SDA 100 Controller Operators Manual
MUSTANG Firmware

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Purpose

"Mustang" is the code name of a release of software for the SteppIR SDA100 hardware. The SDA100 controller is used in conjunction with SteppIR antenna hardware to provide correct configuration of antenna hardware based on frequency, antenna model, and desired pattern.

Some of the new features of the Mustang series of software include:
- Changing antenna type (e.g. 4 element to 3 element Yagi) does not require a firmware reload (if the hardware is capable)
- Last-frequencies are remembered per band when (Manual mode)
- Per-band settings for fine and coarse step adjustments
- Adjustable tuning step size.
- Autotrack mode has frequency step size adjustment per band
- New Autotrack mode will only change the frequency if the band changes
- Enhanced Create/Modify
- The DB36 and DB42 80M dipoles have tuning steps every 100kHz.

Release History

Fall 2016: Version 1304150051
     Initial Public Release of Mustang

Universal SDA100 User's Guide version 5

Theory

Antennas are modeled to provide desired characteristics at a particular frequency or range of frequencies. Traditional antennas with fixed element lengths can be a compromise – they might sacrifice excellent performance at one frequency to provide moderate performance over a range of frequencies. SteppIR antennas dynamically change element lengths to provide an antenna optimized for the frequency that you're using at the time. Under different operating conditions, it's desirable to emphasize different antenna aspects. While hunting a rare DXCC entity, a very narrow antenna pattern may be desirable. During a contest, having a bidirectional pattern could be an advantage to be able to work Asia and the Caribbean at the same time.

The SDA100 controller takes frequency and pattern (Forward, Reverse, Bidirectional) inputs, applies them to an antenna model, and commands antenna hardware to set element lengths and configuration to calculated values.

Using the SDA100 can be as simple as making the SDA100 controller frequency match the radio frequency using the front panel buttons, and then waiting for the "Tuning" indicator to stop flashing.

A note about antenna SWR: SWR is not the only factor that is important for high performance antennas. When we develop antenna designs, the minimum SWR does not always align with the best performance of the antenna. We design antennas to have better than 1.4:1 SWR in the normal operating modes on almost all the models, with 6M and 30M being the exceptions on some models.

Rain and ice accumulation on the antenna affect an antenna's performance. Either can cause the resonant frequency to shift lower by a small amount. Under most circumstances it can be ignored, however such loading can be corrected for by manually shifting the antenna frequency higher. Using the Global Correction in the options menu can be used to correct for the shift.

Operate Mode

The Power-On screen

When the controller is first powered on, the controller model and copyright information are displayed for a brief time, and then the controller enters the operate state.

```
SteppIR SDA100
Copyright 2012
```

Initial Power-On Screen

The controller then displays the controller status screen in Operate mode.

The Controller Status screen

The display in the normal operate state depends on the state of the antenna. The first-time power on screen is displayed as shown.

```
Manual          DB-18E
Elements Home
```

Screen after first-time power-on

The controller's display status screen shows the tuning mode, antenna model, and details of the frequency and pattern. The different areas of the screen display operational status of the controller.

```
<tuning mode>            <antenna model>
<frequency or state>            <band>
```

Tuning mode will be Manual or Auto. Manual mode denotes that the antenna frequency is changed by using buttons on the SDA100 front panel. Auto denotes that the controller is configured to listen for frequency change information via the serial port option. Refer to Setup Mode's Autotrack Setting to configure the controller for automatic frequency tracking.
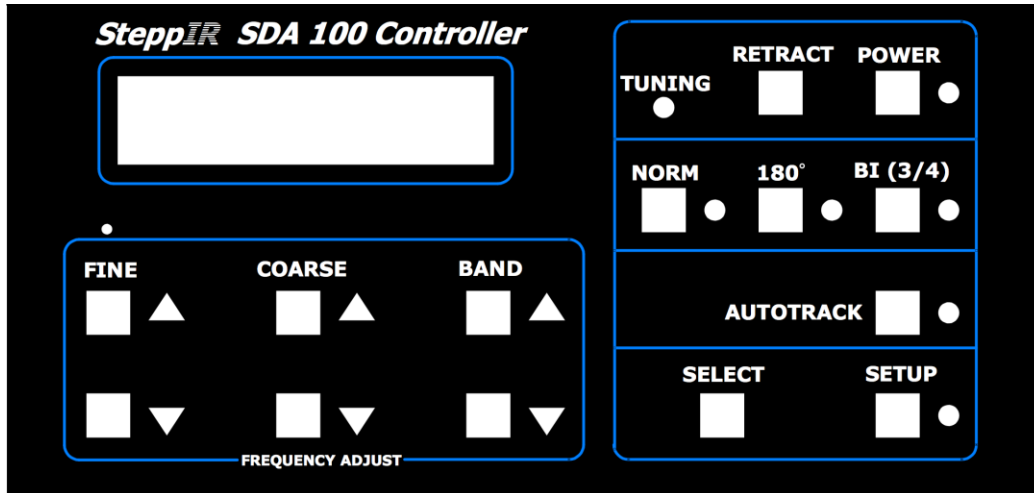
During antenna length changes, the Tuning LED will flash at approximately one second intervals.

```
Manual          DB-18E
14.200MHz          20M
```

Default status screen with elements extended

The factory default setting for initial power on with elements extended is shown above. In "Manual" mode, the frequency is controlled from the SDA100 front panel.

SDA100 Buttons in Operate Mode

The SDA100 Front Panel

The "**FINE Up/Down**" buttons adjust the frequency up and down by the Fine frequency step size specified in the Fine/Coarse Settings menu for the current band.

The "**COARSE Up/Down**" buttons adjust the frequency up and down by the Coarse frequency step size specified in the Fine/Coarse Settings menu for the current band.

The "**BAND Up/Down**" buttons control the currently selected band. When changing to a new band, the last frequency used on that band is recalled and the SDA100 will adjust the element length to match.

The last used frequency for each band is saved separately so the controller will always return to the last frequency used on a band. If the frequency is scrolled outside the band, the next time you leave and return to that band the frequency will default to what has been set as the band limit for the band in question. These limits can be changed in the setup menu.

The antenna direction can be selected with the "**NORM**", "**180**" and "**BI(3/4)**" buttons. For Yagi antennas, these buttons correspond to the forward, reverse, and bidirectional patterns possible with these antennas. For single-element vertical antennas, the pattern is omnidirectional, so "**180**" is not relevant. When "**BI(3/4)**" is pushed, the verticals become ¾ wavelength antennas instead of the normal ¼ wavelength, but only on frequencies above 21.000 MHz where the physical dimensions of the antenna hardware allow this to occur. Pressing an unsupported direction sets the controller to NORM and lights the corresponding LED.

The "**AUTOTRACK**" button toggles the controller between Manual model and Autotrack Mode. In Autotrack mode, the controller responds to frequency updates sent from a transceiver or computer to the SDA100 over the transceiver interface (an SDA100 option). In Manual mode, the SDA100 band and frequency must be adjusted manually using the "**FINE**", "**COARSE**" and "**BAND**" Up/Down buttons. The Transceiver Setup menu must be set to match the transceiver type and baud settings for proper operation of Autotrack mode. To

prevent the controller from updating each time the frequency is changed, the Autotrack step size can be programmed individually for each band. When in Autotrack mode the screen appears as follows:

```
Autotrack        DB-18E
14.200MHz          20M
```

Precautionary Note: When used in Autotrack Mode, some radios send the display frequency via the serial interface. When the radio is in split mode, the change of the frequency displayed between the transmit frequency and the receive frequency may cause frequent and inconvenient antenna tuning. One remedy is to disable Autotrack mode temporarily, another is to set the autotrack step size to be large enough to encompass the transmit and frequency difference. The third way would be to set Autotrack to Band mode, which will only automatically tune if the band changes. When using autotrack mode it is prudent to have a transmitter lockout to make sure that there is no RF being generated while the antenna is tuning. Though your radio alone cannot damage your SteppIR antenna, transmitting with high power levels while the antenna is tuning (elements moving) can. It is good practice to always wait for tuning to stop before transmitting.

The "**RETRACT**" button has two modes of operation. By default, pressing the **RETRACT** button will cause the antenna elements to be homed followed by the elements home message:

```
Autotrack        DB-18E
Elements Home
```

If the Setup Options menu item "Power Off After Retract" is selected, after the elements are homed the controller display will switch off and the controller will go to sleep.

Setup Mode

Pressing the **"SETUP"** button opens the SDA100 Setup Menu.

```
SETUP Key to Exit
Up/Dn to Scroll
```

Setup Main Menu

The Setup Menu comprises thirteen sub-menus, with an optional "Test Relays" menu for antennas equipped with that hardware (All DB series except the DB-36 without the 80 meter option). To scroll through these menus, press **"BAND Up"** to scroll up or press **"BAND Down"** to scroll down. To exit the Setup mode and return to normal operation, press **"SETUP"** at any time, if you have selected one of the menu items pressing "**SELECT**" will

move you back to the main "SETUP" menu, pressing it again will the take you out of "SETUP" mode back to operate mode. The following is a description of each menu item in the order seen when scrolling up after entering the Setup mode. To enter any of these menus, press **"SELECT"** when the desired menu is displayed.

SDA100 Buttons in Setup Mode

SETUP: Press "**SETUP**" once to enter "SETUP" mode, press at any time to exit "SETUP". If you are in a setup menu selection you will need to press it twice, once to get back to the main "SETUP" menus and once more to exit

SELECT: Press this button to confirm a change you have made to a menu item. This button also takes you back to the main "SETUP" menu if you press it again. Pressing this button without making any changes will cause nothing to happen, however, if you press the button again you will then go back to the main "SETUP" menu.

BAND Up/Down: Scrolls through menu items, changes values, or enables/disables options shown in the display directly above it. This could be frequency, transceiver type, turning relays on and off, etc.

COARSE Up/Down: Modifies the option or value appearing on the display above it. In some instances it may toggle a setting on or off.

FINE Up/Down: Modifies whatever appears on the display above it. In some instances it is enabling or disabling something, or allowing scrolling through different choices.

Changing Which Option is Displayed

While in the "Options" main menu, pressing the "**BAND Up/Down**" button will scroll to another "Options" menu item. When finished changing options, press "**SELECT**" to go back to the main "SETUP" menu. The "**BAND Up/Down**" buttons will now scroll through the main "SETUP" menu items. Pressing the "**SETUP**" button also moves you back one menu level, so at **any time** you can press this button (if you are in an option sub-menu you need to press it twice) to take you out of "**SETUP**" and back to normal operating mode.

Changing Settings for an Option

When an option's settings are displayed, the "**FINE Up/Down**" or "**BAND Up/Down**" buttons are used to select a new value for the option's setting. Pressing "**SELECT**" will change the value of the option, which is indicated by the display briefly flashing on and off.   If "**SETUP**" is pressed instead of "**SELECT**" after an option's setting change, the change will NOT be made, and the previous menu will be displayed. If "**SELECT**" is pressed without changing the settings for an option, it's equivalent to pressing "**SETUP**" – the option will not be changed.

Setup Options

6m Passive Element Kit

Note: this option requires the physical installation of the optional 6m aluminum element(s). Not all antennas have this option

```
[ ]Yes     6M Passive
[X]No          Option
```

If the 6M Passive Element Kit is installed on your antenna, select "Yes" with the "**FINE Up/Down**" buttons and press the "**SELECT**" button. The entire display will flash on and off briefly to verify the change has been accepted.

Remote Driver Option

Note: Requires optional remote driver board kit.

```
[ ]Yes         Remote
[X]No          Driver
```

If you are using the optional remote driver board it must be enabled by selecting "Yes" in this sub-menu. The frequency information is then sent from the display board microprocessor via CAT-5 cable to the remote driver and the remote driver board sends back status information. The driver board in the controller housing is required to communicate with the remote driver board! As shipped from the factory, the driver board inside the SDA100 controller has four driver chips than can be used as spares for the remote driver board. When not used with a remote driver board, an SDA100 controller can be used in the normal stand-alone mode (Remote Driver = No) to control any non-DB series beam, or a DB36 without the 80m option. To use a remote driver board select "Yes." This option **must be off for normal (non-remote) operation.**

Power Off After Retract

```
[ ]Yes      Power Off
[X]No  After Retract
```

This option determines whether or not the SDA100 will automatically power off after the elements are retracted when the "**RETRACT**" button on the SDA100 front panel is depressed.

Display Units

```
[ ]mm         Display
[X]inches        Units
```

This option sets the units used for displaying the element lengths. This only affects the Create/Modify menu item.

Global Correction   **Factor**

```
          Global Correction
0.0%              Factor
```

In some installations or in some weather conditions (e.g. ice freezing on the fiberglass tubes), it may be necessary to change the default lengths for the elements by a small correction factor to bring the antenna tuning and SWR back into normal range. This option allows changing the element lengths over a range of -2.0% to 2.0% and affects the element lengths on all bands and modes (180 reverse, bi-directional). If only some bands need a correction factor, there is a per-band setting available in the Create/Modify mode. This might be useful if one or two bands are slightly de-tuned because of proximity to another antenna or metal object or if you find that the global change is not working the same on all bands and modes. Any water, snow or ice on the elements is going to make the elements act electrically longer, moving the antenna's resonant frequency down. Since all elements are affected equally simply applying a negative correction factor (making the elements shorter) until the SWR is low will allow the antenna to operate normally. When the water, snow or ice is gone put the antenna correction back where it was. This feature allows you to use the antenna in any weather conditions with no performance degradation, as opposed to fixed element length Yagis which may be unusable for as long as the elements have the water, snow or ice on them.

To change the correction factor press the "**FINE**" button up for longer and down for shorter. Each press of the button changes the element lengths by 0.1% on **all bands and direction modes.** The lengths change as you press the button so you will see and hear the results in real time. After you are satisfied with the offset you have chosen press "**SELECT**" and the display will flash on and off indicating the change is saved. If "**SELECT**" is pressed without making any change nothing will happen, now pressing "**SELECT**" again will take you back to the "SETUP" menu.

Calibrate

```
Please Wait ...
Calibrating Antenna
```

Selecting Calibrate causes an antenna calibration to be performed. This is the first thing that should be tried if the antenna is exhibiting higher than usual SWR or decreased performance. When the controller is turned off using the power, a small holding voltage is placed on the antenna motors to keep the elements from moving. If power is completely removed from the controller, wind can shake the antenna enough that the elements will slowly creep in. Over time you might occasionally have the motors miss a step or two for whatever reason and performing Calibrate will remedy this. Calibrate mode "over-retracts" the elements in a low-power mode to ensure full retraction into the EHU. After this operation the controller then knows all of the elements are at "home". This usually remedies most cases of the elements being off in their length. The elements are then re-deployed to the appropriate length for the frequency you were on when the calibrate was initiated. Calibration can take two minutes or more depending on the antenna model and **cannot be aborted**, so be cautious or you will be

waiting while the calibrate cycle is completed. Even if the elements are fully retracted the controller still retracts the full length of tape plus some extra. This doesn't cause any damage to the EHU so don't worry about what mode the controller is in, you can initiate a **"Calibrate"** at any time.

Retract Elements

```
Please Wait ...
Homing Elements
```

Selecting Retract Elements causes all antenna elements to be retracted to their home (minimum length) position. Retracting the elements can take up to a minute depending on the currently selected frequency and **cannot be aborted**.

Fine/Coarse Settings

```
Fine/Coarse Settings
 10kHz 100kHz     20M
```

These settings determine the frequency step size when using the **"FINE Up/Down"** buttons and the **"COARSE Up/Down"** buttons to change the frequency of the antenna in normal operating mode. There is a separate fine and coarse setting for each Ham band. If you move the frequency outside of a Ham band while using these buttons the frequency step size remains the same as it was in the Ham band you just exited. The band to be modified is selected with the "**BAND Up/Down**" buttons allowing you to change each band individually as desired. The valid Fine step sizes for each band are 1, 5, 10, 15, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90 and 100kHz. The valid Coarse step sizes for each band are 10 to 250kHz in 10kHz steps.

After the desired setting is shown on the LCD screen press the "**SELECT**" button and the screen will flash off then on indicating the change was made.

Band Limit Settings

Band Limit settings works much like fine coarse settings menu. It is used to set the limits used in the auto track mode, fine coarse and other band sensitive options. It does not effect how the Steppir calculates the element lengths or how create modify works. There is a top and bottom frequency for each band, select must be pressed for changes to take effect.

Autotrack Settings

Note: Autotrack mode requires the optional transceiver interface board

```
┌──────────────────────────────┐
│ Autotrack Settings           │
│        25kHz     20M         │
└──────────────────────────────┘
```

The Autotrack settings determine how much the frequency must be changed before the antenna will retune when AUTOTRACK has been selected using the front panel button. When selected, the green LED next to the AUTOTRACK button illuminates and the controller will track the radio if the optional transceiver interface board is installed. The available settings are 1, 5, 10, 15, 20, 25, 50, 75, 100, 150, 200, 250 kHz, and BAND. The "Band" selection instructs the controller to only retune the antenna when it sees the frequency change to a different Ham band. The band to be modified is selected with the "**BAND Up/Down**" buttons allowing you to change each band individually as desired. After the desired setting is shown on the LCD screen press the "**SELECT**" button and the screen will flash off then on indicating the change was made.

Transceiver Setup

Note: Requires Optional Transceiver Interface Board

```
┌──────────────────────────────┐
│  Din      Dout      Xcvr     │
│  4800     4800       OFF     │
└──────────────────────────────┘
```

These settings determine the data baud rates (both in and out) and the transceiver type connected to the transceiver interface board. The data input baud rate is selected with the "**FINE Up/Down**" buttons. Allowed rates are 1200, 2400, 4800, 9600, 19200, 28800, 38400 and 57600 baud. The data output rate is selected with the "**COARSE Up/Down**" buttons. The transceiver type is selected with the "**BAND Up/Down**" buttons. The currently supported transceivers are Icom, Kenwood, Orion, Yaesu FT847, FT920, FT990, FT1000D, FT1000MP, and FT9000D, and SteppIR. If the transceiver interface board is not installed set the "XCVR" menu to "OFF". Setting this option to "OFF" will also disable the "AUTOTRACK" LED from illuminating if the button is pushed inadvertently.

Test Motors

```
┌──────────────────────────────┐
│ Test  Motors                 │
│ REF    OUT/IN    CYCLE       │
└──────────────────────────────┘
```

Selecting Test Motors will first retract (home) all of the elements and then display the above screen. The "**FINE Up/Down**" buttons are used to select an element (REFlector shown). In addition to the elements on the currently selected antenna, there is an option to select "ALL" elements. Pressing "**COARSE Up**" will cause the selected element to move its copper tape a few inches out of the EHU. Pressing "**COARSE Down**" will retract the copper back inside the EHU. Pressing either "**Band Up**" or "**Band Down**" (CYCLE) will move the copper tape of the

selected element out of the EHU a few inches, and then automatically retract it back inside the EHU approximately two seconds later. If the element makes a chattering noise and doesn't move but then after a few seconds extends out a few inches the motor may be wired incorrectly. If the element doesn't move at all it is either not plugged in, mis-wired, or the controller has a bad driver chip. There is additional troubleshooting information available on the SteppIR website.

Test Relays

Note: This option will only be available on antennas that have relays.

```
Test Relays
Relay1 Relay2 Relay3
```

This mode is provided to allow easy testing of the relays on the DB series of antennas. Refer to the Antenna's Operators Manual for details on how to perform these model-specific tests. This test is essential to perform on a newly built antenna to ensure it is wired correctly. Selecting Test Relays will first retract (home) all of the elements and then move the copper tape for each element a few inches out of its EHU (to allow for an ohm meter connection to the copper tape). Pressing "**FINE UP**" closes (activates) Relay1 and opens (deactivates) the other two relays. Similarly, pressing "**COARSE UP**" closes Relay 2 and pressing "**BAND UP**" closes Relay 3. Pressing "**FINE DOWN**", "**COARSE DOWN**", or "**BAND DOWN**" will open all three relays. When exiting this menu, all three relays are opened and the elements are automatically retracted again.

Software Version

```
Firmware: 1211240011
Xcvr: 99  Driver: A8
```

This menu item displays the Main Controller Board firmware revision, as well as that of the Transceiver Interface Option Board and the Motor Driver firmware. If a Remote Driver Board is connected and selected, then the Remote Driver firmware version is displayed *instead* of the SDA100 internal driver firmware version.

Antenna Selection

```
Select
Antenna          DB-18E
```

Use the "**BAND Up/Down**" buttons to select the antenna that the SDA100 is connected to. After the desired antenna is shown press the "**SELECT**" button and the controller will display "Updating Antenna…" When complete, the controller will restart. Any custom antenna lengths

will be lost when switching to a new antenna.

Firmware Update

```
USB    Master Antenna
Boot   Reset  Default
```

In addition to being the entry point for the firmware update mode this menu also is used to reset the firmware.

USB Boot "**Fine UP**" : this mode is used in conjunction a PC running the Flip Atmel firmware loading utility. If the controller is put in this mode without a PC connected and running the Flip software, power must be removed from the controller (*by removing the power cord*) to get the controller back to the normal operating mode. For more information on loading a new version of firmware, see How to Install or Update SDA100 Firmware.

Master Reset "**Coarse UP**" : pressing this button will reset all parameters back to factory default values, including the antenna type. Must press the "Select" button to confirm.

Antenna Default "**Band UP**" : pressing this button will reset **all** antenna information for the currently selected antenna back to factory defaults. You must press the "Select" button to confirm.

Fault Code Menu

```
Faults:
Press Band Up Scroll
```

When there is a problem a message will flash on the normal operating screen "Controller Problem".
This menu will display more information about what the trouble is. Pressing the "**Band UP/DN**" buttons will scroll through the list of what is wrong.

No Response error message can be intermittent and indicate the controller is having trouble communicating with the device. In the case of the remote driver this can be caused by cable and ground problems.

Driver chip error is a fatal error and must be fixed before the controller can be used. The "U" number is referring to the chip on the driver board that is causing the problem.

Antenna cable open is an indication that one of the elements may not be working. The numbers refer to the pin on the 25-pin connector on the back of the controller. A driver chip can also cause this error.

Create/Modify

```
Create Ant       20M
REF     406.5" 14.200
```

The Create/Modify tool enables the user to customize antenna element lengths, change relay settings, and control special antenna modes. All changes made in the Create/Modify mode will immediately update the antenna but none of the changes are saved until you are finished, so you can experiment and test without worries of mis-configuring the antenna.

The "FINE Up/Down" buttons select what is to be done. It will scroll through a list of the elements and possible actions.
The "COARSE Up/Down" buttons adjust the displayed value.
The "BAND Up/Down" buttons are used to adjust the frequency inside a band. If the frequency is scrolled outside the band segment limit and something has been changed the save message will be displayed. Note: if the frequency is scrolled outside the segment limits and then changes are made they may not get saved where you want them to be.

The "NORM", "180", "BI" button will select the directions for which lengths will be modified.

The "Band Correction Factor" setting allows you to change all of the elements lengths by a percentage for the currently selected band only, so each band can have a unique correction factor. It has a range of +/- 2.0% and will be added to any correction factors that may have been made using the Global Correction Factor options.

```
Band Correction  20M
Factor  0.0%  14.200
```

Wire Dipole Mode: On antennas with a wire dipole option such as the DB36 or DB42 an option will appear when the antenna is on the band where the dipole is active called the "dipole mode". The wire dipoles are unique in that they have a saved length value every 100Khz. The dipole lengths can only be adjusted on even 100Khz frequency boundaries. When in "dipole mode," the "COARSE Up/Down" buttons will adjust both the reflector and the last director (D2 for the DB36/80 and D3 for the DB42/80) at the same time. These two elements are used as top-hat loading for the 80M dipole. If you need to change last Director and Reflector individually to improve the SWR they can be adjusted normally by selecting the individual element name rather than the dipole mode.

When in "dipole mode," the display appears as follows:

```
Dipole mode      80M
599.0",597.0"  3.800
```

The length displayed is for the Reflector, Director. While in this mode, the two elements maintain the original factory reflector to director length ratio.

Relays: On antennas with relays there will be a selection that allows you to switch the relays on and off effectively changing the driven element. For instance in the Dipole mode you can switch off the relay that   selects the dipole.

```
 Create Ant      20M
RLY      No   14.300
```

Element Length: To adjust an element length use "FINE Up/Down" buttons select the desired element. Use the "COARSE Up/Down" buttons to adjust the length, the antenna will immediately track the adjustment.

Restore Default: Will clear or set the currently selected band in all 3 directions (NORM, 180,BI) back to factory defaults and save the values.

```
Restore Default? 20M
Press Select
```

Exit Create/Modify: When done use the "FINE Up/Down" buttons to Exit create/modify. Pressing the "SETUP" key will also exit the Mode.

```
Exit Create/Modify
Press Select
```

If a setting was modified, this menu will be displayed:

```
[ ]Yes      Save Band
[X]No        Changes
```

Use the "Fine" buttons to select Yes or No then press the "Select" Key.

How to Install or Update SDA100 Firmware

Requirements

Atmel Flip programming software
USB Type A cable to USB Type B Mini cable (Amazon B00NH11N5A)

Precautions

Do not connect the SDA100 to the computer with the USB cable until the Flip software has been installed.

The Atmel Flip software may not be compatible with all versions of Windows 10. You may need to run the Flip software on a previous version of Windows.

Instructions

Install the Atmel Flip software

The SDA100 controller can be loaded with new firmware using the Flip software tool available from Atmel: http://www.atmel.com/tools/flip.aspx

At the time of this writing, the tool will run on Microsoft Windows operating systems, as well as x86 versions of Linux. For those that are using Windows 10, Atmel advises installing the version of flip that **includes** the Java Runtime Environment.

Download the Flip software from the Atmel website, and install it, noting the install location. When the SDA100 is plugged in, you may be required to manually locate the required USB driver which is in the FILP USB directory of the installation directory (e.g. C:\Program Files (x86)\Atmel\Flip 3.4.7\usb\)

Download the SDA100 image to your computer

Obtain the SDA100 image from the SteppIR website, and place it in a known location on your computer.

Attach the SDA100 to the PC

Remove power from the SDA100 controller **by removing the power supply plug**
Connect the USB Cable
Reattach the power cable to the SDA100 controller

Place the SDA100 into firmware load mode

If a pre-Mustang release of software is on the controller, do the following to enable firmware load:
1. Press and hold FINE and COARSE UP buttons while simultaneously pressing the POWER switch.
2. The controller will display "FLASH Boot Loader"
   "NORM=BL 180=EE BI=X"
3. Press the NORM button, and the Norm LED should illuminate.

If a Mustang or later release of software is installed on the controller, do the following to enable firmware load:
1. Turn on the controller and enter the setup menu.
2. Select the Firmware Update menu and press the Fine up key.

Program the SDA100

1. Start Flip
2. Click on the Device icon at the top, then select AT90USB647.
3. Select the USB device by clicking on the icon that resembles a USB cable.
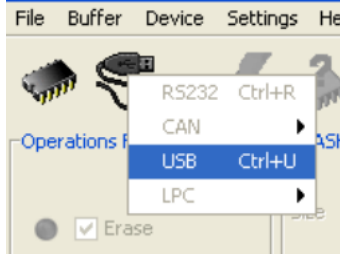
It's recommended to use the options menu on Flip to select USB auto connect.
4. Click the Red and Grey icon with the inward pointing red arrow to bring up the "select hex file" dialog. Locate the SDA100 image file (mustang.hex) and select it. (Or use the File -> Load HEX File menu option)
5. Press the Run button in the lower left corner of Flip
The bottom line of Flip displays the status. The actual firmware load goes quickly.
6. **IMPORANT**: *Verify that the status is verify:pass. If the status does not say verify:pass, do not remove controller power. Make sure the hex file is selected correctly and try again.*
7. Check the "reset" box in the lower right corner of Flip, then click the "Start Application" button next to it to complete the process

Verify that the correct antenna type is selected