run, the unit will enter deep sleep mode 5 minutes after the last key press.
4. While an interruption program is running, the unit will enter power save mode but continue to interrupt. You can press any key at any time to check the status of the interruption program.
 - a. When using start/stop or daily interruption modes, the unit will go into deep sleep during non-interruption hours. Press any key to "wake up" the unit.
 - b. If you wake a unit from power save mode during interruption, it takes two minutes for the GPS to resynchronize. The unit will continue interrupting during resynchronization.
5. To put the unit in deep sleep mode, press and hold the **PREV** key until the screen flashes (approximately 10 seconds) and then release the key.

Determining a Power Source

The GPS360 includes a built-in rechargeable lithium battery and relay. The battery can be used to complete up to 60 hours of interruption without re-charging. However, it is recommended that you use line power with the GPS360, if it is available, to preserve battery power.

Determine how to power the MicroMax interrupter using one of these possible sources:

1. Internal battery.
2. Rectifier - with power turned on to the rectifier, use a voltmeter to locate a power source across two available AC taps. The interrupter requires 8-42 V AC or 10-60 V DC.
3. A 120 V AC convenience outlet to use with the 12 V DC wall adapter.
4. A DC source, such as a 10-60 V DC battery.
5. A USB cable connected to a computer.

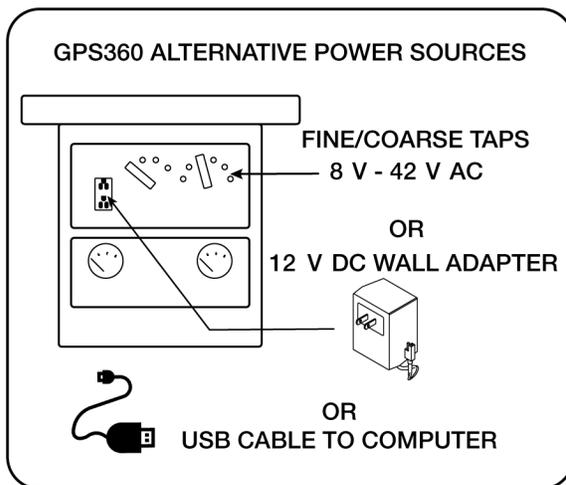


Figure 4-1. Power Source Options

NOTE: If available, use line power to power the GPS360 to save the internal battery power.

Connecting the Built-in Relay to a Rectifier

The GPS360 includes a built-in relay. You can also connect the GPS360 to an external relay. Refer to [Mercury Relay Advisory on page 61](#) if working with a mercury relay.

NOTE: If you will be installing the GPS360 on a **bond**, the relay wires must be connected in series with the two structure wires, one from each of the pipelines.

1. Turn **OFF** all power to the rectifier.
2. Connect the interrupter's relay cables to the rectifier, depending on what you will be interrupting.

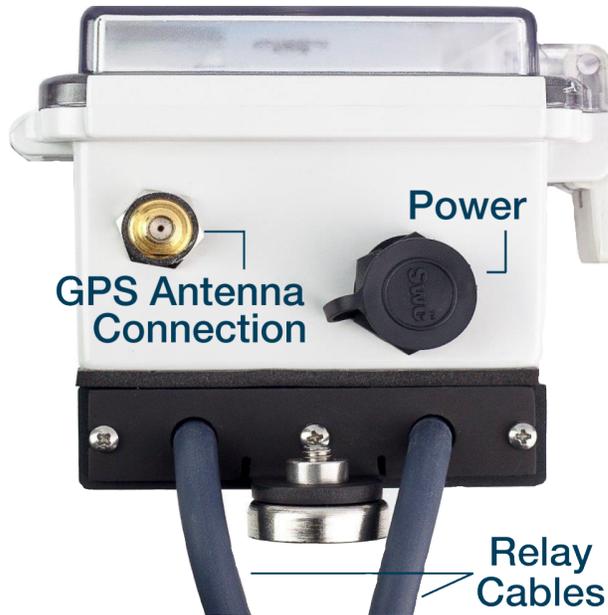


Figure 4-1. Relay Cables

3. If interrupting the **AC power**, remove the tap change bar from the taps and connect both of the interrupter's relay cables to the same tap settings that were connected by the change bar.
4. If interrupting the **DC power**:
 - a. Disconnect DC output cable.
 - b. Connect one of the interrupter's relay cables to the output.
 - c. Slide shrink wrap tube on to the other relay cable.
 - d. Connect the DC output cable to the interrupter's relay cable.
 - e. Wrap relay cables in shrink wrap to prevent shorting the equipment.



Figure 4-2. Relay and DC Output Cable in Shrink Wrap

Connecting the GPS Antenna

After connecting the antenna, ensure that it has a clear view of the sky to get optimum connection to the satellites.

1. Connect the magnetic-mount, GPS antenna to the GPS antenna connection on the interrupter.



Figure 4-1. GPS360 GPS Antenna Connection

2. Mount the GPS antenna on a metal surface, making sure the antenna has a clear view of the sky. If a metal surface is unavailable, glue a flat washer on a suitable surface and then place the GPS antenna on the flat washer.

After applying power to the interrupter, unit information briefly appears in the display.

3. After the initialization process completes, the interrupter displays the main menu. If the main menu does not display, make sure the interrupter is not currently running another program. If another program is running, press **PREV** and then **ENTER**.

The main menu displays available menu options that you can select. To select a menu option, use the keypad to select the number associated with the menu option. For example, press **1** on the keypad to select the **Interrupt** menu option.



Figure 4-2. Main Menu

The main menu also displays current time and date and satellite information. For information on the symbols shown on the screens, refer to [Status Icons on page 30](#).

While the GPS360 battery is charging, a battery icon with a lightning bolt displays in the top right corner. When the unit is fully charged, the icon is replaced by a full battery icon. As the battery power decreases, the

icon changes to reflect the power level of the battery. Also, as long as the interrupter is attached to an alternate power sources, such as a USB connection to a computer, the plug icon  will display.

Refer to [Interrupter Programming on page 30](#) for more information on configuring the GPS360.

Connecting an External Relay with Line Power

The GPS360 can be used with an external relay in place of the internal one. If you are going to use an external relay, the GPS360 **must** be connected to line power, such as to the rectifier.

1. Connect the power cable to the interrupter. Line up the notch on the power cable to the connection on the interrupter. Twist ring on cable to lock the cable into the connection.



Figure 4-1. Power Cable and MicroMax Interrupter Connection

2. Connect the external relay control or coil to the power cable **OUTPUT**. Be sure to observe proper polarity, especially if a flyback diode is present on a mercury relay coil.



Figure 4-2. Power Cable Connections

3. Connect the AC/DC Power Input cable to the power cable's **INPUT** connection.



Figure 4-3. AC/DC Power Input Cable Connected to Twisted Wire Cable

4. Clip the AC/DC Power Input cable's alligator clips to the rectifier Coarse AC taps. Voltage range is 8-42 V AC.

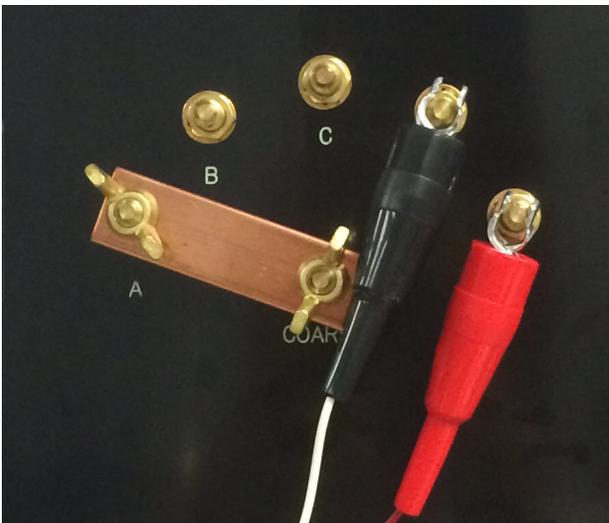


Figure 4-4. Alligator Clips Connected to Rectifier Taps

NOTE: If you are connecting to a DC power source such as a battery, the power requirement is 10-60 V DC.

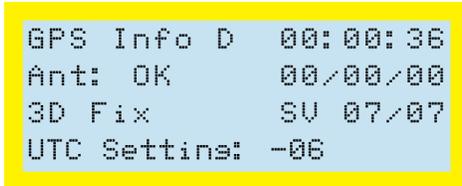
Setting Display Contrast

Use the up  and down  arrow keys on the keypad to adjust the contrast level of the display. Press and hold the up arrow to increase the contrast; press and hold the down arrow to decrease the contrast.

You can adjust the contrast level at any time **except** when the interrupter is running an interruption program.

Viewing GPS Info

With the main menu displaying, press **2** to display the GPS Info screen. Press **PREV** to return to the main menu.



```

GPS Info D  00:00:36
Ant: OK     00/00/00
3D Fix     SV 07/07
UTC Setting: -06
  
```

Figure 4-1. GPS Info

The GPS Info screen includes status information for the current number of satellites in view, time zone, antenna, and the current time and date.

The following list describes the type of information shown on the GPS Info screen:

- **GPS Info D 00:00:36** — The current time and date. The time is shown in military time (24 hours) and uses the HH:MM:SS format to represent hours, minutes, and seconds. The date is shown in MM/DD/YYYY format to represent the month, day, and year. The letter shown just to the right of **GPS Info** is used to troubleshoot an issue with the unit's GPS lock.
- **Ant: OK 00/00/00** — The antenna status. If the antenna is disconnected or loose, the status message **Antenna OPEN** displays. If the antenna is shorted, the status message **Shorted** displays.
- **3D Fix SV 07/07** — Shows whether a 2D or 3D GPS lock has been obtained and the number of satellites seen by the unit. In this example, **07/07** refers to 7 satellites in view out of 7 possible satellites. A 2D lock requires 3 satellites, while 3D lock requires at least 4 satellites. If the unit sees an insufficient number of satellites, move the antenna until at least a 2D lock (preferably a 3D lock) is achieved.

If no satellites are seen, the message **Acq Sat** appears in the display on the left side. The message **3D Fix** displays when the unit has established communication with at least four satellites.

- **UTC Setting: -06** — The Universal Time Constant (UTC) that is used by the GPS system.

IMPORTANT: GPS lock is not needed for the GPS360 to operate. The internal clock updates as soon as the internal GPS locates satellites. For synchronized interruption or interference, make sure the antenna position enables at least a 2D lock.

Running a Test Program

Before programming the interrupter, you can test the interrupter by running a test program.

With the main menu displaying, press  to display and begin the Test Mode. Press **PREV** to cancel the test or when the test is done.

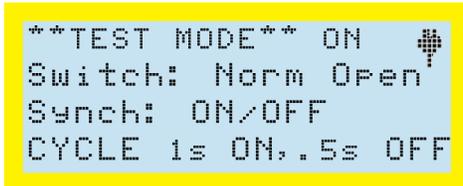


Figure 4-1. Test Mode

The following list describes the type of information shown on the Test Mode screen and that is used for the test:

- **TEST MODE ON/OFF/DONE** — The cycle that the interruption is running during the test. The test runs through an off and on sequence for a few seconds. It will then display **DONE** when it completes the test. The plug symbol ⚡ indicates that power is present.
- **Switch: Norm Open** — Shows whether the relay is normally open or normally closed. The setting is determined by the **Switch** setting in Out Parameters (refer to [Output Parameters on page 36](#)).
- **Synch** — Shows that synchronization begins with On. The setting is determined by the **Int. Cycle** setting in Out Parameters (refer to [Output Parameters on page 36](#)).
- **CYCLE 1s ON, .5s OFF** — The timing of the on and off cycle.

Interrupter Programming

The GPS300, GPS350, and GPS360 interrupters can be programmed either manually by using the unit's keypad or with the Bullhorn Tools configuration software.

Refer to these topics for more information on programming your interrupter:

- *Configuring with Unit Keypad* — using the interrupter's keypad to program the unit.
- *Configuring with Bullhorn Tools* — using Bullhorn Tools to configure the interruption and interference programs.

Status Icons

Table 1-1 defines the status icons shown on the MicroMax GPS300, GPS350, and GPS360 interrupters displays.

Table 5-1. Status Icons

Icon	Description
	3D — indicates that the GPS has a 3D fix on satellites.
	Arrows — use up  and down  arrow keys on the keypad to change the values of input fields. NOTE: the arrows can also be used to change the display contrast.
	Bars — indicates number of available satellites - more bars = more satellites.
	Carriage return — indicates user should press ENTER key on the keypad.
	Plug — indicates that AC or DC power is present.

Table 5-1. Status Icons cont'd

Icon	Description
	Wrench — indicates that user should press the Wrench key  on the keypad to make a change or run a test.
	Battery — GPS360 only; indicates the battery charge state. A full icon means that the battery is full. Refer to GPS360 Power and Battery Information on page 22 for more information on using the built-in battery for interruption.
	Charging — GPS360 only; indicates that the battery is charging. This icon will be replaced by the battery icon when the battery has been fully charged. Refer to GPS360 Power and Battery Information on page 22 for more information on using the built-in battery for interruption.

Configuring with Unit Keypad

The MicroMax interrupters can be programmed through keypad menus and buttons. The following set-up tasks can be done from the keypad on the unit:

- [Setting Up and Running an Interruption Program on page 31](#) — set up to nine different interruption programs.
- [Setting Up an Interference Interruption Program on page 33](#) — set up or run an interference interruption program.
- [Options Features on page 35](#) — set other features of the interrupters, including [Output Parameters](#), [Setting the UTC Offset](#), and [Using Zero Crossing](#).

Setting Up and Running an Interruption Program

Complete the following steps to set up and run an interruption program from the interrupter keypad:

1. With the main menu displaying, press **1** on the keypad.

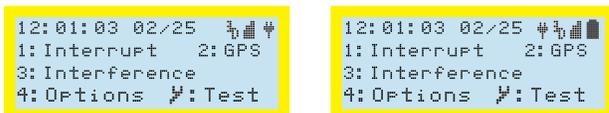
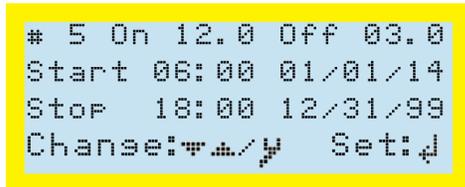


Figure 5-1. Main Menus - GPS300 and GPS350 (L) and GPS360 (R)

The GPS360 main menu includes an icon for the battery. When the battery is fully charged, the icon is solid. As battery power decreases, the icon changes to reflect current battery charge. When the battery is charging, the battery icon is replaced with a charging icon . All other screens for the GPS360 are the same as for the GPS300 and GPS350.

2. Press any key from 1 to 9 to display the Interruption Program Setup screen for that program number.



```
# 5 On 12.0 Off 03.0
Start 06:00 01/01/14
Stop 18:00 12/31/99
Change:⚙️/⬆️/⬇️ Set:⏎
```

Figure 5-2. Interruption Program Setup Screen

The list below describes the type of information shown on the Programming Menu:

- **# 5 On 12.0 Off 03.0:** The program number. Press any number from 1 to 9 to view a saved program. The first line also shows the **On** and **Off** times of the interruption cycle.
 - **Start 06:00 01/01/14:** The interruption schedule (Start/Stop) and the start time and date. For Daily, this line would also include the time set for the interruption to begin and end. For Continuous, this line would only display Continuous.
 - **Stop 18:00 12/31/99:** For Start/Stop interruption only; the stop time and date.
 - **Change and Set:** Use the Wrench  key () to change the interruption schedule. Use the up  and down  arrow keys to change the values. Press **ENTER** () to start the program.
3. Press  to change the interruption schedule. Available interruption schedules include:
 - Continuous
 - Daily
 - Start / Stop

For **Start / Stop** date, enter a date using the MM/DD/YY format to indicate the month, day, and year, such as 08/02/14.
 4. To move from one field to another, press  or .
 5. To enter a time such as **3.0** press the following keys on the keypad:
 - a. **3**
 - b. **0**

- To correct an entry while in a value field, enter the correct value over the current value. Press **DEL** to change the entry to 0.

- Press **ENTER** to start the interruption program or **PREV** to cancel.

When the interruption program begins, a screen similar to the following example displays. The screen displays while the interruption program is running.

```
Program #04 selected
1: Program info
2: GPS info
[PREV] to stop OFF
```

Figure 5-3. Interruption Program Selected

When the interruption program starts, you can either press **1** to view the Program Setup screen or **2** to monitor the GPS status. Press **PREV** to return to the Program Selected screen.

- To stop the interruption program from running, press **PREV** and then **ENTER** to confirm. If **ENTER** is not pressed within a few seconds, the interrupter returns to the interruption program.

NOTE: If the interrupter is powered off or loses power while executing an interruption program, it will automatically continue with the same interruption program once power is restored.

Setting Up an Interference Interruption Program

The MicroMax interrupters include an interference mode that will synchronously interrupt specific groups of rectifiers to determine the influence of each rectifier on the structure under test. Also refer to [Interrupter Overview on page 1](#) for more information on the interference mode interruption program.

Complete the following steps to set up and run an interference program on a :

- With the main menu displaying, press **3** on the keypad.

```
#10 On 13.0 Off 05.0
Delay 002.0
Cycle Time 0088s
Unit #07/10 Next:↵
```

Figure 5-1. Interference Setup Screen

The list below describes the type of information shown on the Interference Setup screen:

- **#10 On 13.0 Off 05.0:** The program number and the on and off times of the interruption cycle.
 - **Delay:** Delay time in seconds.
 - **Cycle Time 0088s:** Indicates the total time of the cycle in seconds. This is a calculated value based on settings you enter for the on, off, and delay times as well as the total number of interrupters in the study.
 - **Unit #07/10 Next:** : Shows this unit's number and the total number of units. Press the **ENTER** key to move to next screen.
2. To move from one field to another, press  or .
 3. Enter new values as necessary using the keypad.
 4. Press **ENTER** to move to the Interruption Program Setup screen.
 5. Set up the interruption program. Refer to [Setting Up and Running an Interruption Program on page 31](#) for instructions on setting up the interruption program.
 6. Press **ENTER** to start the program.

The interrupter will display a series of screens to begin the Interference program:

NOTE: The GPS360 screen will display the battery icon along with the other status icons (refer to [Status Icons on page 30](#)).

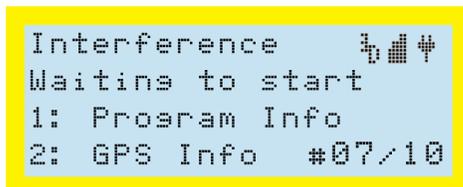


Figure 5-2. Interference Waiting to Start

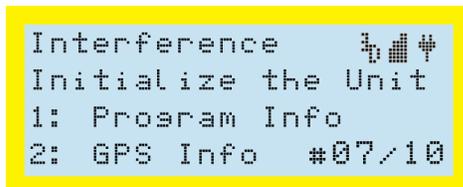


Figure 5-3. Interference Initializing Unit

```

Interference  📶📶📶
ALL Off, Instant Off
1: Program Info
2: GPS Info #07/10

```

Figure 5-4. Interference Program Screen 1

```

Interference  📶📶📶
ALL Off, Instant On
1: Program Info
2: GPS Info #07/10

```

Figure 5-5. Interference Program Screen 2

The program then cycles through the set number of units shown at the bottom of the screen (For example, **10** as shown in this example). When finished, the program begins again.

```

Interference  📶📶📶
ALL On, #01/10 OFF
1: Program Info
2: GPS Info #07/10

```

Figure 5-6. Interference Program Screen 3

- To cancel the program, press **PREV**. A cancellation confirmation screen displays.

```

Do you want to stop?
Press [↵] to confirm

```

Figure 5-7. Cancellation Confirmation Screen

- Press **ENTER** to cancel and return to main menu. If you do not press **ENTER** within a few seconds, the program will continue.

Options Features

Other features, such as setting output parameters, changing UTC offset, using zero crossing, and restoring factory defaults, are completed using the Options menu.

To display the Options menu:

Figure 5-2. Output Parameters Screen

3. To move from one field to another, press **▲** or **▼** until the cursor is positioned on the field you want to change.
4. To change the field, press **↩** until the desired output parameter displays in the selected field.
5. Press **ENTER** to save the setting or **PREV** to return to the Options menu.

Setting the UTC Offset

The UTC (Universal Time) can be set from UTC -12 to UTC +12. The following table lists examples of typical time zones with corresponding UTC. The procedure following the table explains how to configure the interrupter with a UTC of your choice.

Table 5-1. Time Zone and UTC Examples

Time Zone	UTC
Eastern Standard Time	-05
Central Standard Time	-06
Mountain Standard Time	-07
Pacific Standard Time	-08
Eastern Daylight Time	-04
Central Daylight Time	-05
Mountain Daylight Time	-06
Pacific Daylight Time	-07

Complete the following steps to set the UTC:

1. From the main menu, press **4** on the keypad to display the Options menu.

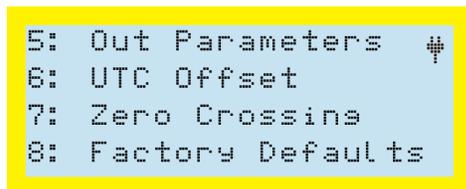


Figure 5-1. Options Menu

2. Press **6** to display the UTC Offset screen:

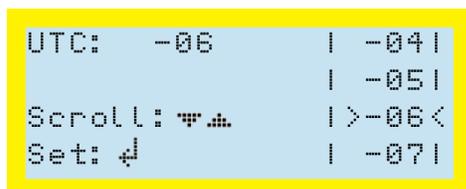


Figure 5-2. UTC Offset Screen

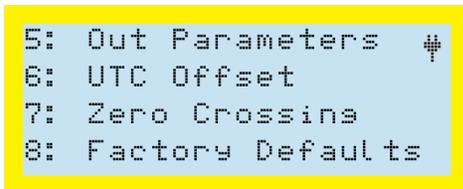
3. Press **▲** or **▼** to scroll through the UTC offset values.
4. Press **ENTER** to set the UTC value and return to Options menu.

Using Zero Crossing

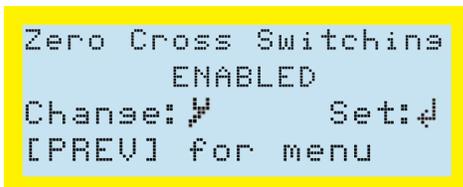
The MicroMax interrupters usually use a GPS reading to take timed measurements. Zero Crossing allows you to use the instant when the AC crosses zero instead of using a GPS reading.

Complete the following steps to enable or disable Zero Crossing:

1. From the main menu, press **4** on the keypad to display the Options menu.

**Figure 5-1. Options Menu**

2. Press **7** to display the Zero Crossing Switching screen:

**Figure 5-2. Zero Crossing Switching Screen**

3. Press **#** to change the status of Zero Crossing from **Enabled** to **Disabled** or from **Disable** to **Enabled**.
4. Press **ENTER** to return to the Options menu.

Resetting to Factory Defaults with Keypad

Complete the following steps to reset the interrupter with factory default settings using the unit's keypad. Refer to [Factory Defaults Settings on page 56](#) for a list of the factory default settings. The unit can also be reset to factory defaults by using tBullhorn Tools software. Refer to [Resetting to Factory Defaults with Keypad on page 38](#) for more information.

1. From the main menu, press **4** on the keypad to display the Options menu.

```
5: Out Parameters  ↵
6: UTC Offset
7: Zero Crossine
8: Factory Defaults
```

Figure 5-1. Options Menu

2. Press **8** to display the Factory Defaults screen:

```
Reset system to  ↵
factory defaults?
Reset: ↵
Cancel: PREV
```

Figure 5-2. Factory Defaults Screen

3. Press **ENTER** to reset the interrupter to factory settings or **PREV** to cancel.

NOTE: Pressing **ENTER** replaces *all* current settings with factory default settings. You will need to reset the unit to any settings that are different than the defaults. After resetting the interrupter, the Options menu displays again. Press **PREV** to return to the main menu.

Configuring with Bullhorn Tools

Bullhorn Tools is the configuration software that can be used to read and program a MicroMax interrupter. The software is available for download from the [Bullhorn Tools](#) launch site.

The following topics detail how to use Bullhorn Tools configuration software to program the interrupter:

- [Installing Bullhorn Tools on page 40](#)
- [Connecting Unit and Starting Bullhorn Tools on page 40](#)
- [Configuring the Interrupter on page 41](#)
- [Exiting Bullhorn Tools on page 54](#)

Installing Bullhorn Tools

NOTE: Bullhorn Tools requires a minimum of 194MB of hard disk space.

Complete the following steps to install Bullhorn Tools:

1. From your browser, open the [Bullhorn Tools](#) launch page.
2. Click **Launch**. The application will launch after installation. Once you have downloaded Bullhorn Tools from the launch website, all future updates will automatically be installed when you launch Bullhorn Tools on the computer it was installed on (with an Internet connection). You will not need to uninstall a previous version and then download a new version and install it.
3. If Bullhorn Tools does not launch automatically, click the Bullhorn Tools desktop icon  or click Windows  Start menu and select Bullhorn Tools.

Connecting Unit and Starting Bullhorn Tools

Complete the following steps to begin the configuration process with Bullhorn Tools:

1. Connect the configuration cable to the USB port of your computer. Connect the other end of the cable to the USB **CONFIG** port on the unit.
2. Double-click the  Bullhorn Tools program icon on the desktop or open it from the **Start** menu.
3. Select the unit, and then click  **Connect**.

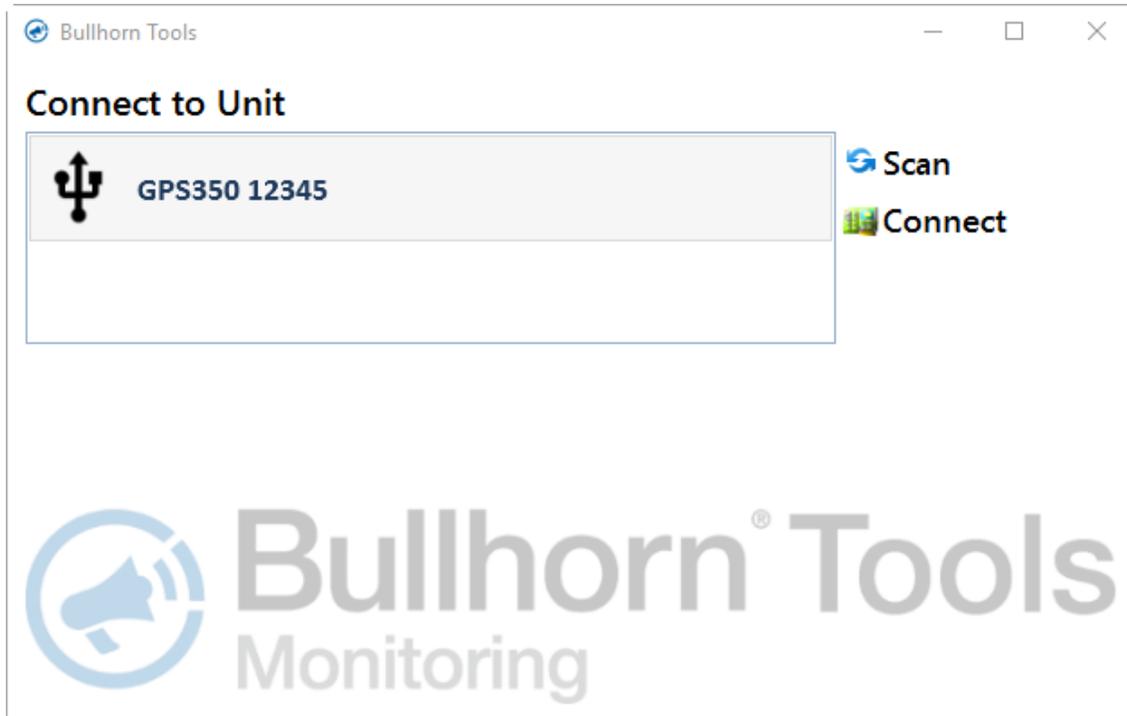


Figure 5-1. Connect to Unit

Configuring the Interrupter

Use Bullhorn Tools to complete the following configuration tasks on the unit:

- *Viewing Unit Information* — the main *Device Overview* window displays current unit information, including Program settings, interruption settings, and battery data.
- *Using Saved Templates* — units can be configured from a previously-saved template that contains unit settings. Current unit settings are overwritten by the applied template.
- *Setting Up Interruption Options* — set interruption options, such as UTC Offset, Output Mode, Sync Mode, and Zero Crossing.
- *Setting Up Interruption Programs* — create up to nine different interruption programs.
- *Setting Up an Interference Interruption Program* — set up interference mode with interruption.
- *Creating a Settings Template* — unit settings can be saved to a template to save time when configuring multiple, identical units. Saved templates can be exported or deleted.
- *Resetting to Factory Defaults with Bullhorn Tools* — resets the unit to settings that were made during manufacturing.
- *Upgrading Firmware* — when available, the unit firmware can be upgraded.

Viewing Unit Information

Use the following steps to check unit and program information:

1. Click the name of the unit in the navigation pane to view *Information*, *Firmware*, *Interruption Settings*, and *Power* panes, as well as separate panes for each Program.

The screenshot shows the Bullhorn Tools interface for a device named 'GPS350 12345'. The interface is divided into several sections:

- Navigation Pane (Left):** Lists 'GPS350 12345' and an 'Interruption' section with sub-items for Program 1 through Program 9 and 'Interference Mode'.
- Device Overview (Top Center):** Contains a 'Refresh' button and a 'Device Overview' title.
- Information (Middle Left):**
 - Serial: 12345
 - Time: 1/1/1980 12:08:44 AM
 - Antenna Status: Ok
- Firmware (Middle Left):**
 - Version: 1.04
- Interruption Settings (Middle Left):**
 - Output Mode: Normally Open
 - Sync Mode: On/Off
 - Zero Crossing: Enabled
- Power (Middle Left):**
 - AC Voltage: 0.09 V
 - 12V Monitor: 2.016 V
 - USB Voltage: 5.408 V
- Programs (Right):** A list of programs with their ON/OFF times and start/stop dates:
 - Program 1:** Off (ON: 3 second(s), OFF: 1 second(s))
 - Program 2:** Start/Stop (ON: 0.8 second(s), OFF: 0.2 second(s); Start: 1/1/2014 6:00 AM, Stop: 12/31/2099 6:00 PM)
 - Program 3:** Start/Stop (ON: 10 second(s), OFF: 1 second(s); Start: 10/19/2016 3:00 AM, Stop: 10/19/2016 3:00 PM)
 - Program 4:** Start/Stop (ON: 4 second(s), OFF: 1 second(s); Start: 10/19/2016 8:00 AM, Stop: 10/19/2016 8:00 PM)
 - Program 5:** Start/Stop (ON: 12 second(s), OFF: 3 second(s); Start: 10/19/2016 6:00 PM, Stop: 10/19/2016 6:01 PM)
 - Program 6:** Start/Stop (ON: 15 second(s), OFF: 5 second(s); Start: 10/20/2016 6:00 PM, Stop: 12/31/2099 6:00 PM)
 - Program 7:** Start/Stop (ON: 0.7 second(s), OFF: 0.3 second(s); Start: 10/19/2016 6:00 PM, Stop: 10/20/2016 6:00 PM)
 - Program 8:** ON: 0.8 second(s)

Figure 5-1. Bullhorn Tools Device Overview Window

2. Click **Refresh** to read unit settings and verify the unit and Bullhorn Tools software are communicating.

Using Saved Templates

If a template is available for the unit type you plan to configure, you can apply the template to the current unit. You can also import a saved template to Bullhorn Tools and then apply it to the current unit.

For information on how to export or delete a saved template, refer to [Exporting or Deleting Saved Templates on page 52](#).

If a saved template is available to use, complete the steps described in one or both of the following sections:

- [Importing a Saved Template on page 50](#) — complete these steps first if the template is saved on your laptop or computer but has not yet been imported into Bullhorn Tools.
- [Applying a Saved Template on page 51](#) — complete these steps if a saved template is currently available to use from Bullhorn Tools.

Setting Up Interruption Options

Interruption options, such as UTC Offset, Output Mode, Sync Mode, and Zero Crossing, can be set up separately from the interruption programs.

Complete the following steps to set up the interruption options on the MicroMax interrupters:

1. Click  **Interruption**.

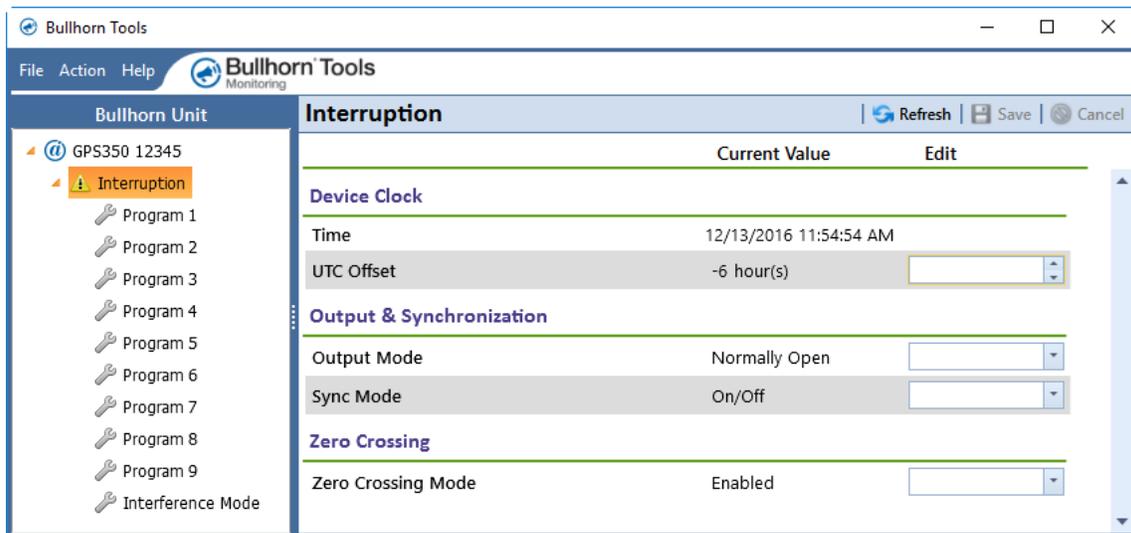


Figure 5-1. Interruption Options

2. To change the UTC Offset, enter a value in the **UTC Offset** field. Refer to the following table for commonly-used time zones.

Table 5-1. Time Zone and UTC Examples

Time Zone	UTC
Eastern Standard Time	-05
Central Standard Time	-06

Table 5-1. Time Zone and UTC Examples cont'd

Time Zone	UTC
Mountain Standard Time	-07
Pacific Standard Time	-08
Eastern Daylight Time	-04
Central Daylight Time	-05
Mountain Daylight Time	-06
Pacific Daylight Time	-07

1. To change the relay output mode, select either **Normally Closed** or **Normally Open** mode from the **Output Mode** drop-down list.
2. To change the synchronization, select either **On/Off** or **Off/On** from the **Sync Mode** drop-down list.
3. The MicroMax interrupters usually use a GPS reading to take timed measurements. Zero Crossing allows you to use the instant when the AC crosses zero instead of using a GPS reading. To enable zero crossing for timed measurements, select **Enabled** from the **Zero Crossing Mode** drop-down list.
4. Click  **Save** to save settings or  **Cancel** to clear all fields.

Setting Up Interruption Programs

The nine interruption programs can be set up from the main Bullhorn Tools window.

Complete the following steps to set up Interruption Program 1 through Program 9:

1. Click the program number; for example,  **Program 1**.

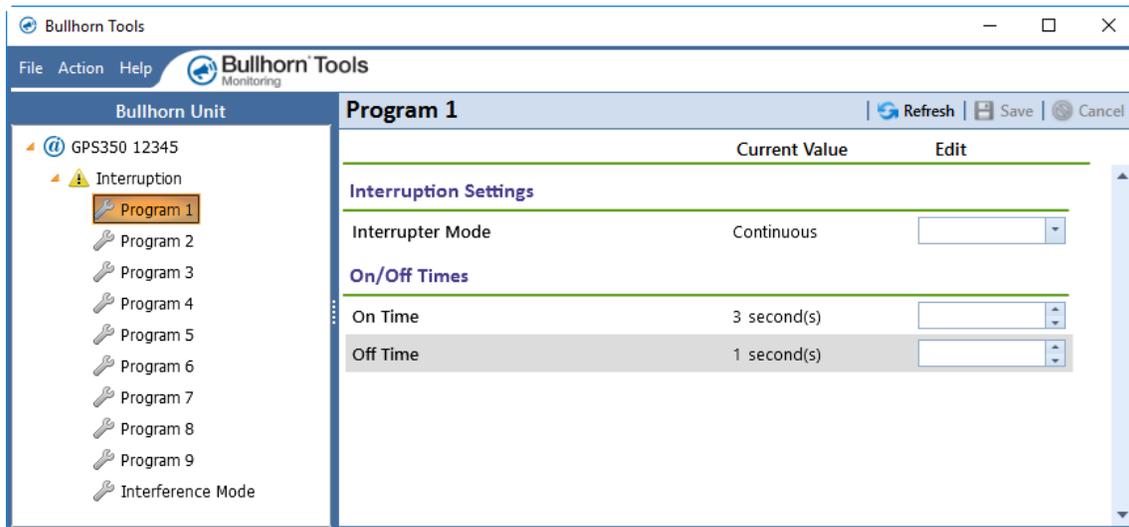


Figure 5-1. Program 1 Setup

2. Select an interruption schedule, such as **Daily**, **Start/Stop**, or **Continuous**, from the **Interrupter Mode** drop-down list.
3. If you selected **Daily**:

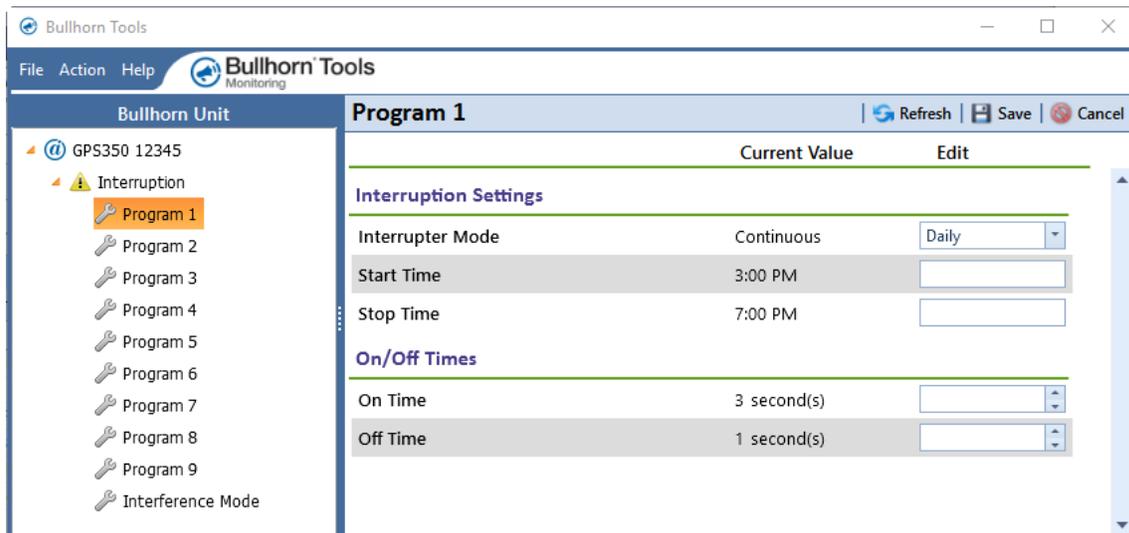


Figure 5-2. Daily Settings

- a. Enter a start time in **Start Time** field. The time defaults to AM; change to PM by clicking on **AM** and then typing **P**.
- b. Enter a stop time in **Stop Time** field. The time defaults to AM; change to PM by clicking on **AM** and then typing **P**.

- c. Enter a value (in seconds) in **On Time** field. Use the up and down arrows in the field to increase/decrease time by 0.1 seconds.
- d. Enter a value (in seconds) in **Off Time** field. Use the up and down arrows in the field to increase/decrease time by 0.1 seconds.

4. If you selected **Start/Stop**:

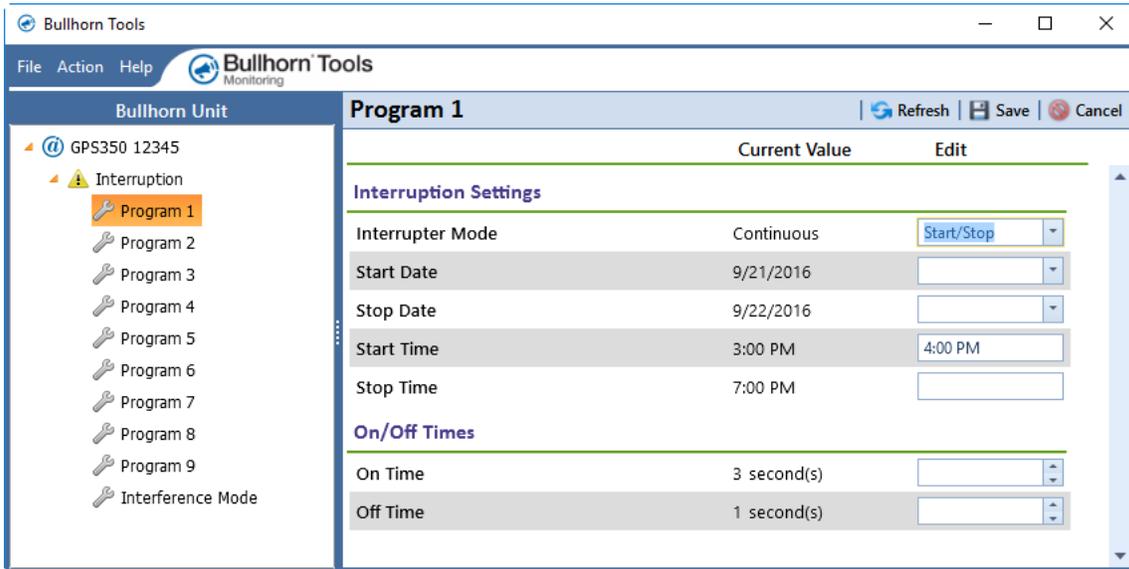


Figure 5-3. Start/Stop Settings

- a. Enter a start date in the **Start Date** field in the m/d/yyyy format. Or, click the arrow in the **Start Date** field and select a date from the calendar.

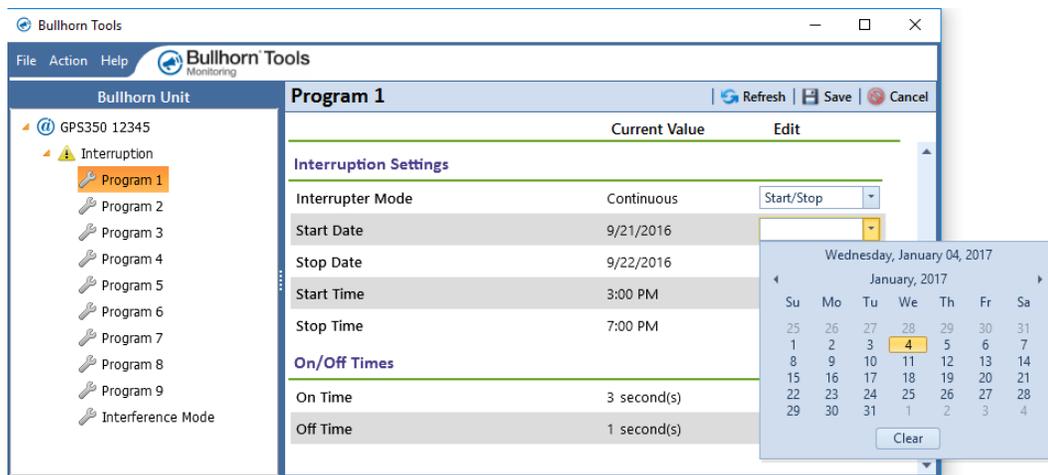


Figure 5-4. Start/Stop Date Calendar

- b. Enter a stop date in the **Stop Date** field in the m/d/yyyy format. Or, click the arrow in

the **Stop Date** field and select a date from the calendar.

- c. Enter a start time in **Start Time** field. The time defaults to AM; change to PM by clicking on **AM** and then typing **P**.
- d. Enter a stop time in **Stop Time** field. The time defaults to AM; change to PM by clicking on **AM** and then typing **P**.
- e. Enter a value (in seconds) in **On Time** field. Use the up and down arrows in the field to increase/decrease time by 0.1 seconds.
- f. Enter a value (in seconds) in **Off Time** field. Use the up and down arrows in the field to increase/decrease time by 0.1 seconds.

5. If you selected **Continuous**:

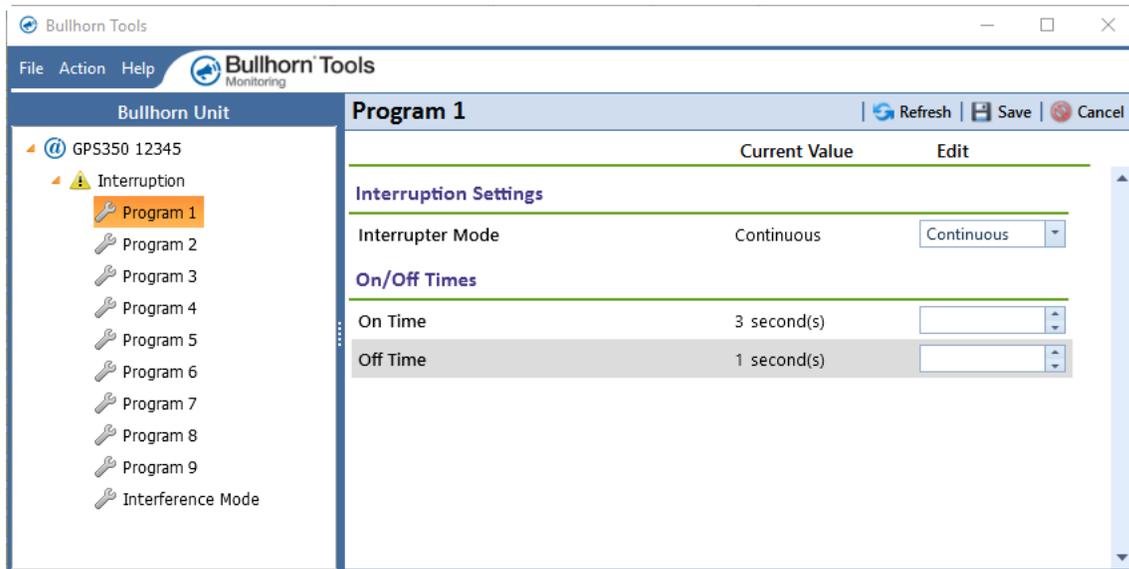


Figure 5-5. Continuous Settings

- a. Enter a value, in seconds, in the **On Time** field. Use the up and down arrows in the field to increase/decrease time by 0.1 seconds.
 - b. Enter a value, in seconds, in the **Off Time** field. Use the up and down arrows in the field to increase/decrease time by 0.1 seconds.
6. Click  **Save** to save settings or  **Cancel** to clear all fields.
 7. Repeat these steps for each additional program.

Setting Up an Interference Interruption Program

The GPS300, GPS350, and GPS360 include an interference mode that will synchronously interrupt specific groups of rectifiers to determine the influence of each rectifier on the structure under test.

Also refer to [Interrupter Overview on page 1](#) for more information on the interference mode interruption program.

Complete the following steps to set up an Interference program:

1. Click  **Interference Mode**.

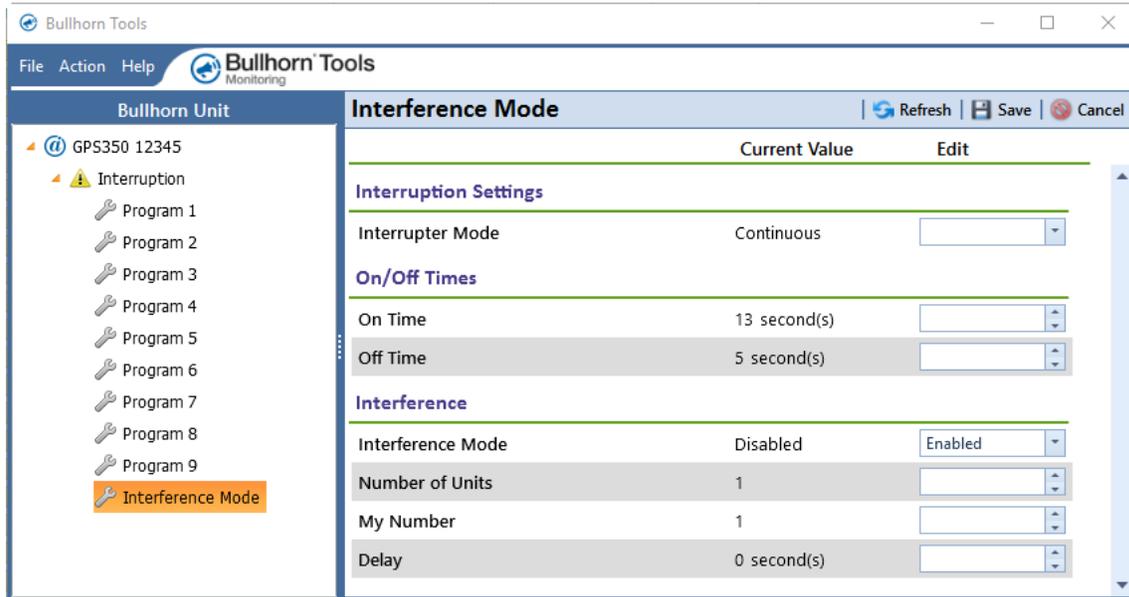


Figure 5-1. Interference Mode

2. Select an interruption mode, such as **Daily**, **Start/Stop**, or **Continuous** from the **Interrupter Mode** drop-down list.
3. Enter a value, in seconds, in the **On Time** field. Use the up and down arrows in the field to increase/decrease time by 0.1 seconds.
4. Enter a value, in seconds, in the **Off Time** field. Use the up and down arrows in the field to increase/decrease time by 0.1 seconds.
5. Select **Enabled** from the **Interference Mode** drop-down list.
6. Enter a value for the total number of units that will be a part of the interference cycle in the **Number of Units** field. Use the up and down arrows in the field to increase the value by 1.
7. Enter a value for this unit in the **My Number** field. Use the up and down arrows in the field to increase the value by 1.
8. Enter a value (in seconds) in the **Delay** field. Use the up and down arrows in the field to increase the value by 0.1 seconds.
9. Click  **Save** to save settings or  **Cancel** to clear all fields.

Creating a Settings Template

After configuring a unit, the settings can be saved in a template. You can use the template to set up another unit. The saved templates can also be exported to your computer or deleted.

Complete the following steps to create a new template:

1. Click **File > Create Template**.
2. Enter a name for the new template.

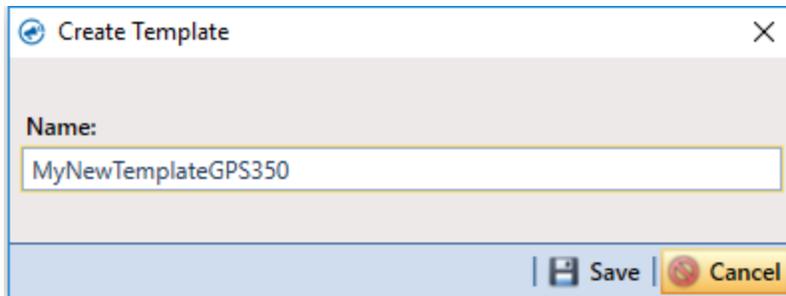


Figure 5-1. Create Template

3. Click  **Save** to create a new template or  **Cancel** or **X** to cancel the process and close the window.

Using Saved Templates

If a template is available for the unit type you plan to configure, you can apply the template to the current unit. You can also import a saved template to Bullhorn Tools and then apply it to the current unit.

For information on how to export or delete a saved template, refer to [Exporting or Deleting Saved Templates on page 52](#).

If a saved template is available to use, complete the steps described in one or both of the following sections:

- [Importing a Saved Template on page 50](#) — complete these steps first if the template is saved on your laptop or computer but has not yet been imported into Bullhorn Tools.
- [Applying a Saved Template on page 51](#) — complete these steps if a saved template is currently available to use from Bullhorn Tools.

Importing a Saved Template

1. Click **File > Template Management**.

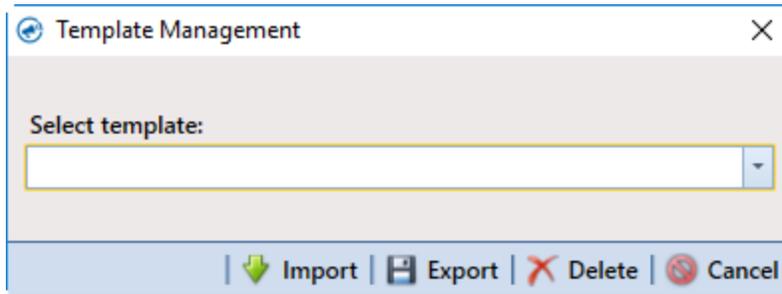


Figure 5-1. Template Management

2. Click **Import** to search for a saved template on your computer.
3. Navigate to the template, and click **Open**. The template now displays in the **Select template** list and will be available to apply.

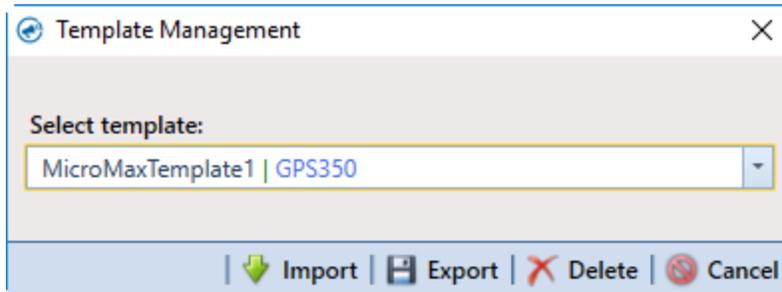


Figure 5-2. Imported Template

4. Click **Cancel** or **X** to close the *Template Management* window.

Applying a Saved Template

1. Click **File > LoadTemplate**.

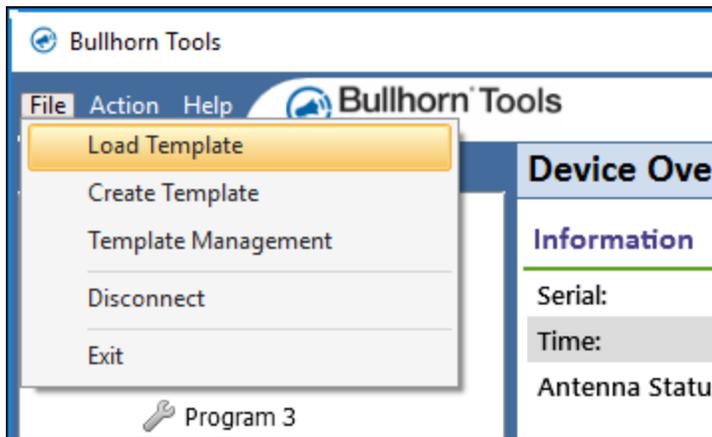


Figure 5-1. Load Template

2. From the *Apply Template* window, select a template that has been previously saved in Bullhorn Tools from the list shown in the **Select template** drop-down menu.

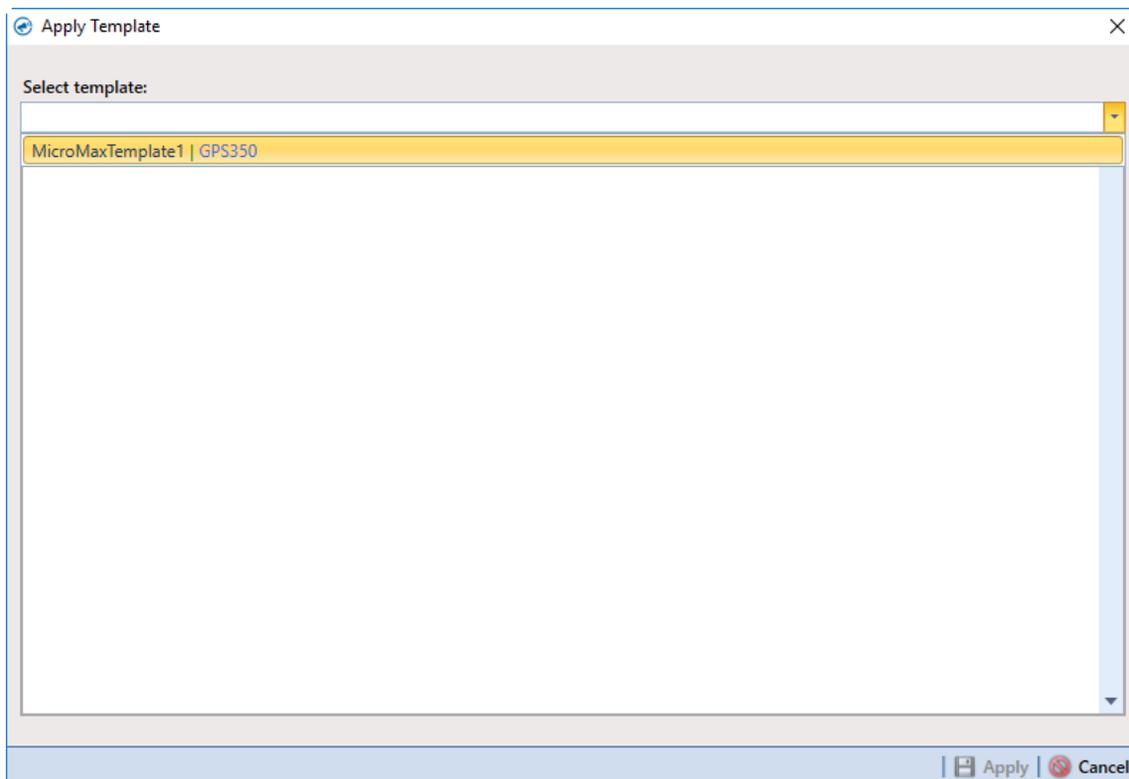


Figure 5-2. Select Template

3. After selecting a saved template, a preview of the template settings will display in the *Apply Template* window.

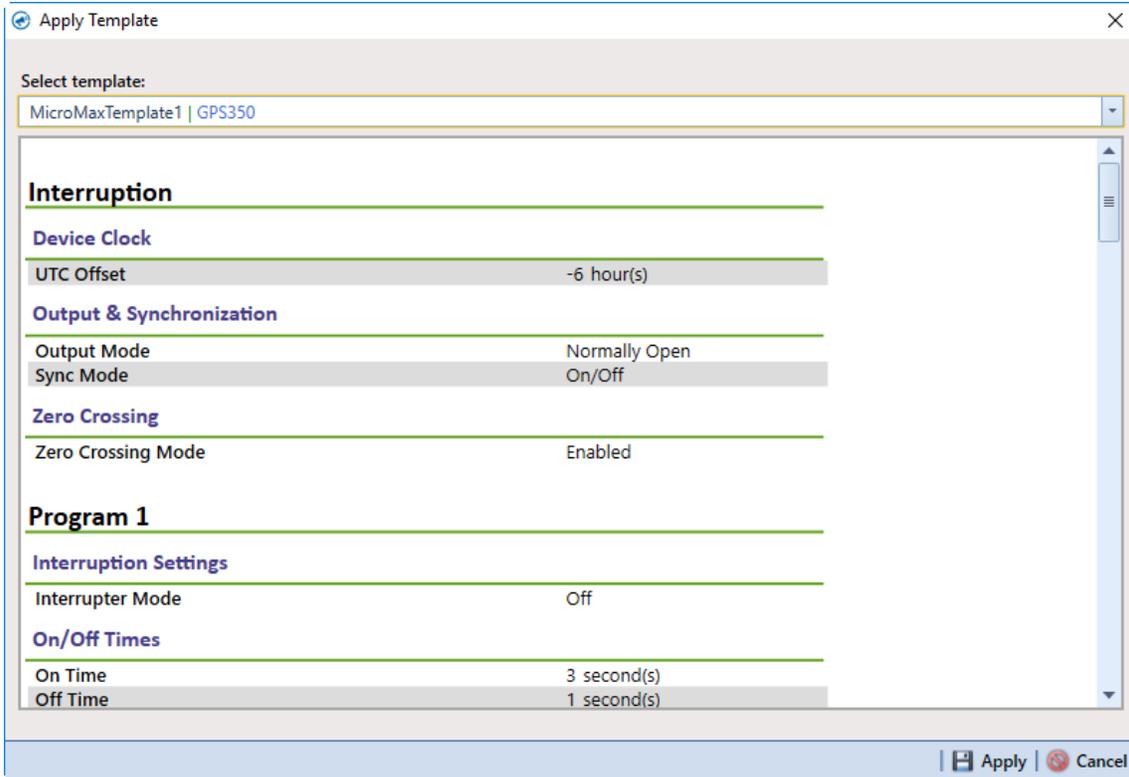


Figure 5-3. Template Settings

4. Verify unit settings, then click  **Apply**. The settings are applied to the unit.

Exporting or Deleting Saved Templates

Saved templates can be exported to your computer or deleted from Bullhorn Tools.

Complete the following steps to either export or delete a template from within Bullhorn Tools:

1. Click **File > Template Management**.
2. Select a template.

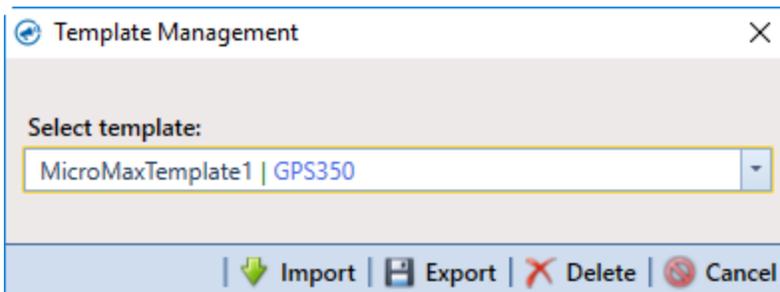


Figure 5-1. Template Management

3. To export the template as a Bullhorn Template (.bht) file, click  **Export**. Select a destination for the file, and then click **Save**.
4. To delete the template, click  **Delete**.
5. To close the window without any action, click  **Cancel** or **X**.

Resetting to Factory Defaults with Bullhorn Tools

The interrupter can be reset to the settings that were made at the time of manufacturing. If you reset to factory defaults, all current settings will be replaced with these default settings. Refer to [Factory Defaults Settings on page 56](#) for a list of these settings. The unit can also be reset to factory defaults by using the unit's keyboard. Refer to [Resetting to Factory Defaults with Keypad on page 38](#) for more information.

Complete the following steps to reset the interrupter with factory default settings using Bullhorn Tools software:

1. Click **Action** > **Reset To Defaults**.

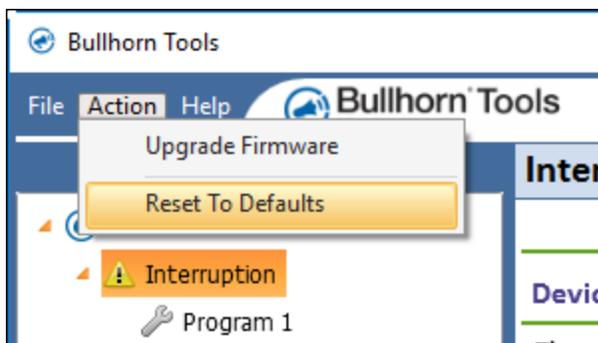


Figure 5-1. Reset To Defaults

A dialog box displays.

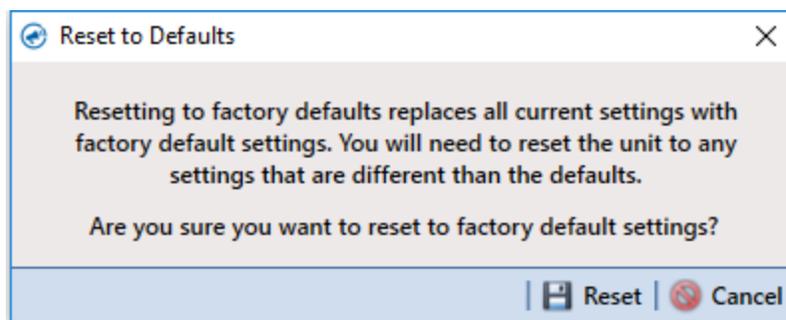


Figure 5-2. Reset To Defaults Confirmation

2. To confirm the reset, click  **Reset**. To cancel and close the window, click  **Cancel** or **X**.

Upgrading Firmware

Available upgrades to the MicroMax interrupters firmware can be applied to the unit. Complete the following steps to upgrade firmware:

NOTE: If the latest firmware is not available, the file can be downloaded from Bullhorn Web (**Help** > **Downloads**). Download the latest firmware upgrade before completing the steps in this section. Contact Technical Services (techservices@aiworldwide.com) for additional assistance.

1. Click **Action** > **Upgrade Firmware**.

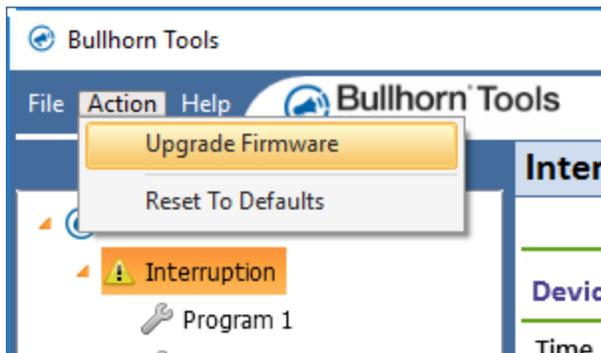


Figure 5-1. Upgrade Firmware

2. Click **Browse** to search for the firmware file. This file should have the extension *.bhf*.

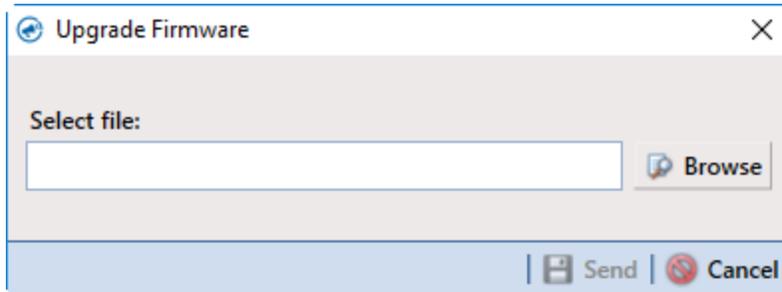


Figure 5-2. Upgrade Firmware - Select File

3. Click  **Send** to install the new firmware, or  **Cancel** or **X** to cancel the upgrade process and close the window.

Exiting Bullhorn Tools

Complete the following steps to close Bullhorn Tools:

1. Click **File** > **Exit**.
2. Disconnect the configuration cable from the unit and your computer.

The configuration is now complete.

Factory Defaults Settings

The following table identifies factory defaults settings for the MicroMax GPS300, GPS350, and GPS360 interrupters.

To reset the unit's settings using the interrupter's keypad, refer to [Resetting to Factory Defaults with Keypad on page 38](#). To reset the unit's settings using Bullhorn Tools, refer to [Resetting to Factory Defaults with Bullhorn Tools on page 53](#).

Table A-1. MicroMax Interrupters Factory Defaults Settings

Setting	Value
Interruption 9 programs, Continuous, on/off times in seconds.	Program 1: 3.0 / 1.0 Program 2: 0.8 / 0.2 Program 3: 3.0 / 1.0 Program 4: 4.0 / 1.0 Program 5: 12.0 / 3.0 Program 6: 15.0 / 5.0 Program 7: 0.7 / 0.3 Program 8: 0.8 / 0.2 Program 9: 9.0 / 3.0
Interference On/off/delay times in seconds.	On: 13.0s Off: 5.0s Delay: 2.0s Cycle time: 88s Unit #01/10
Start Time	Immediate
Stop Time	Never
Output Parameters	Switch: Normally Closed Interruption Cycle: On/Off
UTC Offset	UTC -06
Zero Crossing	Disabled

Technical Specifications

The following technical specifications cover the MicroMax interrupters. For additional specifications on load current, refer to [Derating Tables on page 59](#).

Table B-1. Interrupters Specifications

Specification	GPS300	GPS350	GPS360
Input Power	10-60V DC or 8-42V AC	10-60V DC or 8-42V AC	10-60V DC or 8-42V AC
GPS Synchronization	Yes	Yes	Yes
Interruption cycle	Range: 0.1 - 999.9s Increments: 100 mS	Range: 0.1 - 999.9s Increments: 100 mS	Range: 0.1 - 999.9s Increments: 100 mS
Auxiliary relay drive capacity	0.5 A	0.5 A	0.5 A
Operating temperature	-30 °C to +70 °C CD visible from -20 °C to +60 °C	-30 °C to +70 °C LCD visible from -20 °C to +60 °C	-30° C to +70° C LCD visible from -20 °C to +60 °C
Programmable schedules	9 programmable schedules start phase: on/off	9 programmable schedules start phase: on/off	9 programmable schedules start phase: on/off
Display and enclosure	LCD display fully waterproof case transparent cover	LCD display fully waterproof case transparent cover	LCD display fully waterproof case transparent cover
Dimensions	6.0" x 4.5" x 2.8"	6.0" x 4.5" x 4" (with magnets attached)	6.0" x 4.5" x 4" (with magnets attached)
Weight	1 lbs. 11 oz. (0.77 kg)	3 lbs. 1 oz. (1.39 kg)	3 lbs. 1 oz. (1.39 kg)
Integrated solid-state relay	N/A	Load current: Refer to Derating Tables on page 59 . Load voltage: 100 V Peak DC 70 V Peak AC Type: Normally Closed, Solid State	Load current: Refer to Derating Tables on page 59 . Load voltage: 100V peak DC 70V peak AC Type: Normally Closed, Solid State

Table B-1. Interrupters Specifications cont'd

Specification	GPS300	GPS350	GPS360
Relay Options	Mercury Normally Closed (NC): 30 A, 60 A and 100 A AC Solid State Normally Closed (NC): 80 A and 100 A DC Solid State Normally Closed (NC): 100 A	Can be used with external relays	Can be used with external relays
Integrated battery	N/A	N/A	Operating time: 60 hours Charging time: 8 hours (USB, 12V DC) Charging suspension temperature: -10 °C

Derating Tables

Before setting up the GPS350, or GPS360 interrupter, consider the outside temperatures (both high and low) that the interrupter will be exposed to for the duration of your survey. For each temperature maximum, American Innovations recommends a maximum rectifier current for a given interruption cycle.

The following tables identify the maximum rectifier current that is recommended when using the interrupter in the corresponding maximum outside air (ambient) temperature. Refer to these tables when setting up the GPS350, or GPS360 interrupter.

- [GPS350 Derating Table on page 59](#)
- [GPS360 Derating Table on page 59](#)

GPS350 Derating Table

Before setting up the GPS350 interrupter, consider the outside temperatures (both high and low) that the interrupter will be exposed to for the duration of your survey. For each temperature maximum, American Innovations recommends a maximum rectifier current for the given interruption cycle.

Table C-1. GPS350 Derating

Ambient Temperature		Interruption Cycle	
Celsius	Fahrenheit	0.8 s ON — 0.2 s OFF	4 s ON — 1 s OFF
25°	77°	60 A	80 A
35°	95°	60 A	80 A
45°	113°	58 A	78 A
55°	131°	49 A	66 A
65°	149°	38A	51 A

GPS360 Derating Table

Before setting up the GPS360 interrupter, consider the outside temperatures (both high and low) that the interrupter will be exposed to for the duration of your survey. For each temperature maximum, American Innovations recommends a maximum rectifier current.

Table C-1. GPS360 Derating Table

Ambient Temperature		Maximum Current (A)	
Celsius	Fahrenheit	Setup 1	Setup 2
25°	77°	83	100
35°	95°	76	100
45°	113°	66	90
55°	131°	56	80
65°	149°	42	65

For **Setup 1**, the GPS360 can be in any orientation with the mounting magnets attached for easy installation.

For **Setup 2**, the GPS360 mounting magnets have been removed, and the heatsink (the full back surface of the unit) is in full contact with the metal surface of the rectifier enclosure, or with another metal plate or box, to ensure good temperature regulation.

Mercury Relay Advisory

The information in this section is intended to notify American Innovations (AI) customers of the manufacturer's published limitations on mercury relays.

Customers primarily purchase mercury relays for use with current interrupters. Current interrupters provide great programming flexibility to enable customers to use a wide variety of interruption cycles.

AI supplies mercury relays from a variety of respected and reliable vendors including MDI and American Electronic Components (AEC). These manufacturers publish expected relay lives of 3 to 6 million cycles depending upon the type of relay selected. AEC, the manufacturer of Durakool relays, indicates that relay life will be significantly shortened at rates exceeding 1,500 cycles per hour. MDI recommends no more than 900 cycles per hour. Depending upon the interruption cycle chosen by the customer, it is possible to exceed the manufacturer's recommendation, which would result in a likely reduction of service life.

As an example, customers who elect to use mercury relays to interrupt at 1 cycle per second will generate 3600 cycles per hour. Customers should consult the manufacturer's documentation to select the appropriate relay for the application.

Durakool information can be found on the AEC web page at the following address:

<http://www.aecensors.com/html>

In the Durakool documentation, the following two situations are explained that may impact the current carrying capacity of the relay: 1) cycle rate and 2) voltage values. The sizing tables indicate a methodology for determining the maximum amperage that can be carried depending upon the cycle rate. An additional derating table for mercury relays is provided for those instances where voltage in excess of 48 V DC is being interrupted. When selecting relays, customers should be aware of both of these derating tables to choose the best relay for the application.

To avoid depolarization of the CP system, the mercury relays we sell that AI sells are of the normally closed variety. It is possible that a normally closed relay will fail at the end of its life in the open position due to a malfunction of the spring mechanism which drives the plunger/contacts into a normally closed position. If this occurs, a depolarization situation would result. AI has the following two recommendations:

1. Customers using mercury relays should consider periodic replacement of these relays based upon engineering estimated life via a preventive maintenance program to reduce the likelihood of an open circuit failure.

2. If fast cycle operation is common, AI recommends a solid state relay for maximum life and reliability.

Although most interrupters are capable of being programmed for faster interruption cycles, AI recommends that customers not exceed 900 cycles per hour (or a cycle time of less than four seconds) and will not warranty devices that are utilized in this manner. AI adds a serial number to relays that is supplied that we supply to enable the tracking of the shipment date. The approximate age of the relay may be used to assist AI in return material response, failure analysis, and warranty claims. Manufacturers will be consulted to help determine failure cause and to advise customers that warranties may not be honored if it is deemed that the mercury relay is used outside of recommended parameters.

If you have any questions or need further assistance, give us a call at 1-800-229-3404 or email us at techservices@aiworldwide.com.

Regulatory Notices

The following FCC requirements are met by the products described in this guide.

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 this 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 one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment in 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.

Export Control Classification Number

The Export Control Classification Number (ECCN) assigned to the Bullhorn Tools software by the U.S. Bureau of Industry and Security (BIS) is as follows:

- **ECCN Classification** — No Classification
- **ECCN Code** — EAR99 or NLR