STATION MASTER DeLuxe

*micro*HAM

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1 – FEATURES AND FUNCTIONS

General:

- Programmable Antenna, BPF, Rotator and PA controller
- Twenty (20) programmable relay outputs for local use
- Integrated level converter for transceiver CAT control port
- Decodes all frequencies of connected transceiver, including 75m, 6m, VHF and UHF
- Unlimited number of custom defined frequency segments “bands”
- Single USB connection to computer
- Stand alone operation
- Internal Rotator control
- Virtual Rotators function
- Separate RX/RX2/TX antenna support
- Automatic Antenna Scan function
- Unlimited number of custom defined sequencer outputs
- Automatic power amplifier support
- Fully compatible and simple integration with *micro*HAM “keyers” (*micro*KEYER, DigiKeyer, CW Keyer, *micro*KEYER II, and MK2R). Advanced integration with *micro*KEYER II and MK2R(+).
- Proprietary SteppIR and UltraBeam support for selective automatic tuning and protection
- Hot Switch protection with user defined timing
- TX Inhibit support for Yaesu, Ten-Tec and Elecraft K3 transceivers
- Receive only antenna support
- Optical isolation from computer
- PS/2 keyboard or keypad with dual control of Station Master Deluxe and *micro*HAM “keyer”
- Integrated chokes and filters for maximum RFI resistance
- Metal/Aluminum case, powder coated and silk screened
- Free, no time limit firmware/software upgrades via Internet

Radio control:

- Integrated level converter for CI-V, FIF-232, IF-232, or RS-232
- Up to 57600 Baud with fake handshake support
- Supports most Elecraft, Icom, Kenwood, Ten-Tec, Yaesu and other radios
- iLINK connectivity to *micro*KEYER II and MK2R(+)

Antenna Control (Port A):

- Ten (10) programmable relay outputs
- Configurable common
  - ground
  - 13.8V positive
  - external power, max. + 24V
- Programmable break-before-make delay
- Compatible with all remote antenna switches using common ground or positive control

Additional Antennas or BPF Control (Port B):

- Six (6) programmable relay outputs
- Configurable common
  - ground
  - 13.8V positive
  - external power max. + 24V
- Compatible with all automatic BPF on the market
- Four (4) programmable relay outputs
- Both poles of relay contact available

Internal Rotator Control:

- Three (3) programmable relay outputs
- Both poles of relay contact available
- Configurable support for BRAKE or SPEED control
- Support for multi-turn rotators
- Support for rotators with analog (pot) or discrete (pulse) azimuth read back
- Programmable software limit switches
- Dead zone definition
- Target finding strategy selection for optimal handling
- Support for “slipping” rotators
- Four memories for most wanted azimuths
- Automatic azimuth control from logger

Virtual Rotator Control:

- Unlimited number of antennas can be joined to Virtual Rotator
- Programmable azimuth ranges for each Virtual Rotator antenna
- Automatic azimuth control from logger
- Unlimited number of Virtual Rotators per Band

Power Amplifier Control:

- Automatic tuning for CI-V controlled automatic amplifiers (Icom PW1, Expert SPE, OM-Power)
- Automatic band switching for BCD controlled amplifiers (Yaesu VL-1000, FL-7000)
- Support for QSK Power Amplifiers
- Support for “shared” Power Amplifiers

uLINK Features

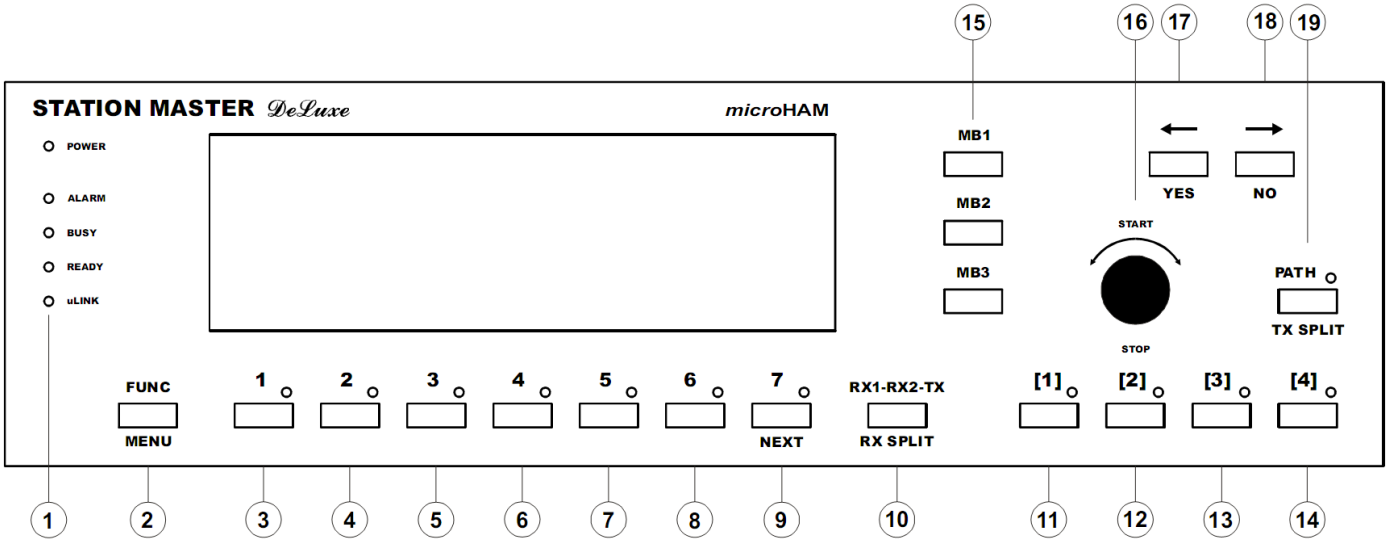
- Allows control of all station devices (antennas, rotators, amplifiers) by multiple operating positions
- Virtually unlimited number of configurable relay outputs
- Virtually unlimited number of rotators
- Virtually unlimited number of serial port control devices
- Support for stacked antennas including complex topologies (e.g., stacked stacks)
- Intelligent rotator control including linked/slave rotators like rotator on rotary tower
- Configurable interlocks to prevent damage and support various operation styles or contest rules in any kind of multi-transmitter stations
- Special handling of "shared" devices – e.g., muti-band antennas, shared amplifiers, SteppIR and UltraBeam antennas

2 - IMPORTANT WARNINGS

ALWAYS check the polarity of the 13.8 V power supply.

If your radio includes upgradeable firmware
DO NOT perform any upgrade through Station Master Deluxe.

3 - HARDWARE DESCRIPTION
Front Panel



1. **STATUS LEDs**

   POWER
   LED lights when +13.8V is applied (power switch on).

   ALARM
   LED lights when “ALARM” condition happens, transmission may be inhibited.

   BUSY
   LED lights when “BUSY” condition happens, transmission is inhibited.
   LED flashes when “BUSY” condition happens, transmission is allowed.

   READY
   LED lights when transmission is allowed.
   LED flashes when transmit condition has been changed and will be applied on next transmission cycle.

   uLINK
   LED lights when uLINK interface is powered from uLINK HUB.

2. **FUNC/MENU**
   Short press and release opens “Function” list.
   Press and hold for more than one second opens “Menu” list.

3. **Antenna selection nr. 1**

4. **Antenna selection nr. 2**

5. **Antenna selection nr. 3**

6. **Antenna selection nr. 4**

7. **Antenna selection nr. 5**

8. **Antenna selection nr. 6**

9. **Antenna selection nr. 7/NEXT**
   Antenna selection nr. 7. If there are more than 7 selections this button moves to next page of antenna selections

10. **RX1-RX2-TX/RX SPLIT**
    A short press moves between antenna selections for the RX1, RX2 and TX paths
    Press and hold for more than one second toggles RX1/RX2 receive antennas split “RX SPLIT”
    RX SPLIT is indicated by small 1 or 2 number on left side of focus mark

11. **[1]** Antenna sub-selection nr. 1

12. **[2]** Antenna sub-selection nr. 2

13. **[3]** Antenna sub-selection nr. 3

14. **[4]** Antenna sub-selection nr. 4

15. **MB1, MB2, MB3**
    Short press and release recalls memory bank 1, 2, or 3 settings.
    Press and hold for more than one second stores current settings to memory bank 1, 2 or 3.
    Each memory bank is band-dependent.

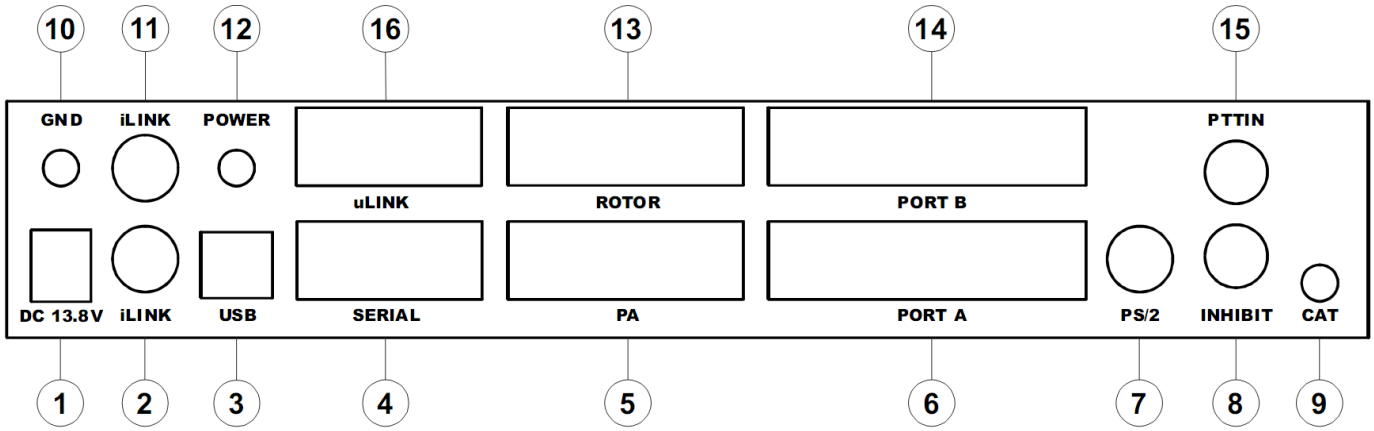
16. **ENCODER**
    Rotary encoder with push button. Functions vary based on configuration and antenna selection.

17. **<-/YES**
    Button for browsing backward among available antennas and menu navigation.

18. **->/NO**
    Button for browsing forward among available antennas and menu navigation.

19. **PATH/TX SPLIT**
    Short press invokes selected PATH properties menu if exist.
    Press and hold for more than one second toggles RX/TX antennas split, “TX SPLIT”.
    TX SPLIT enabled is indicated by yellow led above button.

Rear Panel



1. **DC 13.8V**
   Power Supply - 2.1 x 5.5 mm coaxial jack, center is positive (+).
   IMPORTANT: Be sure to observe the proper polarity!

2. **iLINK**
   MiniDIN-6 for connection with microHAM MKII, MK2R or function expansion module.

3. **USB**
   USB B connector for computer connection.
   Standard USB A-B cable.

4. **SERIAL**
   RS232 level serial port.
   DB9 female jack.
   See “Connecting Hardware” chapters for details.

5. **PA**
   DB15 female jack for connection with Power Amplifier.
   Compatible with microHAM “PA” cables.
   See “Connecting Hardware” chapters for details.

6. **PORT A**
   DB25 female jack for antenna switch connection.
   See “Connecting Hardware” chapters for details.

7. **PS/2**
   MiniDIN6 for PS/2 keyboard or PS/2 keypad.

8. **INHIBIT**
   Power inhibit output for transceiver.
   RCA jack TIP - Signal SHELL – GND.

9. **CAT**
   4 pole 3.5mm phone jack for transceiver control. Compatible with microHAM “CAT” cables.

10. **GND**
    Terminal for connection to station ground.

11. **iLINK**
    MiniDIN-6 for connection with *micro*HAM *micro*KEYER II, MK2R, or function expansion module.

12. POWER
Power Switch.

13. ROTOR
DB15 female for connection with Antenna Rotator.
See “Connecting Hardware” chapters for details.

14. PORT B
DB25 female for antenna switch, BPF and/or sequencer connection.
See “Connecting Hardware” chapters for details.

15. PTTIN
input for PTT output from transceiver or PAPTT from microHAM “keyer”.
Active when grounded.
RCA jack: Tip – signal, Shell – ground.

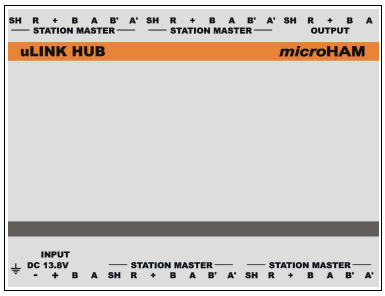
16. uLINK
uLINK network connection.
DB9 female jack.
See “Connecting Hardware” chapters for details.

uLINK MODULES

uLINK Modules are micro-controller based remote boxes used for control and interface of *“shared”* devices. “Shared” devices are all devices included in the station setup which have to be available to and controlled by more than one station (SMD). Such shared devices are antenna switches, stack switches, four square controllers, rotator controllers, tuners, serial port wattmeters, matching networks, power amplifiers etc …

microHAM provides several modules with different control interfaces and functions to control a variety of shared devices.

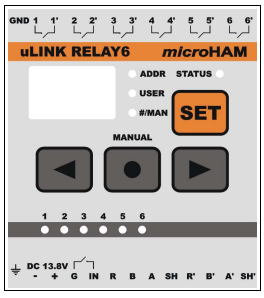
uLINK HUB



The uLINK HUB serves as a concentrator and isolated power source of SMD controllers connected to the uLINK bus. Up to four SMDs can be connected to one uLINK HUB. uLINK HUB is a basic element of the uLINK network, every setup must contain at least one.

Each SMD is connected to the uLINK HUB by single CAT5/6 cable but the connection uses two wire pairs - one incoming, one outgoing - to maintain the daisy-chain topology. The third and fourth pairs are used for feeding isolated power from uLINK HUB to uLINK circuits in the SMD to keep uLINK bus isolated from all other circuits, minimize interference, maximize immunity and keep bus functionality even when some stations are turned off. The power pairs are connected in parallel to decrease resistance. There is a dedicated LED on the front panel of SMD, indicating that the uLINK bus is powered.

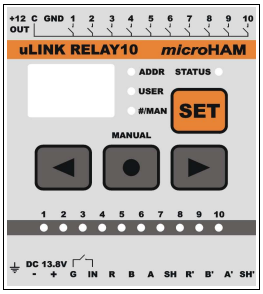
uLINK RELAY6



uLINK RELAY 6 and uLINK RELAY 10 are the most used uLINK network module – they provide relay contact outputs for device control. The relay modules are used for any device requiring simple control – switch input to ground, connect to power or connect two input ports together. uLINK RELAY6 has six (6) isolated SPST contacts located at top terminal. Each contact is rated 3A @ 125VAC or 30VDC.

This module could be used for interfacing devices with few control lines; AC/DC controlled devices (like a K9AY controller or Ameritron RCS-4), making AND or OR logic condition; whenever access to both terminals of the contact are necessary; and when connection to a common positive or common ground is not an option.

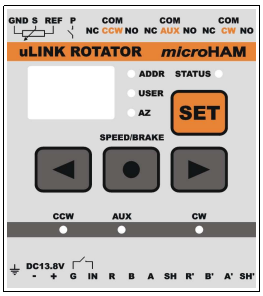
uLINK RELAY10



uLINK RELAY10 has ten (10) separate relay contacts and one common pole located at top terminal. Each contact is rated 3A/125VAC/30VDC. Common pole can be connected by external wire jumper to GND terminal pin for sinking outputs (connected to ground) or to +12 OUT terminal pin for 12V sourcing output. If controlled device requires different control power it can be applied to the C and GND terminal.

This module can be used with almost all antenna switches on the market including microHAM switches as well as DX Engineering or Array Solutions boxes.

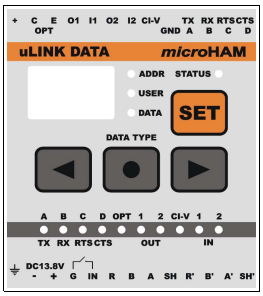
uLINK ROTATOR



uLINK ROTATOR is an uLINK module which can control commercial or home made rotator with discrete control of AC or DC (non PWM) motors.

uLINK Rotator supports either analog sensor (pot) or pulse counting sensor (reed contact) direction indicators. There are three relay contact outputs (CW, CCW and AUX). AUX may be configured as either SPEED (Yaesu style) or BRAKE (Hy-Gain style). LEDs CCW, AUX and CW on the bottom row indicate currently actuated relays. Contact current rating is 16A/250VAC/30VDC.

uLINK DATA



uLINK DATA is designed to control data devices and supports: one RS232 serial port with RTS/CTS, a CI-V port (translates frequency of the transceiver coupled to SMD into the Icom protocol, two configurable inputs, two configurable open collector outputs and one optically isolated output.

These capabilities allow uLINK DATA to control most automatic power amplifiers, serial antenna tuners, rotators with RS232 ports, SteppIR controllers, and other RS232 devices. The list of supported devices will be extended based on users request.

Alternatively, the serial port outputs can be switched to BCD TTL BAND DATA outputs by moving four (4) jumpers to BAND DATA position. By default, uLINK DATA jumpers are set to RS232 serial port.

uLINK BUS

uLINK is a name for microHAM station network. It is an isolated, industrial standard RS-485 multi-master bus which provides device control networking for the SMD system. All SMDs are connected to the uLINK bus through uLINK HUB boxes and share control of multiple uLINK modules. These modules serve as network interface devices to control antenna switches, stack switches, four square switches, rotator controllers, tuners, power amplifiers, etc …

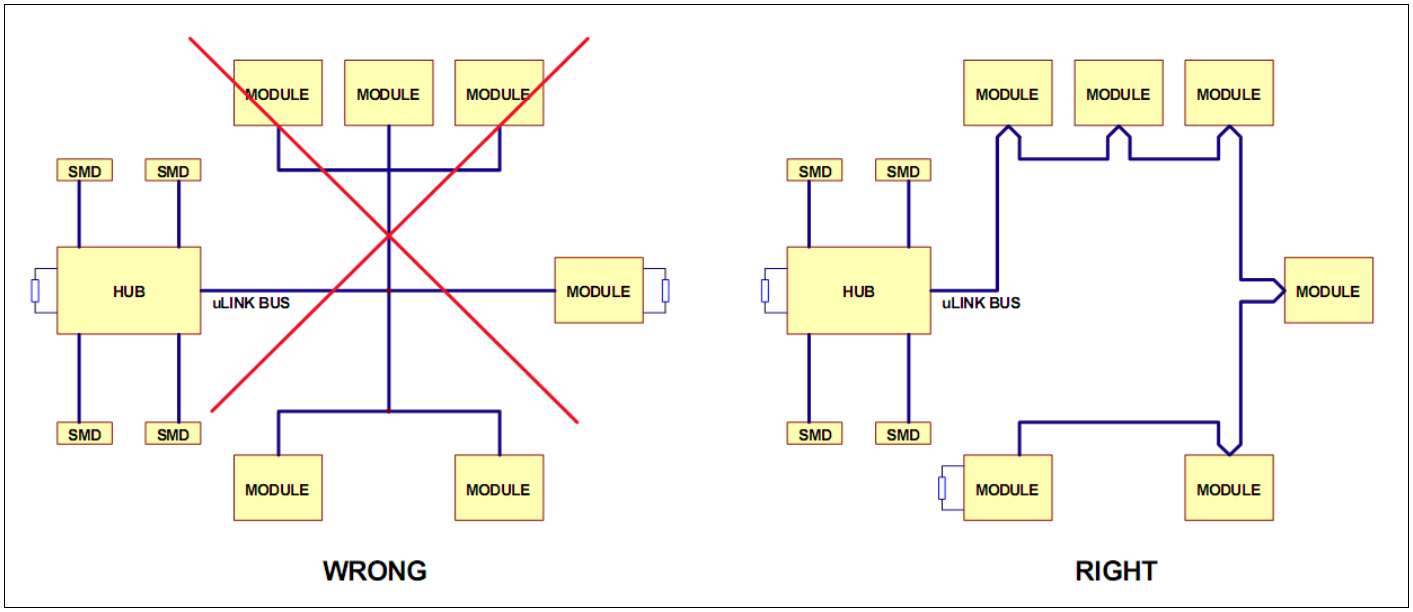
NOTE: uLINK bus is completely different from, and independent of, a computer LAN network, never connect them together.

Every uLINK device on the network is identified by its unique network address. uLINK supports up to 31 SMD controllers (31 radio operating positions in any combination from 31 individual operating positions to 15 SO2R operating positions). Each SMD can access up to 128 uLINK interface modules.

Hardware observations:

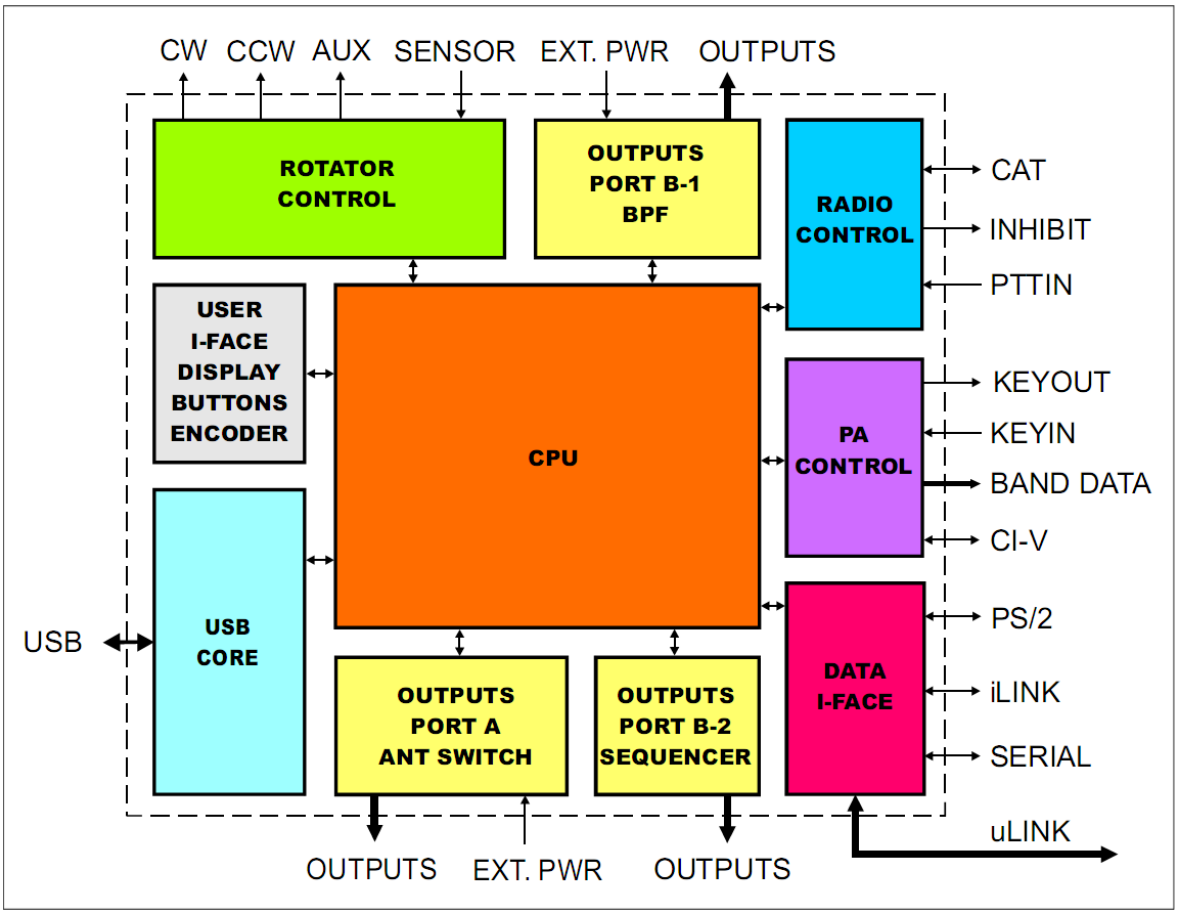
uLINK bus is strictly a **linear** bus; the physical connection must be a daisy chain, going from one device (module) to another. Total length of the uLINK bus **must not** exceed 1.2km (4000 ft). Star topology is not allowed.

uLINK, is a transmission line having specific impedance and must be properly terminated at both ends. uLINK is designed to match the impedance of easy to obtain CAT5/6 cables which should be used as the network media. The bus uses one pair of shielded cable for data, one, parallel connected, pair as a common relative reference point and two pairs for power distribution. Details are described in the Connecting Hardware chapter.



IMPORTANT: If possible, put the control cable under ground if the control cable runs outside the shack into the antenna field. The control cable can lay on the ground but avoid placing it near the end of radials, close to transmitting elements or antenna feed points. Never allow the control cable to hang in open air where it can pick up RF!

4 – Block Diagram



Station Master Deluxe block diagram

5 - INSTALLATION

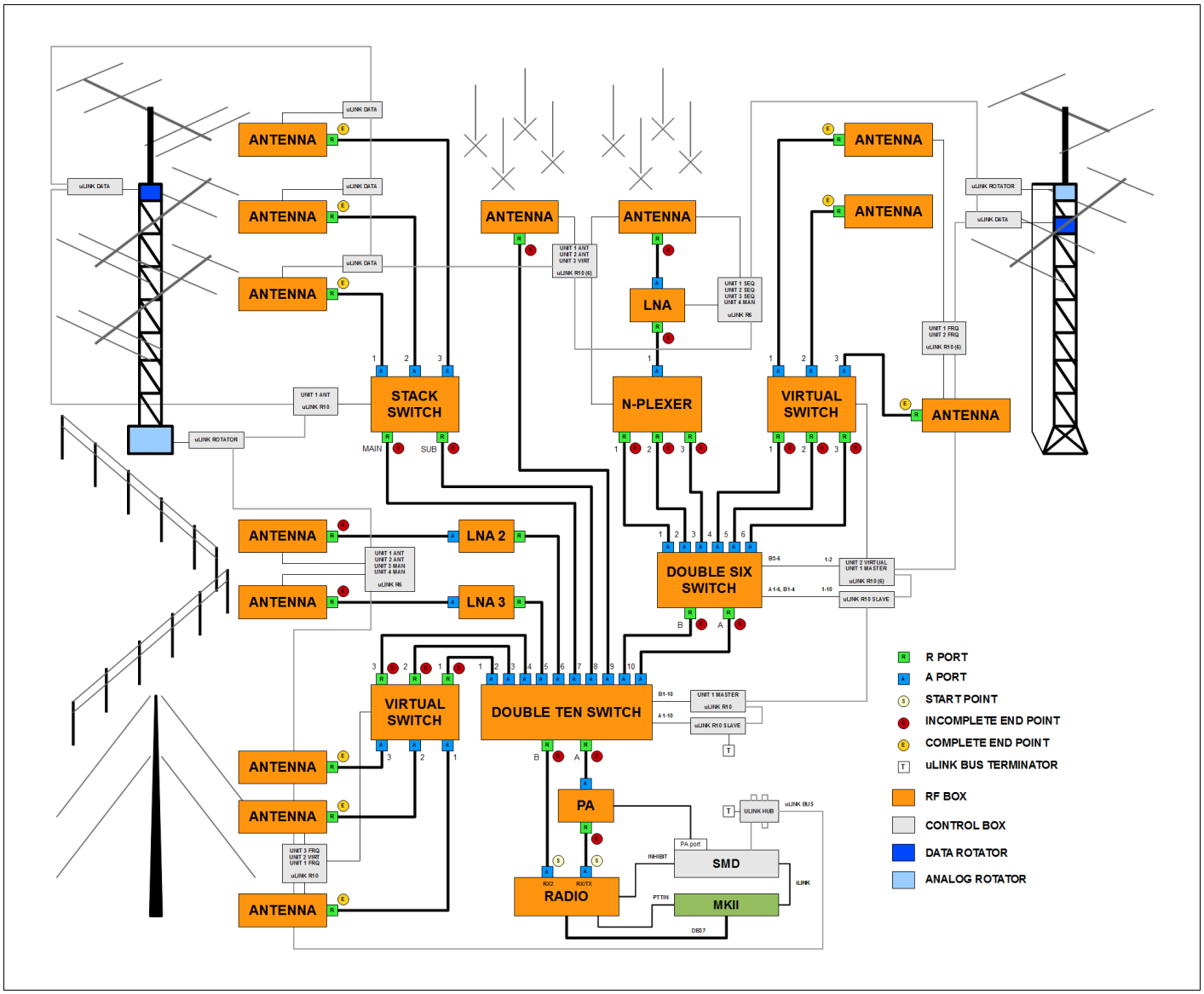
Installing Station Master Deluxe (SMD) consists of several steps:

1) **Read this manual completely - there is no quick setup!**
2) **Do not connect power to Station Master Deluxe until instructed to do so!**
3) **Document your station.** Prepare a diagram showing the entire system with all switches, antennas, rotator controllers, filters, power amplifiers, etc.
4) Layout and install the uLINK network.
5) Prepare Station Master Deluxe for your station – set the jumpers, make the necessary connections to antenna switches, power amplifiers, rotators, the uLINK bus, transceiver and microHAM Keyer (if present)
6) Install microHAM USB Device Router (the control and interface software).
7) Configure Router and Station Master Deluxe for the hardware in your station (see the “Connecting Hardware” chapters of this manual for details).
8) Load the configuration and **verify that the setup operates as intended!**
9) **Enjoy!**

CONFIGURATION MANAGEMENT TERMS

In order to make a valid configuration there are several precautions which have to be observed.

- Layout and document your RF installation. It is vital to start with a diagram showing the entire system, including every component - transceivers, antennas, switches, amplifiers, filters, rotators etc. Station Master Deluxe must know every device in the system in order to control everything correctly and safely. In this manual, components of the RF setup are called "**RF Boxes**."
- Give every RF BOX a short but easily understood name. This name will be included in many of SMD reports.
- Add the controls for every RF BOX. Document the number and function of the control wires, the type of any RELAY control unit - ANTenna switching, FReQuency based switching, SEQuenced switching, MANual, - the type of ROTATOR modules, and DATA modules.
- Define **addresses** and **units** for the uLINK modules and verify the design.



TERM **RF BOX**

RF box is any device in the RF system controlled by SMD or uLINK module. RF boxes have **"A"** and **"R"** ports. Termination points - transceivers and antennas - are special RF boxes which have only A ports (transceivers - a simple transceiver has one A port, a dual RX transceiver with separate 2nd RX antenna port has two A ports) or only R ports (antennas). Other RF boxes can have more than one R or A port; for example, a 6 way antenna switch has one R port and six A ports. A Band Pass Filter or Power Amplifier has one R and one A port. Our Double Ten Switch has two R ports and ten A ports.

IMPORTANT: The only valid connection is from one A port to one R port. Connecting ports in parallel, connecting an A port to another A port or an R port to another R port is not allowed.

TERM **CONTROL BOX**

Generally stands for uLINK module or Relay Unit.

TERM **A PORT**

Is a port of the RF box which connects to another RF box going toward the antenna.

TERM **R PORT**

Is a port of RF box which connects to another RF box going toward the transceiver (radio).

TERM **ADDRESS**

Every device (SMD and uLINK module) on the uLINK Bus is identified by its unique address. The address range from **1 to 31** is reserved for SMDs and addresses from **32 to 254** are designated for uLINK modules. Address 0 and 255 are reserved. The address for SMD is set in Router. Addresses of the uLINK modules are set on the module.

TERM **UNIT**

Unit is a group of outputs on a uLINK RELAY module used to control a specific RF Box. Outputs are grouped into units. One uLINK Relay Module may be used to control multiple RF Devices and two uLINK Relay modules may be paired to control an RF device requiring more than 10 control lines.

For example: we might to control two RF devices - a 6 way switch and a 4SQ box - using one uLINK Relay10 module. Since the Six way switch needs 6 control wires and the 4SQ box needs 2 control wires, we would define two (2) units for this module. The first unit would have six outputs for the Six Switch, the second unit would have two or three outputs for the 4SQ. Any remaining outputs could be assigned to a third and/or fourth unit for use with another device.

IMPORTANT: One unit always consists of a continuous sequence of outputs. Relay outputs may be skipped only between units. Pin numbering always begins at the lowest output on the first unit and continues upward.

NOTE: One uLINK relay module can be divided into a maximum of four (4) units.

NOTE: The local ports of SMD (PORT A and PORT B) are treated as 20 outputs in at most 10 units.

TERM **SLAVE MODE**

Slave mode is a special behavior of a uLINK RELAY module used only when an RF switch requires more than 10 control lines. Typical examples are the Double Six Switch (12 lines) or Double Ten Switch (20 lines). If module is set as slave, all of its outputs - six (6) for uLINK RELAY6 or ten (10) for uLINK RELAY10 - are treated as a single SLAVE unit. The first unit of any other uLINK Relay module can be used as the Master (enable) for this unit.

IMPORTANT: All outputs on the slave module must be used. Master for a slave module must be the first unit (Unit 1) of a different module. Pin numbering always begins with the first (lowest) output of the slave unit and continues upward with the lowest output on the first unit of the Master module.

NOTE: RF boxes (switches) and associated items (rotator, serially-controlled devices, etc.) connected to the local ports of SMD can be controlled only from that SMD. Any resource that is to be shared among multiple positions (transceivers) - for example, shared antennas or shared amplifiers, must be connected to uLINK modules.

TERM START POINT

START point is **always** a single A port of the transceiver, RX/TX or RX2 port.

TERM END POINT

End points are generally antennas (complete END point). However, in specific situations END POINT can be any R port (an incomplete or "dead" END).

NOTE: When an incomplete end point is used in an antenna selection, SMD "fills out" the connections from that point with the **last used** control values from its memory. These values use the appropriate values for TX, RX or RX2 but **do not** consider frequency dependencies. SMD considers frequency **only** when using complete endpoints (explicit paths). As an example, a radio's start point is connected to the antenna switch with two antennas - one antenna for 160m and second antenna for 80m. Both bands have to antennas defined - one using complete end point (the specific antenna) and a second (incomplete) endpoint defining only the antenna switch. If the last used antenna selection for 80m was the incomplete path ending at the switch and the last used 160m antenna was the specific 160m antenna, on switching from 160 to 80m SMD will select "last used" antenna for 80m (the path ending at the switch) and the last used state of the switch (the 160m antenna) thus selecting the wrong antenna.

SMD uses additional, real time error checking for protection, so transmission will be not allowed. Once the complete endpoint (80m antenna) is selected, SMD will remember that selection and the proper path will be used (even if an incomplete path is selected) until the next band change. Avoid using incomplete paths whenever possible.

TERM ANTENNA SELECTION

Is a term for user choice of which Antenna Path will be built when pressing one of the seven main Antenna Selection buttons. Virtual Rotators and Antenna Groups are special types of Antenna Selections - both will be explained separately.

TERM ANTENNA PATH

The complete connection from the START point to one or more END points including all attributes involved in the signal path.

NOTE: Antenna Path may not be just a simple connection from START to END point, it may have several "branches", each having its END point definition.

These terms are defined here because they will be used through this manual and we will not explain them again. When a new term is introduced, it will be marked with a **TERM** icon.

Preparing Station Master Deluxe for Use

Do Not turn the Station Master Deluxe On until instructed to do so!

Connecting Station Master Deluxe with *micro*KEYER, DigiKEYER, DigiKeyer II or CW KEYER:

1. If your station includes a *micro*HAM *micro*KEYER, DigiKeyer, DigiKeyer II, or CW KEYER disconnect the computer control lead (CAT) from the radio. Connect the appropriate CAT cable (optional accessory) for your radio to the CAT jack of SMD and the computer control port of your radio.

2. Connect a RCA cable (supplied) from the PTTIN jack on Station Master Deluxe to the PTT output (amplifier PTT) of your transceiver. Refer to the Operator's Manual for your transceiver for the proper signal connection. PTT output is on the REMOTE DIN for Kenwood, the Band Data jack for Yaesu, and ACC2 (DIN 7) for Icom.

   If your transceiver does not have an RCA connector for PTT Output, it will be necessary to make the proper adapter.

   IMPORTANT: This connection is required for proper operation of Station Master Deluxe with VOX.

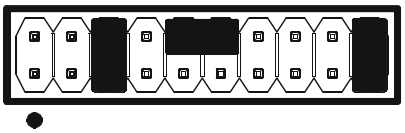
3. Using an RCA "Y" cable (Radio Shack 274-881 or equivalent, not supplied), connect the PAPTT output of *micro*KEYER or DigiKEYER or the PTT output of CW Keyer to the PTT IN jack of Station Master Deluxe.

4. If your transceiver has an INHIBIT input (Yaesu often labels INHIBIT "LINEAR" on the BAND DATA jack), connect inhibit input of your transceiver to the INHIBIT output jack of SMD.

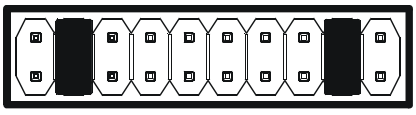
   IMPORTANT: Connecting INHIBIT is best way to prevent hot switching.

5. Remove the top cover from Station Master Deluxe and set the CAT jumpers as shown in the following chart. The CAT interface jumpers must be configured to select the proper signal level for your transceiver.

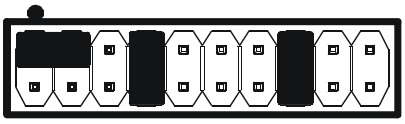
RS-232 levels:
Elecraft: K2, K3, Icom: 7800, JRC: JST-245
Kenwood: all radios with DB9 CAT connector
Ten-Tec: all radios with DB9 or DB25 connectors
Yaesu: all radios with DB9 CAT connector



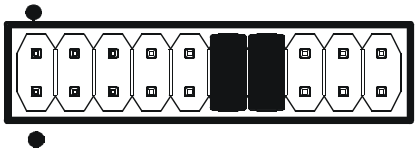
IF-232 levels:
Kenwood: TS-140, 440, 450, 680, 690, 711, 790, 811, 850, 940, 950



FIF-232 levels:
Yaesu FT-100, 736, 747, 757GXII, 767, 817, 840, 857, 890, 897, 900, 980, 990, 1000, 1000D



CI-V levels:
Icom: all radios except 7800 with RS-232
Ten-Tec: all radios with 3.5 mm connector



NOTE: the CAT interface is not configured at the factory.

Connecting Station Master Deluxe with *micro*HAM *micro*KEYER II, MK2R or MK2R+

1. If your station includes a *micro*HAM *micro*KEYER II or MK2R or MK2R+, keep the computer control (CAT) connection from the *micro*HAM keyer connected to the radio. The Station Master Deluxe CAT jack will not be used for radio control.

2. Connect the supplied 6 pin mini-DIN cable from one of the iLINK jacks (the jacks are identical) on Station Master Deluxe to the REMOTE jack of the keyer. If you are connecting two Station Masters Deluxe units to a MK2R or MK2R+, connect an iLINK cable to each SMD.

3. If your transceiver has an INHIBIT input (Yaesu often labels INHIBIT "LINEAR" on the BAND DATA jack), connect the inhibit input of your transceiver to the INHIBIT output jack of SM.

   If you are connecting two SMD units to the MK2R or MK2R+, be careful to connect the INHIBIT line from from Radio1 to the SMD associated with with Radio 1 and INHIBIT signal from of the Radio 2 to the SMD associated with Radio 2.

   IMPORTANT: Connecting INHIBIT is best way to prevent hot switching.

Connecting Station Master Deluxe without a *micro*HAM "keyer"

1. If you don't have a *micro*HAM "keyer," connect the appropriate CAT cable (optional accessory) for your transceiver from the CAT jack of Station Master Deluxe to the computer control port of your radio.

2. Connect an RCA cable (supplied) between the PTTIN jack on Station Master Deluxe and the PTT output of your transceiver. Refer to the Operator's Manual for your transceiver for the proper connection.

3. If your transceiver does not have an RCA connector for PTT output, it will be necessary to build the proper adapter. PTT output is on the REMOTE DIN for Kenwood, the Band Data jack for Yaesu, and ACC2 (DIN 7) for Icom.

   IMPORTANT: This connection is required for proper operation of Station Master Deluxe with VOX.

4. If your transceiver has an INHIBIT input (Yaesu often labels INHIBIT "LINEAR" on the BAND DATA jack), connect inhibit input of your transceiver to the INHIBIT output jack of SMD.

   IMPORTANT: Connecting INHIBIT is best way to prevent hot switching.

5. Remove the top cover from the Station Master Deluxe and set the CAT jumpers as shown in the chart in Item 5 on the previous page.

Installing *micro*HAM USB Device Router

The Windows setup utility will start and ask into which folder Router and its supporting files should be installed. Note: unless you have a very strong reason to install Router elsewhere, please accept the default location.

IMPORTANT: Locate the USB cable but **DO NOT** connect it to the USB jack of Station Master Deluxe at this time.

To install Router click on the ***Install USB Device Router*** link on the installation CD or download the most recent installation package from the web site: www.microham.com/contents/en-us/d29.html

If you download an updated package, click on "urouter_release_xx_xx.exe" (xx_xx is version) to start the installation.

When the Router installation is completed, click "Finish" to launch Router for the first time.

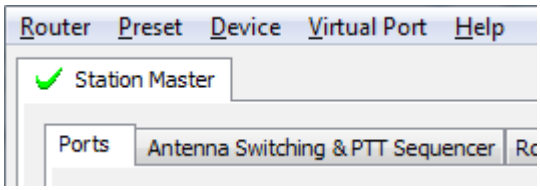
- Connect a 13,8 to 16V DC supply to the **DC 13.8V** jack of SMD.
  Be sure to observe the proper polarity.
- Plug in the USB cable.
- Turn on the Station Master Deluxe and proceed to Configuration Management tab of Station Master Deluxe device to enter your station configuration.

Configuring *micro*HAM USB Device Router

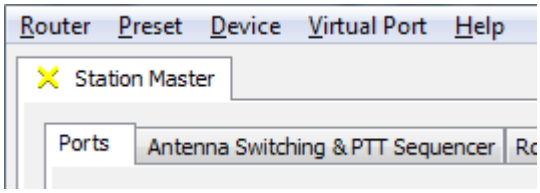
The *micro*HAM USB Device Router (Router) program provides a Windows compatible *configuration tool* for *micro*HAM USB Devices (Station Master Deluxe as well as microKEYER II, DIGI KEYER, *micro*KEYER, CW Keyer and USB Interfaces*)* and *software interface* to other Windows applications (logging software, digital mode software, etc.). The software interface is provided as *Virtual Serial Ports*.

In order to configure and use Station Master Deluxe with Windows compatible application programs, you must be running Router and have turned on Station Master Deluxe Router is then configured as required by the application (logging, control or digital mode) software.

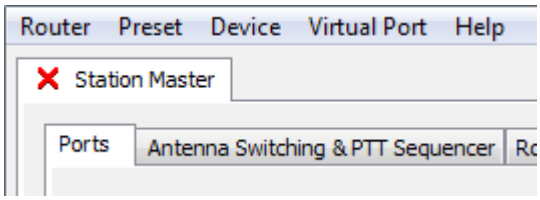
Station Master Deluxe Status



When the USB driver is installed correctly and Station Master Deluxe is turned on Router will show a device tab with a **GREEN** ✓ beside the device name.



When Router shows a **YELLOW** "**X**" instead of a green ✓, it means the USB driver is correctly installed but Router can not communicate with the controller in Station Master Deluxe. This is usually because SMD is not turned on.



When Router shows a **RED** "**X**" instead of a green ✓, it means the device is disconnected and Router does not see the USB part of Station Master Deluxe. This happens when the USB cable is unplugged or the USB driver is not correctly installed.

Creating and Using Virtual Serial Ports

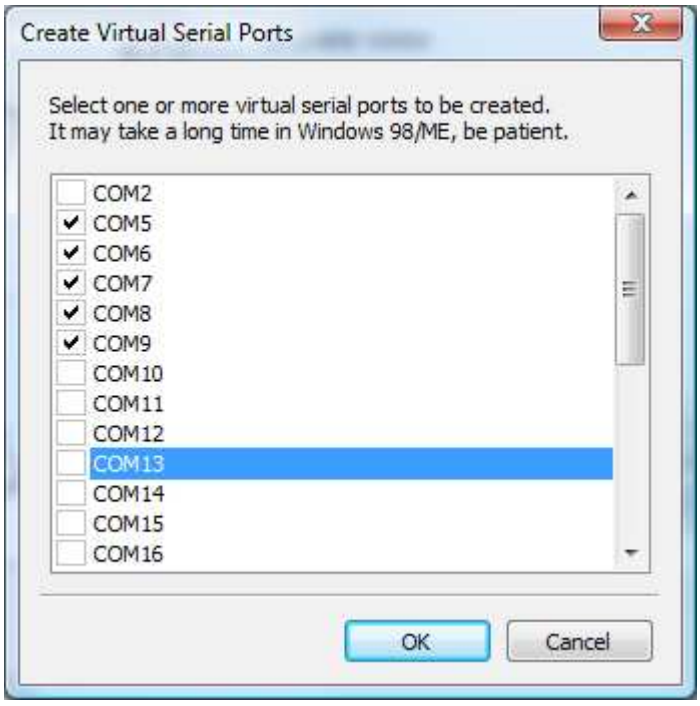
*micro*HAM Router provides a set of virtual serial ports which allow Windows applications (logging or control software) to work with Station Master just as they would work with "real" (hardware) serial ports.

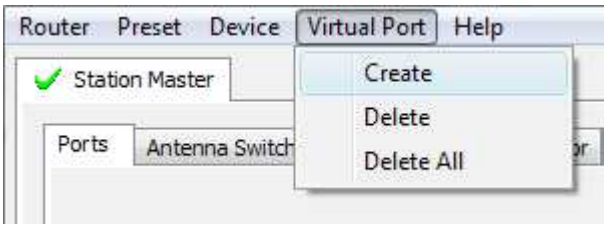
In order to use these virtual Ports, you must first create the ports and then assign a port to each function you wish to use (CAT radio control, Rotator, etc.).

DO NOT define a port that is already in use (for example, COM1 or COM2 which are hardware ports on many motherboards) or a virtual port that is used by another USB device. Even though Router will not allow creating a virtual port on a COM port number which is already present in the system (like hardware COM ports or internal modems), sometimes these ports are hidden. If another device that also uses virtual ports (external USB devices, bluetooth devices, mobile phones, PDAs etc.) is not connected when creating virtual ports in Router, the ports can overlap and will not work properly when you connect such device.

WARNING: Before you begin to create virtual ports, attach all external devices you are using with computer and allow them to connected to the system. Restart Router and then create virtual ports.

Virtual ports are created and deleted from the Virtual Port menu.





Create - Creates virtual COM ports. It is possible to select more than one port at a time by holding the *Ctrl* key on keyboard and clicking on COM port numbers. Creating virtual ports may take a long time (several tens of seconds), be patient.

Delete - Deletes any single virtual port.

Delete All - Deletes all previously created virtual ports.

Do not delete a virtual port until all applications using that port have been closed.

TIP: If you have removed another device which used virtual ports and Router does not offer the released port number, you will need to reset the virtual port bus. You can do this by deleting all virtual ports in Router at once. Select "Virtual Port | Delete All" then create the ports again. Any missing COM port numbers should appear.

6 - *micro*HAM USB DEVICE ROUTER

ROUTER MENU

Restore Router Settings: used to restore settings from a *urs* file created by the backup command.
A *urs* file can be used only with the device for which it was generated (the file contains the unit serial number) on a computer with same port assignments.

WARNING: Restoring a backup deletes all current Router settings including presets, use it carefully!

Backup Router Settings: used to create backup *urs* file.
This file contains Router settings (including Presets) for all devices defined in Router.

Options | General

Load Router on Start-up: when checked, Router will start automatically each time the computer is started or rebooted.
Start Router Minimized: when checked, Router will started minimized
Default Region: Select your default band plan region.

Options | Band Map: (Not used with Station Master Deluxe)
Customizable band edge boundaries used to drive the band data output. BCD codes can be customized for driving antenna switches or bandpass filter control.

Options | Digital Band Map: (Not used with Station Master Deluxe)

Options | Audio Devices: (Not used with Station Master Deluxe)

Options | DVK: (Not used with Station Master Deluxe)

Options | USB:

Noise immunity: selects how many times an undelivered USB packet will be repeated before the USB device is disconnected from the operating system.
Response time: selects how long the USB interface will wait for additional data before sending data to the operating system.

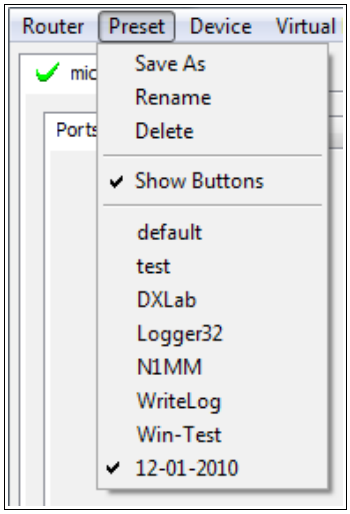
Minimize: Clicking this will minimize Router to the system tray at the bottom right corner of the Windows Task Bar (the "System Notification Area").

TIP: When Router is minimized you can restore it by double-clicking on the Router tray icon. You can also restore Router by double-clicking on the Router icon on the desktop or in the Programs menu.

Exit: Clicking on this item will terminate Router.

NOTE: When Router is terminated the virtual ports will be closed and application software will be unable to communicate with Station Master Deluxe and the radio.

PRESET MENU



For easy switching among applications, Router supports up to 12 user definable **Presets**. Different configurations can be stored in these presets and recalled almost instantly simply by clicking on the preset button.

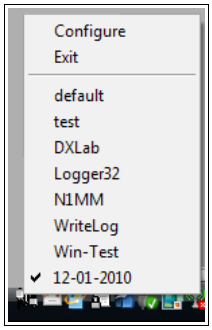
Each preset contains the settings for all devices connected to, and controlled by, Router. For example, if Router controls a Station Master Deluxe, microKEYER II, and a USB Interface II, each preset remembers the settings for **ALL** devices including the assignment of COM ports and the contents of all sub-tabs except the FSK and CW Messages tabs.

NOTE: Presets are not available until they have been saved by the user using Preset | Save as.

There are three ways to apply a preset once it is created:

1. Click on **Preset** and select it from the pull-down menu.
2. Click on a preset button. To have buttons visible in Router, **Preset | Show Buttons** must be checked. When the settings from a preset are applied, a green light located in the preset button is lit. This green light is on ONLY when all settings in Router are same as those stored in the preset.

3. By right clicking on the system tray icon when the Router is minimized.



The presets and the current router configuration are stored to the registry when Router is closed and recalled when Router is loaded.

Save as - Saves the current Router settings to a preset for future use.

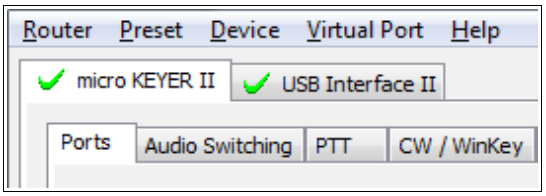
Rename - Allows renaming of an existing preset.

Delete - Delete chosen preset.

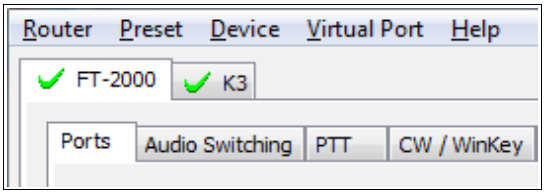
Show buttons - When checked, Router shows the preset buttons.

DEVICE MENU

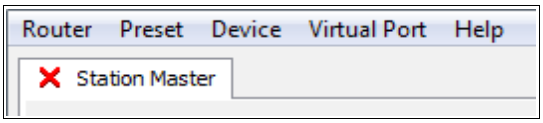
Router can control several devices. This allows configuring the settings for all (interfaces) connected to the computer at the same time using the Presets.



Each device has its own tab (page) in the main Router notebook. The content of each device tab depends on the type of device. Adding a device is automatic when Router detects a new device. Once detected, a device remains in Router even though device is disconnected. Each device is identified by a unique serial string.



Rename – Creates a custom device name. This is useful if two or more devices are connected to the Router. For example CW KEYER, microKeyer and USB Interface II can be renamed to more identifiable names as shown here...



Delete - Removes a device from the Router. Only devices that have been disconnected (those with a **RED** **"X"** on device tab) can be removed. To disconnect a device from Router, unplug the USB cable.

Save Template - will save the current Router settings to template file.

When clicked, Router will open a standard File Save dialog window – the default location is *C:\Documents and Settings\All Users\Application Data\microHAM\cfg.* If a hypertext (*html)* or plain text (*txt)* documentation file of the same name as the template is present in the same directory, it will be associated with the template.

Load Template – will automatically configure Router from a template (*.*tpl* file).
When clicked, Router will open a standard File dialog – the default location is: C:\Documents and Settings\All Users\Application Data\microHAM\cfg - and the desired template can be chosen. When Router loads a template, it looks for an html or txt file with the same name as the template in the same directory. If such file is found, it is displayed.

TIP: Templates are a powerful tool for quickly configuring Router to work with a particular application. Template files are interchangeable between computers and ideal for cloning setups in multi-computer stations or for sharing configurations between users **IF** all hardware is identical.

Store as Power-Up Settings: - will store the current settings of the Keyboard, Display and System tabs to the Station Master's EEPROM. If Station Master Deluxe is operated without connection to the computer it will use the settings stored in EEPROM. If Station Master Deluxe is connected to a computer running Router, the power-up settings will be overridden by the Router settings but the default settings are retained in EEPROM.

Upload Firmware: *micro*HAM will occasionally release updates to the firmware in Station Master Deluxe The update may support new features in Router or improve application compatibility. The most recent public version of the firmware is always available from www.microham.com/contents/en-us/d29.html

To update firmware, download the firmware file to your computer, then click on **Device | Upload Firmware.** A Windows file dialog will open, navigate to the directory into which you downloaded the firmware file and select the file.

NOTE: When upgrading Router, the upgrade will include the latest firmware for Station Master Deluxe. If the firmware is newer than the currently installed firmware, Router will automatically ask for permission to update the installed firmware the first time it connects to Station Master Deluxe.

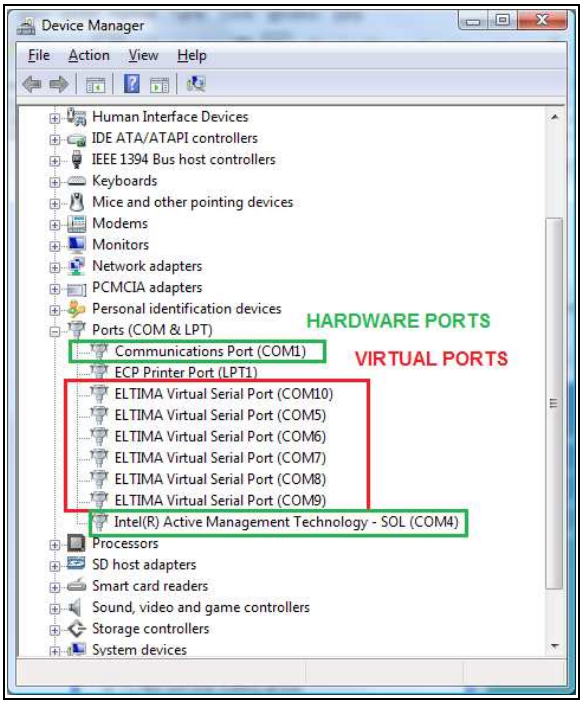
NOTE: After a major version change, the configuration data in the SMD memory may need to be replaced due to changes in the organization and content of the configuration data. After uploading firmware, Station Master Deluxe will prompt you to clear the old configuration by pressing the FUNC button. After clearing the memory, upload the configuration data by pressing the *Store SMD cfg* button on the Control Boxes tabs in Router.

VIRTUAL PORT MENU

*micro*HAM Router provides a set of virtual serial ports which allow Windows applications (logging or control software) to work with Station Master Deluxe just as they would work with "real" (hardware) serial ports.

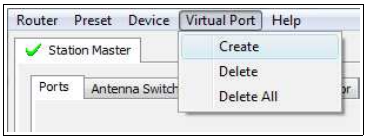
In order to use these virtual Ports, you must first create the ports and then assign a port to each function you wish to use (CAT radio control, Rotator, etc.).

DO NOT define a port that is already in use (for example, COM1 or COM2 which are hardware ports on many motherboards) or a virtual port that is used by another USB device. Even though Router will not allow creating a virtual port on a COM port number which is already present in the system (like hardware COM ports or internal modems), sometimes these ports are hidden. If another device that also uses virtual ports (external USB devices, bluetooth devices, mobile phones, PDAs etc.) is not connected when creating virtual ports in Router, the ports can overlap and will not work properly when you connect such device.



WARNING: Before you begin to create virtual ports, attach all external devices you are using with computer and allow them to connected to the system. Restart Router and then create virtual ports.

Virtual ports are created and deleted from the Virtual Port menu.



Create - Creates virtual COM ports. It is possible to select more ports at once by holding the *Control* key on the keyboard and clicking on COM port numbers. Creating a virtual port may take a while, be patient.

Delete - Deletes any single virtual port.

Delete All - Deletes all previously created virtual ports and resets Virtual Serial Port bus.

Do not delete a virtual port unless all applications using that port have been closed.

NOTE: Properly working ports should not display an exclamation mark (!).

TIP: If you have removed another device which used virtual ports and Router does not offer the released port number, you will need to reset the virtual port bus. You can do this by deleting all virtual ports in Router at once. Select "Virtual Port | Delete All" then create the ports again. Any missing COM port numbers should appear.

HELP MENU

Manuals: Link to microHAM manuals located on your system.

Setup Guides: Link to software configuration guides for many common applications. Documents must be installed from installation CD-ROM or downloaded by invoking Download Documents menu item.

Cable Schematics: Link to cable diagrams. Documents must be installed from installation CD-ROM or downloaded by invoking Download Documents menu item.

Download Documents: Downloads microHAM documentation including updated manuals and setup guides. You may specify the products for which you want documentation.

NOTE: Requires an internet connections.

microHAM Home Page: Link to www.microHAM.com

microHAM Downloads Page: Link to www.microham.com/contents/en-us/d29.html

Show Tooltips: When checked, small, single line help is displayed below the mouse cursor.

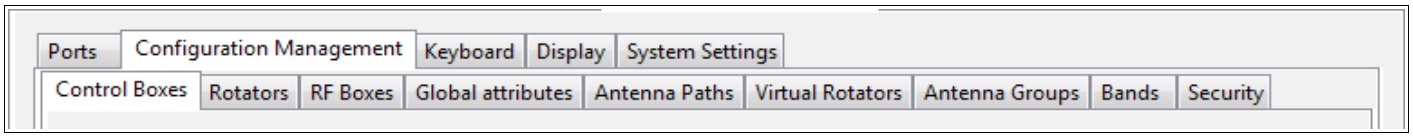
Update Router: Download and install the most recent version of Router.

IMPORTANT: Whenever it is possible, always perform Router upgrade here!

About: Shows the Router's internal version number.

DEVICE CONFIGURATION TABS

There are five (5) tabs for configuring Station Master Deluxe Each tab controls part of Station Master's functions. Except already explained tab for Configuration Management, any change is applied immediately.



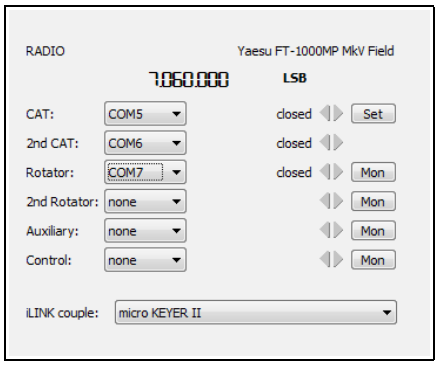
- **Ports:** assign virtual ports to the Station Master Deluxe for use by applications.
- **Keyboard:** configures operation of PS/2 keyboard or keypad.
- **Display:** configures operation of the LCD display.
- **System Settings:** configures power control and displays system power.
- **Configuration Management:** contains sub-tabs for configuring RF network, antenna selections, antenna definitions, rotators, and their relationship.

PORTS TAB

Once the virtual ports have been created they must be associated with a specific function or device channel (e.g., CAT, Rotator, etc.). These assignments should correspond to settings of the application software and must be configured first in Router then in the application.

IMPORTANT: Correct port assignment is critical for proper operation with application software.

Station Master Deluxe has six channels – each channel provides an indication of the settings applied by the application and current state (e.g., or or off):



- **CAT** (uses RxD and TxD)
- **2nd CAT** (virtual "fork" for the main CAT channel)
- **Rotator** (uses RxD and TxD)
- **2nd Rotator** (virtual "fork" for main Rotator channel)
- **Auxiliary** (uses RxD and TxD)
- **Control** (uses RxD and TxD)

NOTE: Do not assign virtual ports to the channels/functions that are not used by your applications. It is unnecessary and only consumes resources.

- **iLINK couple –** used to connect Station Master Deluxe with a *micro*HAM *micro*KEYER II, MK2R, or MK2R+.

CAT (RADIO) & 2nd CAT PORT

The CAT channel is used by the host application to control transceiver frequency, mode, and many other parameters. The application communicates with the radio using a serial protocol. Although most modern radios implement some form of serial control, nearly every radio implementation is different. The degree of control available for each radio depends on that radio and the application (logger or digital program).

NOTE: The COM port number assigned in Router MUST match the port number assigned in the host application. First configure the virtual COM ports in Router then configure the application.

When a COM port is assigned in the Router but not in the application (or the application is not running) Router will indicate the channel is **closed**.

When an application opens the COM port assigned for CAT (usually at start-up), Router shows the channel as **open** and displays baud rate, data bits, parity and number of stop bits used by the application. For example, 9600 8N2 means: 9600 baud, 8 bits data length, parity = none, and two stop bits.

Data flowing through the Control channel is indicated by two arrows. A green arrow shows data flow from the host application to the radio and a red arrow shows data flow from the radio to the application.

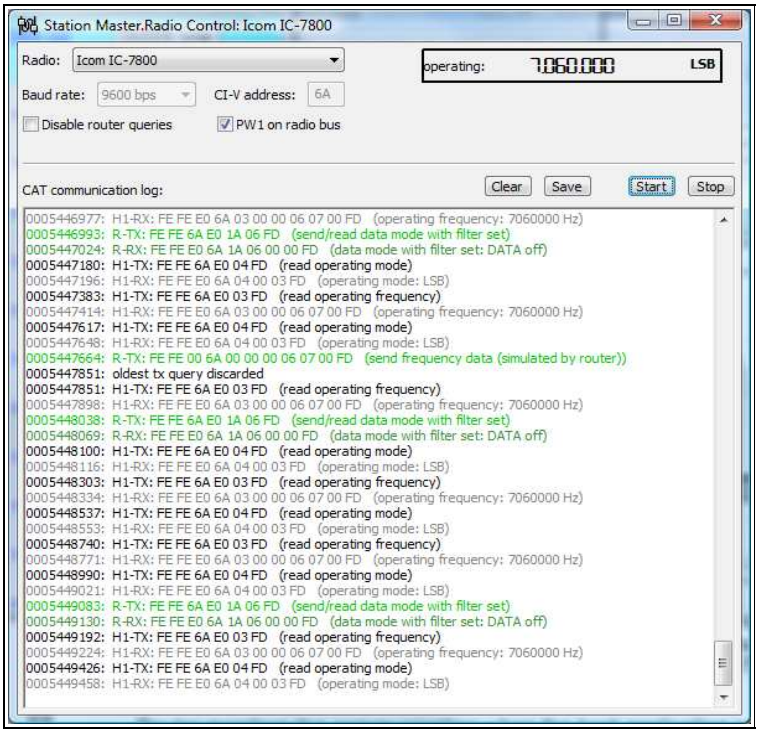
NOTE: The virtual COM port assigned for radio control in Router does not use handshaking signals. Configure DTR and RTS settings in your application program (logger) to OFF. Do not select "Handshake."

In order for Router to determine the operating frequency and mode, it must know what radio (CAT protocol) is being used. To select the radio, click the **Set** button. Choose your radio in the **Radio** combo box. Then select communication speed in the **Baud rate** box.

IMPORTANT: The baud rate must be supported by your radio.

NOTE: When Station Master Deluxe is connected to microKEYER II, MK2R or MK2R+ via iLink, and set as coupled (see the iLink chapter below) there is no need to configure CAT ports or Radio in Station Master Deluxe

All Icom and some Ten-Tec radios require the correct **CI-V address**. If everything is configured properly, your radio's current operating frequency and mode should be displayed.



TIP: Disable the Autobaud function in any radio that supports it. Configure the radio, Router, and application software to operate at the same data rate.

Disable router queries – When this box checked, Router will not poll when the CAT port is open.

NOTE: "Disable router queries" disables Router polling only when the CAT port is open. In order to support the automatic switching functions of Station Master Deluxe, Router always polls when the virtual port is closed. If it is necessary to disable all polling, select the "No Radio" option in the Radio Box.

PW1 on radio bus – When this box checked, Router periodically generates an Icom "Transceive" broadcast to keep the PW1 synchronized.

NOTE: Do not connect a PW-1 or other Icom compatible peripheral in parallel with the transceiver when using Station Master Deluxe. Instead configure and use the local PA Port. The PA port will provide an isolated CI-V bus and avoid the documented problems with collisions on the bus.

The bottom two-thirds of the **Radio** window is a serial communication monitor. The monitor uses colors and tags to indicate which device is responsible for the data. Black queries (H1-TX or H2-TX) and grey radio responses (H1-RX or H2-TX) are from the "host" application (e.g., logger), H1 indicates the host application on the main CAT port, H2 is the host application on the 2nd CAT port. Green packets (R-TX and R-RX) are polls/responses from/to Router and not routed to the application.

Router monitors the communication when the host application performs control and polls the radio periodically for any missing information (VFO frequencies and mode). Because some applications do not poll the radio regularly or completely, Router must break this communication to update its internal state. In order to avoid confusing the application when Router polls the radio, data from the application is buffered and sent to the radio after Router receives a response to its query. If Router does not receive response to a poll within the time allowed or does not understand the response, it displays "oldest query discarded" but forwards all data to the virtual serial port to avoid confusing the application (logger).

USB transmits data in frames with a delay between frames. Router indicates frame boundaries with three dots (...) when a packet is split between frames.

IMPORTANT: If Station Master Deluxe is to operate in stand alone mode (without Router), the settings must be saved as power-up defaults using “Device | Store as Power-Up Settings.”

2nd CAT PORT

Beginning with version 7.0, Router provides unique control capability: the 2nd CAT Port is an intelligent data fork (software 'Y' connector) that allows a second application to share control of the radio. Router monitors the data from each application and routes the radio's responses to the correct virtual port.

IMPORTANT: Both applications must use same communication parameters (baud rate, data length, parity and number of stop bits) for proper operation!

Neither CAT port has priority. Polls/commands from each application are processed alternately. In order to avoid collisions and avoid confusion due to unexpected data, responses from the radio are returned only to the application that generated the command. Unsolicited data from the radio such as automatic frequency/mode updates (Icom "transceive" packets or "Auto-information" data from Kenwood, Elecraft and recent Yaesu transceivers) are forwarded to both CAT ports.

Due to physical limitation of data channel throughput on radio and the controller capabilities in various transceivers, there are several important rules which must be observed.

- Total data throughput from both loggers must not exceed maximum throughput of the radio control port and transceiver controller. In other words, the polling rate from one application may need to be decreased to provide data space for the second application and vice versa.
- Applications must be tolerant of delayed responses from the radio. Each logger must wait patiently for radio response while another logger communicates with the radio.
- Due to protocol deficiencies in handling VFO split commands with many transceivers (particularly Icom), split mode must be initiated and ended by only one application and manual split control (from the front panel of the radio) should not be used.

NOTE: Although Router has been tested extensively using many different applications for the CAT and 2nd CAT ports, *micro*HAM cannot guarantee proper operation with every possible combination of software.

Rotator & 2nd Rotator PORTS

The rotator and 2nd rotator channel are used by host applications to control the azimuth of the current rotator. Both rotator channels are active when selected work in parallel in last one win logic. The protocol is **Hy-Gain DCU-1**, select this rotor model in your application.

When a COM port is assigned in the Router but not in the application (or the application is not running) Router will indicate the channel is **closed**.

When an application opens the COM port assigned for control (usually at start-up), Router shows the channel as **open** and displays baud rate, data bits, parity and number of stop bits used by the application. For example, 9600 8N2 means: 9600 baud, 8 bits data length, parity = none, and two stop bits.

Communication parameters on the two channels do not need to be same. The only requirement is 8 bit data.

NOTE: Rotator control is only active if the selected Antenna (or multiple antennas) has an association with Rotator (or multiple rotators) or if a Virtual Rotor group is selected for RX or TX. If the selected RX and TX antennas in different Virtual Rotor groups, both virtual rotors are controlled simultaneously.

Mon: Opens a "Rotator Protocol Monitor" window to capture data between the application and the Rotator control interface. Controls for the monitor include **Start, Stop, Clear** and **Save**.

The Rotator Protocol Monitor should not be used under normal conditions. However, for debugging purposes, it may be useful to **Start** a capture and close the window. When a problem occurs, the window can be opened and the Rotator Port log **Saved** for analysis.

The monitor log is circular – only the last 20 kilobytes or so will be saved in order to prevent creating very large files.

If a line ends in three dots (...) it means that the command or response has been broken across two USB packets.

AUXILIARY PORT

The Auxiliary Port allows an application program to control an auxiliary device attached to the SERIAL port on the rear panel of Station Master Deluxe Only serial in (RxD) and serial out (TxD) are supported. To enable the Auxiliary port, add local Serial Port control for a given R port of controlled RF box, and set it to Auxiliary function.

When an application opens the Auxiliary port, Router reports port as **open** and displays settings used to configure COM port.

Data flowing through the channel are indicated by two arrows. The green arrow indicates data flow from the application and a red arrow indicates data to the host application.

Mon: Opens an "Auxiliary Serial Port Monitor" window to capture data between the application and auxiliary device. Controls for the monitor include **Start, Stop, Clear** and **Save**.

The Auxiliary Serial Port Monitor functions are the same as the Rotator Port Monitor.

NOTE: Auxiliary function **does not support** serial ports on uLINK DATA modules.

CONTROL PORT

The Control Port allows an application program (logger) that implements the microHAM Control Protocol to make use of Station Master's antenna switching control.

When an application opens the control port, Router reports port as **open** and displays settings used to configure the port.

Data flow is indicated by two arrows. The green arrow indicates data flow from the application and a red arrow indicates data to the host application.

Mon: Opens a "Control Protocol Monitor" window to capture microHAM Protocol communications between a logger and Router. Controls for the monitor include **Start, Stop, Clear** and **Save**.

The Control Protocol Monitor functions the same as the Rotor Port Monitors.

iLINK couple

When Station Master Deluxe is used with *micro*KEYER II, MK2R or MK2R+ and the two devices are connected using the iLINK port, the **iLINK couple** box specifies the keyer to which Station Master Deluxe coupled. When SMD is coupled to a keyer, all important data such as frequency, mode, keying, locks and native control data (Control Port) are transferred between Station Master Deluxe and the keyer to synchronize operations.

IMPORTANT: Don't forget to set SMD to the CAT mode by entering menu [m1] and selecting * CAT *** !**

IMPORTANT: When SMD is coupled, click Device | Store as default settings on both SMD and the keyer! Otherwise coupling will not work in stand alone mode.

NOTE: If Station Master Deluxe is not physically connected to the iLINK port of a *micro*HAM keyer or coupling is unwanted even when the devices are physically connected, select **none** in the coupling box.

IMPORTANT: If coupling is enabled, the keyer expects an SMD on the iLink port even if SMD is not connected to Router (or USB bus). When devices have to be decoupled, coupling MUST be set to none, even if the SMD tab has a red cross!

The CAT and 2nd CAT ports operate differently depending on the type of *micro*HAM interface being used.

Read carefully!

- When SMD is used with *micro*KEYER, DigiKeyer, DigiKeyer II, or CW Keyer, the transceiver radio control port must be connected to the **Station Master Deluxe** – the CAT connection on the **KEYER** is not used. The CAT and 2nd CAT port settings on Ports tab for the **KEYER** are ignored.

  Use the Control port on the **KEYER's** Ports tab for native control from applications that support the *micro*HAM Control protocol.

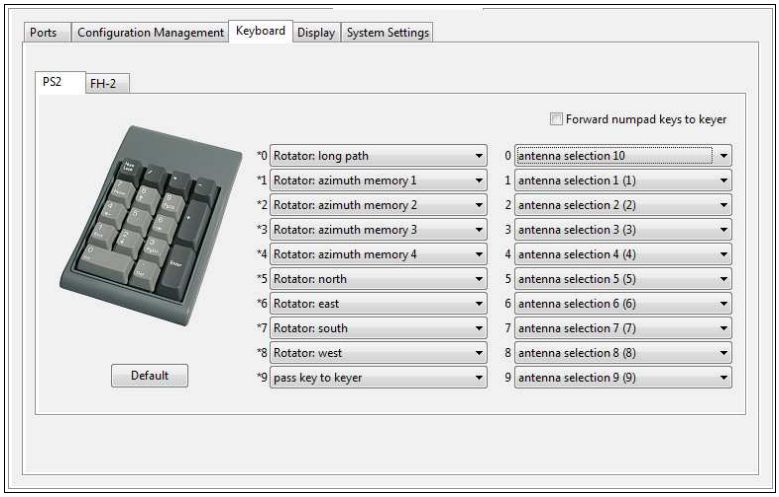
- When SMD is coupled with *micro*KEYER II, MK2R or MK2R+, the transceiver CAT port must be connected to the **KEYER** and the SMD CAT port is not used. The CAT and 2nd CAT port settings on Ports tab for **Station Master Deluxe** are ignored.

  Use the Control port on the **KEYER's** Ports tab for native control of both devices from applications that support the *micro*HAM Control protocol.

KEYBOARD TAB

The Keyboard Tab controls the operation of a PS/2 keyboard or numeric keypad connected to the PS/2 jack. It is also possible to define control functions for the numeric keypad.

The PS/2 and FH-2 sub tabs allow assigning control functions to PS/2 and FH-2 style keypads. When a PS/2 keyboard is attached to Station Master Deluxe, all keys except those on numeric keypad are forwarded to the attached keyer. Checking **Forward numpad keys to keyer,** will cause the numeric keypad keys on the keyboard or all keys on a separate numeric keypad to be forwarded to the keyer connected via iLink. Default key assignments:



NumLock: toggle to enable/disable TX SPLIT, separate TX and RX antennas. When split is enabled, NumLock on the keypad will light on keypads with a NumLock LED.

Decimal dot: toggle to enable/disable RX SPLIT, separate RX and RX2 antennas.

/: / followed by three digits enters rotator target azimuth. To cancel entry press /.

+, -, Enter: these keys have the same function as rotary encoder on SMD front panel. + is one step CW, - one step CCW and Enter replaces an encoder push.

Keys 0-9 on numeric keypad, and additional *shift* functions, are user configurable. The * key is used as a shift key. Individual keys can be configured to be forwarded to Keyer connected via iLink.

When using an FH-2 style keypad all keys are user configurable. FH-2 keys cannot be shifted.

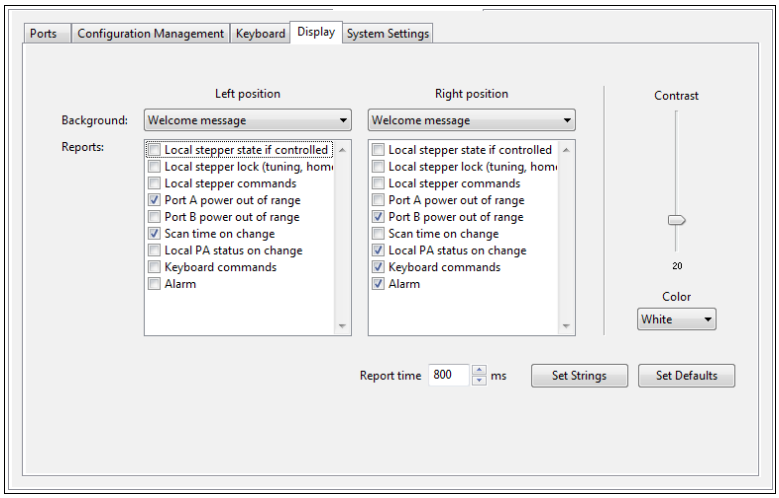
The FH-2 keypad must be connected to the PS/2 jack of SMD using a special adapter. FH-2 can operate at the same time as PS/2 keypad.

NOTE: The FH-2 cannot control Station Master Deluxe and a transceiver at the same time. FH-2 can only be connected to the Station Master Deluxe **or** the transceiver.

IMPORTANT: The settings on this tab are recalled only when Station Master Deluxe is connected to *micro*HAM Router. In order to function in stand alone mode, the settings must be saved to Station Master Deluxe as power-up defaults using “Device | Store as Power-Up Settings.”

DISPLAY TAB

The display tab provides controls for configuring the SMD display.



Each line can display one of eight default (background) functions and any of "temporary" status reports. The "background" functions are those that appear at idle. The status messages appear depending on operating status.

Contrast:
Controls the LCD contrast.

Color:
Sets the LCD backlight color.

Report time:
Sets the length of time that transient (status change) reports remain visible.

Set Strings:
Set the "Welcome Message" to be displayed when SMD is initialized.

Set Defaults:
Returns the display to factory settings.

IMPORTANT: The settings on this tab are recalled only when Station Master Deluxe is connected to *micro*HAM Router. In order for SMD to function in stand alone mode, the settings must be saved to Station Master Deluxe as power-up defaults using "Device | Store as Power-Up Settings."

SYSTEM SETTINGS TAB

System Power:

Displays the source voltage for local PORT A and PORT B separately. If the jumpers are configured for INT/SRC, the voltage displayed will be approximately .3V-0.7V less than the power supply voltage. If either jumper is set for SNK, the voltage displayed for particular port is 0V.

Acceptable voltage range is +11 to 24V.
If the voltage is less that 11V, UNDERVOLTAGE will be displayed.
If the voltage is more than 24V, OVERVOLTAGE will be displayed.

Enable sleep mode :

If Station Master Deluxe is connected to a microKEYER II it will follow the MK II sleep status.

NOTE: Sleep control has no function if Station Master Deluxe is not used with an MKII.

Enable button beep:

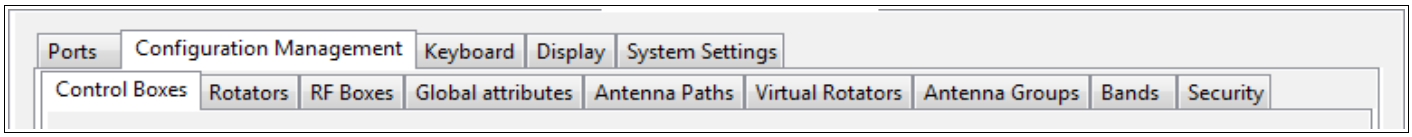
When checked, SMD will generate short beeps on each button press.

Enable alarm beep:

When checked, SMD will generate three short beeps in an alarm condition.

IMPORTANT: The settings on this tab are valid only when Station Master Deluxe is connected to *micro*HAM Router. In order for SMD to function in stand alone mode, the settings must be saved to Station Master Deluxe as power-up defaults using “Device | Store as Power-Up Settings.”

CONFIGURATION MANAGEMENT TAB



SMD is a tool for station automation providing **control** of all devices in the path from a transceiver to antenna including Power amplifiers, Rotators, Switches, Stacks etc. while allowing other SMDs to share the same devices while providing safety protection individually adjusted for each specific configuration.

Control of the whole setup should be considered as some boxes connected to the same bus (uLINK bus). Boxes are all SMDs included in the setup, each is connected to its transceiver and/or transceiver with interface (MKII, MK2R+). Than boxes are uLINK relay modules driving all RF boxes (Antenna Switches, Stacking boxes, 4 SQ boxes …) and special uLINK boxes (Rotator and Data) controlling or driving Rotators, SteppIR / UltraBeam antennas, Tuners, shared Power Amplifiers ...

In order to achieve individual control of the entire station from one or several operating positions (one or several SMDs), Router must know whole setup and accordingly compile configuration for all SMDs and uLINK modules because SMDs is controlling the setup thru its own ports and thru shared ports on uLINK modules.

To let Router know the setup, complete information has to be entered to the Router, from radios at the beginning up to antennas at the end. Every station component which is accessed by any radio and has to be controlled by any SMD must be included in the setup, regardless of if setup contains only one radio / one SMD, two radios / two SMDs (SO2R) or if it is a multi-station setup.

The Configuration Management tab and all its sub-tabs serves exactly for this purpose, provides an editor for entering whole setup in to the Router; defining all RF connections between all parts of the setup, assigning control for all RF boxes and “programming” the behavior for ALL SMDs and ALL uLINK modules included in the station setup by setup elements requirements and user definition.

IMPORTANT: It is very important to realize that the configuration covers the entire installation including all operating positions, not just one Station Master Deluxe.

IMPORTANT: The state of each SMD's internal ports is not visible to other SMDs in the uLINK network. This means that the local outputs of SMD (relay outputs, serial port, internal rotator controller) cannot be used for devices (antenna switches, rotators etc...) that must be accessed by other stations or if other stations need to be aware of their state in order to achieve certain protection level. For example local relay outputs can be used for BPF control with the associated transceiver but cannot be used for controlling one half of Double Ten Switch in SO2R setup. This is because the Double Ten Switch contains antenna connections for both radios and its status must be visible to all stations for interlock and protection. Remember this rule when you will define your configuration.

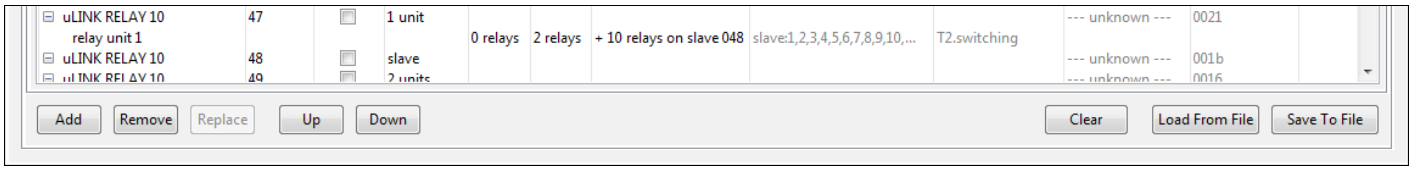
CONFIGURATION MANAGEMENT - Control Boxes

The Configuration Management sub-tab of Station Master Deluxe tab in Router contains all the sub-tabs pertinent to the RF network and associated Control Module configuration.

It is recommended that configuration in Router only be attempted after making a detailed drawing of the setup, identifying the needed RF Boxes (transceivers, antennas, switches) with their associated Control Units (grouped into Control Modules), and auxiliary Control Modules controlling rotators, PAs, stepper antennas etc. The list of Control Boxes (Control Modules and SMD) is then entered in the Control Box sub-tab. Subsequently, the RF Boxes are entered in the respective sub-tab, setting their connections according to the RF network, and assigning Control Units and auxiliary Control Modules to each of them. The Rotators and Global Attributes sub-tabs are used to add more detail to the network description.

The second group of sub-tabs describe the network from the perspective of the SMD user. They allow set up and control of individual Antenna Paths, grouping antenna paths into Virtual Rotators and Antenna Groups (which together with Antenna Paths are collectively called Antenna Selections), and for determining which Antenna Selections will appear on the menu display for each band on the SMD. Changes made in the first four sub-tabs are reflected in the second group of tabs automatically - while every attempt is made to preserve antenna path names and their "membership" in groups, if the RF layout changes significantly, the antenna path names are re-generated, and paths in groups which no longer exist are changed to "No Antenna".

The last sub-tab, Security, controls the band-lock feature, and is relatively independent from the first eight tabs.



Bottom buttons

The sub-tabs always contain one or more lists of items, which then have various controlled properties. Thus, a basic set of buttons at the bottom of window acts in a consistent way across all tabs (some buttons may be unavailable on certain sub-tabs):

- **Add**
  Adds control box to the list. Both SMD and all available uLINK modules can be added.

- **Remove**
  Removes selected control box from the list.

- **Replace**
  Allows to replace the selected item for a similar item. Not used on this sub-tab.

- **Up**
  Moves selected item up in the list.

- **Down**
  Moves selected item down in the list.

NOTE: The position of particular item in the list in first four sub-tabs and the last Security sub-tab is not important, reordering is there only to allow a more understandable/logical display. The Antenna Path sub-tab listing is generated automatically – reordering (or Add/Remove/Replace) is not supported. In the RF Boxes, Virtual Rotator, Antenna Groups and Bands sub-tabs, the order of the items determines the order in which these items will appear in the user interface of SMD.

The following three buttons are not directly related to sub-tabs and control the network configuration "globally":

- **Clear**
  Remove whole configuration from the Router. Use it to enter brand new configuration.

- **Load From File**
  Load previously saved configuration to the Router. All previous configuration will be discarded.

- **Save To File**
  Save current configuration to file. The default extension for SMD network configuration is ".uad".

NOTE: Besides explicitly saving through Save To File, network configuration is saved automatically when the Router program is closed unless no configuration was loaded/created. The automatically saved configuration is named "Last cfg [serial number] Station Master DeLuxe.uad".

NOTE: **Clear**, **Load From File** and **Save To File** buttons are global buttons available on all Configuration Management sub-tabs. Meaning of the buttons is same on each tab.

Changing properties of list items

In list items, there may be several properties (e.g. name or value) which can be changed by user. Properties, which are displayed in gray, cannot be changed (i.e. they are either implicit, displayed only for information; or they are controlled elsewhere). After highlighting the required item, after a short pause (so that it is not seen as a double-click), **single-click** on the required property to change it. If the property is a **check-box**, use a **double-click** on the box to toggle it.

In several cases, a resource (e.g. a Control Box) can be assigned to certain item, usually through a pull-down selection. Such resources cannot be shared, so if the same resource is chosen for multiple items, only the last item has this resource assigned, and the resource for previously assigned items are automatically changed to "unassigned".

Control boxes is the first Configuration Management sub-tab. Control box is a global name for every uLINK network element, it can be SMD or any uLINK module. This tab serves for adding/removing and configuring all Control boxes and storing configuration to one particular SMD connected to the Router.

Adding and configuring Control Boxes

Press Add button on bottom of tab to add a new control box. From the selection window, chose the type of Control Box to be added.

Highlight the line with Control box, then after a short pause single-click on the number in Address column to select address for this Control box. If the Control Box is a uLINK module, the selected address must match the address set on the module itself.

If the Control box is a uLINK module, the Invert IN column contains a tick-box determining the active polarity of the tamper input on the module. Double-click the tick-box, if the input is normally closed to GND; leave it open if it closes to GND when active.

If the Control box is SMD, uLINK Relay 10 or uLINK Relay 6, their relay outputs can be split into individual units. Highlight the line with name of Control box, then after a short pause single-click on the description in the Relay units column and select either “slave” (unavailable for SMD), or the required number of units. Outputs are assigned sequentially to the units; for each unit, select number of outputs to be skipped before the first output of that unit (in Skipped column), and the number of outputs for that unit (in Used column). For first unit of any Relay module, additional outputs can be set through assigning it a slave Relay module in the Slave column.

Assignment of modules/units and their further properties is controlled from the subsequent tabs.

Top buttons

- **Store SMD cfg**
  Stores SMD configuration to the connected SMD. At the same time stores to connected SMD its address specified in next drop down box.

IMPORTANT: When you are using a saved setup to configure another SMD (associated with a different transceiver/station), don't forget to change new SMD address in the drop down box next to this button. Each SMD must have unique address.

- **Store box cfg**
  Stores configuration to selected uLINK module.

- **Store cfg to all**
  Stores configuration to all uLINK modules in the list in sequence.

IMPORTANT: uLINK network must be fully functional and uLINK modules up and running using correct address.

IMPORTANT: In multi-transmitter setups always make sure that no other operating position transmits before the new configuration has been stored to the uLINK modules. Best practice is to turn off all other SMDs.

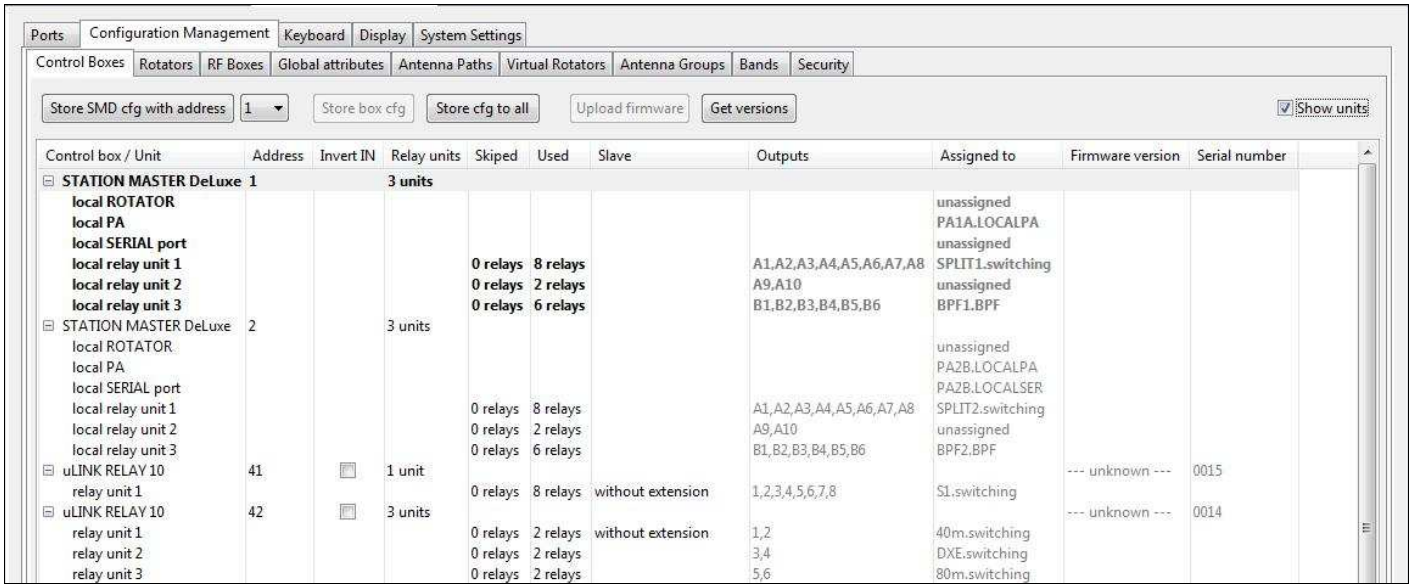
- **Upload firmware**
  Updates firmware for selected uLINK module. Keep same precautions as above.

NOTE: Firmware must be updated for each uLINK module separately.

- **Get versions**
  Retrieves firmware version of each uLINK module, displayed in Firmware version column of the list.

- **Show units**
  Expands every control box in the list and displays all their units.

Main list contains all components of the uLINK network (SMDs and uLINK modules) and displays/edits their parameters in several columns.



Control box / Unit	Address	Invert IN	Relay units	Skiped	Used	Slave	Outputs	Assigned to	Firmware version	Serial number
STATION MASTER DeLuxe	**1**		**3 units**							
local ROTATOR								**unassigned**		
local PA								**PA1A.LOCALPA**		
local SERIAL port								**unassigned**		
local relay unit 1				**0 relays**	**8 relays**		**A1,A2,A3,A4,A5,A6,A7,A8**	**SPLIT1.switching**		
local relay unit 2				**0 relays**	**2 relays**		**A9,A10**	**unassigned**		
local relay unit 3				**0 relays**	**6 relays**		**B1,B2,B3,B4,B5,B6**	**BPF1.BPF**		
STATION MASTER DeLuxe	2		3 units							
local ROTATOR								unassigned		
local PA								PA2B.LOCALPA		
local SERIAL port								PA2B.LOCALSER		
local relay unit 1				0 relays	8 relays		A1,A2,A3,A4,A5,A6,A7,A8	SPLIT2.switching		
local relay unit 2				0 relays	2 relays		A9,A10	unassigned		
local relay unit 3				0 relays	6 relays		B1,B2,B3,B4,B5,B6	BPF2.BPF		
uLINK RELAY 10	41	☐	1 unit						--- unknown ---	0015
relay unit 1				0 relays	8 relays	without extension	1,2,3,4,5,6,7,8	S1.switching		
uLINK RELAY 10	42	☐	3 units						--- unknown ---	0014
relay unit 1				0 relays	2 relays	without extension	1,2	40m.switching		
relay unit 2				0 relays	2 relays		3,4	DXE.switching		
relay unit 3				0 relays	2 relays		5,6	80m.switching		

Columns

- **Control box / Unit**
  Shows name of control boxes. When control box is expanded, column shows all configured units of the control box. Expanded SMD control box shows local ports (ROTATOR, PA, SERIAL) along to relay units. uLINK DATA and uLINK ROTATOR modules have no units.

  Content of this column is not editable, control boxes can be added, removed or reordered by Add, Remove, Up and Down buttons at the bottom of this tab.

- **Address**
  In this column is assigned unique address to each control box. SMD address range is 1 to 31, uLINK modules address range is 32 to 254. To change address click on the control box row / address column first (single click) and than click again to pop up drop down box. Address for particular uLINK module here have to be same as address entered to this particular module.

- **Invert IN**
  Every uLINK module has special input located at the bottom terminal (IN). Sole purpose of this input is to not allow to transmit using RF path to which module is assigned. It can be used for example for a door switch. When input is active (closed), module reports “inhibit” state to SMD.
  Invert IN check box allows to invert polarity of the input, to make active state open. You need double click to check or uncheck it.

- **Relay units**
  Defines to how many groups (units) all outputs of each control box will be divided.
  SMD can have max. 10 units, uLINK RELAY6 and uLINK RELAY 10 can have max. 4 units each. Only control boxes with relay outputs can have units. Every such control box must have at least one unit.
  Special unit is a **SLAVE** unit already described.

- **Skipped**
  Allows to define how many relay outputs will be left unused before the very first output of this unit. It is used when there is a requirement to make a gap at terminals between two units. Normally not used and default value is zero.

- **Used**
  Defines how many relay outputs a particular unit contains. “Virtual” is a special value meaning the unit will use zero (0) physical outputs. Virtual units are used to control virtual (conditional) switches which effect the operation of the network but do not control physical outputs.

- **Slave**
  Specifies that outputs extend to a slave module. Only the first unit 1 (unit 1) can have a slave unit, default value is “without extension”.

- **Outputs**
  Shows the output numbers used in ascending order for the unit.
  Content of this column is not editable. Outputs are assigned automatically depending on how many relays has been defined for the unit and how many was skipped.

- **Assigned to**
  Shows to which RF box a control box or unit is assigned.
  Content of this column is not editable. Assignment is done automatically according to control association for given RF box at RF Boxes tab.

- **Firmware version**
  Displays firmware version of uLINK module when uLINK and SMD is up and running. Router check for firmware version after configuration is loaded from the file or after click on Get versions button. Normally is version shown in black.

IMPORTANT: When the version number is displayed in orange there is a new firmware available for this module. When the version is red, the module using this address number does not match module type defined in Control box column. For example, when firmware version is red for a uLINK RELAY 10 at address=50, it means that the module with address 50 is not a uLINK RELAY 10 but some other type of the uLINK module.

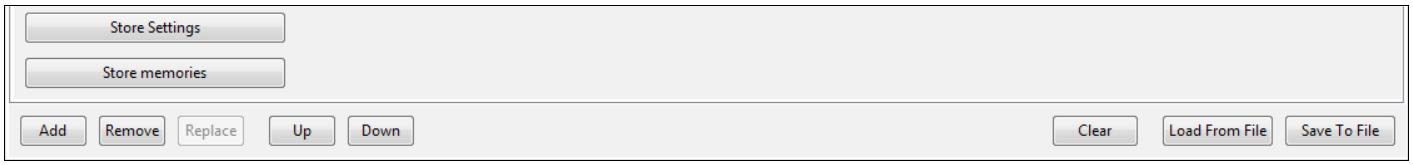
- **Serial number**
  Shows the unique serial number of the uLINK module. Serial number is required for forced firmware update, normally not needed.

CONFIGURATION MANAGEMENT - Rotators

This tab serves for a management of all rotators included in the setup, the rotator connected to the SMD's local Rotator port or rotators connected to uLINK ROTATOR modules or uLINK DATA modules.

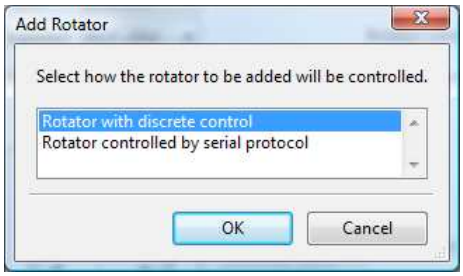
The local Rotator port or uLINK ROTATOR modules support rotators using direct discrete control – those that switch the motor/brake on and off and reads position using a potentiometer or pulse position sensor.

The uLINK DATA module supports rotators controlled by a serial (RS232) port using Hy-Gain DCU-1 or ProSisTel protocols.



There are again several buttons at the bottom of the tab.

Buttons

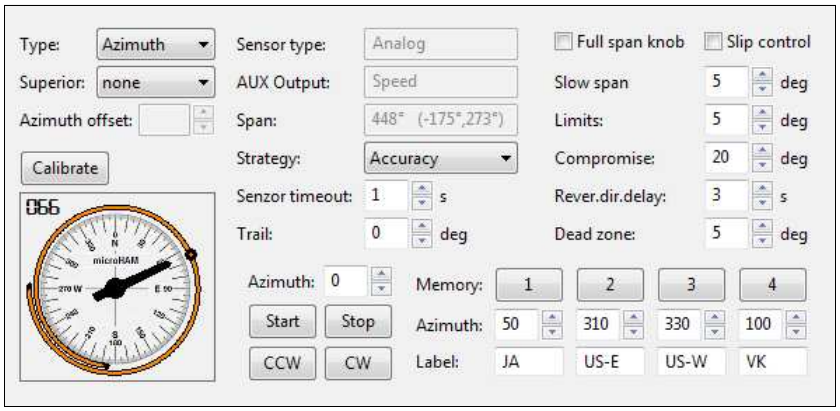


- **Add**
  Adds new rotator to the list.
  When adding a new rotator to the list, it is necessary to specify if it is rotator with direct – discrete control or RS232, serial protocol controlled rotator.
- **Remove**
  Removes selected rotator from the list.
- **Replace**
  Not used on this sub-tab.
- **Up**
  Promotes selected rotator to the higher position in the list.
- **Down**
  Demotes selected rotator to the lower position in the list
- **Store Settings**
  Stores settings of particular rotator to the uLINK module or SMD selected in CONTROL BOX drop down box. Function of this button is equivalent to “Store box cfg” button at Control Boxes tab.
- **Store Memories**
  Stores four (4) azimuth memories and their labels to SMD. Memories are also stored with rest of SMD configuration at Control Boxes tab.

NOTE: The Azimuth presets are stored in each SMD. Each SMD contains a single set of presets which apply to all selected rotators. It is not possible to store individual presets for each rotator.

The Rotator tab allows configuring the internal rotator control interface for your particular rotator hardware.

Rotators with discrete control - Parameters



SMD supports two types of rotators. First is a rotator with discrete control – those in which the controller can directly switch power to motor and read its sensor. The second type is a rotator with RS232 serial port using one of supported protocols for its control.

At the left side of the Rotator tab is an azimuth circle with direction needle and orange line around the circle. The orange line displays the operating range of the rotor; the black areas at the ends of the *spiral* are the portion of the operating range that is protected by the software limits. The black circle on the spiral shows the current azimuth in relation to the full operating range.
The current azimuth is displayed numerically in upper left corner and indicated by the black pointer. The "target" azimuth is displayed in the upper right corner and indicated by the gray needle. When the rotor reaches the target value, the current and target values will be the same and the black needle will cover the gray one.

The right side of the Rotator tab contains controls for configuring the rotor interface and controlling its operation.

- **Sensor**
  Displays the type of position feedback sensor. Options are: **Analog** if the position feedback is a potentiometer or variable voltage position signal or **Pulse** for pulse (magnetic/reed switch) feedback. The sensor type is chosen during the calibration process and can not be changed directly. The sensor must be connected as described in the "Connecting the Rotator" section of this manual.

- **AUX Output**
  Displays the function of the AUX relay. Options are **Speed, Brake,** or **None.** AUX relay function is set during the calibration process and can not be changed directly. When set to **Speed,** the rotator interface energizes the AUX relay once the antenna has moved a preset distance and releases the relay a predetermined distance before the target. When set to **Brake,** the rotator interface energizes the AUX relay before the rotor stats its movement and holds the relay for the "Brake tail" period after the antenna reaches its target.

- **Span**
  The total range of the rotor in degrees. This value is calculated automatically in the calibration process and can not be changed directly.

- **Limits**
  Software limit switch which sets a "safe zone" for stopping the motor before it reaches the end of travel. Five (5) degrees means the motor will stop five degrees before reaching the physical limit. The same value is used at both ends the rotation and applies to both manual and automatic operation. The limits are represented by the black zones on the ends of the orange operational zone.

- **Strategy**
  The rotator interface implements one of two strategies for reaching the target azimuth:

  Accuracy moves the antenna to the selected azimuth using the "shortest way around." When the target azimuth is outside the rotor limits (for example, a side mount rotor with a span less than 360 degrees), the motor will not start.

Speed moves the antenna to the target by the shortest route as with accuracy strategy but if the shortest route to the destination is across the limits, the rotor can turn into the limits if the limit is within the "compromise" angle.

- **Compromise**
  Angle value in degrees used by SPEED strategy.

- **Sensor timeout**
  Defines value in seconds in which the sensor must begin to change when the motor is commanded to start. Serves as a protection against broken sensor or broken sensor wires.

- **Rever.dir.delay** (Reverse Direction Delay)
  Sets time delay before starting a new motor movement after the target has been reached. If BRAKE is used, the brake delay should be longer than reverse/forward delay to prevent unnecessary brake operation.

- **Trail**
  This parameter should be set to the appropriate value if the rotator coasts after the CW or CCW relay is released and overshoots the target. The controller will turn off the motor early to allow the rotor to coast to the target.

- **Dead zone**
  Sets the value in degrees by which a new azimuth must differ from the current heading before the controller will move the antenna. If the current azimuth is 270 degrees and the dead zone is 10 degrees a new heading must be greater than 280 degrees or less than 260 degrees before the rotor will be commanded to the new azimuth. If the dead zone is changed, press and release the encoder to update the azimuth.

- **Full span knob**
  If checked, SMD's rotary encoder can set an absolute azimuth anywhere withing the full span of the rotor. Otherwise the encoder operates only in the 0 – 359 degree range.

- **Slip control**
  If rotor being controlled is prone to slipping (for example in high wind), SMD can "hold" the antenna in position if the position sensor follows the antenna slip and the slip control is enabled. The value set for Dead zone determines how far a rotator is permitted to slip before being corrected.

- **Calibrate**
  Starts calibration process for selected rotator. Please refer to Connecting hardware: Rotator chapter for step-by-step calibration guide.

- **Adjust**
  Starts quick recalibration process for selected PULSE sensor rotator. Please refer to Connecting hardware: Rotator chapter for step-by-step calibration guide.

IMPORTANT: A rotator connected to SMD's ROTOR port can be controlled ONLY from the SMD to which the rotator is physically connected. While it is not important in single SMD setups, for SO2R or multi-station setups this is a serious limitation. Therefore, we do not recommend using SMD's local ROTATOR port in configurations with more than one SMD. Connect your rotators to uLINK ROTATOR modules to provide shared control.

Rotators controlled by serial protocol

SMD supports rotators with RS232 serial ports connected to uLINK DATA modules. Currently only Prosistel rotators and RS232 port rotators compatible with Hy-Gain DCU-1 protocol (GreenHeron etc …) are supported.

Since calibration and all parameters are under control of original controller, there are only two parameters needed to be set for uLINK DATA module.

- **Protocol type**
  Router supports Prosistel and Hy-Gain DCU-1 protocols.

- **Baud rate**
  Communication speed between uLINK DATA module and rotator controller.
  Supported speeds are 1200 – 19200Bd. For Prosistel rotators select 9600Bd, for other brand rotator supporting Hy-Gain DCU-1 protocol please refer to its operating manual to match required data speed.

Common Rotator Parameters

Each rotator – whether it is local, connected to uLINK ROTATOR, or connected to uLINK DATA module - has several common parameters.

- **NAME**
  Specifies rotator name, max. 10 characters long.

- **LABEL**
  Specifies short rotator button label, max. 5 characters long.

NOTE: The NAME and LABEL fields are used to identify the particular rotator on other Configuration Management boxes as well as for rotator identification on SMD display. Set them meaningfully.

- **CONTROL BOX**
  Sets assignment of the rotator to its Control Box. Control Box can be the internal SMD (local) controller, uLINK DATA module or uLINK ROTATOR module. Only those choices valid for the selected rotator type when the rotator was added to the list are shown. (See Configuration Management – Rotators chapter).

IMPORTANT: Only previously defined Control Boxes can be selected. Additional control boxes (modules or SMD) must be added via the Control Boxes tab before they can be selected.

- **Type**
  Specifies if the rotator is an Azimuth or Elevation antenna rotator. At present only azimuth rotators are supported. Support for elevation and combined AZ/EL rotors is planned.

- **Superior**
  Sets rotator which is superior to selected rotator – that is a rotator on which the selected rotator is mounted. This special function was developed to support *"rotator over rotator"* configurations: rotators mounted on rotating towers or to rotators mounted on a mast which is turned by another rotator. This feature allows independent, **True Azimuth Control** of both rotators.

- **Tower**
  Sets assignment of the rotator to the tower. If two or more rotators are assigned to the same tower and there is a request to move more than a one rotator at the same time, only one rotator will be moving at a time, other will start to move only after finished movement of already moving rotator and after **idle** delay timeout.

  This function can significantly decrease torque load to the tower for stacked antennas using separate ring

rotators. Function can be turned off assigning rotator to “Tower 0 (zero)”.

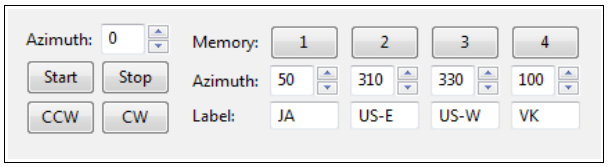
NOTE: When **Tower** assignment is changed, even for just one rotator, configuration for all Rotator controllers must be updated (stored again).

- **Idle**
  Sets delay between stop of one rotator and start of another when they are assigned to the same Tower.

- **Azimuth offset**
  Defines angular displacement between the superior rotator and current rotator at the center of their span.

Rotator control from the Router

Each rotator can be controlled from Router using these controls:



- **CW**
  Rotator moves clockwise while this button is held.

- **CCW**
  Rotator moves counter clockwise while this button is held.

- **Start**
  Rotator moves to the entered azimuth in range from 0 - 359 deg after clicking on this button. While rotator is moving, clicking the **Stop** button will stop the movement immediately.

- **Stop**
  Stops rotator movement.

- **Memory**
  Four memory buttons can be used for quick azimuth selection. Each button can be set to a custom azimuth and identified by a label up to 4 characters long. Once memories are defined and stored to SMD, they can be recalled with the rotary encoder or a PS/2 keypad attached to the PS/2 jack.

IMPORTANT: Changes in Parameters are not effective until they have been stored in the Control Box with the **Store Settings or Store Memories** button. Multiple parameters can be changed at once and stored with a single click on the Store buttons. SMD internal rotator parameters and memories are also stored with SMD configuration at Control Boxes tab. Same is applicable to rotator parameters for uLINK DATA or uLINK ROTATOR modules, parameters are stored to modules at Control Boxes tab as well.

NOTE: Azimuth preset memories are located in the SMD and are same for all rotators included in the setup, it is not necessary to store them separately for each rotator.

CONFIGURATION MANAGEMENT - RF Boxes

The RF boxes tab is the most extensive part of the Configuration Management. On this tab are defined all RF boxes of the setup, interconnections between them, their relationship to Control boxes, their operation frequency ranges, relationship to sub-selection buttons, antenna assignment to rotators and many other details.

There are again several buttons at the bottom of the tab.

Buttons

- **Add**
  Adds a new RF Box to the list. When adding a new RF Box to the list, it is necessary to specify RF Box type.

- **Remove**
  Removes selected RF Box from the list.

- **Replace**
  Replaces selected RF Box for another.

IMPORTANT: While Router takes a lot of care to preserve custom configuration for every RF Box in the setup like Interconnections, Names, Labels, Rules and few others, it is impossible to keep everything intact if the replacement box is not 100% equivalent to the box being replaced. Parameters which do not match are cleared. This process is irreversible, use with care.

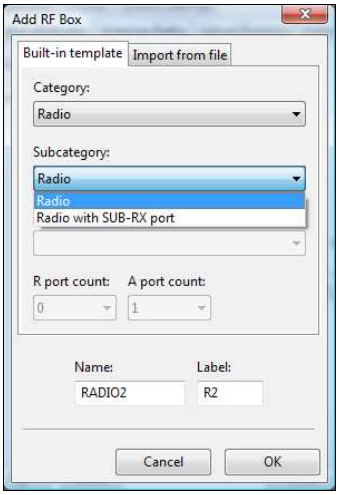
- **Up**
  Promotes selected RF Box to the higher position in the list.

- **Down**
  Demotes selected RF Box to the lower position in the list

NOTE: Position of particular RF Box in the list is used for automatic generation of Antenna Paths and Antenna Selections. Reordering has no impact to setup functionality but may help to make the setup more readable.

Router supports four (4) general types of RF Boxes. They are: Radio, Antenna, Two-port device and Switch.

RF BOX CATEGORIES - Radio



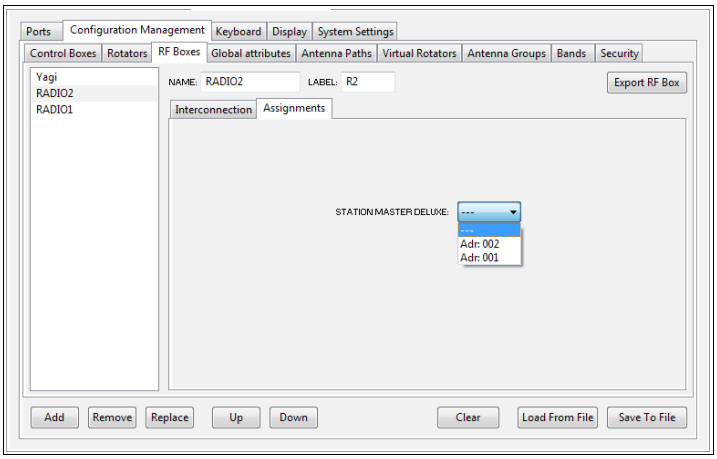
This type of RF Box is reserved for addition of all transceivers included in the setup.

There are two sub-categories, one for a **Radio** with one A port (antenna port for transmit TX and receive RX) and second for **Radio with SUB-RX port** (a transceiver with two ports - one dedicated as a main RX/TX port and second port for sub receiver antenna input, RX2).

IMPORTANT: If transceiver allows configuring its antenna ports for various transmitter/receiver combinations (Ten-Tec transceivers or K3) or assignment to various antenna ports (all radios with antenna switch included), always configure it to have transmitter output on the same port as main receiver input and second receiver input on another port. This configuration cannot be changed and it is the only configuration in which SMD fully protects against possible damage!

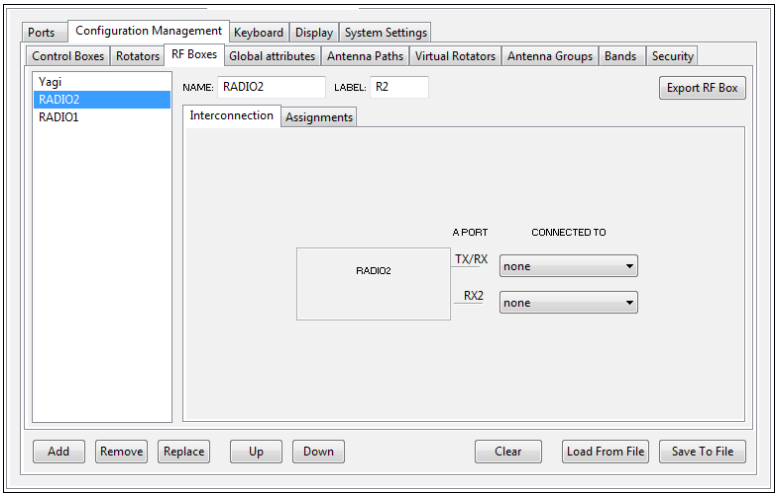
NOTE: Transceivers with separate RX antenna port (even not true dual receiver models) can be added to the setup as a **Radio with SUB-RX port**. If is added that way, SMD can manage main RX/TX and RX ANT (marked as RX2) paths separately and provide independent antenna selection for both RX/TX and RX ANT ports, including separate antenna selection for transmitting for a total of three different antenna paths.

IMPORTANT: If a transceiver with SUB-RX port is defined, SMD will never allow sharing of any RF boxes used for main RX/TX port with SUB-RX port. SUB-RX port has always fully separated, independent path.



When radio is added to the setup, list box on the left shows its NAME and main area shows two sub tabs, Interconnections and Assignments.

Content of NAME and LABEL fields can be changed in the same manner as before, NAME max. 10 and LABEL max. 5 characters long.



Interconnections tab specifies the (next) RF box to which the ports of the Radio RF box are connected.

Assignments tab specifies to which SMD the added Radio RF box is connected. SMD is specified by the address previously specified on Control Boxes tab.

NOTE: Assignment is possible only if SMD exists on Control Boxes tab.

RF BOX CATEGORIES – Two-port device

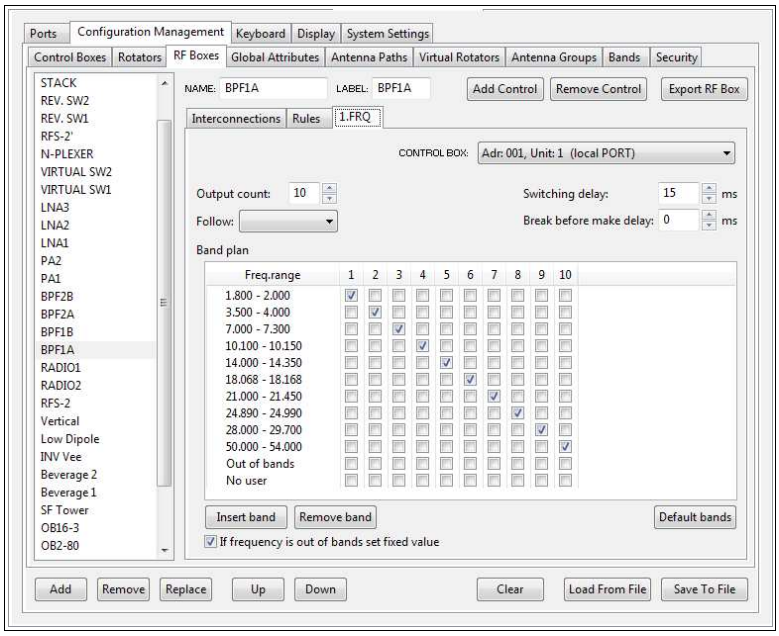
This type of RF Box allows adding any two-port device (one R and one A port) which needs some kind of control from SMD to the setup . Typical two-port devices are: multi-band Band Pass Filter (BPF with band switching control), Low Noise Preamplifier (LNA with sequenced bypass during TX), Power Amplifiers (PA with keying or automatic band switching control) etc …

There are three sub-categories with predefined templates by purpose and type of control.

First is a FRQ type which generally stands for all two-port devices with relay control based on frequency.

BAND PASS FILTER (FReQuency type)

When the RF Box is added to the list, three sub-tabs are generated: Interconnections, Rules and 1.FRQ. Number one in front of means that the control box is linked to the first (and in this case only) R port of the RF box. This allows identifying control boxes for RF boxes which have more than one R port.



The **Interconnections** tab specifies to which RF box the A port is connected. The R port is connected to an A port on the previous RF Box.

The **Rules** tab specifies the frequency range of the R port along with other advanced settings (described later because they are related to the other forms of control). However, can be used with FRQ control if needed as well.

The details of the third tab vary depending on control box type, in this case it is a relay unit of **FRQ** type.

FRQ control allows a control box to be configured/used to control an RF box based on operating or transmit frequency. This is generally used for band selection.

- **CONTROL BOX**
  Specifies which control box will be used for this RF box control. The control box must be a relay unit with exactly same number of relay outputs as the Output count. Only control boxes with the proper number of relay outputs will be shown in drop down menu.

- **Output count**
  Specifies how many control wires are needed to control the RF box (maximum 20). For more than 10 outputs available in a single uLINK RELAY 10, the master/slave method must be used.

- **Switching delay**
  For safe band or transmit/receive antenna switching, SMD must know how long it takes for the switch to activate and settle. SMD inhibits transmission for this period after each relevant change. This value can be set individually for each control box/RF box. For all *micro*HAM antenna switches the default 26 ms is a safe time. If you are using switches from another manufacturer, contact the manufacturer or distributor for the appropriate value.

- **Break before make delay**
  Allows adjustment of this delay if the RF device box requires separate break and make control.

- **Follow**
  Specifies which the source of the frequency values used to control the outputs. If set for RX frequency, the control box will automatically select main RX or RX2 frequency based on the path. For a TX bandpass filter, control should be set to TX Frequency.

- **Band Plan**
  Specifies frequency vs. output switching table. Table is fully editable, separate frequency ranges can be added or removed by **Insert band** and **Remove Band** buttons or altered by single clicking on selected frequency display in the list. Output state can be set or cleared by double click on output matrix check box. The table can be set to default values according to regional band map by clicking on **Default bands** button.

  The list box contains two special lines. First is marked as **No user** and specifies the output state if no SMD is using the RF box. This state is also the default, power-up, not used state as well. The second special line is **Out of bands** and permits specifying the state if the control frequency is outside the defined ranges. When "**If frequency is out of bands set fixed value**" is not selected, the control box will keep last used outputs until a frequency closer to another "band" segment is selected.

Each RF box R port can be linked to as many control boxes with the same or different function as necessary - there is virtually no limit. If an RF box requires more than 20 wires for control, it is possible to add an additional uLINK RELAY unit. If RF box needs a sequencer output for some timing and/or additional CI-V control both are possible by simply assigning additional control boxes. The Control boxes can be derived from local ports as well as uLINK modules.

The top two buttons are used for Control box management:

- **Add Control**
  Adds another control box for the selected RF box.
- **Remove Control**
  Removes extra control box from selected RF box.

NOTE: Multiple Control boxes assigned to an RF box have no priority, each operates independently.

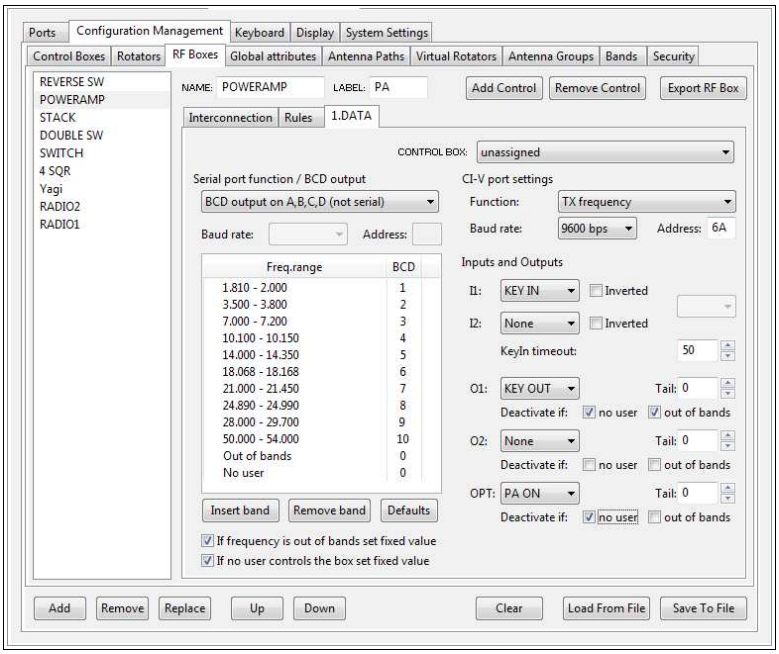
POWER AMPLIFIER controlled by uLINK DATA module (DATA type)

Another predefined template for a two-port RF box is a Power Amplifier. It contains same Interconnections and Rules sub-tab as FRQ type type of control with same meanings but uses a different control box - by default a uLINK DATA module. Of course, a different type of Control box can be specified or multiple Control Boxes can be added as for any RF box.

uLINK DATA module contains all the ports necessary for power amplifier control. The three Band Data ports (RS-232 serial, BCD or CI-V) allow uLINK DATA to control almost any manual or automatic power amplifier currently available, including popular automatic amplifiers by Acom, Icom, OM-Power, SPE or THP.

The uLINK network design allows a Power Amplifier and uLINK DATA module to be placed anywhere in the setup topology (at a common path) and therefore shared by any station with access to the uLINK network.

DATA type of control allows setting several parameters:



- **CONTROL BOX**
  Specifies which control box will be used to control this RF box. uLINK DATA or SMD local PA Control Box must be present in the list of Control Boxes.

- **Serial port function / BCD output**
  Only valid choice for PA control is **BCD output on ABCD** ports. The box provides BCD code over 4 wires at TTL levels. It is necessary to move jumpers from serial port to BCD inside the DATA module.

- **Band Plan**
  Specifies frequency/BCD code table. Table is fully editable, separate frequency ranges can be added or removed by **Insert band** and **Remove Band** buttons or altered by single click on selected frequency display in the list. BCD code for each band can be set independently by clicking on selected line. Table can be set to default values according to regional band map by clicking on **Default bands** button.

  The list box contains two special lines. First is marked as **No user** and specifies output state if no SMD is using the RF box. This state is also the default, power-up, not used state as well. The second special line is **Out of bands** and permits specifying the state if the control frequency is outside the defined ranges. When "**If frequency is out of bands set fixed value**" is not selected, the control box will keep last used outputs until a frequency closer to another "band" segment is selected.

- **CI-V port settings**
  These parameters control the the Icom protocol simulation over the CI-V port of the uLINK DATA module.

  Function
  Serves to specify which frequency will be used for CI-V data updates, RX, TX or RX2. For Power Amplifier control TX frequency should be used.

  Baud rate
  Specifies communication speed of CI-V port. It can be set from 1200 up to 19200 bps. Default speed is 9600 bps

  Address
  Specifies simulated "sender" address. Value is two digits hexadecimal number. Default address is 6A.

- **Inputs and Outputs**
  uLINK DATA module has two configurable inputs marked as I1 and I2, two configurable outputs O1 and O2 and special opto-coupler transistor output marked OPT.

- **I1, I2**
  Both inputs can be configured to function as KEYIN input or INHIBIT input. KEYIN and INHIBIT input are active when closed to ground. Input polarity can be inverted separately by clicking on related **Inverted** check box. An inverted input is active when open. The only power amplifier known to have inverted KEYIN signal is the Expert SPE 1K.

When input is set as INHIBIT, module generates INHIBIT signal for SMD when active. If both inputs are configured as INHIBIT, they can be processed by a logical function chosen in the next drop down box. Available logical functions are OR, AND and XOR.

When an input is set as KEYIN, module generates three signals - KEYIN OK, KEYIN TIMEOUT and KEYIN DROPPED - during the each T-R sequence. KEYIN should be always paired with an output configured as KEYOUT; their primary function is to interface to the keying signals of the Power Amplifier. When input is configured as the KEYIN, **KeyIn timeout** field specifies maximum time allowed for KEYIN to arrive after KEYOUT was generated. If KEYIN does not arrive in time (broken cable, PA error), the module will generate KEYIN TIMEOUT, SMD will display a small **KEYIn** message, and prevent transmission. If KEYIN arrives within timeout, KEYIN OK signal is generated and transmission will be enabled.

NOTE: If a configuration contains multiple Power Amplifiers driven by one radio/SMD, the SMD will prevent transmission until KEYIN OK signals have been received from all of the active amplifiers in the selected (active) TX antenna path.

If KEYIN signal arrives within **KeyIn timeout** but then drops (which may happen due to error but most often occurs when an automatic amplifier re-tunes), transmission is inhibited till KEYIN returns to the active state. During this period the SMD display will show “KEYIN dropped” and the module address.

NOTE: If neither input is used as a KEYIN or INHIBIT, for example if the Power Amplifier doesn't provide KEYIN signal, **KeyIn timeout** changes its name and function to **Inhibit lead** and value sets fixed time during which module generates a fixed length INHIBIT signal. **Inhibit lead** time generally provides protection against hot switching the power amplifier.

IMPORTANT: If the TX path contains more than one Power Amplifier and one or more of them don't connect KEYIN signal, all Power Amplifiers will have fixed Inhibit Lead time equal to the longest defined lead time. This time changes dynamically according to selected TX path and presence of Power Amplifiers in TX path.

- **O1, O2, OPT**

These outputs can be configured to function as KEYOUT or PA ON. KEYOUT is the Power Amplifier PTT (e.g., PAPTT) and PA ON allows ON and OFF control if the the amplifier supports it. The OPT output only supports the PA ON function. The same parameters are available for both functions:

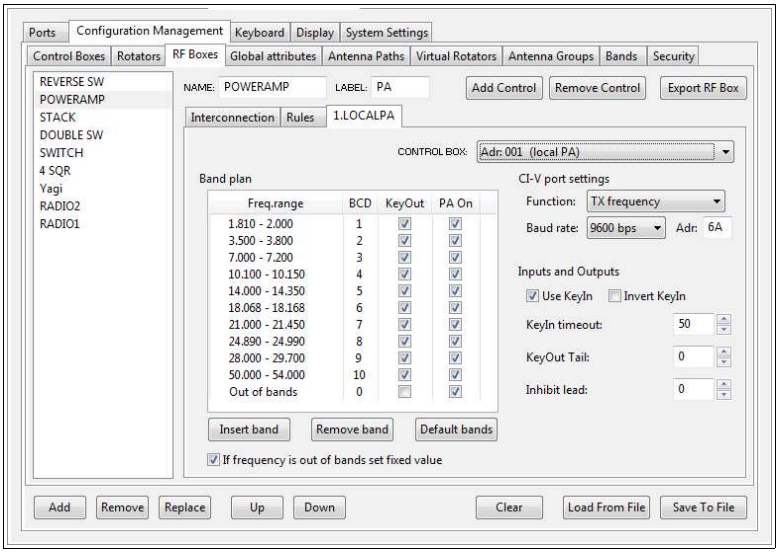
Tail
Specifies tail time, additional delay at the end of each T-R or Power OFF cycle.

Deactivate if Specifies how the outputs will be handled under two situations.

No user specifies if output will be deactivated if no user (SMD) uses the control box.

Out of bands specifies if output will be deactivated (inhibited) if the TX frequency is out of the defined frequency range. Normal use of this control is to automatically enable/disable (turn amplifier on/off or disable generation of KEYOUT signal) according to the frequency and whether the amplifier is selected.

POWER AMPLIFIER controlled by local PA port of SMD (local PA type)



Complementary to uLINK DATA control, Power Amplifier can be controlled also directly from the SMD local PA port. Local PA port provides dual band data outputs (BCD and CI-V) and can be chained with local serial port providing a band data over proprietary protocol (Acom 2000).

Unlike PA controlled by uLINK DATA module, amplifier connected to local PA port can be used by only the radio/SMD to which it is physically connected. The PA cannot be shared by other stations and must be placed in an antenna path which can have only one dedicated user – usually behind the interfaced radio or BPF.

There are several parameters for setting up such Power Amplifier control:

- **CONTROL BOX**
  Specifies which control box will be used for this PA. The only valid choice is "local PA". The SMD is selected by its unique address specified at Control Boxes tab.

- **CI-V port settings**
  These settings are the same as those for uLINK DATA modules.

- **Band Plan**
  Specifies frequency/BCD code table. Table is fully editable, separate frequency ranges can be added or removed by **Insert band** and **Remove Band** buttons or altered by single click on selected frequency display in the list. BCD code for each band can be set independently by clicking on selected line. Table can be set to default values according to regional band map by clicking on **Default bands** button. **Out of bands** defines the BCD outputs if control frequency is out of defined frequency ranges. When "**If frequency is out of bands set fixed value**" is not selected, the control box will keep last used outputs until a frequency closer to another "band" segment is selected.

  KeyOut column specifies if generation of KEYOUT signal is allowed for selected frequency range. Similarly, **PA On** column specifies if PA can be turned ON at selected frequency range. Function of KEYOUT and PAON signal is fixed to specific, equally named pins on PA port

  NOTE: Band Map for local PA control is always fixed to TX frequency.

- **Inputs and Outputs**
  These controls set the behavior of local PA port KEYIN and KEYOUT signals.
  Use **KeyIn** should be checked if the Power Amplifier provides keying output signal connected to KEYIN input on PA port. Polarity of this signal can be inverted clicking the **Invert KeyIn** checkbox. **KeyIn timeout** field specifies maximum time KEYIN can lag the generation of KEYOUT. Error states and error handling are the same as those for KEYIN signal on uLINK DATA module.

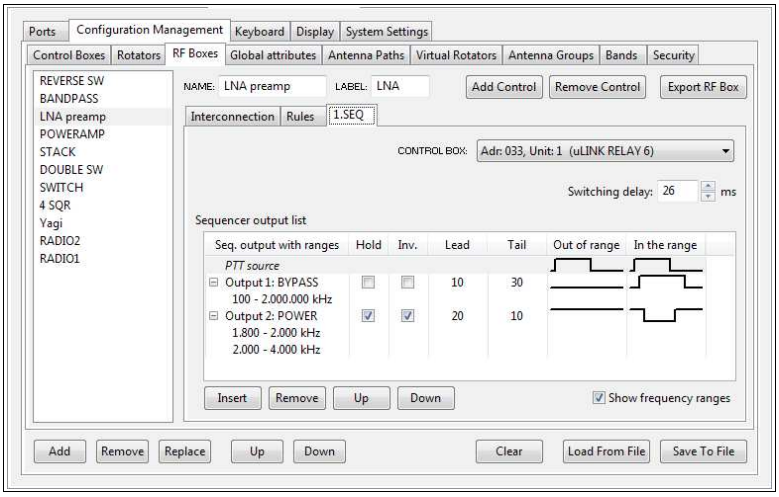
  Inhibit lead specifies fixed T-R switching time for the PA if it does not provide a KEYIN signal. During this time SMD generates INHIBIT signal for transceiver which prevents generation of RF power out from the radio.

  NOTE: Inhibit lead time should be zero (0) if the amplifier provides KEYIN signal and it is connected to PA port.

  KeyOut Tail specifies tail time of KEYOUT signal, additional delay at the end of each T-R cycle.

OTHER TWO-PORT DEVICE (SEQuencer type)

Additional types of two-port RF boxes can be added using **Other** template. When using **Other** template, Router generates Interconnections and Rules tabs as for the other two-port RF boxes but control box must be added manually using the **Add Control** button. Any combination of control boxes can be used with a two port RF box. In addition to the special local PA control type, DATA type for PA control purpose, and FRQ type for frequency dependent relay outputs, SEQ type T/R switching may be defined using relay outputs.



To add sequencer control for an RF box, **uLINK or local RELAY sequencer** control box must be added using **Add Control** button.

CONTROL BOX
Specifies which control box will be used for this RF box control. The control box must specify a relay unit with exactly same number of relay outputs as used for sequencer outputs. Only control boxes with equal relay outputs will be shown in drop down menu.

Sequencer outputs list
First line *PTT source* in the list window is just informative and shows T-R waveform in both IN and OUT frequency ranges for better visibility.

Sequenced Outputs can be added or removed using the **Insert** and **Remove** buttons and reordered with the **Up** and **Down** buttons. The Order reflects the physical position of the outputs within a control box unit. Outputs are numbered upward from the lowest to the highest reference in the unit, Output 1 is the lowest output number in the unit.

- **Frequency ranges**
  One or more frequency ranges can be defined for each output. The default frequency range can be edited by a single click on selected range. To show frequency ranges, click on **Show frequency ranges** button or expand list tree by clicking on the + icon.

  IMPORTANT: Each output can be renamed by single click on Output line. We recommend naming each output because the output relay can be changed with the UP and DOWN buttons. Without names, it is easy to lose track of the purpose of each output.

  NOTE: Frequency ranges for sequencer are always fixed to TX frequency.

- **Hold**
  Specifies sequencer output polarity if frequency is Out of range. Hold polarity can be set independently for each SEQ output. Output can be active or inactive. Out of frequency range sequencer output does not copy PTT source.

- **Invert (Inv.)**
  Defines sequencing polarity. Active state (while PTT lasts) can be open or closed contact. Rising edge on waveform means that contact is closing.

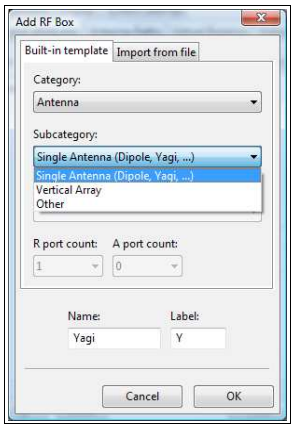
- **Lead**
  Defines delay between rising edge of PTT source (start of the T-R source cycle) and start of sequencer output in milliseconds.

- **Tail**
  Defines delay between falling edge of PTT source (end of T-R source cycle) and end of sequencer output in milliseconds.

- **Switching delay**
  Defines additional time which is added to the largest lead time. During this time control box generates INHIBIT signal for SMD. It generally stands for T-R switching delay of sequenced RF box.

  To make it absolutely clear please check the picture. Output 1, BYPASS has 10ms lead time. Output 2 POWER has 20ms lead time. Switching delay is set for 26ms. The largest lead time is 20ms on POWER output. It means that, BYPASS output will be active after 10ms from PTT arrival, POWER output will be active after 20ms from PTT arrival and control box will generate INHIBIT signal for 20ms + 26ms = 46ms from PTT arrival. During this time transmission from the radio will be disabled by SMD.

RF BOX CATEGORIES – Antenna



This type of RF Box allows adding R-port(s) only RF boxes – antennas to the configuration.

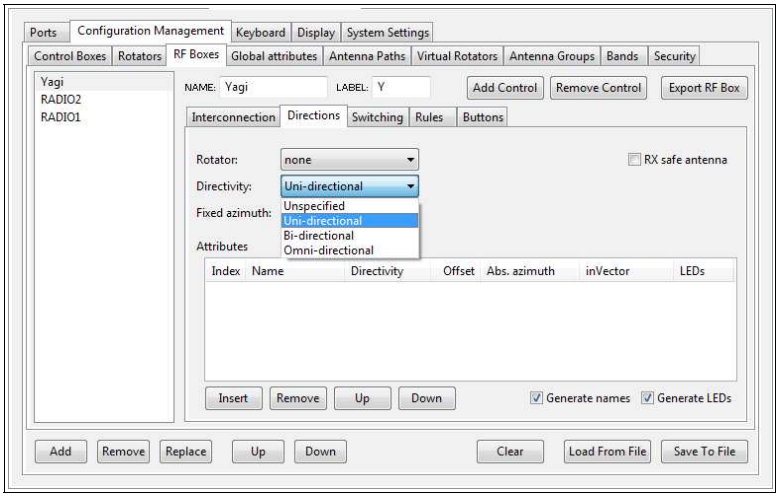
There are three sub-categories with predefined templates by purpose and type of control. First template is for simple, Single Antenna. Second for Vertical Arrays and third named Other stands for any, custom antenna.

SINGLE ANTENNA

When this RF Box is added to the list, five sub-tabs are automatically created.

Interconnections
Is a tab specifying to which RF box the R port of the antenna is connected. This tab is for information only as the connection an antenna is assigned from an A port on the preceding RF box (typically a switch).

Directions



- **Rotator**
  If an antenna can rotate, the Rotator selection specifies the rotator to which the antenna is assigned. The box shows only rotators defined on the Rotators tab. If antenna is fixed select **none.**

- **Directionality**
  Specifies directional pattern of the antenna which is used for drawing compass on SMD display.

  Directional beams (Yagis, Quads etc ..) should be selected as **Uni-directional** antennas. Bi-directional antennas are for example dipoles, Omni-directional are verticals. If this field is set as **Unspecified**, directional compass will not be displayed for that antenna.

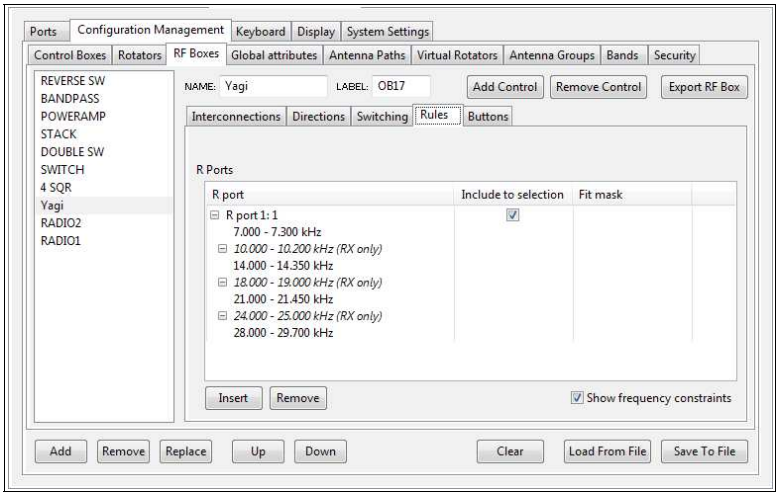
- **Azimuth offset / Fixed Azimuth**
  This field changes meaning depending on the Rotator and Directionality settings. If antenna is assigned to a rotator, this field allows to setting the antenna **Azimuth offset** relative to the rotator. If rotator is set to none, this field allows specifying a **Fixed azimuth** for Uni and Bi-directional antennas.

- **RX safe antenna**
  Using this flag, an antenna can be set as "same band RX safe antenna." This flag is useful only for setups with two or more SMDs and serves as an special antenna property which allows using the antenna for receiving even if two stations are tuned on same band. Use of such antenna will be described further on the **Security** tab.

WARNING: Do not set this checkbox until you 100% sure there is sufficient isolation between any TX antenna and the **RX safe** antenna. In sufficient isolation may cause receiver damage!

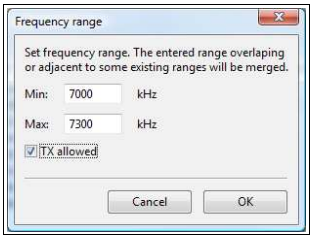
- **Attributes**
  This list, **Generate names** and **Generate LEDs** boxes have no function for this Single Antenna RF box as well as whole **Switching** and **Buttons** tabs. They will be described for **Vertical Array** antenna.

Rules



Rules tab specifies frequency range of the antenna's R port along with two another settings.

IMPORTANT: You should enter the correct frequency ranges of the antenna when the antenna is added to the list. Much of the internal processing is based on frequency; an incorrect or too broad frequency range can reduce the number of available options for each band.



Frequency ranges can be quite complex, including separate frequency ranges for TX and RX Only. When a frequency range is specified with **TX allowed** box checked, the range is considered as valid for both RX and TX antenna path. If TX allowed is not checked, range is automatically considered as RX only and antenna path will not be offered among others TX antenna paths in this range. The picture above shows the frequency definition for 40/20/15/10m multiband antenna with wider, "RX Only" segments around WARC bands. TX ranges are set exactly.

Include to selection is enabled by default for all antennas. When is enabled, an antenna is automatically added as a final antenna selection for other processing and as one of the antenna choices available for manual selection with the antenna selection buttons on SMD.

Fit mask is an advanced parameter, which will be described later.

Show frequency constraints box automatically expands the frequency ranges for all R ports when checked. When they are collapsed, ranges can be individually expanded by tree + control.

Additional Control Boxes

Optional control boxes can be added to any Single Antenna RF box (switch) using the **Add Control** button. These additional controls can be of any type, DATA, FRQ, MAN or SEQ and they can be assigned to any single R port using local I/O ports (local serial port or local relay units) or I/O ports located at uLINK module. Typical use of additional control boxes could be:

SEQ type controls relay outputs according to T-R sequence and allows bypassing preamplifier located at the antenna during transmission.

FRQ type controls relay outputs based on frequency and allows switching the matching/tuning networks of an antenna. A typical example is to switch between CW/SSB segments on 80m antennas.

MAN type controls relay outputs by manual action through PATH properties button. This type of control can be used to change the state of an output (on/off) without effecting other parameters of the antenna path.

DATA (serial) type controls an R port according to a specific protocol. This allows interfacing an external antenna controller with SMD and would typically be used with frequency agile antennas like those by SteppIR or UltraBeam.

IMPORTANT: Local control can be used only if the antennas are accessed by one SMD (radio). For configurations using more than SMD, always use a uLINK module as the control box.

VERTICAL ARRAY ANTENNA

Is another sub-category of Antenna RF box. **Type** allows choosing from predefined templates for all commercially available Vertical Array boxes.

Interconnections

This tab has the same meaning as for Single Antenna and is for information only.

Before going further, we need to define some new terms. While it may not be necessary for most configurations because the built-in templates cover the commonly used RF boxes, these concepts will be important when adding a custom RF Box to the system.

TERM INVECTOR
Is an unique request (max. 16 bit code) from SMD to RF box defining a particular state for all of the internal control of the RF box to define the relationship between a particular R port and the A ports on the box. InVector has the same number of bits as the box has A ports (A1 – An from left to right) plus the number of control attributes. Zero InVector must always be defined (inVector with all A ports cleared) as the default, "no user" state.

TERM ATTRIBUTES
The number of properties (states) of the RF box.

TERM OUTVECTOR (Outputs)
Describes outputs state for a particular InVector.

To make these terms more understandable, consider an example. In order to build an RF path from the radio to an antenna, SMD must properly set each element of the configuration to complete the path. To do so, SMD must set the control box connected to each RF Box (set the local outputs or uLINK Relay modules). Each time an antenna path is changed, SMD sends request – an InVector - to all of the control boxes included in the antenna path to apply the required state. Every control box confirms the request and ONLY when all of the control boxes confirm the inVector is the path enabled.

Vertical Array is an example of an RF box controlled by inVectors. As far as SMD is concerned, the entire array is one antenna – it has a single R port – no matter how many elements the array might contain. Because every antenna RF box has zero A ports, it means that there are no A port bits included in the InVector. However, we know that the "antenna" can be directional by inserting a phase shift among the array elements - these "directions" become our **Attributes**. Since the RF Box (antenna) has no A ports but a number of directions (Attributes), the InVector will be as long as the number of attributes. If antenna array has four (4) directions + special Omni property (feature, direction), there will be five (5) InVectors to control it. The control signals applied to the antenna (phasing unit) control port inputs for each direction (Attribute) - the OutVector – is defined on the Switching tab.

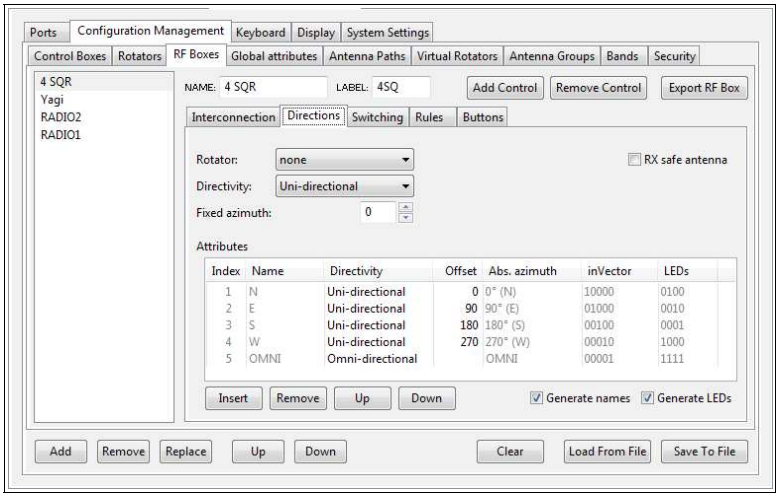
Directions

- **Rotator**
  If antenna can rotate, the Rotator selection specifies to which rotator is antenna assigned. Box shows only rotators defined at Rotators tab. For Vertical Arrays should be set to none.
- **Directionality**
  Specifies the directional pattern of the antenna which is used for drawing compass on SMD display. Since Vertical Array is a directional antenna the recommended setting is **Uni-directional**. If some position in the antenna properties has different pattern, it can be changed individually.
- **Fixed Azimuth**
  This field allows setting **azimuth** of the first InVector (default array position) referenced to North. It is the absolute azimuth of the default direction.

- **RX safe antenna**
  Using this flag, an antenna can be set as “same band RX safe antenna”. This flag is useful only for installations with two or more SMDs and serves as a special antenna property which allows using the antenna for receiving even if two stations are on same band. The use of such antenna will be described further on the **Security** tab.

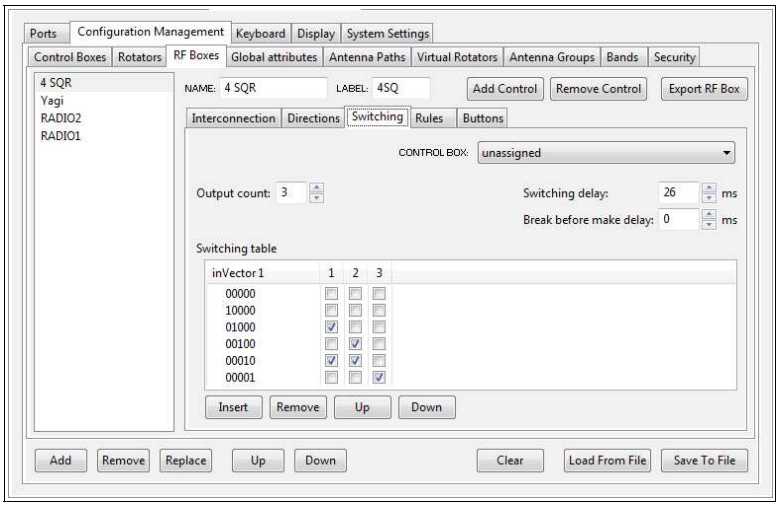
  WARNING: Do not set this checkbox until you are 100% sure there is sufficient isolation between any TX antenna and the **RX safe** antenna. Insufficient isolation may cause receiver damage!

Attributes



- **Index** - Attribute number.
- **Name** - Specifies name of the attribute. If **Generate names** box is not checked, Name can be edited by single click.
- **Directionality** - This column specifies directionality of each attribute. Each can be edited by single click, as a Base-directionality is used default value specified in main Directionality box. According to directionality settings is drawn compass on SMD display.
- **Offset** - Defines offset of the attribute relative to first attribute. Offset can be edited for each attribute separately.
- **Abs. Azimuth** - Shows absolute azimuth of the direction considering fixed azimuth settings and offset.
- **InVector** - Shows Attribute's InVector. Number of InVectors can be increased or decreased by **Insert** and **Remove** buttons.
- **LEDs** - Specifies which LED lights of SUB SELECTION buttons [1]... [4] on SMD front panel will be activated for each attribute. If **Generate LEDs** box is not checked, LED control can be customized. Order is from left to right according to its position, 1 means LED is ON.

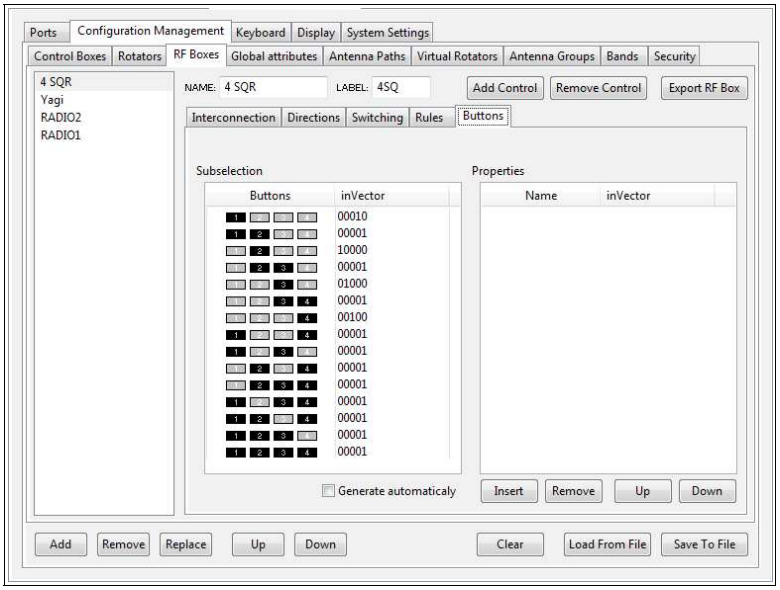
Switching



- **CONTROL BOX**
  Specifies which control box will be used for this RF box control. Control box must specify a relay unit with exactly same number of relay outputs as are set in Output count. Only control boxes (units) the proper number of relay outputs will be shown in drop down menu.
- **Output count**
  Specifies how many control wires are needed to control RF box. Maximum value is 20. For more than 10 outputs controlled by uLINK RELAY module, the master master/slave method must be used.

- **Switching delay**
  Specifies how much time is required for the antenna switching to settle in order to prevent hot switching.
- **Break before make delay**
  Allows adjusting this delay parameter if RF box requires break before make delay.
- **Switching table**
  Defines relationship between InVectors and Outputs. For each InVector the Output states can be specified separately. InVectors can be edited but they must match the InVectors defined on the Directions tab.

Rules



Rules tab specifies frequency range of the antenna's R port along with two another settings. Frequency ranges and Include to selection boxes were explained previously.

Fit mask serves a special purpose; it tells Router how to handle InVector. In the case of Vertical Array Antenna, if Fit mask is set to its default value (all zeros), it means that the array will be added as one, main selection on SMD with direction control on the sub selection buttons [1]... [4]. If Fit mask is changed, for example to 10000, selection list will contain a main array selection as before and a separate selection which has the same InVector as Fit mask. In our four square antenna example this would mean the main selection and an extra position for North.

Fit mask also allows the special character X in addition to 1 or 0 where X stands for a mask. In our case, if Fit mask is xx000 there will be three options available for SMD front panel; a global one for the array and additional for selections with InVector equal 10000 and 01000 (Fit mask 11000 would be invalid in this case invalid because that InVector does not exist). In our four square antenna, this means the available selections will be main, North and East.

Buttons

All RF boxes which have more than one InVector defined can also have associations between InVectors and the **Subselection** buttons. These associations are defined on the Buttons tab and shows which InVector will be requested by SMD for every combination of the subselection buttons. There are fifteen (15) valid combinations (all buttons Off is not valid).

InVector can be explicit like 10000 or contain special characters. X means **"don't change last state"** for this bit and T means **"invert (or toggle) the last state"** of this bit.

Properties field will be described in RF box – Switch – Stack Switch chapter.

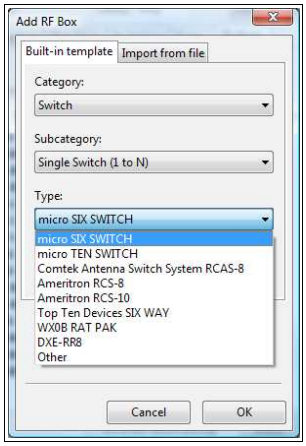
OTHER ANTENNA

Other Antenna is a choice for all other antennas which do not fit either Single Antenna or Vertical Array antenna template. Settings are the same as the other antenna types and can be edited without limits.

RF BOX CATEGORIES – Switch

Switch is a last category of the RF box which can be added into the setup definition. There are several sub categories which specifies the kind of switch to be added.

SINGLE SWITCH (1 to N)

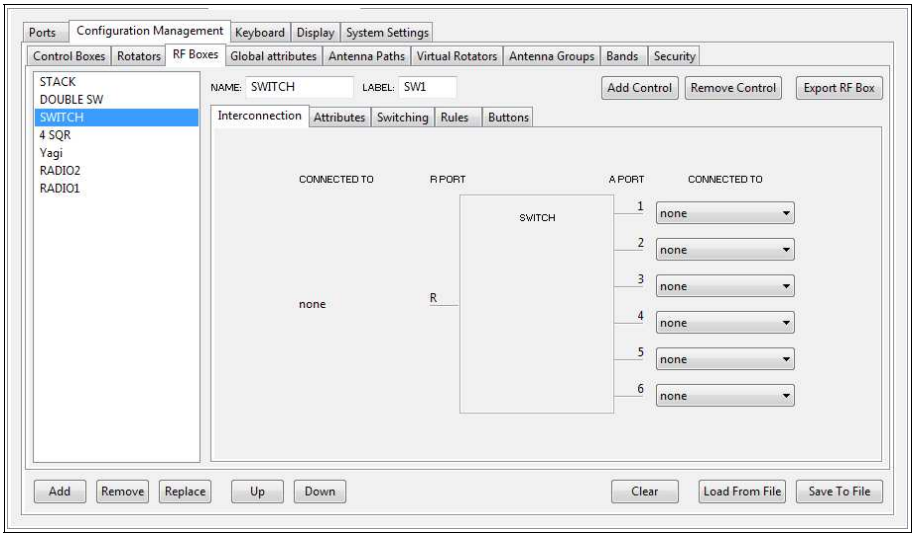


It is a simplest antenna switch with one R port and N number of A ports. Router includes predefined templates for antenna switches from *micro*HAM as well as switches from Ameritron, Array Solutions, Comtek, DX-Engineering and Top-Ten. Any other two (2) to ten (10) way switch can be added as **Other** switch.

When a new switch is added to the configuration, five (5) sub-tabs will be generated.

Interconnections

The first sub-tab shows to which RF box feeds the R port of the antenna switch and allows defining the A port connections to other RF boxes.



Attributes

A standard N-way antenna switch has no attributes – this tab will be explained further in the "Stack Switch" section. However, the principle is the same as with a Vertical Array Antenna RF box and can be applied to any switch in general. Attributes is a list of additional properties of the switch and are implemented as additional bites in the InVector. These attributes can then be controlled by sub-selection buttons or by the special **Path Properties** button.

Switching

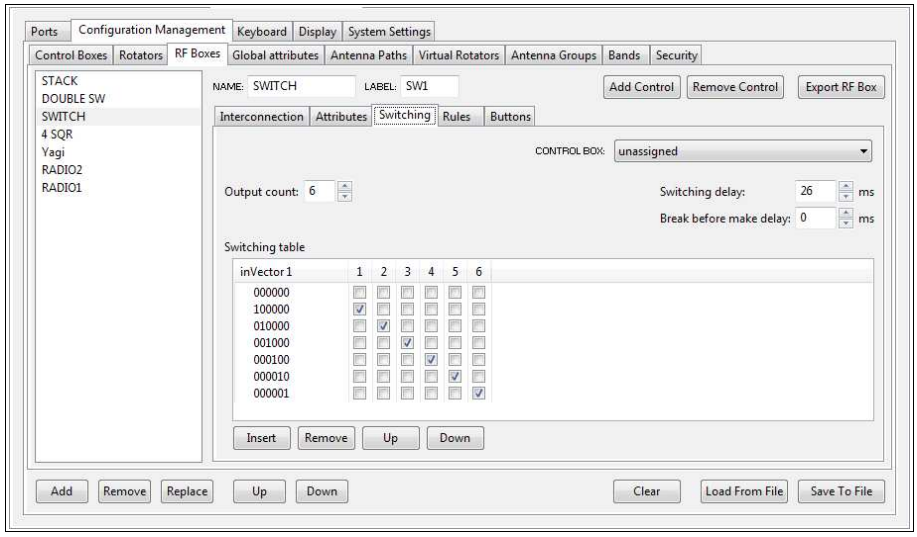
- **CONTROL BOX**
  Specifies which control box will be used to control this RF box. The Control box must specify a relay unit with exactly same number of relay outputs as are set in Output count. Only control boxes with equal relay outputs will be shown in drop down menu.

- **Output count**
  Specifies how many control wires are needed to control RF box. Maximum value is 20. If more than 10 control wires as provided by a uLINK RELAY 10 module are required, the master/salve method must be used.

- **Switching delay**
  Specifies how much time is required till antenna switching is done and can be safely used. Safe value for all microHAM switches is 26ms.

- **Break before make delay**
  Allows to adjust this delay parameter if RF box requires such kind of control.

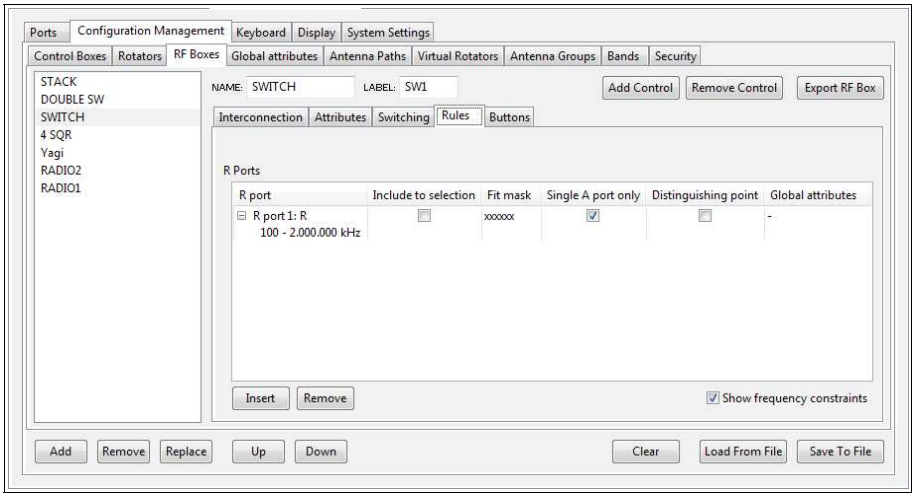
- **Switching table**
  Defines relationship between InVectors and Outputs. For each InVector the Outputs state can be specified separately.



Rules

The Rules tab specifies frequency range of the antenna's R port along with five another settings. Frequency ranges and Include to selection boxes were already explained in the chapter on Vertical Arrays.

In case of antenna switch is rarely necessary to set a frequency range for R port. Default, wide band range is fine for almost all setups. However, if it is necessary to limit frequency for any reason, it can be set here.



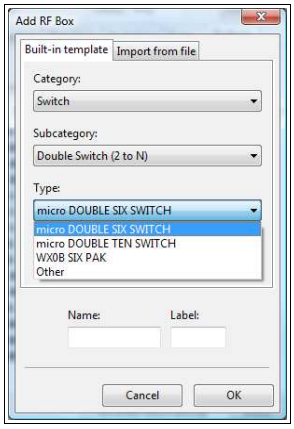
Include to selection checkbox has the same meaning as for antennas or two port devices. When checked, the R port will be added as a separate antenna selection for direct access from the SMD main antenna selection buttons. Since a simple N way switch will most likely have antennas or additional switches connected to its A port(s), the default value is that R port of an N way switch is not included in the available antenna selections.

Fit mask serves to limit the available A ports. By default the fit mask is set as xxxxxx (the same length as the InVector) meaning that all InVectors are allowed. If there is a requirement to limit number of available InVectors (selections), the fit mask can specify which InVectors are to be excluded. For example, fit mask = xxx000 means that only first three A ports of six way switch will be used for rest of configuration.

Single A port only serves to set additional limitations of which antenna selections will be offered for direct access from the SMD antenna selection buttons. However, for a simple N way switch there is no reason to use "Single A Port only" since an N way switch does not provide a "splitting" feature. This option will be explained under Stacking Switcher – where it is applicable.

Distinguishing point and **Global attributes** are advanced parameters and will be explained separately.

DOUBLE SWITCH (2 to N)



Double switches are special safety switches, originally designed for connecting two radios to several antennas. In our language, these are switches with two (2) R ports and several A ports. By design, the two R ports can not simultaneously select the same A port.

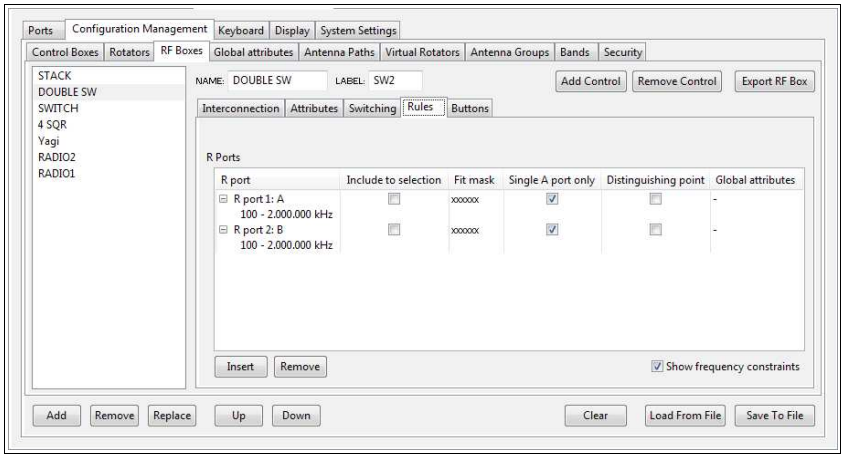
microHAM provides two versions, Double Six Switch with six antenna ports and Double Ten Switch with ten (10) antenna ports.

Settings on the sub-tabs are similar to Single Switch, so we will focus on what is different.

Rules

The most obvious difference between a Double Switch and Single Switch is that the Double Switch has two Frequency Ranges and all other parameters. This is because the parameters apply to each R port of the RF BOX.

IMPORTANT: Rules are always referenced to the RF BOX's R port, not to RF BOX globally. Each R port can have own rules of behavior.

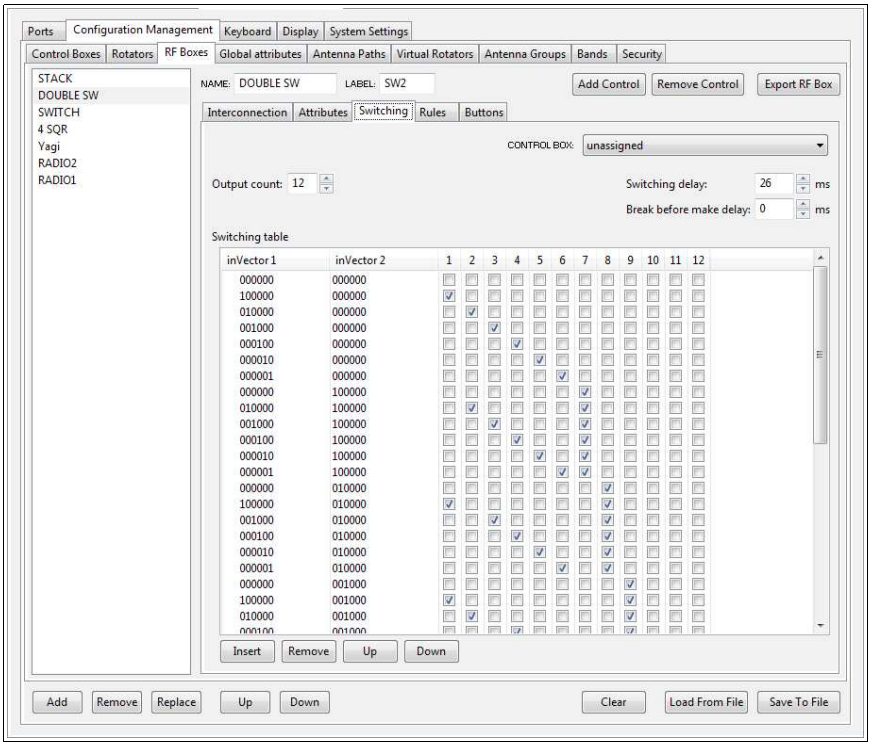


IMPORTANT: The control box for a double switch must control both R ports from within one relay unit.

Switching

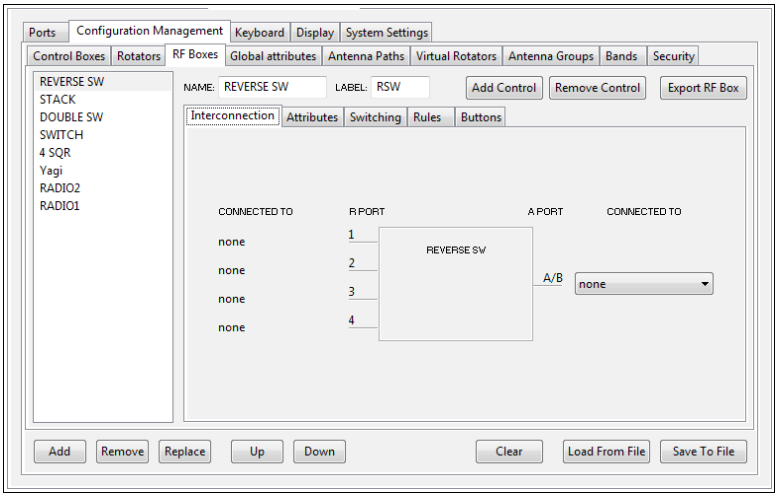
As shown in the picture, the switching table has additional column. Each R port has own set of InVectors. The relationship between output states and InVectors is always considered for both both R ports because they are used for different antenna paths. They can be used by the same SMD for separate RX2 and TX antenna selections or by two SMDs, each connected to different radio.

Both InVectors are controlled from one Control box – a relay unit of as many outputs as are needed for full control of the RF box. Both R ports of the Double Switch are handled together in order to identify and prevent possible collision in advance - before antenna path is even created.



REVERSE SWITCH (N to 1)

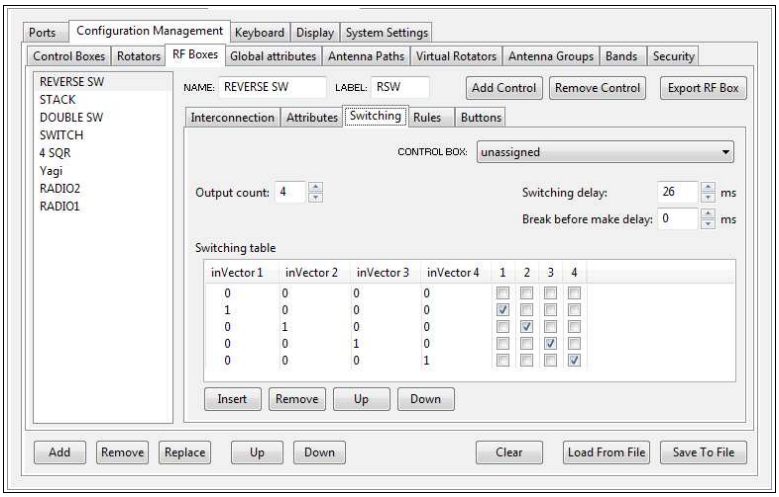
Reverse switches are safety (interlocked) antenna switches used in reverse direction. Instead of switching RF from one transceiver among multiple antennas, they provide the ability to distribute (switch) one antenna among multiple transceivers (or transceiver antenna ports). By design, these switches prevent two or more radios from connecting to an antenna or each other at the same time.



The only commercially available switches are the two way A/BSS switch from Top Ten Devices and the microHAM Four + Four Switch (two four way reverse switches in a common enclosure) - in SMD terms, these switches have one (1) A port and two (2) or four (4) R ports.

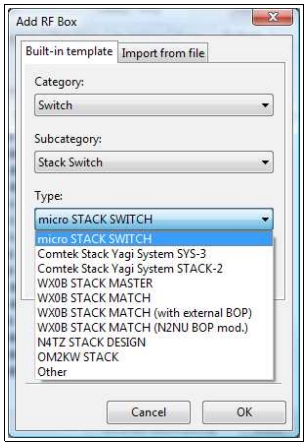
Reverse switches are vital part of every RF configuration where more than two transceiver ports are needed.

From configuration perspective, reverse switches are very similar to double switches but the Rules and Switching tabs are expanded to support the additional R port definitions. As is shown on the picture for 4+4 switch, the InVector for each port has just 1 bit because each R port is controlled only by a single wire with ON/OFF state, but all four InVectors are controlled at once by single control box unit (not shown).



STACK SWITCH

Stacking switches are special purpose switches made for distributing power to/from several antennas at the same time while keeping impedance of all antennas matched. SMD supports all available products, custom stack switches can be added using **Other** selection and knowing relationship between stacked antennas selection and state of its control port. For explanation we will use the microHAM three antenna Stack Switch, because it has a unique feature – the SUB port, a separate R port that allows independent use of any antenna not currently used for stacking on the MAIN port.

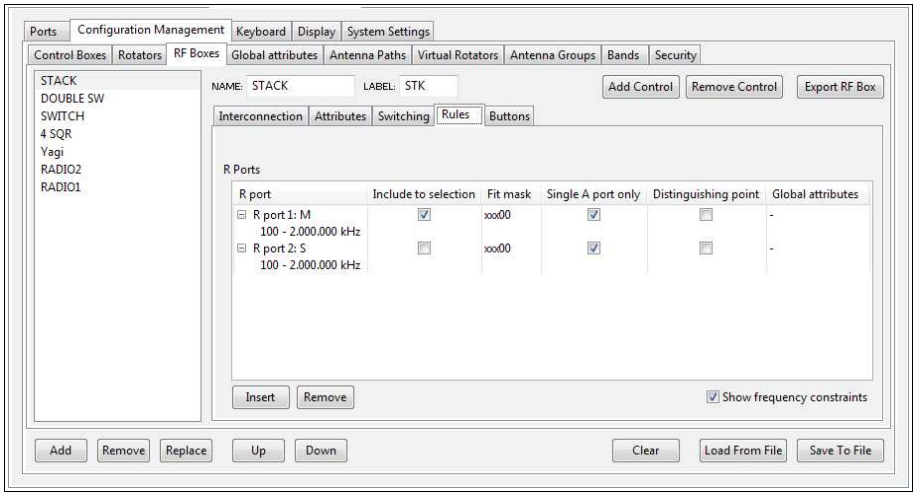


The **Interconnections** tab is again very similar to other switches. It shows which RF boxes are connected to the MAIN and SUB R ports and allows selecting connections for the A ports.

The **Attributes** tab isn't empty because Stack Switch has two special features. First is a BOP feature which allows connecting two antennas out of phase (ANT1+ANT2 or ANT2+ANT3). The second feature called FULL (ANT1+ANT2+ANT3) disables SUB port of the Stack Switch.

Because Stack Switch has three A ports, the first three bits represent A ports and another two BOP and FULL.

Switching



The Switching tab contains two columns for InVectors because Stack Switch has two R ports, MAIN and SUB. All Output combinations are related to both InVectors applied at once according to Stack Switch internal control logic.

Rules

R port column again defines frequency ranges for both R ports.

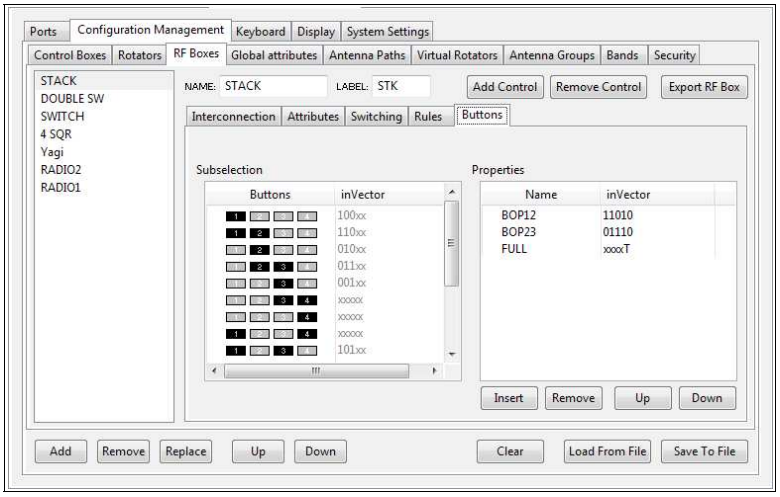
Include to selection is active when Stack Switch is enabled (selected). It is important because Stack control is different than normal switch control. Antennas connected to the Stack Switch should have at least one band in common. When the R port is added to the selection, the combination of stacked antennas can be controlled by sub selection buttons.

Fit mask is set to xxx00. It means that all Stack Switch antenna combinations will be added to the further processing. Router handles disconnected A ports automatically. It is not necessary to change fit mask if some A port of the Stack Switch (or any other RF box A ports) is not connected, for example, if only two antennas are stacked.

When **Single A port only** is enabled no stack combination will be offered as a main selection – only single A port selections (ANT1 or ANT2 or ANT3 alone) will be offered. In this case, Stack Switch will act much like a "Double Three" switch. If direct selection of a specific stack combination is desired (for example ANT2+ANT3), the **Single A port only** checkbox must be disabled.

Distinguishing point and **Global attributes** are advanced parameters and will be explained separately.

Buttons



All RF boxes which have more than one InVector (more than one control) can also have an association between the InVectors and **Subselection** buttons. These associations are defined at Buttons tab and shows which InVector will be selected for each of the fifteen (15) valid combinations of the subselection buttons.

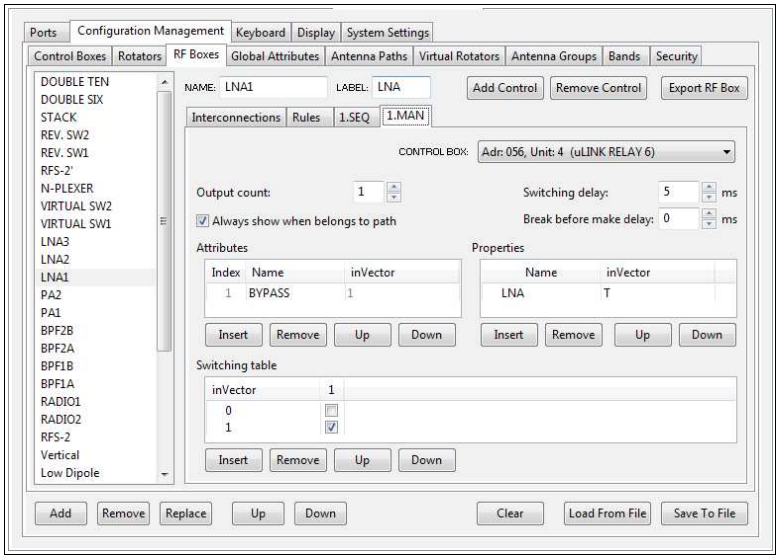
The InVector can have explicit form like 10000, it can contain an **X** - meaning **"don't change last state"** for this bit, or it can contain a **T** – meaning **"invert (toggle) the last state"** of this bit.

The **Properties** field provides another way to apply an InVector. In addition to applying (selecting) the InVector using the main antenna selection buttons (buttons 1 .. 7 on front panel) or the Subselection buttons, the InVector can be chosen using the the **PATH** properties button. When this button is pressed, the bottom line of SMD display shows all of the choices defined in Properties list. Each property can then be applied by one of seven main selection buttons. Because the name is not shown on the SMD display, PATH properties should be reserved for selecting special features of the RF box. In case of Stack Switch, PATH properties are useful for selecting BOP features (out of phase states) or the FULL property (takes exclusive control of Stack Switch and prevent any other radio [SMD] from using an un-used antenna through the SUB port).

OTHER SWITCH

The “other switch” template allows adding and defining any custom N to N switch. All configuration parameters must be set manually.

MANual type of control



With the definition of attributes and properties out of the way, we can introduce last type of added control for any R port – MANual type.

In some situations it is useful to have a manually controlled device in the antenna path. A manually controlled output **cannot** change a structure of the antenna path but can change its properties. In other words, it can switch something on/off in the antenna path. The most common use of a manually controlled output is to bypass a preamplifier.

This control can be added to any R port using the **Add Control** button and selecting “uLINK or local RELAYS manually controlled by properties.” Manual Control has no default settings and all parameters must be set manually.

Output count defines number of outputs as before. The **Attributes** and their names must be defined first. The number of attributes determines how wide the InVector will be and how many possible combinations (states) will be available. The **Switching table** defines the relationship between InVectors and Outputs. **Properties** determines what controls will be available using the **PATH** properties button on SMD.

The Router screen above shows the definition of single, toggle property controlling one output – in this case an LNA bypass.

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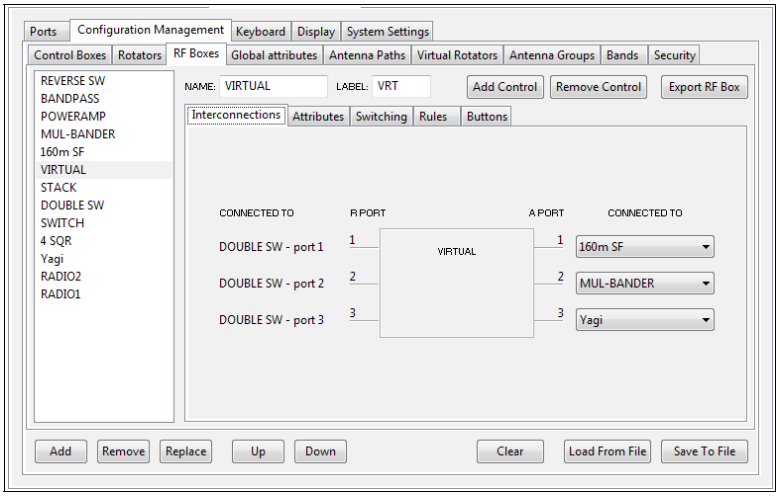
RF BOX CATEGORIES – Special Devices

VIRTUAL EXCLUSIVITY BOX (VIRTUAL SWITCH)

The Virtual Exclusivity Box (Virtual Switch) is a feature of the uLINK network. The virtual switch acts like a mechanical interlock – it prevents any SMD from accessing a resource (for example an antenna) if another SMD is already using a mutually exclusive resource. The virtual switch is an internal N x N matrix.

Since the virtual switch is unique to Station Master Deluxe, let's look at an situation with mutually exclusive resources where the Virtual Exclusivity Box might be used.

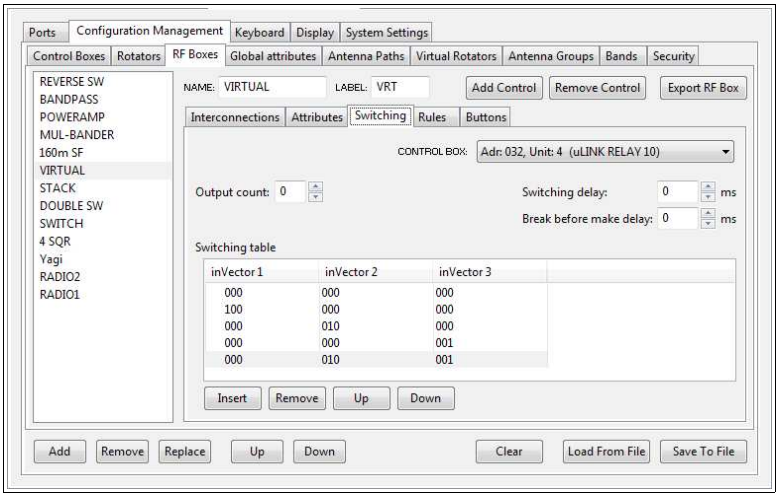


Consider a SO2R installation (two radios, two SMDs) … among the antennas are a shunt fed tower for 160m with a multi-band antenna for 20/15/10 meters and an 80 meter yagi mounted at the top. While both beams can be used simultaneously, if either radio selects the shunt feed no other radio should be allowed to use either of the beams. This critical situation is an interaction among three separate antenna paths. The virtual switch (virtual lockout) was developed to handle these interactions.

In our example we will insert a 3 x 3 virtual switch between the "real" antenna switch and the antennas. On the **Interconnections** tab we will connect the three A ports of the preceding "double switch" to the R ports of the virtual switch and connect the antennas to the A ports of the virtual switch.

Since switch is virtual, it does not need any control outputs. However, to be controlled it must have a (virtual) Control box associated with the (virtual) RF box. For this purpose we can use a virtual unit of zero (0) outputs on any uLINK RELAY module as long as the unit is defined on the Control Boxes tab.

Once the unit has been defined, we can set the InVectors on the **Switching** tab. **Switching** and **Break before make delays** can be zero because switch is instantaneous – it has no moving parts. The **Output count** is zero because the (virtual) RF box is not controlled by any physical relays – only the InVectors.



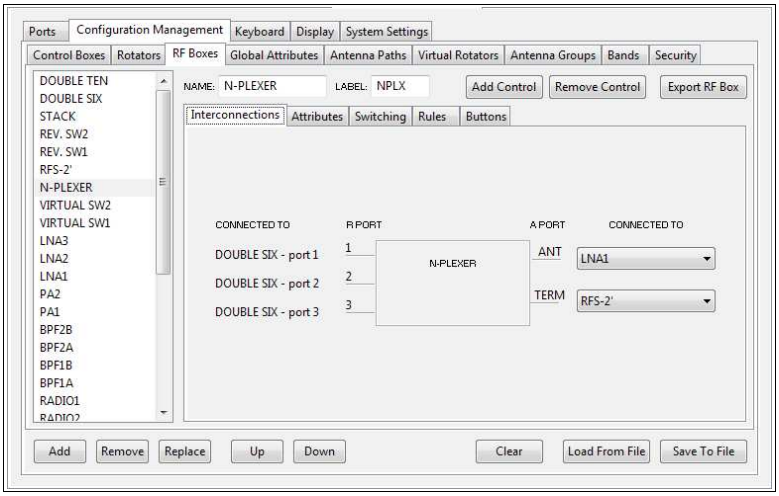
The **Switching table** contains three columns – one for each R port since an R port can only connect to its associated A port. The InVectors specify the allowable combinations.

In our case, InVector 100 000 000 means that when R port 1 (160m) is used, the other A ports must be off (first 100 part) and the other R ports may not be used (000 of other two parts). When R port 1 is not engaged, R ports 2 and 3 can be freely used. This gives three possible combinations: tribander only (000 010 000), 80m Yagi only (000 000 001) or both by separate radios (000 010 001). All combinations **must** be explicitly defined. Masks are not allowed for virtual switches.

IMPORTANT: Each InVector can control and define only its A port, other A ports must be zeroed. A virtual switch can only be used to connect an R port to its associated A port (R1 to A1, R2 to A2, etc.) - it can not be used for "cross switching."

Attributes, **Rules** and **Buttons** are available as in any other type of switch but they are of little use with a Virtual Switch.

N-PLEXER



Another special part of the uLINK network is the N-Plexer. N-plexer is an RF box which allows a single A port to be expanded (split) to multiple R ports without switching. Typical examples of an N-plexer are a receiving splitter, the BCC "Beverage Box", a multi-band antenna with separate feedlines for each band (e.g., Force 12 C31XR), and classic diplexer or triplexer.

IMPORTANT: N-Plexer is the ONLY RF Box that allows connections from multiple R ports to a single A port.

Because the A port of the N-Plexer can be connected to RF boxes which requires additional control (for example 4 square antenna with direction control), only one user (start point) can be the "master" of that control. Therefore no matter how many R ports an N-Plexer has it looks like a box with two A ports. The first A port is the main (Antenna) port and the radio (SMD) using that A port is the "Master of control." The second A port is a mirror of the main port (marked "term") and all other stations connect to the second A port through separate R ports. The Term port serves as the "destination" for all non "Master" connections.

The TERM port cannot be left unconnected but also has no physical connection so it must be terminated by a "virtual" termination - in this case a "special box" called an "N-plexer terminator." For convenience, it is wise to name each N-Plexer terminator the same as the antenna connected to the main port with an added apostrophe or other symbol to make it easy to recognize the master and mirror antennas.

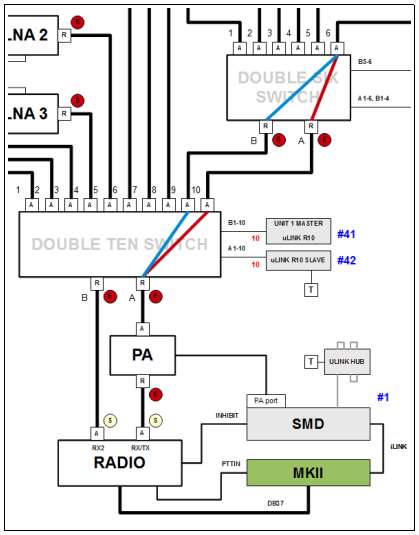
Like the virtual switch, N-Plexer does not need any control outputs. However, since it is controlled it must have a Control box associated with the (virtual) RF box. Again, we use a virtual unit of zero (0) outputs on any uLINK RELAY module defined on the Control Boxes tab. **Switching Delay** and **Break before make delay** can be zero because switch is virtual and the **Output count** is zero because the control is entirely by InVector.

The InVector table **should not be changed**, it is always defined based on the number of R ports. The most important part of defining an N-Plexer is to properly set the frequency range and "TX allowed" flag for each port.

WARNING: Be very careful in defining frequency ranges and TX allowed attribute for each R port. If transmitting is allowed with the N-plexer, insure that the frequency range of each R port is unique and that there is no overlap. Any mistake may cause severe damage to receivers connected to other ports of the N-Plexer!

Special R-port rules: Distinguishing point and Global attributes

TERM ALTERNATIVE GROUP



Is a group of all alternative antenna paths reaching same end point merged to one single Antenna Selection.

In some setups (including our example) a particular end point can be reached using different antenna paths. This situation is shown on picture by red and blue colors. These paths are equivalent but cannot be fixed separately for a particular start point because such definition will be limiting – particularly in configurations with more than two radios. To deal with this problem, Router combines multiple paths that reach same end endpoint into an **Alternative Group**. When a user (SMD) attempts to connected to a particular endpoint and this endpoint is reachable by more than one path, SMD automatically finds a free path in the Alternative Group.

It works similarly to travel by car using GPS - if one road (path) is blocked, SMD searches for alternative routes and if another route is found in the Alternative Group the connection is made. Without this capability, many of the more complex antenna systems could not be fully utilized.

In some cases, all alternative paths are not equal. For example, if there are shared amplifiers in the system – one capable of 500W output and a second capable of 1500W output, we want to be able to control which amplifier is being used. In these cases, the amplifier becomes a **distinguishing point.** If the "Distinguish Point" option is selected for an R port, any path which uses that port will be excluded from the Alternative Group. Using our GPS analogy, a distinguishing point is like a way point.

In some situations even a Distinguishing point is not enough to specify how the Alternative Group should be split. In large Alternative Groups we may not want to split the group into a few distinct paths plus a larger group but into several "sub groups" where each path in the sub group is equivalent. This is the purpose of **Global Attributes**. Global Attributes allows marking particular end point by a letter and than using the letter as a parameter to define the "sub groups." This mechanism will be explained in Global Attributes chapter.

RF BOXES SUMMARY

- Each part of the configuration, including transceivers and antennas, are defined as RF boxes
- The RF connection ports of RF boxes are called A and R ports. A and R ports can never be connected in parallel. Ports can only be connected one R port to one A port.
- RF boxes are controlled by Control boxes – either uLINK modules, relay units or ports on SMD.
- All parameters for an RF box is related to its R ports.
- If RF box contains switching that can change antenna path the associated Control box is defined on the Switching tab. If an RF box has more than one R port (for example a "double switch" or stack switch) the control box always controls all R ports.
- Each R port can have own frequency table and an R port can be RX/TX or RX only.
- Each R port can have an unlimited number of additional control boxes for different types of control: FReQuency based switching, T-R SEQuence based switching, MANual control and DATA functions.
- The "parameters" define how each RF boxes will be controlled by SMD front panel.

CONFIGURATION MANAGEMENT - Global Attributes

The concept of Global Attributes is used for advanced configuration control and is unlikely to be used in simpler setups. It is recommended that the user leave this tab empty until he has become familiar with other elements of the configuration.

Global Attributes are used as a method of distinguishing equivalent Antenna Paths leading to the same end-point or combination of end-points, which would otherwise be grouped together into a single Alternative Group.

Global Attributes are tags, marked by capital letters A, B, C, etc., assigned to individual R-ports, in the RF boxes->Rules tab of the respective RF box. Multiple attributes can be assigned to a single R-port, simply by listing all of them in the **Global attributes** column for the given R-port.

When a path is being constructed, Global Attributes entered for R-ports along this path are concatenated, and the resulting combination of attributes enters the matching process against the list in the Global Attributes tab. For each line of that list, first, those attributes from the path's combination are selected, which are contained in the list in **Group** column. Then, the resulting combination is matched against the combinations listed in the **Value list** column. If there is a match, this path is marked by the name from the **Name** column. If the **RX only** checkbox for that line is checked, the matching paths are marked as RX only.

For example, if a path passes through R-ports some of which have assigned Global Attributes AE and others B, the resulting attribute list for this path is ABE. If then in the Global Attributes tab a line contains ABCD in the Group column, this path's attribute combination for this line is AB, and this combination is searched for in the Value list column of this line. If found, this path is marked by the name of this line and if RX only checkbox for this line is checked, this path becomes also RX only. Otherwise, this line is ignored for this path.

This process is repeated for the rest of the list, and as a result, a path can have several markers at once; if there was no match for the given path, it may have no marker at all. The Alternative Groups are then split so that only paths with the same combination of markers are grouped together.

Configuring the Global Attributes tab

Like other tabs in Configuration Management, lines in this tab can be added/removed using the Add/Remove button, and can be reordered using the Up/Down button. The order of lines has no significance.

Name

Every line in this tab must be given a name, which then serves as a marker if a match for a given path is found according to the process described above. Highlight the line, and after a brief pause single-click on the name to change it.

Group

This is the list of attributes which are taken into account when seeking a match for a path's attribute combination. Highlight the line, and after a brief pause single-click to enter the group. Type simply all attributes (capital letters) to be taken into account, e.g. “ABCD”.

Value list

After selecting only those attributes from the path's list which match the attributes in Group column, the resulting combination is matched against a list of attributes' combinations in the Value list column. Highlight the line, and after a brief pause single-click on the Value list to change it. Combinations in the list are separated by comma. For example, the following string may be entered as a value list: “A,AB,AC,ABC”.

The "-" character is a special item that denotes "no attribute", i.e. the match requires that after selecting the path's attributes according to Group, no attribute remains. It can be freely combined with other combinations in a Value list.

RX only

If a path matches a line in the Global Attributes list and the RX only checkbox is checked for that line, the path is marked as RX only. Double-click on the checkbox to toggle its state.

CONFIGURATION MANAGEMENT - Antenna Paths

After the RF network has been described in the previous tabs, all possible Antenna Paths are generated automatically. Here, Antenna Path describes a single selection accessed through pressing one of the buttons 1 to 7 below the LCD display on the SMD.

In simple configurations, Antenna Paths correspond to individual antennas. In more complex setups, Antenna Paths may include also combinations of antennas, for example if a stack switch is present. The RF network may include several branching points resulting in many combinations all of which can be presented as one Antenna Path.

In general, not only can branching occur but paths can be also merged or join at different points of the network. This can possibly result in several different paths to a single antenna or other resource in the network. Since the operator does not generally care which particular path leads to the required resource, such equivalent paths are grouped in a single Alternative Group. Alternative Groups rather than the individual paths are assigned to a single button on SMD. The user still can actively chose a particular Antenna Path from an Alternative Group by multiple presses of the same button but when switching away and subsequently returning to a given endpoint, SMD will automatically chose the first available alternative depending on what resources are using by other stations (SMDs) in the network.

How Antenna Paths are generated

The basic rule for generating Antenna Paths is, that every **end-point** represents one Antenna Path. End-points are R-Ports of RF boxes, which have the "Include to selection" box checked in Rules. When an antenna is added in the RF Boxes tab, this box is checked by default since we normally want to have all antennas available for use. When switches are added, the "selection" box is normally not checked. However, if there is a reason to specify a path to a switch instead of an antenna, this box may be checked and the port/switch will appear as another endpoint.

NOTE: The term "end-point" is slightly misleading here. It is meant as the point where control for given path ends, rather than the physical end of the path. The physical path always extends to an element that has no A-port (that is to an antenna or group of antennas). If the endpoint is not an antenna but the R-port of a switch and there are additional switches "down the line" all of the switches will assume their "last used" state (the state last set by the SMD currently in control).

Every Antenna Path has a **name**, which is generated by Router in such way that it uniquely identifies the Antenna Path, which is displayed in the **Description** column in Antenna Paths tab. If the Antenna Path ends in a single antenna, the path name is that of the antenna. If the path ends on the R-port of a switch with only one R-port, the path name is that of the switch. If the path ends at a switch with more than one R-port, the path name will be the name of the switch with the name of the port appended (e.g., Double Six Switch #2.A for R-port A on Double Six Switch #2).

The special path, **No Antenna**, is automatically generated in every configuration to allow disconnecting all antennas.

Further Antenna Paths through combinations of end-points

Some end-points may include **user-controllable** features. This is most often the case when the end-point is an R-port of a switch but can also occur with antennas that have an associated control box – for example a vertical array (4-square). If the antenna path to this end point is selected, the feature is controlled by the "sub-selection buttons" ([1] through [4]) on SMD below the rotary encoder based on the attributes in Router → RF Boxes → Buttons for that end-point. The name of the Antenna Path is enclosed to square brackets. For example, if a switch named SW1 has two R-ports and its first R-port (R1) is marked as end-point in RF Boxes → Rules → Include to selection, the Antenna Path representing this end-point will be named [SW1.R1].

If there are switches in the RF network which allow simultaneous selection of multiple antennas (or generally, multiple path branches) through a matching circuitry such as a stack switch, Antenna Paths representing **combinations** of end-points are added to the list. The name of this combination consists of names of single end-points with "+" between them. For example, if a stack switch has three A-ports with antennas named A1, A2 and A3, Antenna Paths A1, A2, A3, A1+A2, A1+A3, A2+A3 and A1+A2+A3 are generated (provided that the stack switch allows all of the combinations and that is reflected in the switching table that switch).

If the end-points appearing in a combination are themselves controllable, all control combinations of the end-points are generated. For example, if a path contains a Stack Switch (STACK1) followed by two four-squares (FS1 and FS2), in addition to the single Antenna Paths [FS1] and [FS2], two additional combinations are generated: [FS1]+FS2 (where the sub-selection push buttons control features of FS1), and FS1+[FS2] (where sub-selection push buttons control FS2).

In addition, switches can have certain **Attributes** (additional inputs to the switching table under user control). The combinations of switched end-points and these attributes also become Antenna Paths depending on the combinations enabled in the Switching table for that switch. Those combinations are identified by they name of the end-point (or combination of end-points) followed by "with", the name of the R-port through which the path passes, a semicolon and the attribute or combination of active attributes. For example, one of the automatically generated names for a path containing a microHAM Stack Switch, antenna (A1) and a controllable four-square (FS1) might be "(A1 + [FS1]) with STACK1.M:(BOP,FULL)"

Automatic name generation may cause too many Antenna Paths be generated; this may not be desired as many of them them would never be used, the list of Antenna Paths would be unnecessarily long and thus hard to use. For example, if the RF network contains a 1:N switch with N antennas connected the user may decide not to have individual Antenna Paths for every antenna. Instead, he might choose to create only a single Antenna Path by marking the R-port of the switch as end-point and use the sub-selection control for that end-point to select individual antennas. This is an unlikely scenario constructed as a simple example as the individual antennas can easily be excluded as "button" selections in the Bands tab while they are retained as options in Virtual Rotators and Antenna Groups. It is usually the large number of combinations generated for stack switches that need to be suppressed.

There are two methods for restricting the number of generated Antenna Paths combinations, both are controlled from the Rules sub-tab of the switch. As Antenna Path combinations may also originate on antenna arrays, there is also a simplified version of this control available those antennas. When using the built-in templates to create RF Boxes where combinations might arise, the controls are already set so the combinations are restricted to a reasonable minimum.

The first way to restrict the number of combinations is using a Fit mask. Only those InVectors from the Switching table which match the Fit mask for corresponding R-port in Rules tab are used to create Antenna Paths. Each character in Fit mask corresponds to one bit in the InVector (which in turn corresponds to an A-port or an Attribute): '0' and '1' in Fit mask requires this value for the corresponding bit in the InVector; 'x' allows any value for that bit.

The second restriction is the "Single A port only" checkbox. If the "single port" box is checked, only the single antenna options are used as Antenna Paths.

Antenna Paths grouped into Alternative Groups

In a complex setup, an antenna path may be directed through many branches (e. g., in a 1:N switch) and some of those branches may be merged (e. g., in an N:1 switch) later in the RF network. In such networks, several paths might reach a single end-point (or to a combination of end-points). Where these paths are equivalent, the operator would not care which of the available paths was selected when asking for a particular end-point. These alternative paths are merged into a group, called Alternative Group and treated as a single on SMD.

There is one more level of grouping paths - if two or more R-ports of a single switch are marked as end-points, paths ending at these end-points are considered as equivalent and are grouped together. This “higher level” antenna groups receives the name of the switch, omitting the name of individual R-ports.

In the Antenna Paths tab, the paths are organized by Alternative Groups even in simple setups where there is only one Antenna Path per Alternative Group.

How can Alternative Groups be split, if needed

In some setups, not all paths in an Alternative Groups are equivalent. For example, some of the paths may contain elements which can't handle power during transmission and are as RX-only. In addition, the user may want to reserve those paths which pass through a certain point or resource in the network. There are two ways of achieving a separation of paths. The simpler method is to mark some of the R-ports as a “Distinguishing point” in RF Boxes → Rules for the respective RF box. Paths that contain Distinguishing points will be moved to a separate Alternative Group. The second method allows more precise control and involves using Global Attributes. This method was described in the previous chapter.

Configuring the Antenna Paths tab

The main purpose of the Antenna Paths tab is to display the generated Antenna Paths and their grouping into Alternative Groups. Checking the “Show alternatives” checkbox displays all Antenna Paths within the groups, unchecking this checkbox hides the individual Antenna Paths and the lower level grouping, leaving only the list of higher level Alternative Groups as they are then used in the Virtual Rotators, Antenna Groups and Bands tabs. The user cannot add, remove or reposition items within the list; the Add, Remove, Replace, Up and Down buttons below the list are inactive in this tab.

Changing names for Antenna Paths and Alternative Groups

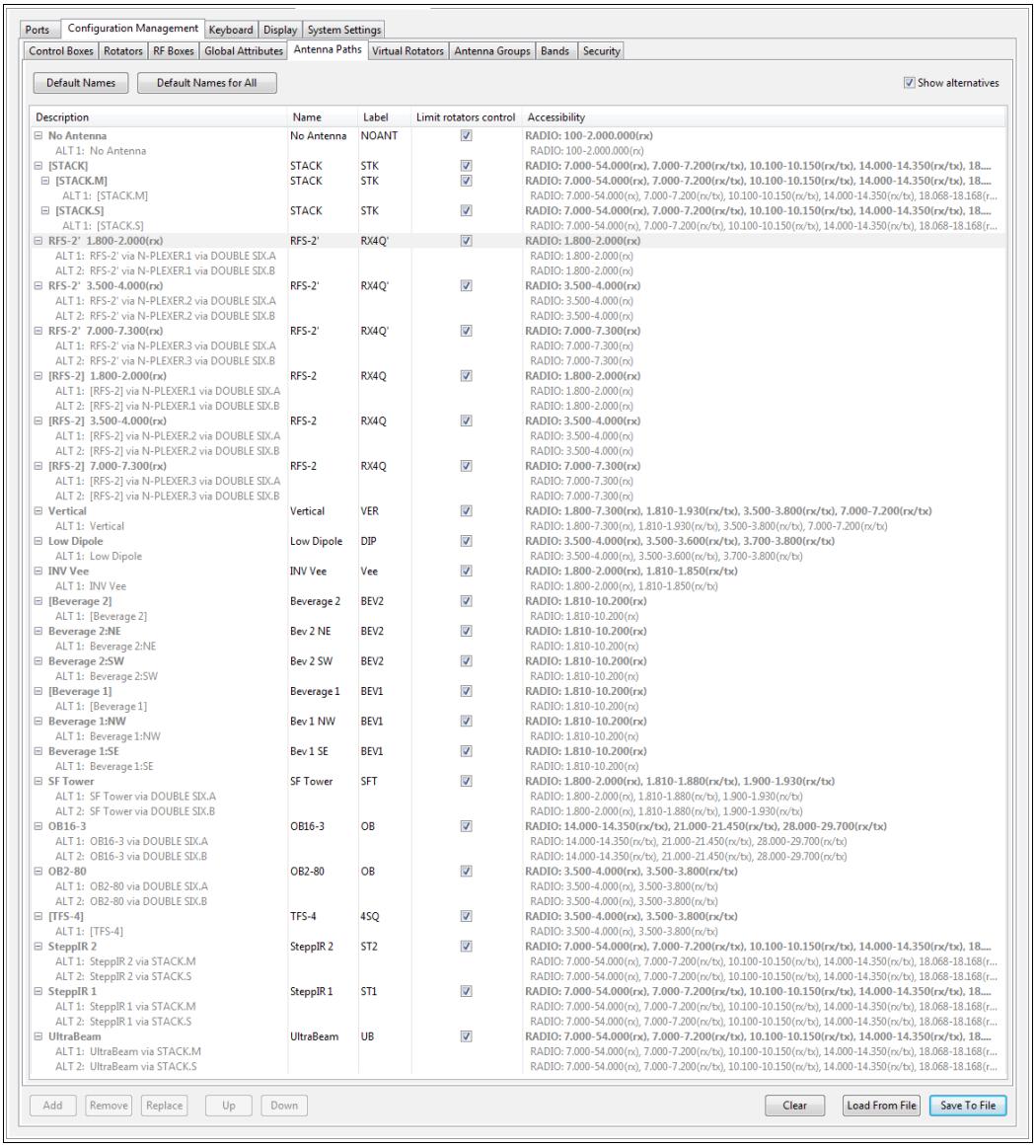
Each Alternative Group and Antenna Path has an unique name, generated according to the rules described in previous paragraphs, displayed in Description column. While these names provide a brief but complete description of the Group/Path, they are impractically long for usage both in following tabs of Router, and in SMD.

For each Alternative Group - both the lower and higher level - the user can chose a shorter descriptive **name** and a **label**. Initially, when a new path or group appears in the list, name and label are automatically generated by Router. The user can then change name and label by highlighting the required line, and after a brief wait single-clicking on the string in Name or Label column. For a highlighted item, the name and label can be reverted to the automatically generated by pressing the **Default Names** button above the list. Pressing the **Default Names for All** button will revert all names and labels to the automatically generated ones.

Limiting Rotators control

For Antenna Paths in setups where antenna combinations are available (e.g. through stacking), multiple rotators can be associated with the multitude antennas. The default behavior of rotator control is that all rotators associated with an Antenna Path are controlled simultaneously. This can be suppressed when the checkbox in “Limit rotators control” column is checked. In that case, if the Antenna Path has a controlling end-point, only rotators on sub-paths switched through that end-point are controlled (e.g. when the controlling end-point is a stack switch, only those rotators which are associated with the antennas of the currently switched stack are controlled). Double click on the checkbox to toggle its state.

Accessibility



It is worth noting that at this point, Antenna Paths (and thus also Alternative Groups) do not consider the starting points, i.e. Radio A-ports. This is because most antennas (and other end-points) are generally accessible from most starting points. However, all these paths differ from each other at least in their initial part or can include elements with different frequency ranges, limiting the usable frequency range of the given Antenna Path for each Radio. A list of Radios (A-ports), for which a given Antenna Path is accessible, together with the allowed frequency ranges, is given in the Accessibility column. Similarly for Antenna Groups, accessibility is defined through a “liberal” rule: the Group is accessible for a Radio (A-port), if the radio can access at least one member of the Group. The user has the option to selectively exclude any Antenna Group from the menu of the SMD associated with a particular Radio (A-port), by deselecting the checkbox for that Antenna Group in the respective Radio column in Bands tab.

CONFIGURATION MANAGEMENT - Virtual Rotators

Virtual Rotators are Antenna Selections, which consist of groups of Antenna Paths. Each Antenna Path in the Virtual Rotator has assigned an azimuth span. During operation, a Virtual Rotator is controlled in the same way as an antenna with rotator - i.e. using the rotary encoder on SMD, or a suitable program in PC (like a logger) through Router; but instead of physically rotating, antennas are instantaneously switched according to the chosen azimuth.

Adding Virtual Rotators

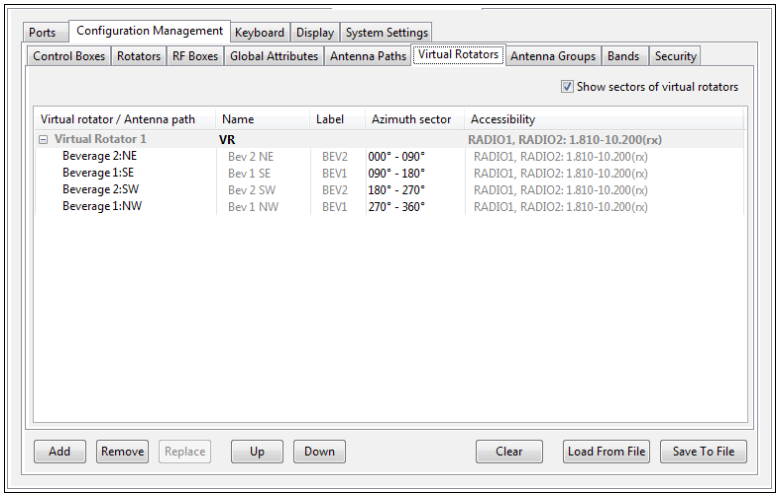
If there is no Virtual Rotator defined yet, simply press **Add** button on bottom of the tab to add a new Virtual Rotator. Otherwise, highlight one of the existing Virtual Rotators and press the Add button. A new Virtual Rotator will be added above the highlighted one.

To move Virtual Rotators in the list using the Up and Down buttons, as well as to remove an unneeded Virtual Rotator using the Remove button, the line with name of Virtual Rotator has to be highlighted. Otherwise, these buttons apply to individual Antenna Paths within the Virtual Rotator. Ordering of Virtual Rotators in the list is not important and is for better readability only.

Naming Virtual Rotators

Highlight the name of the virtual rotator, then after a brief pause single-click on the name in **Name** column to change the name. This name will be used to identify the Virtual Rotator as one of the Antenna Selections on Bands tab and on SMD's display.

Single-click on the **Label** column to enter a short label (max. 5 characters). This label will identify the Virtual Rotator in the space-constrained list of accessible Antenna Selections in the bottom row of SMD's display.



Adding Antenna Paths to Virtual Rotators

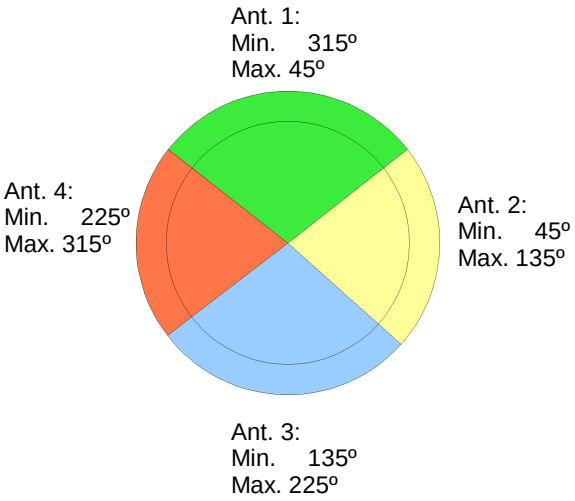
Highlight one of the Antenna Paths within the Virtual Rotator and press the Add button. A new Antenna Path will be added above the highlighted one. Single-click on the Antenna Path name, select one of the existing Antenna Paths from the pull-down list then press the Up/Down buttons to move the Antenna Path within the Virtual Rotator's list. Note: the order of Antenna Paths is important.

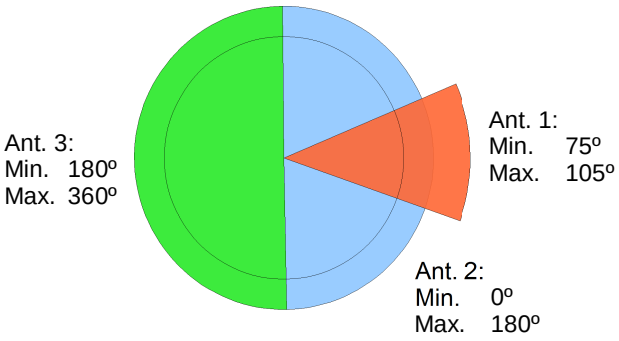
Assigning Azimuth sector to Antenna Path

Each Antenna Path is assigned as an Azimuth Sector. Single-click on the azimuth range in the Azimuth sector column to change the minimum (inclusive) and maximum (exclusive) azimuth. Note, the minimum azimuth can be set higher than the maximum azimuth, which implies the part of circle including 0. Azimuth sectors may overlap.

When this Virtual Rotator is selected as the current Antenna Selection during operation and an azimuth is selected by the rotary encoder or from PC, the list of Antenna Paths of this Virtual Rotator is scanned from top to bottom. The first Antenna Path which includes the given azimuth will be selected.

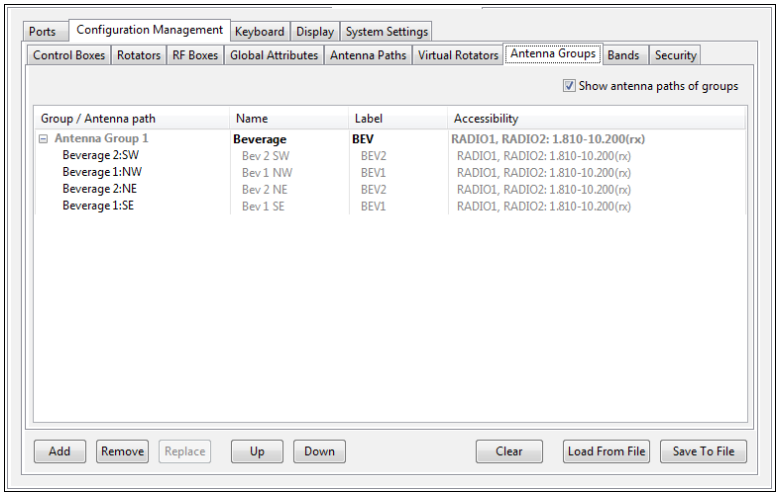
No azimuth range should be left unassigned. If an unassigned range is encountered during operation, a NO ANTENNA alarm is issued, the last Antenna path remains connected and transmission is disabled.





CONFIGURATION MANAGEMENT - Antenna Groups

Similar to Virtual Rotators, Antenna Groups are Antenna Selections consisting of groups of Antenna Paths. However, unlike Virtual Rotators Antenna Paths in Antenna Groups don't have assigned azimuths and don't respond to azimuth control; they simply represent a group of antennas, which are consecutively switched when the encoder knob on SMD is turned. The unique feature of Antenna Groups is the Autoscan mode, where antennas within an Antenna Group are automatically switched in round-robin fashion with an adjustable speed.



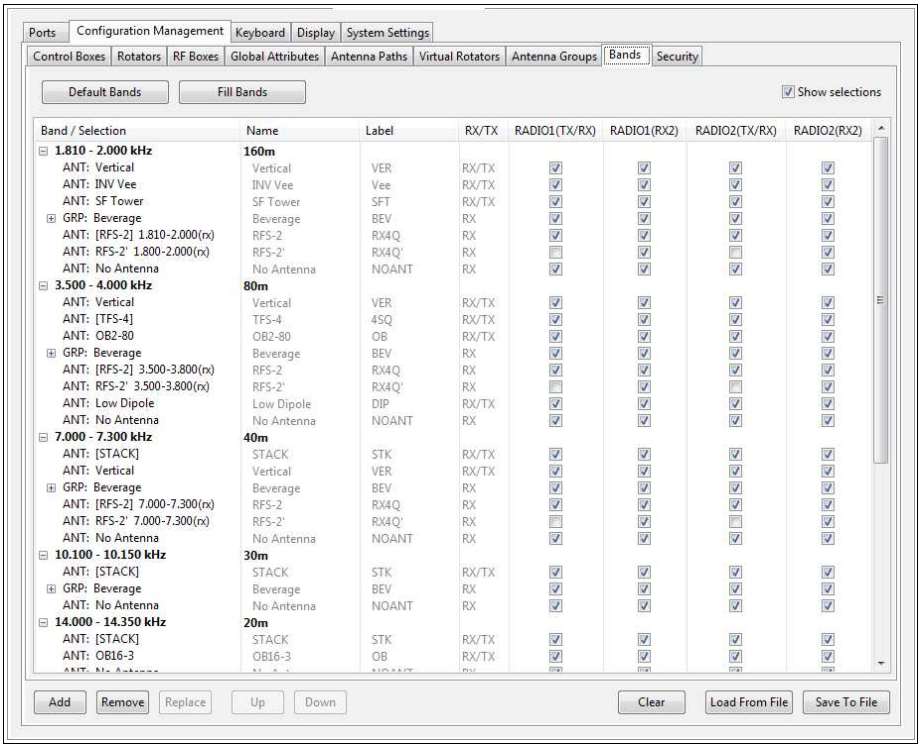
The process for adding Antenna Groups, changing their names and labels, adding and reordering Antenna Paths within the groups are the same as those for Virtual Rotators.

TIP: If you want to allow direct selection of the individual antennas in an Antenna Group or Virtual Rotator or allow direct selection of directions in a Vertical Array antenna, change the Fit mask in the antenna's RF Box → Rules tab from 0000 to xxxx.

CONFIGURATION MANAGEMENT - Bands

Menus of antenna choices for individual frequency bands can be set up on the Bands sub-tab. The frequency ranges for bands can be set arbitrarily to fit the specific installation and need not match the allocated radio amateur frequency bands.

Top buttons



These buttons are intended for rapid, automatic generation of a band plan during initial setup, after antenna selections (Antenna Paths, Virtual Rotators and Antenna Groups) have been already set up.

- **Default Bands**
  Generates a set of bands according to ITU amateur radio frequency allocation. A dialog offering choice of one of the three ITU regions is displayed. The initial frequency ranges are set for the selected region and the previous band plan discarded.
- **Fill Bands**
  All antenna choices accessible for a range are inserted into the defined frequency ranges.
- **Show selections**
  When ticked a list of antenna selections for each band is displayed. When unchecked the bands “fold up” so only the list of frequency ranges is displayed

Adding bands

In an empty band plan, simply press the **Add** button on bottom of the tab. If some bands are already defined, highlight any of the lines containing the frequency range, then press the Add button. A dialog will open where the minimum (inclusive) and maximum (exclusive) frequency for the new band can be entered; the frequencies default to the frequency gap just above the highlighted line. The frequency range of any band can be adjusted any time: highlight the respective line, then single-click on the frequency range in Band/Selection column. Bands may not overlap.

Bands are sorted by frequency automatically. Note, that while it is possible to remove a highlighted band using the Remove button, it is not possible to reorder them using the Up and Down buttons.

Naming bands

Highlight the line with frequency range, then single-click on the name in Name column. The name is used on SMD, e.g. when SMD is not governed by frequency determined from decoding CAT information, allowing to select a band “manually” through the MENU.

Adding Antenna Selections to Bands

Highlight one of the antenna selections inside the required band, then press the Add button at the bottom of the tab. A “No Antenna” selection will be added above the highlighted line and can be subsequently edited or moved using the Up and Down buttons as required.

NOTE: There is always at least one antenna selection in a band: when the band is created, the “No Antenna” selection is added automatically. It is not possible to remove the last antenna selection using the Remove button.

While the antenna selection is highlighted, single-click on its name in the Band/Selection column. A pull-down menu is displayed, with all the Antenna Selections, Alternative Groups, and Virtual Rotators accessible for the given frequency range.

For the chosen antenna selection, the following columns display their Name and Label, as they will appear on SMD, and accessibility for reception/transmission in the given frequency range, in RX/TX column. The following columns, one (or two, if SUB-RX is present) for every radio in the setup, contain checkboxes where the antenna is available for the given radio port. Double-click a tick-box to add or remove the antenna selection to/from the offer for a given radio.

TIP: Move RX/TX antenna selection to be first in order. If you have more than seven Antenna Selections on a band, having RX/TX selection first prevents paging to reach desired TX antenna if RX/TX antenna split is turned on.

CONFIGURATION MANAGEMENT - Security

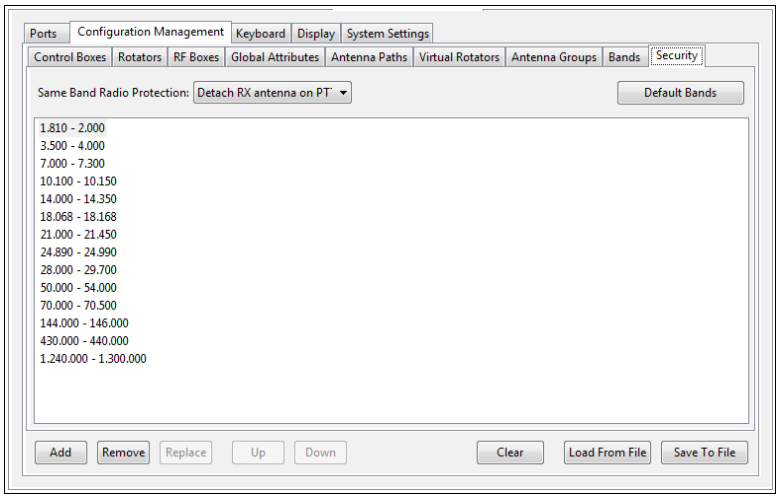
The Security sub-tab sets up the band-lock feature which prevents transmitting on bands where other radios are currently receiving on non RX safe antennas. Frequency ranges within which the band-locking occurs can be selected freely and are not bound in any way to frequency ranges in Bands tab. Several strategies for protection can be selected. As with other network configuration settings, all SMDs in a given installation must share the same band-lock settings for the feature to work properly.

Adding frequency ranges

Frequency ranges within which band-locking occurs can be added simply by pressing **Add** button. This feature works similarly to adding frequency ranges in the Bands tab - a minimum (inclusive) and maximum (exclusive) frequency must be defined. Frequency ranges are sorted automatically.

Default Bands

This button provides a quick initial setup of the frequency ranges. Bands are provided based on the standard amateur allocations for all three ITU regions.



Radio Protection

Using this pull-down menu, select the required protection mechanism:

- **No protection**
  Band-locking is disabled.

- **Prevent TX**
  Upon attempt to transmit, if any other radio is detected to have its RX frequency within the same frequency range and its RX antenna is not tagged as RX-safe (in Directions sub-tab for that antenna in RF Boxes tab) TX will not occur and SMD will display a message for the operator.

- **Detach RX antenna**
  When transmission is attempted, all radios with an RX frequency within the same frequency range and a non-RX-safe antenna, will have their receiving antenna paths disconnected. When the transmitting SMD leaves this frequency range all other SMDs will be notified and display a message announcing this fact to the operator.

- **Find safe RX antenna**
  When transmission is attempted, all other radios which have RX frequency within the same frequency range will be switched to an antenna tagged as RX-safe.

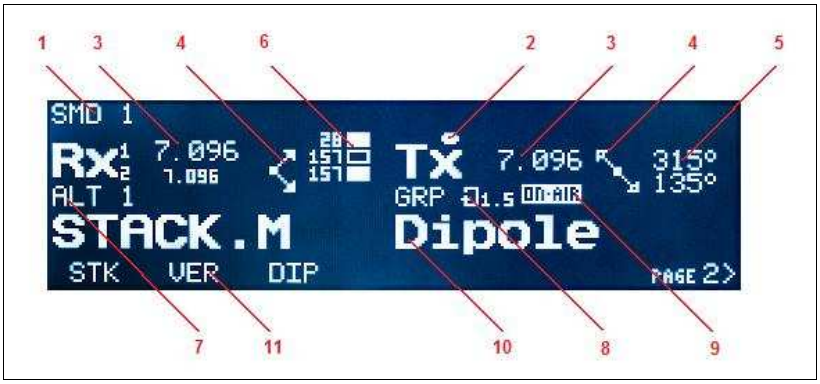
- **Detach RX antenna on PTT**
  When transmission is attempted, all other radios with an RX frequency in the same frequency range and a non-RX-safe antenna will have their receiving paths temporarily disconnected. When the transmission ends the paths are automatically restored.

TIP: For single radio installations, create a single frequency range from the lowest to the highest frequency used (typically 1800 – 30000 KHz). This setting will protect the RX2 input during TX.

7 – OPERATING Station Master DeLuxe

Operation of Station Master Deluxe depends the configuration stored by Router. Once the configuration data has been stored in Station Master's memory, the front panel buttons, encoder, LCD display and LEDs provide a real-time user interface.

LCD display layout during operation



1. Status line
2. RX/TX/SUB-RX indicators
3. Current frequency (in MHz)
4. Indication of azimuth of selected antenna (if applicable)
5. Azimuth of selected antenna
6. Status indicators for stacked antennas
7. Alternative Group (ALT) / Virtual Rotator (VR) / Antenna Group (GRP)
8. ALT: number of chosen alternative / GRP: autoscan indicator
9. TX path status indicator
10. Antenna path name
11. List of antenna selections

During operation there are four distinct areas on the SMD screen:

- top line with status messages
- bottom line with selections, corresponding to buttons and LEDs 1-7 below the LCD
- center area, with selected path/antenna and status information for RX/SUB-RX (on the left) and TX (on the right)

Antenna Selection Controls

One of most important capabilities of Station Master Deluxe is the ability to select one of several available antenna paths on each band. When Station Master Deluxe is properly configured, antenna selection is extremely easy, just a button press.

ANTENNA SPLITS

Antenna selections can be selected either separately for RX and TX (TX-SPLIT) or the same selection is used both for RX and TX if the antenna is not RX-only (non TX-SPLIT). TX-SPLIT can be switched on or off by pressing and holding for 1 second the **TX SPLIT** button (Front panel, pos.19) and its current state is indicated by the yellow LED above that button.

If SMD is configured for a radio which has separate port for SUB-RX (RX2), a third antenna selection can be made for that port. This can be switched on or off by pressing and holding for 1 second the **RX SPLIT** button (Front panel, pos.10) and its current state is indicated by displaying one or two frequencies for RX (LCD display, pos.3 left). The name RX SPLIT is used in an analogy to TX SPLIT.

The state of both splits is stored individually for each band in the internal non-volatile memory.

Selecting RX/TX/SUB-RX focus

When one or both splits are on, either of RX, TX or SUB-RX can be chosen (focused) for subsequent control. Pressing briefly button **RX1-RX2-TX** (Front panel, pos.10) cycles focus. Current focus is indicated by a dot (LCD display, pos.2), and if RX SPLIT is on, also by a digit for RX (RX1) and SUB-RX (RX2) and font size of the displayed frequency.

RX split, indicated by digit next to dot and two frequencies next to "Rx", focus on RX1

The list of available selections changes according to the current focus (LCD display, pos.11).

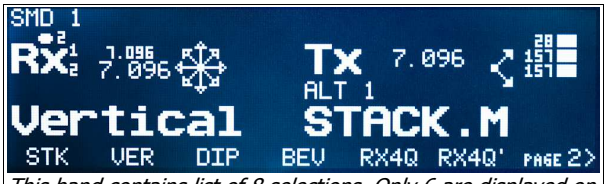
NOTE: When TX SPLIT is on and focus is set to TX, the list of available selections contains only those selections which are not RX-only.

TX split, focus on Tx indicated by dot above "Tx"

When PTT goes active (transmission starts), the focus is changed automatically to TX but it can still be changed by pressing the RX1-RX2-TX button. When PTT goes inactive (transmission stops), focus is returned to the state where it was before PTT went active.

Basic antenna selections

Antenna selections are chosen simply by pressing one of the buttons 1-7 below the LCD display. This will select the corresponding selection displayed on the bottom line of LCD for given focus, or, if TX-SPLIT is off and focus is not on SUB-RX, for both RX and TX. Currently active antenna selection is indicated by a LED lit next to the corresponding button 1-7.



This band contains list of 8 selections. Only 6 are displayed on the 1st page, the 7th button is used to switch to 2nd page

If the list of antenna selections available for a certain focus contains more than 7 items, button 7 is no more used for choosing antenna selections, instead, it serves for changing pages of selections.

NOTE: This is true even for TX focus, when RX-only antennas are not displayed.

2nd page of the same list of selections, displays the remaining 2 selections. 7th button is used to switch back to 1st page.

Alternatively, antenna selections can be selected consecutively using the left (YES) and right (NO) buttons.

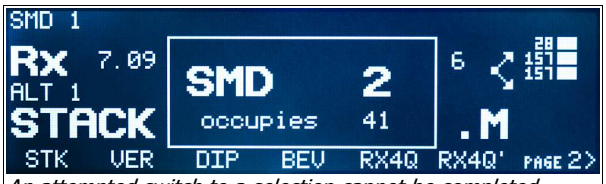
IMPORTANT: If antenna selection is changed during transmit, the new antenna path is not built immediately. The choice is remembered, and the new antenna path will be built when the transceiver returns to receive. Meantime, LED above button corresponding to the new selection will flash, as well as the READY LED.

The last antenna selection is remembered in the non-volatile memory of SMD for all three paths in every band.

Events that may occur when changing antenna selections

There are several potential causes preventing a selected antenna path to be built. In such case, a message explaining the cause of problem is displayed for a couple of seconds, and the previous path is restored.

- Some of the control modules required for the chosen selection may be occupied by one or more other SMDs, i.e. the newly selected path would collide with already built paths from other SMDs. Message “SMD [nr of SMD] - occupies [nr of module]” is displayed.



An attempted switch to a selection cannot be completed, because module 41 is occupied by SMD 2

- If the SMD uses SUB-RX and RX-SPLIT is on, the newly selected path may collide with already built path on the same SMD originating on the other RX port. In this case, “OTHER RX - Take over? Y/N” is displayed. If the user hits the “YES” button while the message is displayed, the path originating at the other RX port will be disconnected, and the path for the currently focused RX port will be built.

Requested selection is in conflict with the other Rx path of the same SMD. Pressing YES button will disconnect the other RX path and connect the requested path (here, focus is on RX1, so the RX2 path is conflicting and can be disconnected)

- Several other messages may be displayed, indicating some sort of failure, e.g. “BOX [nr of module] - not responding” when there is a bus fault (possibly disconnected wire), or “SMD [nr of SMD] - is owner of [nr of module]” when the setup is misconfigured (not all elements of the setup configured from the same configuration file).

Requested selection could not be completed because of an error on the bus, a faulty module, or misconfiguration

Building a path (or even both RX and TX path, if TX split is off) may involve communication with many control modules over the bus - especially with large installations - where multiple alternative antenna paths may be available and might have to be tried to avoid conflicts between stations. Even though communication occurs at a relatively high speed, in some instances this process may take as much as second or two. During this process subsequent button presses are ignored until the path is completely built or it is rejected for any reason.

Selecting sub-selections

In some antenna paths, there are points where the path can be diverted to several sub-paths, and a rapid control of these points is desirable. Typically, these are stacks and vertical antenna arrays (such as four-squares). These points have in Router->Configuration Management->RF Boxes->[module name]->Rules ticked the checkboxes in the **Include to selection** column; and then its Description in the Antenna Path tab is enclosed in square brackets.

In a non-split state (indicated by no dot and the LED above TX SPLIT button is not lit), a four-square type antenna with name TFS-4 and label 4SQ is selected (as indicated by the displayed name and the LED above button 2 lit). Sub-selection 2 is selected, as indicated by LED lit above button [2] and the displayed azimuth according to the setting for this antenna selection in Router.

When switching to such antenna path, sub-paths following the controlled point are selected quickly by pressing buttons [1] to [4] (Front panel, pos.11-14), or their combinations. The last subselection for every antenna selection is remembered in the non-volatile memory of SMD. When switching back to these antennas after switching away, an attempt is made to build the same path and subselection. If the selected subpath is not available (due to a conflict with other existing paths), the first available subpath is selected automatically, with no notification to the user, except the indication of the currently selected subselection as described below.

A stack-type of path is selected, and state of sub-selections is indicated by the combination of full (connected A-port) and empty (not connected A-port) “boxes”.

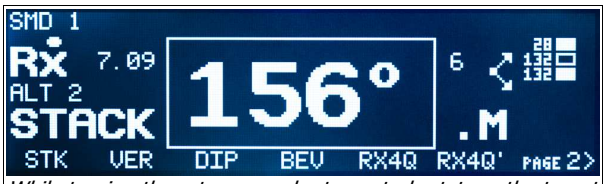
Assignment of a particular button/combination to individual subpaths (represented by respective inVectors) is given by the table in Buttons subtab of controlling module's settings in Router.

The current subselection is indicated by LEDs above the buttons [1]-[4]. If the controlled point is an antenna (vertical array), the pattern of LEDs is governed by a table in Directions subtab of RF box. In addition, the displayed azimuth and corresponding compass arrow (LCD display, pos.4 and 5) follow the selected direction. When the controlling point is a switch (stack controller) the LED patterns are given directly by the lower 4 bits of current inVector and a set of "boxes" shows the current subpath (LCD display, pos.6) on the LCD.

The same stack-type of path is now accessed through a second R-port (SUB), which is indicated by the cross in the "box" corresponding to the connected A-port

Controlling rotators

When there are any antennas with associated rotators on the active path, turning the rotary encoder (Front panel, pos.16) clockwise or counter clockwise will set the target azimuth for those rotators. However, the encoder provides access to several other features:



While turning the rotary encoder to control rotators, the target azimuth is displayed in large digits.

- **Dynamic control**
  If the encoder is turned slowly, the azimuth is set in one degree steps. If the encoder is turned quickly the azimuth is adjusted; in 10 degree steps. This allows making large changes in azimuth with less movement of the encoder.

- **Quick Start, Immediate Stop**
  When the azimuth is set to a value larger than the "dead zone," the rotator will begin turning one second after the encoder stops moving. If the encoder knob is pressed and released after setting a new azimuth the rotator will begin moving immediately. If the encoder is pressed while the rotator is turning, it will stop but the target azimuth will be retained and rotation can be resumed by pressing and releasing the encoder or a new target may be set by rotating the encoder.

When pressing the encoder and turning it clockwise, one of four "memory" azimuth positions can be selected.

- **Memory Jump**
  The four programmable memory positions may be recalled by pressing and holding the encoder and rotating clockwise. The rotator will start moving when the knob is released.

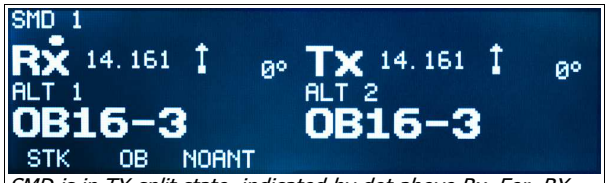
- **Position Jump**
  If the encoder knob is depressed and held while the knob is rotated counter clockwise the azimuth can be set in 45 degree increments. The first position is [LP] which will turn the antenna 180 degrees from its current heading. The other positions are show in compass mode.

When pressing the encoder and turning it counter-clockwise, one of the "compass" azimuth positions can be selected.

Alternatively, the target azimuth for rotators can be sent to SMD from any software capable of controlling DCU-1 rotators via the Router.

Alternative Antenna Paths (ALT)

In a complex setup, multiple paths can exist from a particular radio port to a given antenna. These paths are automatically recognized by the Router while entering the setup and they are logically merged and presented to the user as a single antenna selection.



SMD is in TX-split state, indicated by dot above Rx. For RX path, alternative 1 (indicated as ALT 1), for Tx path, alternative 2 (ALT 2) of the same antenna selection is set.

When switching to an antenna selection with alternate paths and a specific path is not available due to a conflict, the next free path is selected automatically. While using that antenna selection, the user can select among the other alternatives by repeatedly pressing the same selection button (1-7). The selected path is stored in the non-volatile memory. SMD will attempt to use the last selected alternative when returning to that antenna.

The number of the currently selected alternative is displayed next to ALT above the name of current antenna path (LCD display, pos.7).

Virtual Rotators (VR)

When an antenna selection defined as a Virtual Rotator is selected, its azimuth can be controlled in the very same way as with individual rotators - either using the rotary encoder (Front panel, pos.16), or from PC. Antenna paths corresponding to azimuth changes are switched instantaneously as the target azimuth changes.

This antenna selection is a virtual rotator, indicated by VR above the selection name together with its current azimuth.

The current azimuth of Virtual Rotator is displayed next to VR above the name of current antenna path (LCD display, pos.7). The last azimuth (i.e. the last antenna path) is remembered in the non-volatile memory of SMD.

Antenna Groups (GRP)

When an antenna selection defined as a Group is selected, the rotary encoder is used for quick antenna switching. Turning the encoder CW or CCW selects the antenna path, every step is different antenna path from the group. Alternatively, buttons [1]-[4] (Front panel, pos. 11-14) can be used to select from among the first four antennas path from the group; LEDs above these buttons indicate the selected antenna path.

This antenna selection is an antenna group, as indicated by GRP above the selection name. When in autoscan mode, or when the autoscan delay is being adjusted, the autoscan time is displayed next to GRP. During autoscan time adjustment, the autoscan time is displayed also in the top line, if enabled by ticking "Scan time on change" in Router->SMD->Display tab.

Pressing the encoder knob briefly starts the antenna scanning mode which can be stopped by pressing the encoder knob again. By holding the encoder knob depressed while turning it the time between switching antennas (scan time) can be adjusted from 0.3 sec to 5.0 sec in 0.1 sec steps. The current scan time is displayed next to GRP above the name of current antenna path (LCD display, pos.7). The last selected antenna is remembered in the non-volatile memory of SMD.

Automatic antenna scan and its features can be enabled/disabled via the FUNCtion menu.

Antenna Selection Properties

Some antenna selections have additional features, e.g. a control unit controlling the microHAM Stack Switch can control its two BOP combinations. These settings are normally not controlled directly through push buttons and the rotary encoder; rather, they are accessible through an additional "Properties" menu. This menu is accessed by pressing the **PATH** button (Front panel, pos.19) briefly. If there is a Properties menu associated with the current antenna selection the LED above this button will start to flash and options will be displayed on the bottom line of LCD (LCD display, pos.11).

The individual items can be selected or toggled by the respective button (1-7) below the LCD. Selecting an item will exit the menu.

Memory Banks

Several items have been described that are stored in the non-volatile memory - status of splits for each band, the last selected antenna selection for each band, the last used sub-selection for a given antenna, etc. As a group, these settings represent the operating status of the SMD. This status can be stored in one of the three memory banks, by pressing and holding one of the **MB1-MB3** buttons to the right of LCD (Front Panel, pos.15) for one

second. The stored status can later be recalled by briefly pressing the same button. Memory banks an easy way to quickly change complex antenna selection assignments.

NOTE: Updating the configuration of SMD from Router will reset all items in the non-volatile memory and all of the memory banks to their default state.

Events that may occur when attempting to transmit

While transmitting, the TX path status is displayed above name of TX antenna path (LCD display, pos.9). Several events may be indicated:

When attempting to transmit, an error occurred, as indicated by "ERROR" displayed below the TX frequency. Additionally, the reason of error is displayed in the top line - here, no valid TX antenna was selected prior to PTT.

- **ON-AIR**
  This is the normal, TX-in-progress, state.
- **ERROR**
  This indicates a permanent error, usually a missing or invalid TX path.
- **BUSY**
  This indicates a transitional reason for TX inhibit, for example a SteppIR antenna is tuning or the tamper input on a module is active.
- **KEYIn**
  This indicates that TX inhibit is raised as long as a PA present in TX path is not ready to transmit.

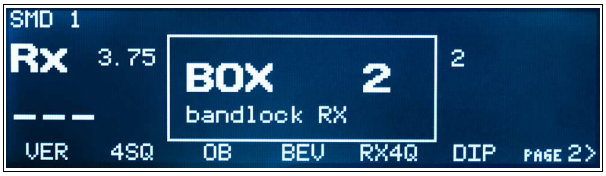
When attempted to transmit, a PA controlled directly from SMD (rather than from a networked module) failed to assert KeyIn within a set time slot, potentially indicating a permanent problem.

In the same setup, after a successful start of transmission, the KeyIn signal went inactive, e.g. due to excessive SWR.

In addition, some specific, permanent reasons for TX disable may result in more descriptive messages - "INHIBIT raised", "KeyIn timeout", etc. - and the number of the offending unit where appropriate.

If band locks are configured (Router, Configuration Management -> Security), several messages may be displayed as consequence of attempted TX on a shared band.

If "Prevent TX" protection is selected, message "BOX [nr of other SMD] - rejected PTT" is displayed on the SMD attempting to transmit on a shared band.

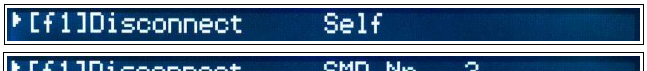


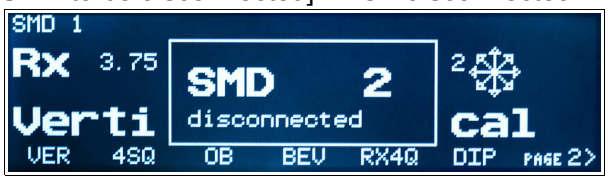
If "Detach RX antenna" protection is selected, the message "BOX [nr of other SMD] - bandlock RX (or RX2)" is displayed on the SMD receiving on a band where other SMD started to transmit, while its RX path is disconnected. If the offending SMD subsequently leaves this band, a "BOX [nr of other SMD] - left RX (or RX2) band" message is displayed.

FUNC button

A short push of the FUNC button will call the FUNCtion menu. The function number is displayed on the top line in square brackets followed by the function name. The function can be enabled or disabled using the left (Yes) and right (No) buttons. The rotary encoder is used to scroll through the functions. Changes in status are applied immediately and the values are retained even when Station Master Deluxe is turned off.

- **[f1] Disconnect**
  This is the notable exception in this menu, as it is not a stored value. Using the left (Yes) and right (No) buttons, select SMD which has to be disconnected, then press FUNC to confirm the selection. If "Self" is selected, all antenna paths of this SMD are immediately disconnected. If any other SMD is selected, a request to disconnect is sent to that SMD, which then displays a "SMD [nr of SMD requesting the disconnect] - disconnect Y/N" message. The Disconnect request can be rejected by pressing the No button, or by activating PTT. Pressing any other button or a 5 second inactivity (timeout) will result in disconnect. If the SMD to be disconnected is not present on the bus (e.g. was switched off unexpectedly), all modules and units which had been occupied by this SMD are freed up. The SMD which requested the disconnect is then notified and a "SMD [nr of SMD to be disconnected] - disconnected" or "SMD [nr of SMD to be disconnected] - NOT disconnected" message is displayed to the user.





  In multi-station setups, it is a good practice to always perform a Disconnect Self before leaving the operator position in order to free up all the resources this SMD might be occupying.

- **[f2] Scan Ena**
  Enable/Disable automatic antenna scanning within a group. Scan is automatically suspended while the transceiver transmitting.

- **[f3] Scan Rst**
  When YES, scan will start always from antenna #1 whenever a scan is initiated or the transceiver switches from transmit to receive. When NO, scan will resume from the current antenna.

- **[f4] Sc.PTT Stop**
  When YES, scanning will not resume after transmitting. When SMD is connected to microKEYER II or MK2R, scanning will only be canceled if the transmission was the result of a footswitch (or hand mic) PTT.

- **[f5] PA standby**
  When YES, KeyOut is not generated, and Key in is ignored, regardless of the flags set in Router. This is valid for all PAs in the currently selected TX path.

- **[f6] PA OFF**
  When YES, the POWER SW output on the PA connector is kept off regardless of the (per band) PA flag settings in Router; and the KeyIn input is ignored. This applies only for the local PA of the given SMD.

- **[f7] Steprs HOME**
  When changing from NO to YES, all stepping antennas not owned by other SMD at that moment, are retracted to their HOME state. When changing from YES to NO, stepping antennas return to the position before retracting. Please note, that this operation leaves all the controllers occupied by the SMD from which this operation was performed and prevents other stations from using them. The intended use is to leave all stepper antennas in a safe position before leaving the station and should be combined with "Disconnect Self" (see [f1] above) unless the entire installation is powered down.

MENU button

Pushing the MENU button for more than one second will invoke MENU mode. The menu number is displayed on the top line followed by the menu name. Item values can be changed using the Left (Yes) and Right (No) buttons. The rotary encoder is used to scroll through the items. Changes in status are applied immediately and persist through power cycles.

- **[m1] Select band**
  Selects one of the defined bands (band segments) or automatic band decoding (CAT).
- **[m2] Rota Ena**
  Enables/disables internal rotator controller.

Lights

There are five light on front panel, POWER, ALARM, BUSY, READY and uLINK.

POWER: Indicates power status of the Station Master.

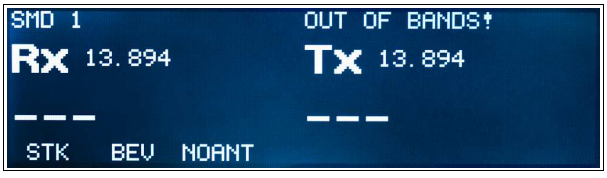
- Off: main power is off
- On: normal operation
- Slow blinking: sleep mode
- Fast blinking: Input power (+13.8V, Port A or Port B) is out of range (high or low)

ALARM: Indicates an alarm condition. Alarms are those problems that require operator action.

When ALARM LED is lit, the FUNC button will display the reason for the alarm on on the LCD display rather than the regular FUNC menu. If there are multiple alarms, the left and right buttons will step through the list.

- **NO TX ANTENNA**
  Attempting to transmit when no valid TX antenna is selected. This can happen when there is no TX split (i.e. the TX antenna selection follows the RX antenna selection) and a RX-only antenna is selected. The problem can be resolved by selecting a valid transmit antenna.
- **NO BAND DATA**
  The alarm LED will flash if there is a loss of internally decoded band data, data from Router, or data from a *micro*HAM keyer. The alarm LED will be permanently on if band data is not available at start-up. Transmitting is not restricted but changing antennas is not allowed. Band can be selected manually through the menu until the problem is fixed.

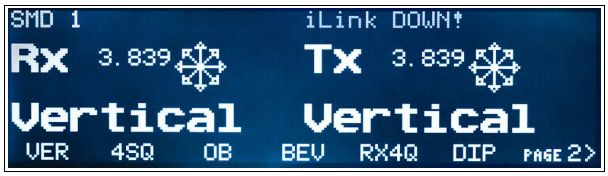
- **ROTATOR FAULT**
  Local rotator sensor timeout; the most likely cause is a defective sensor or broken connection. Motor power is disabled but transmitting is not inhibited. The rotator controller can be disabled until problem is fixed.
- **OUT OF BANDS**
  The Operating frequency is outside any defined band. Transmitting is not allowed but antenna selections can be changed.



- **OUT OF BANDLOCK**:
  Operating frequency is outside any band defined in Router, Configuration Management → Security, while security is set to other than None. Transmitting is not allowed.

- **NO ANTENNA**
  Virtual rotator is set to an azimuth for which no antenna is defined. The virtual rotator definition must be fixed in Router.

- **iLink DOWN**
  The *micro*KEYER II, MK2R or MK2R+ connected to the iLINK port is not responding.



- **ROTA NEGATIVE**
  Local rotator sensor input is set to its negative range. Check rotator connection and/or adjust OFFSET trimmer setting.

BUSY: Indicates various busy conditions. Busy conditions are usually conditions which inhibit transmission for a given period of the time and Station Master Deluxe expects them to clear automatically. Busy conditions can not be cleared manually and must expire.

- On during sequencer operation. Sequenced switching is in progress and switch delay or lead delay has not timed out. Light lit while sequencer switching is in progress and switch delay not timeouts. Also on if connected keyer or serial device like SteppIR is responding busy. Transmitting is inhibited while busy.

- Flashing when band data does not appear after start-up.

READY: Indicates ready to transmit.

- On – Station Master Deluxe is operating normally.

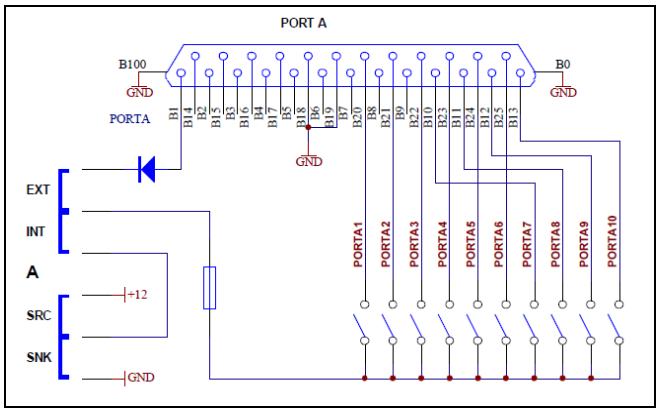
- Off - transmitting is not allowed. If ALARM and BUSY are off, a receive only antenna has been selected.

- Flashing – a new antenna was selected during transmit. The new antenna will become active when the transceiver returns to receive.

8 - Connecting SMD hardware
Output Ports

Station Master Deluxe provides twenty (20) relay outputs. They are physically located on the two rear panel DB25 connectors - PORT A and PORT B. The connections are described in Appendix A.

PORT A
Has a common terminal and ten (10) relay outputs. The common terminal can be configured for internal or external power and source or sink by selecting the appropriate jumpers.

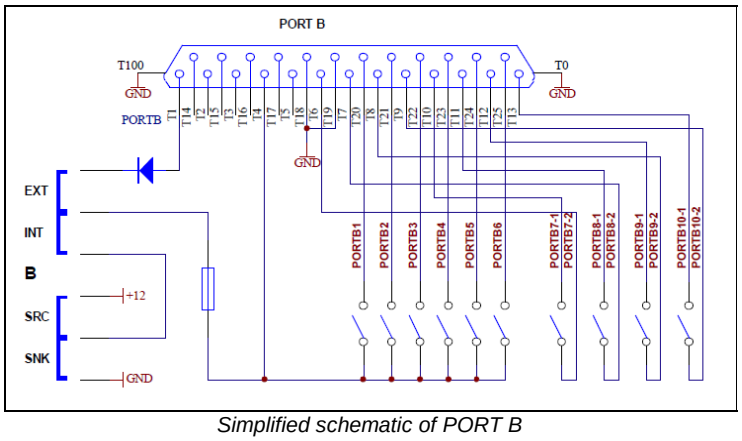


Simplified schematic of PORT A

The **EXT** position connects the common terminal to the special "input" pin on the PORT A connector. This pin is used for a POSITIVE external control voltage.

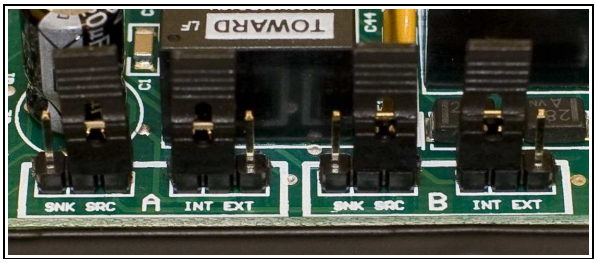
The **INT** position connects the common terminal to the **SRC/SNK** jumper. In the **SRC** position, the common terminal is connected to Station Master's power supply (+13 Volts); in this configuration the outputs are voltage *sourcing.* In the **SNK** position, the common terminal is connected to Station Master's ground; these outputs are *sinking (switch to ground).* Total current (source or sink) for all active outputs is 1 A.

PORT B
Has six (6) outputs with single common terminal (B1-B6) and four (4) outputs (B7-B10) with isolated contacts. The common terminal of relays B1-B6 can be configured for internal or external power and source/sink operation by using the PORT B jumpers in the same manner as the PORT A jumpers. Total current (source or sink) for all active outputs is 400 mA.



Simplified schematic of PORT B

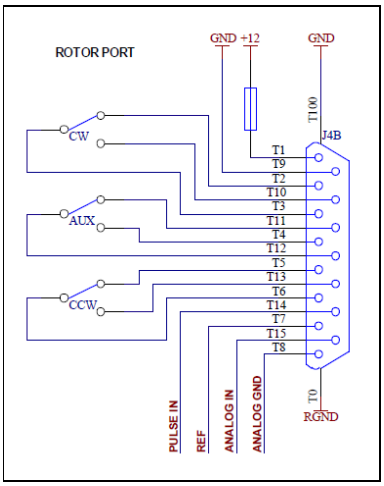
Outputs B7-B10 can be connected to the same common as B1-B6 by connecting pins 19, 20, 21, and 22 respectively to pin 17.



NOTE: The default factory settings for both PORT A and PORT B are INT / SRC (internal sourcing).

Rotator Port

The ROTOR port connects to external rotator hardware. There are three (3) SPDT relay contacts for controlling CW and CCW direction and AUX for custom purpose (BRAKE or SPEED), analog pot input, pulse contact input, reference output for pot and 12V output for external power relays.

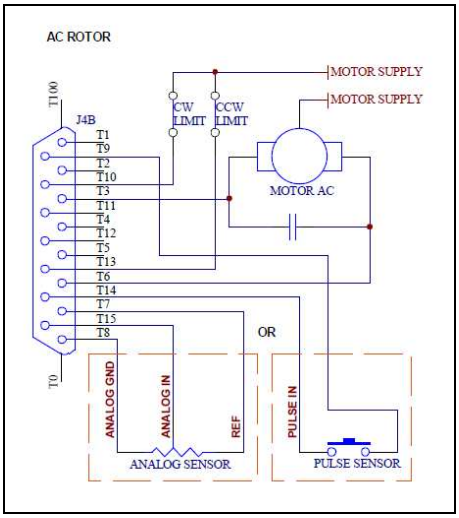


NOTE: The Rotor port does not provide power for the motor. The original controller or an appropriate replacement power supply is required for commercial rotators.

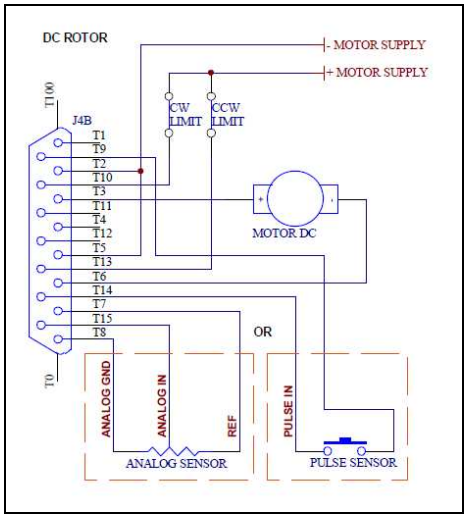
IMPORTANT: The maximum rating for the CW, CCW and AUX relay contacts is 24V AC/DC, 3A. If greater capacity is required, use external 12V DC relays. Pin 1 supplies +12V DC which can be used to power external relays.

To the right are examples of the connection for home brew AC and DC motors. Only one type of position sensor is needed. For analog systems, 500 ohms provides proper power supply loading and optimum immunity to RFI. However, any value from 500 to 5K ohm is acceptable.

IMPORTANT: Don't forget to protect motor supply with a fuse! The fuse will protect relays contacts as well.



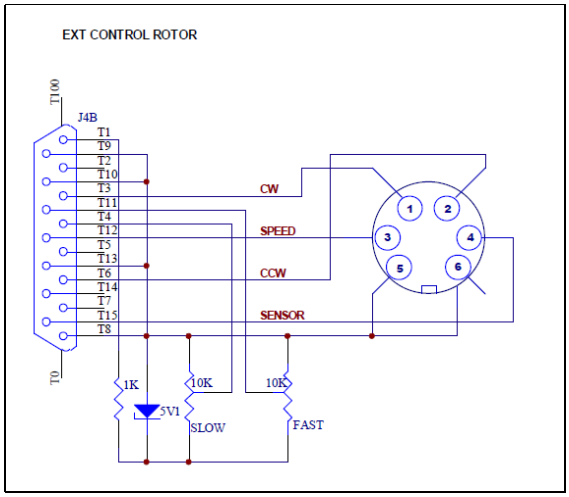
Typical connection for an AC motor



Typical connection for a DC motor

Commercial rotators can be connected two ways. Rotators with an external control port as Yaesu DXA or DXC series can be connected as shown here.

Commercial rotators without external control ports will require connections inside original controller. Please refer to the manual of your rotator or ask us for help.



Connection to Yaesu DXA/DXC rotator series.

Internal Rotator Calibration

The calibration process is absolutely necessary for proper rotator control and consist of two parts: setting rotation limits and calibrating the position indicator. Both calibrations are done simultaneously.

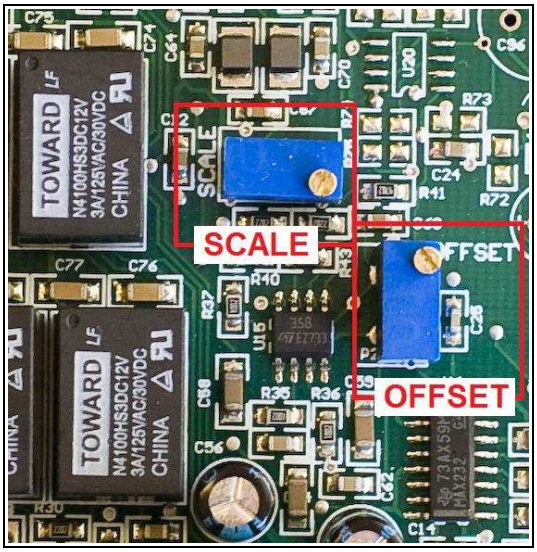
IMPORTANT: During calibration the previously defined parameters are not used. Clicking Cancel during the calibration will abort the process and retain the old values.

1. Properly connect the rotator controller to the ROTOR port, refer to the previous chapter for details. Open SMD's top cover.

2. Select rotator that is going to be calibrated in the rotators list and click Calibrate button. Make sure that the CONTROL BOX field shows proper SMD address (local ROTATOR).

3. Select Sensor type, ANALOG for potentiometer sensor or voltage feedback, PULSE for pulse sensor.

4. If your rotator uses BRAKE, set AUX relay for BRAKE function. During calibration, AUX will be activated when the rotator moves, but will be deactivated if rotator is idle for more than 15 sec, to prevent overheating the brake or power supply. If your rotator uses SPEED control, set AUX for SPEED function. During calibration AUX will be activated to set the rotator speed to slow.



5. Turn rotator fully counter clockwise (CCW). If rotator turns in the opposite direction, check the “Reverse direction” box. If your rotator does not have hardware limits, turn the rotator to the desired maximum counter-clockwise position.

6. If rotator has an ANALOG sensor, adjust the OFFSET trimmer in Station Master Deluxe until the sensor value shows 0002 (is in range 0001-0003) and click next.

   If rotator has PULSE sensor, click next step.

7. Turn the rotator fully clockwise (CW). If your rotator does not have hardware limits, turn it to the desired maximum clockwise. If your rotator uses pulse counting, do not turn it CCW at all as this will result in an inaccurate pulse count and effect the calibration.

8. If rotator has an ANALOG sensor set SCALE trimmer in Station Master Deluxe until sensor value shows 1021 (between 1020-1022) and click next.

   If value cannot be set with SCALE trimmer and remains unchanged, click “Reverse Sensor”, and set OFFSET trimmer until sensor value shows 0002 (between 0001-0003).

   If rotator has PULSE sensor, check if sensor value is non zero, click next and skip to step 13. If sensor value is zero or has very low number (below 20), check the sensor connection and repeat calibration.

   Turn rotator fully counter clockwise (CCW) or to desired maximum CCW position.

9. Slightly readjust OFFSET for improved accuracy until sensor value shows 0002 (between 0001-0003) and click next.

   If “Reverse Sensor” was checked in previous step, set SCALE trimmer until sensor value shows 1021 (is in range 1020-1022) and click next.

10. Turn rotator fully counter clockwise (CW) or to desired exact final CW position.

11. Slightly readjust SCALE trimmer for improved accuracy until sensor value shows 1021 (between 1020-1022) and click next.

    If "Reverse Sensor" was checked, readjust OFFSET trimmer for improved accuracy until sensor value shows 0002 (between 0001-0003) and click next.

12. The span of the rotator has now been calibrated. To calibrate the absolute azimuth, it is necessary to enter two points as far apart as possible but at least 30 degrees from the limits on each end of the rotation.

13. Start with the rotator at the CW limit and turn the rotator counter clockwise (CCW), at least 30 deg from the clockwise limit. Enter the azimuth of the rotator as accurately as possible into the entry field.

14. Turn rotator at least 90 degrees further counter clockwise (CCW), but not within 30 degrees of the counter clockwise limit. Enter the angle through which you turned rotator counter clock wise from previous calibration point as accurately as possible.

    If you have multi-turn rotator and you turned the rotator more than 360 deg, you must enter cumulative angle value. For example, if you turned rotator exactly one and half turns counter clockwise, enter 540 deg (180+360).

15. Click Finish. The new calibration values are automatically stored to the SMD.

IMPORTANT: The local rotator settings and calibration are stored in SMD memory. Local ROTATOR settings and calibration can be performed only for the rotator connected to the SMD selected in Router. If Router controls two SMDs (SO2R setup) and each SMD has a local rotator, each rotator must be set and calibrated from within the correct SMD tab.

Adjust (Quick Recalibration)

Due to their nature, PULSE sensor rotators need occasional recalibration. In these cases it is only necessary reset the current heading.

IMPORTANT: Quick Recalibration cannot be used before performing a full calibration and is available only for PULSE sensor rotators.

NOTE: The previously defined parameters and delays are used during Quick calibration.

1. Click Adjust button.
2. Set antenna to a known azimuth.
3. Enter value of this azimuth to the entry field.
4. Click OK. New calibration values are automatically stored into SMD.

Power Amplifier Port

If you are using a Power Amplifier connected to the local PA port, is necessary to connect it properly. Pin assignments for the signals at the PA connector are in Appendix A.

NOTE: All configuration parameters are set in Router, Configuration Management – RF Boxes – Two Port Devices – Power Amplifier.

The Power Amplifier port contains several signals:

- **KEYOUT (pin 7)**
  PTT Output for keying the amplifier.

  IMPORTANT: The KEYOUT line is an open collector circuit capable of 45V @ 800mA maximum. If the open circuit voltage is more than 48 volts or negative, a keying buffer must be used between Station Master Deluxe and the amplifier. All modern amplifiers including all solid state power amplifiers can be switched directly without a buffer.

- **KEYIN (pin 6)**
  Input from the Power Amplifier OUTPUT (if available) that switches to low (closes to ground) to control RF power generated by transceiver. If your amplifier provides such output, always connect it to KEYIN and enable the **Key In** signal. If the amplifier output is active high (open when ready as in the case of SPE Expert) check the **Invert Key In** flag .

- **POWER SW (pin 9)**
  Some amplifiers can be turned on and off remotely by applying +12V to a remote input. SMD supports this function and provides switched +12V output on the POWER SW pin. This output is frequency dependent; SMD permits selecting which power amplifier operation on a per-band basis.

  IMPORTANT: The POWER SW signal can provide at most 100mA. If your amplifier needs more power, an external buffer/relay is mandatory. Please refer to your amplifier manual for more details.

- **CI-V (pin 5)**
  Icom format and level compatible output signal for automatic control of a power amplifier or antenna tuner using the Icom interface. The proper **Baud Rate** and CI-V **Address** must be set for the amplifier. Please see your amplifier instruction manual for the proper parameters and set-up procedure.

  For all transmitting devices (Power Amplifier or tuner), **TX frequency** is recommended.

- **BCD BAND DATA (pins 1-4)**
  TTL Band Data in Yaesu format for automatic band switching of amplifiers or turners that use the Yaesu interface.

microHAM offers optional PA cables for most modern automatic and solid state amplifiers currently available on the market. Check your vendor's website or www.microham.com for cable diagrams, availability and price.

Serial Port

Station Master Deluxe contains one RS232 port that can be used for control of a locally connected SteppIR or UltraBeam antenna, provide support for Icom compatible accessories, or be used as a general purpose serial port.

Auxiliary port:
When Serial port function is set to Auxiliary port, data is transferred between the “Auxiliary” virtual port defined on Ports tab and the SERIAL port without modification. Maximum data rate is 19,200 baud. There is no relationship between transferred data and SMD functions.

CI-V port:
When Serial port function is set to CI-V, SMD simulates Icom's *CI-V transceive* function and broadcasts the chosen frequency in Icom format (at RS232 levels) even when the transceiver connected to the Station Master is not an Icom radio. The CI-V address and baud rate of simulated radio is set in appropriate field.

There are five types of frequencies which can be sent: RX frequency, TX frequency, Operating frequency, VFO A frequency, VFO B frequency and SUB RX frequency. In practice, operation of each setting depends on the transceiver and its CAT protocol. All settings may not work with some radios.

Acom2000:
When the Serial port function is set to Acom2000, SM controls an Acom 2000 amplifier connected to serial port. SMD automatically presets the Acom 2000 to actual TX frequency.

SteppIR and UltraBeam support:
SM can control SteppIR and Ultra Beam antennas using the antenna's native protocol.

Native mode control has some advantages over connecting the controller to the transceiver CAT port.

- SMD protects the antenna while elements are moving (retuning). Transmission can not be initiated using PTT while the antenna is retuning. When using VOX, SMD will not activate KEYOUT signal to prevent a Power Amplifier from operating while the automatic antenna when is tuning.
- When operating in split frequency mode, the transmit frequency is sent to the automatic antenna to prevent retuning between transmit and receive when operating with wide splits.
- Station Master adjusts the automatic antenna only when that antenna is selected. This means that when you jump from one band to another but you have selected the automatic antenna for use on only one band (or not at all) the automatic antenna elements stay on last used frequency and do not move unnecessarily. This saves antenna wear and decreases the “ready to operate” time to zero.

NOTE: This function does not replace the antenna manufacturer's controller, the controller is still used.

IMPORTANT: The original SteppIR controller MUST be switched into the GENERAL mode. Manual band changes on controller front panel are disabled. Autotrack must be turned on with the SDA-100. Use 4,800 bps or less for reliability. The uLINK DATA module must be connected with the SteppIR DATA OUT port using a cross-wired (“null modem”) DB9F/DB9M cable. Only three wires are used: pin 2 to pin 3, pin 3 to pin 2 and pin 5 to pin 5. DO NOT use standard null modem cables which connects all pins.

Due to software issues with some versions of the SteppIR transceiver interface, it is not possible to always keep Station Master Deluxe and the SteppIR controller in sync if changes are made using the SteppIR local controls. If you make changes using the SteppIR controller, it will be necessary to “undo” the function (¾, wave, bi-dir, 180, band change, etc.) on the SteppIR controller.

All SteppIR functions are also available on a PS/2 keypad attached to Station Master Deluxe. Using the keypad allows manual control while keeping Station Master Deluxe and SteppIR in sync.

IMPORTANT: Baud rate must be set to 19200 bps for Ultra Beam. A special DB9M-DB9M adapter must be used between the Station Master serial port and antenna controller. Cable connects pins 2-2, 3-3, 5-5 from end to end and a jumper between pins 4 (DTR) and 8 (CTS) on the Ultra Beam end.

Important Considerations

When Station Master Deluxe is used with *micro*HAM Keyer: *micro*KEYER, *micro*KEYER II, DigiKEYER, DigiKeyer II, CW Keyer, MK2R, or MK2R+

With *micro*HAM keyers, Station Master Deluxe monitors both the PTT output of the radio and the PAPTT signal from the keyer. However, with VOX operation or FSK operation using MOX, the radio can switch to transmit and generate power before Station Master Deluxe is able to switch all of the connected devices.

- Be sure that Station Master Deluxe is connected according to the installation instructions.
- Set the INHIBIT (INH) time slightly longer than the Switch Delay, any T/R delay in your power amplifier, and/or longest sequencer lead delay.
- Make the PTT lead time in the KEYER equal to the INH time in Station Master. If your transceiver does not have an inhibit input, make the PTT lead time slightly longer than the longest Switch Delay, T/R delay or sequencer lead time.

WARNING: If your transceiver does not have an INHIBIT input or INHIBIT is not connected, the sequencer **can not** protect your devices and prevent hot switching. Using VOX or FSK with MOX can result in switching antennas with power applied when split TX and RX antennas are used. We strongly recommend that you NOT use sequencer outputs or split TX/RX antennas without an INHIBIT connection when using a power amplifier!!!

When Station Master Deluxe is used without a *micro*HAM keyer:

Station Master Deluxe monitors the PTT output of the transceiver. This means that the radio has already switched to transmit and can be generating power before Station Master Deluxe has switched from receive to transmit.

- Be sure that the SMD is connected according to the installation instructions.
- Use zero (0) lead time for all sequencer outputs.
- Set the INHIBIT (INH) time slightly longer that Switch Delay or any T/R delay in your power amplifier.

WARNING: If your transceiver does not have an INHIBIT input or INHIBIT is not connected, the sequencer **can not** protect your devices and prevent hot switching. Antennas can be switched with power applied when separate TX and RX antennas are used. We strongly recommend that you NOT rely on Station Master Deluxe to bypass receive devices or use split TX/RX antennas without an INHIBIT connection when using a power amplifier!!!

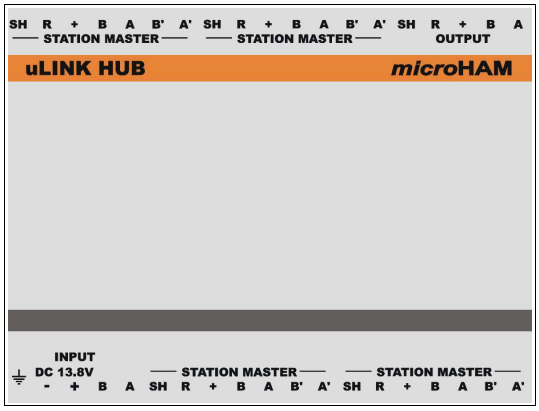
TIP: If your radio does not have an INHIBIT input you may be able to use Station Master Deluxe to bypass receive devices or for split TX/RX antennas. To do so, the transceiver PTT must be controlled entirely by footswitch or computer generated PTT; **VOX, MOX and QSK can not be used.**

Connect the footswitch and computer PTT output in parallel to Station Master's PTT IN connection. Set the Lead time of one sequencer output slightly longer than any other lead time, Switch Delay and/or the T/R delay in your power amplifier and connect this sequencer output to the PTT input of your transceiver. The sequencer output used should be configured for common ground (sink) or use one of the isolated relay outputs B7-B10.

9 - Connecting uLINK hardware

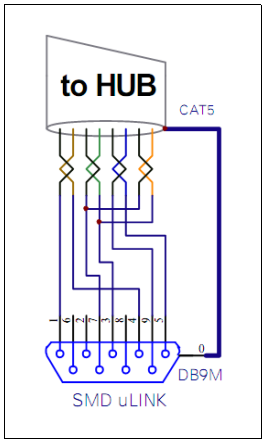
uLINK hardware contains two types of devices, uLINK HUB and uLINK modules.

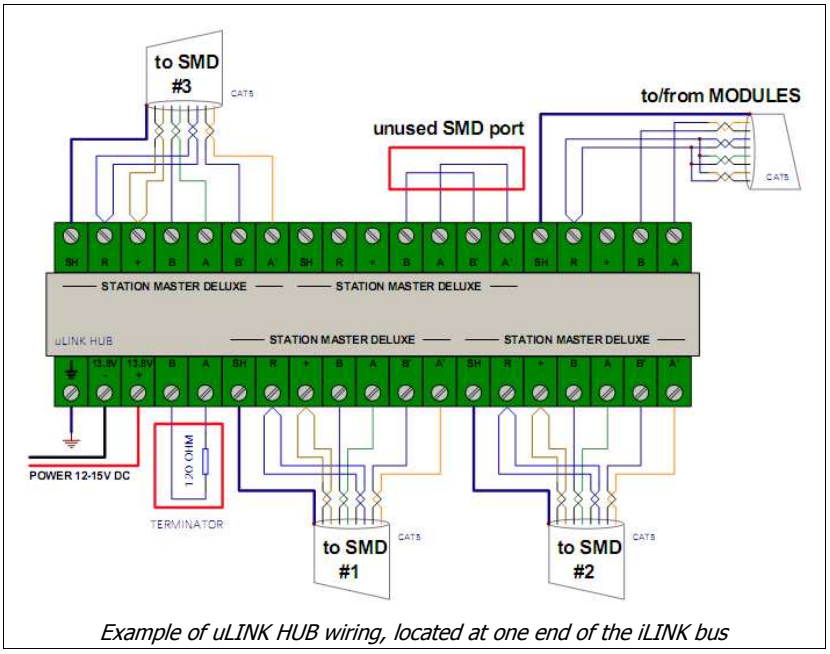
uLINK HUB



The uLINK HUB serves as a concentrator and isolated power source for SMD boxes connected to the uLINK bus. Up to four SMDs can be connected to one uLINK HUB. uLINK HUB is a basic element of the uLINK network and every setup must contain at least one.

The uLINK HUB enclosure is an industrial standard 100mm wide case designed to be mounted onto DIN rail. Terminals are removable, however we do not recommend removing them for other than emergency purposes, troubleshooting, or setup to avoid unnecessary stress to the circuit boards.





Example of uLINK HUB wiring, located at one end of the iLINK bus

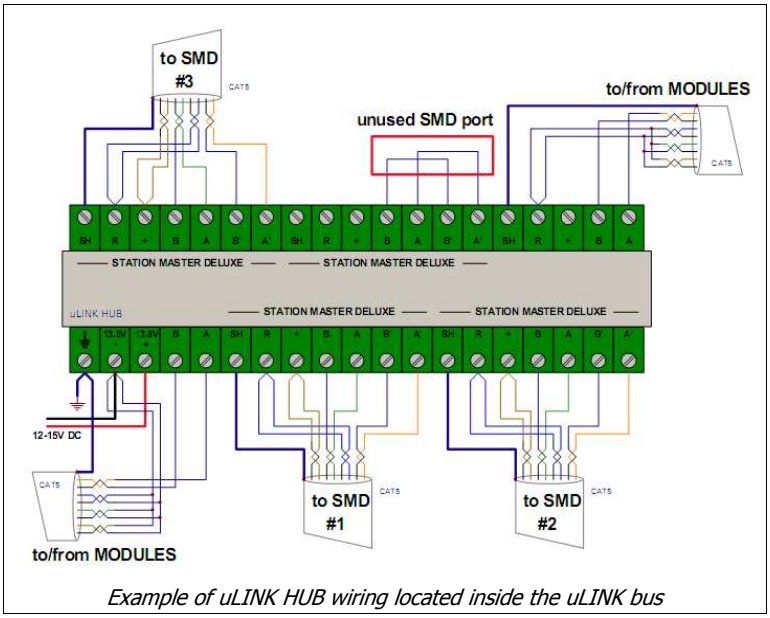
CAT5 wire color	uLINK DB9M pin number	uLINK HUB SMD terminals
Orange	3	A'
Orange/White	7	B'
Blue	5	R
Blue/White	9	R
Green	3	A
Green/White	7	B
Brown	4	+
Brown/White	1	+
Shield	SHELL	SH

Each SMD is connected to the uLINK HUB by single, shielded CAT5/6 cable, but each connection uses two wire pairs to maintain the daisy-chain topology. The third and fourth pairs are used to provide galvanically isolated power for the uLINK circuits in the SMD in order isolate the uLINK bus from any other circuits, minimize interference, and maximize RFI immunity. Power pairs are connected in parallel to minimize voltage losses.

NOTE: When designing the uLINK bus, don't forget to include twice the length of the cables from the uLINK HUB to each SMD in the total length of the uLINK bus.

IMPORTANT: Unused SMD ports on the hub cannot remain unconnected. Unused ports data terminals must be looped with jumpers from A to A' and from B to B' as shown on drawing.

uLINK HUB can be placed anywhere in the network, however the most practical location it at one end of the uLINK bus as shown above. When the hub is placed at one end of the bus, the bus can be directly terminated on the HUB terminals.



Example of uLINK HUB wiring located inside the uLINK bus

CAT5 wire color	uLINK HUB terminals
Orange	A
Orange/White	B
Blue	R
Blue/White	R
Green	R or N/C
Green/White	R or N/C
Brown	R or N/C
Brown/White	R or N/C
Shield	SH or Earth

IMPORTANT: When connecting uLINK HUB to the uLINK network, always use two twisted pairs of CAT5/6 cable. One pair use for data A and B terminals and one pair connected in parallel for return R terminal. Unused pairs can be connected in parallel to R terminal for lower return resistance. Never cross data wires, A can be connected only to A and B to B, regardless if you are connecting additional hub or module.

NOTE: uLINK network has no input or output, it is a bus. It has only two ends and both must be terminated. All R terminals are connected together internally but isolated from ground, the power supply - pole (return) and earth terminal.

uLINK HUB is a powered device it requires a 12-15V DC power supply.

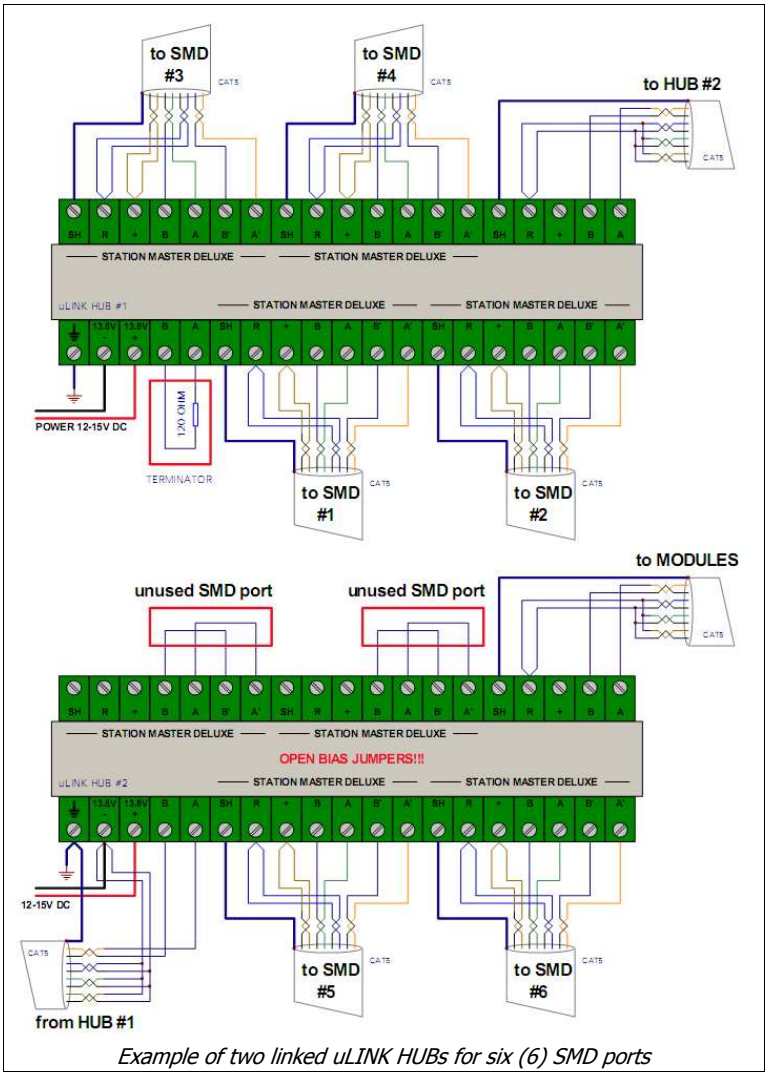
Additional uLINK HUBs must be used to connect more then four (4) SMD into the network. These additional hubs can be placed anywhere on the uLINK bus. By default, each uLINK HUB has by bias biasing resistors connected to the A-B bus wires. Since only one hub may provide bias to the bus, the bias must be disconnected by opening two jumpers on the bottom boards of the additional hubs.

If the uLINK bus contains more than one uLINK HUB, each must be powered separately. Avoid daisy chaining of power leads, connect each separately to the power supply.

IMPORTANT: Always open the bias jumpers on additional uLINK HUBs. No damage will occur but communication will be not reliable or may not work at all.

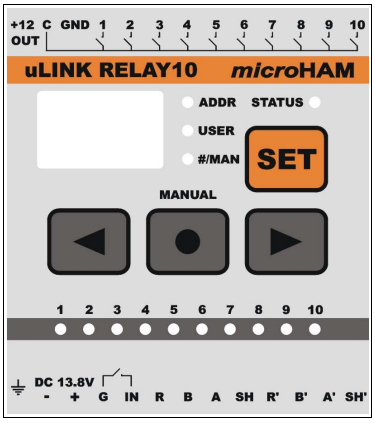
IMPORTANT: Never open the bias jumpers if there is only one uLINK HUB, communication will be not reliable or may not work at all.

IMPORTANT: Ground every uLINK HUB with separate ground lead from the ground terminal to the central ground point in the station.



Example of two linked uLINK HUBs for six (6) SMD ports

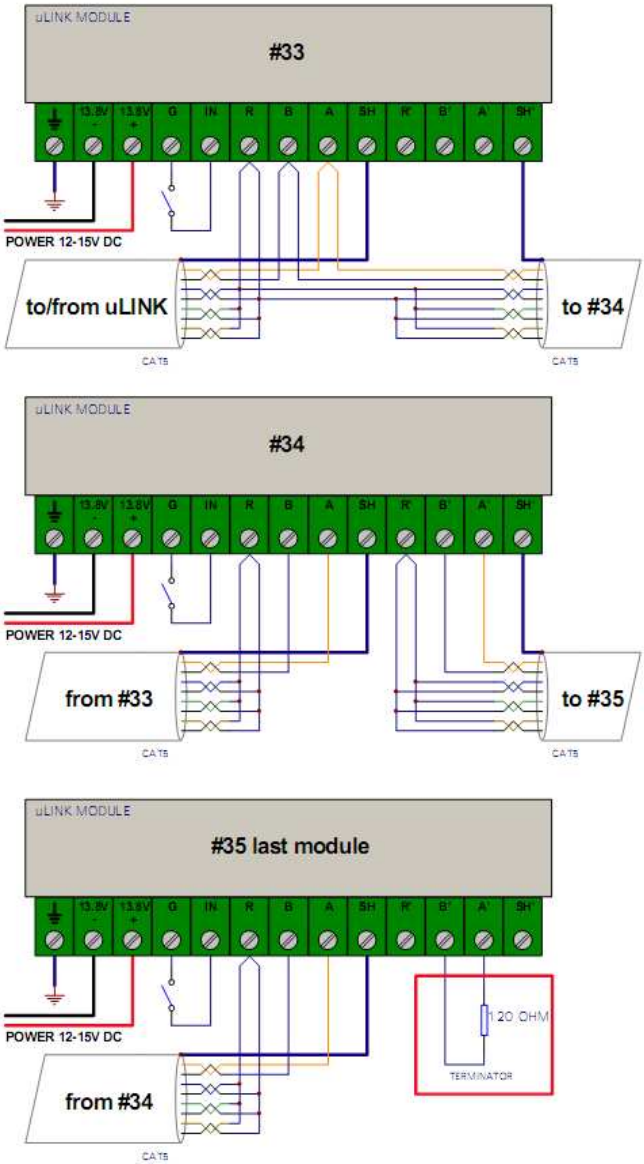
uLINK MODULES



The module enclosures are industrial standard 70mm wide cases designed to be mounted onto DIN rail. The terminals are removable but in order to avoid unnecessary stress we do not recommend removing them except for emergency purposes, troubleshooting or setup.

Hardware observations:

All modules included in the station setup must be connected to the uLINK bus and must be powered from a 12-15V DC supply. They can be placed anywhere on the uLINK bus as long as the daisy-chain topology is maintained. The uLINK bus must be properly terminated on both ends. Each module must be grounded.



uLINK modules wiring examples

IMPORTANT: Ground every uLINK module to the station central ground point or nearest ground point if installed in the field.

IMPORTANT: Always observe proper polarity!

Modules can be connected to the bus in two ways depending on priorities.

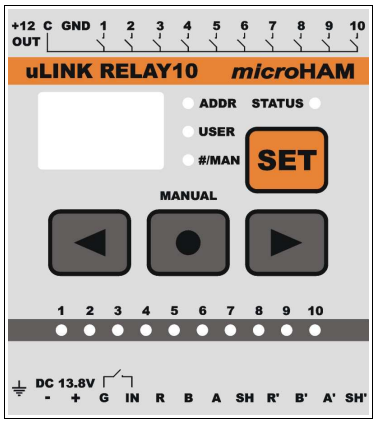
If the priority is keeping the network operating even with limited functionality when a module must be removed, connect incoming and outgoing data wires in parallel to the A/B terminals as shown in the picture for module #33. The shields of incoming and outgoing cables must connected separately to the SH/SH' terminals.

If the priority is safety, the incoming data wires should be connected to the terminals A/B and outgoing data wires to terminals A'/B' as shown in the picture of module #34.

Terminals A-A' and B-B' are connected together inside the module. This means that removing the terminal from a module actually breaks the bus when a module is removed.

Every module has a general purpose input contact input on the bottom terminal strip. This contact could be used for safety purposes as a tamper or installation box door switch. When the input is active, the module reports an INHIBIT state to SMDs and module cannot be used. If module is part of the active transmit path for one or more SMDs, all SMDs effected go to TX lock state. The general purpose input is connected between the IN and G terminals - G is connected internally to the power supply return and earth terminals. Input polarity of can be reversed in the module configuration in Router, Configuration Management → Control Boxes, default is active=closed.

uLINK MODULES Settings



Every module has four (4) buttons, a set of status LEDs and a 3 digit display. Description below is valid for all modules.

STATUS LED provides information about the state of the module.

- The Status LED flashes red when module confirms that the data wires are connected with the proper polarity and sees the network. The LED will flash for two second after each received packet.
- The Status LED will be steady red when the module receives a data packet or query addressed to the module. The LED will remain on for two seconds after every command is received.
- The Status LED will be steady green for 2 seconds during transmission when the module is part of an active transmitting path.
- The Status LED will be steady yellow when module is in the inhibit state.
- If the Status LED is flashing yellow, the module is in the inhibit state and communicating with an SMD.

The three LEDs to the right of the display indicate the display function. The function is selected by a short press of the **SET** button.

ADDRESSING

When the ADDR LED is lit, the display shows the module address. To change address, hold the **SET** button until the ADDR LED begins to flash. While the ADDR LED is flashing, the address can be changed using the ◂ ● ▸ keys. The ◂ ▸ keys have auto-repeat function and the ● button can be used for quickly increasing or decreasing module address by 10. When the address has been set, press the **SET** button to exit.

The address range for modules is limited to 32-255.

IMPORTANT: Every network device (module or SMD) MUST have unique address. Two devices with same address will create bus conflict and defunct whole setup.

IMPORTANT: Never change address while station is in use! Changing address requires re-configuration of each SMD on the network. Address should be manipulated only during setup.

NOTE: We recommend setting addresses by functional groups as this will help during configuration. For example, if you need three modules for stack control and rotators on 20 meters, start addressing from #100, 101, 102. The use #110, 111, 112, etc. on 15 meters and so on. There is not problem if some addresses are skipped and shorter addresses do not make communication faster.

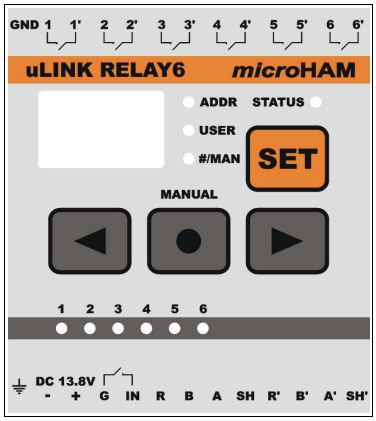
When the USER LED is lit, the display shows address of the controller connected to the module. A module may have only one controller a time. uLINK DATA modules show the “owner” controller address directly; DATA modules have one logical unit which can have only one owner at a time. The “owner” display for uLINK RELAY modules is more complex because these modules can be divided into as many as 4 independent units and each unit can have different owner for each of its R ports. The USER display scrolls owners of R ports. The left decimal point indicates Unit 1, the middle decimal point indicates Unit 2, the right decimal point indicates Unit 3, and the middle/right decimal points indicate Unit 4. The display shows X-YZ where X is the R port and YZ is the R port user's (owner) address. When a module is configured as a slave (expansion module) the display will scroll SLA-YZ where YZ is the address of the master module.

When display shows module USERs, buttons have no functions.

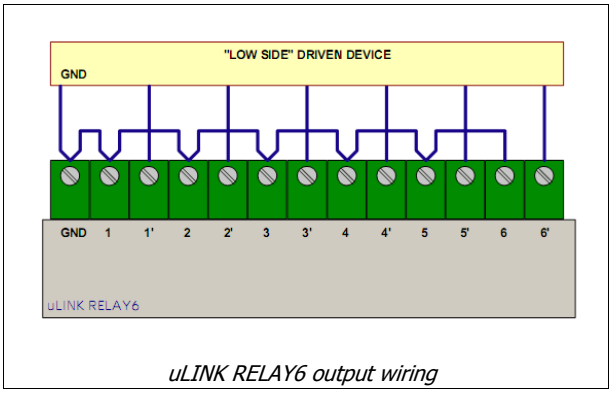
Operation with the DATA LED lit and the function of the bottom row of LEDs is specific to each module type and will be described later for each type of module.

Connecting uLINK hardware: uLINK RELAY6/10

uLINK RELAY6 and uLINK RELAY10 are most commonly used uLINK network modules. They provide relay contact outputs. These modules are used for any device that requires simple control – switch input to ground, connect it to defined voltage, or connect two input ports together. The bottom row of LEDs show which contacts are active (closed).

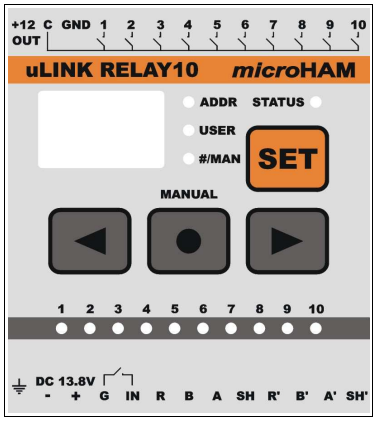


uLINK RELAY6 has six (6) isolated SPST contacts **1 – 6** located at top terminal. Each contact is rated 3A @ 125VAC or 30VDC. The left **(GND)** terminal is connected to the Earth pin of bottom terminal.



uLINK RELAY6 output wiring

This module should be used for interface devices with low pin control ports, AC/DC controlled devices (like K9AY controller or Ameritron RCS-4) or low pin sinking control boxes (like Top Ten Devices antenna switches).



uLINK RELAY10 has ten (10) separate relay contacts **1 - 10** and one common pole **C** located at top terminal. Each contact is rated 3A @ 125VAC or 30VDC. The Left terminal, **+12 OUT,** is connected to the positive input (**+13.8V)** on the bottom terminal and **GND** is connected to the **Earth** pin of the bottom terminal.

The relay common can be connected by jumper to the GND terminal pin for sinking outputs ("switch to ground") or to +12 OUT for source outputs. If the device to be controlled requires a different control voltage a separate power supply can be connected to the C and GND terminal. This module can be used with almost all antenna switches on the market including microHAM switches (of course) as well as those be DX Engineering or Array Solutions.

IMPORTANT: With uLINK RELAY10 always remember - in the sourcing configuration, power is supplied by the module power source. The power supply must be capable of providing the necessary current. The +12 OUT output is internally limited to 1.3A with electronic fuse.

IMPORTANT: Don't forget to connect the uLINK module to the central ground point in the shack or nearest ground point in the setup if used in field.

IMPORTANT: Never exceed contact ratings, improper use and burned relays are not covered by warranty!

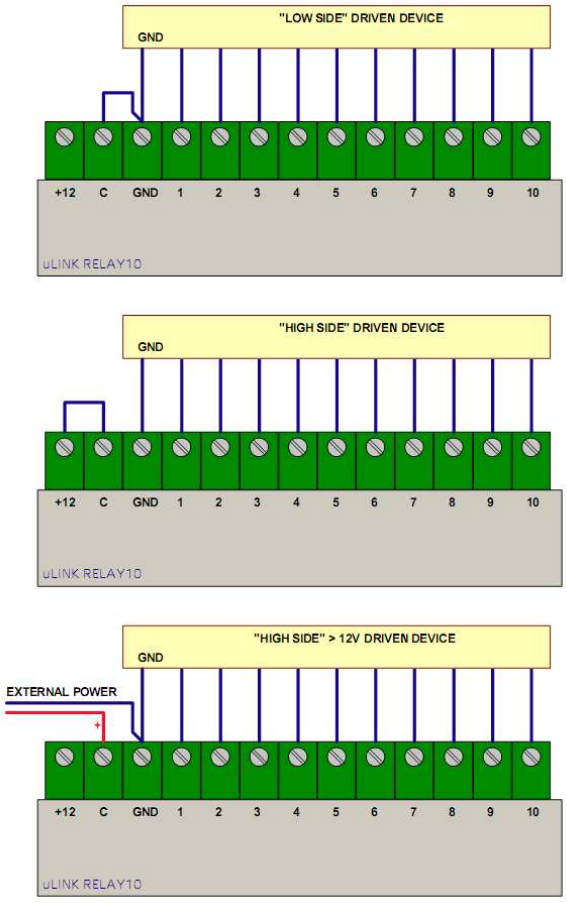
MANUAL CONTROL

Normally when the display is set to #/MAN, the module will display the index # for the module's output vector table and will cycles the display for each configured unit. Different units are indicated by decimal points in the same manner as they are shown in USER display. The Left decimal point shows the first unit, middle the second, right the third, and middle and second fourth unit.

For troubleshooting purposes it is possible to control outputs of the module manually. To switch module into the manual mode, cycle the SET button until #/MAN LED is lit then press and hold SET button until #/MAN LED starts flashing. When #/MAN is flashing the module is in manual mode and automatically generates INHIBIT signal to the SMD preventing usage of the module by any SMD.

In manual control mode, all outputs are exclusively controlled individually by the front panel buttons. The display will show output number 001 to 006 (010). Use the ◂ ▸ buttons to select the output and the ● button to toggle output state.

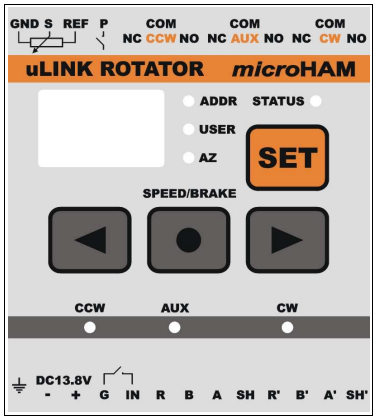
Relay modules have no internal jumpers or adjustments; the case does not need to be opened for setup or operation.



uLINK RELAY10 output wiring

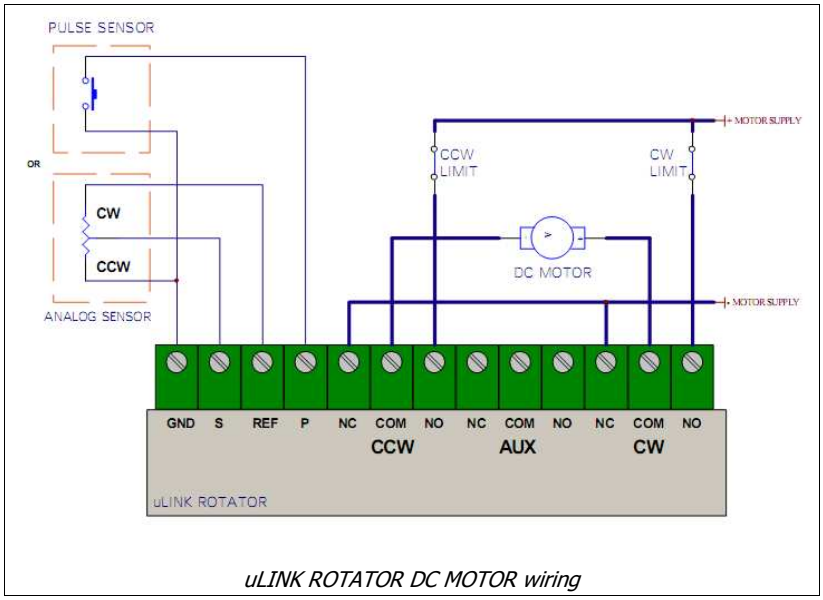
Connecting uLINK hardware: uLINK ROTATOR

uLINK ROTATOR is an uLINK module which can control any non PWM driven commercial or home made rotator.

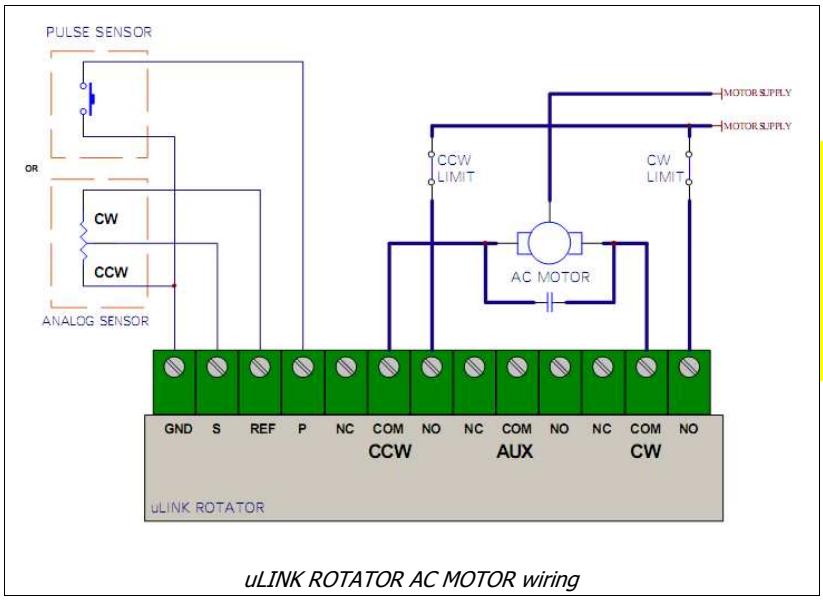


uLINK ROTATOR supports either analog sensor (pot) or pulse counting sensor (reed contact) direction indicators. There are three relay contact outputs (CW, CCW and AUX). AUX may be configured as either SPEED (Yaesu style) or BRAKE (Hy-Gain style). LEDs CCW, AUX and CW on the bottom row indicate currently actuated relays. Contact current rating is 16A @ 250VAC or 30VDC.

uLINK ROTATOR module uses same circuit design as rotator interface integrated in the SMD, but on the output has larger relays capable of handling most high current motors or solenoids. For a detailed description please see the previous Rotator chapter.



uLINK ROTATOR DC MOTOR wiring



uLINK ROTATOR AC MOTOR wiring

Each SPDT relay contacts for CW, CCW and AUX are located on top terminal.

Module provides reference voltage output on **REF** terminal for a position sensor (analog) pot sensor (analog). Specifications are the same as the SMD reference output. Analog input (wiper) is connected to the **S** terminal with common to **GND**. Pulse counting is a switch between the **P** terminal and **GND.**

MANUAL CONTROL

When the is set to AZ, the module displays absolute azimuth of the rotator in the range of 0-359 degrees. The left decimal point indicates CCW overlap and the right decimal point indicates CW overlap when span is larger than 360 degrees. Any antenna specific offset is not shown.

Observe safety precautions, do not touch wires, terminals or parts, which are, or could be, under power!!!

uLINK ROTATOR Calibration

The calibration process is absolutely necessary for proper rotator control and consist of two parts: setting rotation limits and calibrating the position indicator. Both calibrations can be done separately.

Prior first use of each uLINK ROTATOR module, A/D converter min/max ranges (CW/CCW limits) must be set if module is going to be used with analog sensor.

NOTE: For pulse sensors it is not necessary to adjust and the rotator can be directly calibrated.

Rotators with analog (potentiometer) sensor

1. Properly connect the rotator to the uLINK ROTATOR module, refer to the previous chapter for details.
2. Open top cover of the module. There are two miniature multi-turn trimmers labeled OFFSET and SCALE located on the board. Use a 1mm flat screwdriver for adjusting.

   WARNING: Always open the top cover first when assembling or disassembling modules. Failure to do so may result in damage to the trimmers.
3. When module display is set to AZ position press and hold SET button. AZ led will start flashing and ADDRESS led will illuminate indicating that the module has entered analog sensor calibration mode and is ready for CCW limit calibration.
4. Turn rotator with ◂ and ● button fully CCW. If your rotator does not have hardware limits, turn the rotator to the desired maximum counter-clockwise position.

   If the rotator moves in the opposite direction exchange all three leads connecting CCW relay with all three leads of CW relay, because rotator is wired backward. When CCW limit is reached continue on next step.
5. Set the OFFSET trimmer until display shows value 002 or slightly higher number. Number represents A/D converter RAW data. When set, turn rotator slightly CW with ▸ and ● button and verify that the value is increasing. If yes, return the rotator to the desired CCW limit and continue on next step.

   If the value is decreasing, sensor is wired backward and must be reversed. The voltage on S relative to GND terminal must increase in with CW rotation. When fixed return to step 2.
6. Press and hold ● and **SET** for two (2) seconds to register CCW limit. The ADDRESS LED will turn off and the USER led will illuminate indicating that the module is ready for CW limit calibration.

NOTE: If you want to switch to the next step without setting CCW limit value, press ● and **SET** simultaneously for less than one second.

7. Turn the rotator with ▸ and ● button to the CW limit. If your rotator does not have hardware limits, turn it to the desired maximum clockwise position.
8. Set SCALE trimmer until display shows slightly less than 0.21 (the decimal point indicates that the leading number is not shown). The raw value is 1021 or almost full scale for the 10-bit A/D converter.
9. Press and hold ● together with SET button for two (2) seconds to register CW limit and store both limits to module EEPROM memory. USER led goes off and AZ led stops flashing. It means that the limit calibration is finished.

If trimmers were too far off, you may repeat steps 2 to 8 for increased accuracy.

IMPORTANT: Pressing the SET button alone anytime during calibration will abort the calibration process without saving the limit values. The previous values remain valid.

Once CW and CCW limits are set for each uLINK ROTATOR module, rotators can be calibrated.

Calibration

IMPORTANT: During calibration the previously defined parameters are not used. Clicking Cancel during the calibration will abort the process and retain the old values.

1. Select the rotator to be calibrated in the rotators list of the RF boxes tab and click Calibrate button. Make sure that the CONTROL BOX field shows proper module address (uLINK ROTATOR).
2. Select Sensor type, ANALOG for potentiometer sensor or voltage feedback, PULSE for pulse sensor.
3. If your rotator uses BRAKE, set AUX relay for BRAKE function. During calibration AUX will be activated when the rotator moves, but will be deactivated if rotator is idle for more than 15 sec, to prevent overheating the brake solenoid or power supply. If your rotator uses SPEED control, set AUX for SPEED function. During calibration, AUX will be activated to set the rotator speed to slow.
4. Turn rotator fully counter clockwise (CCW).
5. If rotator has an ANALOG sensor, verify the sensor value. The value should be as set during previous CCW limit settings procedure (002). Click next.

   If the rotator has PULSE sensor, click next step.
6. Turn the rotator fully clockwise (CW). If your rotator uses pulse counting, do not turn it CCW even for a bit, as this will result in an inaccurate pulse count and effect the calibration.
7. If the rotator has an ANALOG sensor verify the sensor value. The value should be as set during previous, CW limit settings procedure (1021). Click next.

   If rotator has PULSE sensor, check if sensor value is non zero, click next and skip to step **11**. If sensor value is zero or has very low number (below 20), check the sensor connection and repeat calibration.
8. Turn the rotator fully counter clockwise (CCW) or to desired maximum CCW position. Click next.
9. Turn rotator fully counter clockwise (CW) or to desired exact final CW position. Click next.
10. The span of the rotator has now been calibrated. To calibrate the absolute azimuth, it is necessary to enter two points as far apart as possible but preferable at least 30 degrees from the limits on each end of the rotation.
11. Start with the rotator at the CW limit and turn the rotator counter clockwise (CCW), at least 30 deg from the clockwise limit. Enter the azimuth of the rotator as accurately as possible into the entry field.
12. Turn rotator at least 90 degrees further counter clockwise (CCW), but not within 30 degrees of the counter clockwise limit. Enter the angle through which you turned rotator counter clock wise from previous calibration point as accurately as possible.

    If you have multi-turn rotator and you turned the rotator more than 360 deg, you must enter cumulative angle value. For example, if you turned rotator exactly one and half turns counter clockwise, enter 540 deg (180+360).

Click Finish. The new calibration values are automatically stored to the particular uLINK ROTATOR module.

Adjust (Quick Recalibration)

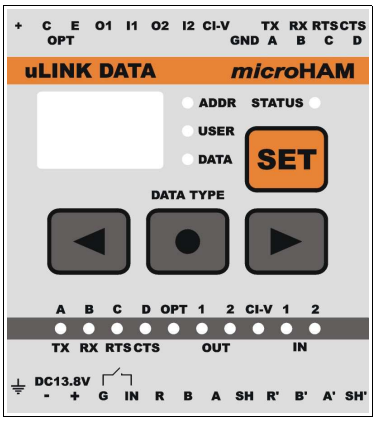
Due to their nature, PULSE sensor rotators need occasional recalibration. In these cases it is only necessary reset the current heading.

IMPORTANT: Quick Recalibration cannot be used before performing a full calibration and is available only for PULSE sensor rotators.

NOTE: The previously defined parameters and delays are used during Quick calibration.

1. Click the Adjust button.
2. Set the antenna to a known azimuth.
3. Enter value of this azimuth in the entry field.
4. Click OK. New calibration values are automatically stored into SMD.

Connecting uLINK hardware: uLINK DATA



uLINK DATA is designed to control data devices and supports: one RS232 serial port with RTS/CTS, a CI-V port (translates frequency from the connected transceiver (SMD) to Icom protocol), two configurable inputs, two configurable open collector outputs and one optically isolated output.

These capabilities allow uLINK DATA to control most automatic power amplifiers, serial antenna tuners, rotators with RS232 ports, SteppIR controllers, UltraBeam controllers, and other RS232 devices. The list of supported devices will be extended based on user input.

Inputs, outputs and data ports are located at top terminal.

The serial port can be configured for BCD TTL BAND DATA ("Yaesu") outputs by moving four (4) jumpers to BAND DATA position. By default the uLINK DATA module is configured for RS232 serial port.

LEDs on the bottom row from left to right:

- **TX** indicates outgoing data. When output is switched to BAND DATA, TX indicates data bit A
- **RX** indicates incoming data. When output is switched to BAND DATA, RX indicates data bit B
- **RTS** indicates outgoing RTS signal. When output is switched to BAND DATA, RTS indicates data bit C
- **CTS** indicates incoming CTS signal. When output is switched to BAND DATA, CTS indicates data bit D
- **OPT** indicates the optically decoupled output is active
- **OUT1** indicates the open collector 1 output is active (closed to ground)
- **OUT2** indicates the open collector 2 output is active (closed to ground)
- **CI-V** indicates incoming or outgoing CI-V data on CI-V bus port
- **IN1** indicates input 1 is active (closed to ground)
- **IN2** indicates input 2 is active (closed to ground)

DATA DISPLAY

The DATA display changes based on the module configuration and serial port function. If the module is used for serial rotor control, DATA will display azimuth. If the module is used for SteppIR/Ultrabeam control, DATA will display frequency. If the module is configured for BCD output, DATA will show the band data code (0-15).

Connecting KEYIN and KEYOUT:

IMPORTANT: The KEYOUT line is an open collector circuit capable of 45V @ 800mA maximum. If the open circuit voltage is more than 48 volts or negative, a keying buffer must be used between uLINK DATA module and the amplifier. All modern amplifiers including all solid state power amplifiers can be switched directly without a buffer.

Connecting SteppIR:

The original SteppIR controller MUST be switched into the GENERAL mode. Manual band changes on controller front panel are disabled. Autotrack must be turned on with the SDA-100. Use 9,600 bps or lower for reliability. The uLINK DATA RS232 port must be connected with the SteppIR DATA OUT port using three connections: pin 2 to TX, pin 3 to RX and pin 5 to GND, shielded cable is highly recommended.

DO NOT make any other connections to SteppIR's DATA OUT connector.

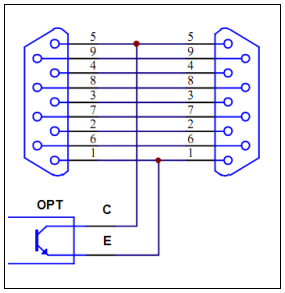
Due to software issues with early versions of the SteppIR transceiver interface controller, it is not possible to keep Station Master Deluxe and the SteppIR controller in sync if changes are made using the SteppIR local controls. If you make changes using the SteppIR controller, it will be necessary to "undo" the function (¾, wave, bi-dir, 180, band change, etc.) on the SteppIR controller.

Connecting UltraBeam:

Baud rate must be set to 19200 bps and function to Ultra Beam. The uLINK DATA RS232 port must be connected with the UltraBeam Serial port using three connections: pin 2 to RX, pin 3 to TX and pin 5 to GND, shielded cable is highly recommended. There must be a jumper between pins 4 (DTR) and 8 (CTS) on the Ultra Beam cable end.

Connecting Acom 2000:

Baud rate must be set to 1200 bps and function to Acom 2000. The uLINK DATA RS232 port must be connected with the Acom serial port using three connections: pin 2 to TX, pin 3 to RX and pin 5 to GND; shielded cable is highly recommended. The OPT output can be used directly for the PA power on function when connected between pins 1 and 5 of REMOTE connector.



10 - CONFIGURATION EXAMPLES

Using several examples from simple to complex we will show SMD configuration. The examples were chosen to show as many varied situations as possible. The RF boxes used were chosen from real products available off the shelf with no preference to any manufacturer.

Each configuration must start with detailed setup description. In our first example we will show how to configure SMD for one radio with two independent receivers with various kind of antennas and interactions.

SINGLE RADIO, DUAL RX CONFIGURATION

Setup requirements

As a first we need to list all antennas and provide for each antenna several parameters given by manufacturer and its physical installation like frequency coverage for RX and TX, control requirement, assignment to a particular position (tower) and rotator, RX safe attribute if antenna can be used for receiving while other station transmits on the same band, and special requirements if exist.

Antennas:

1. **UltraBeam 4 EL YAGI**
   Frequency coverage RX/TX: 40-6m
   RX Only: NO
   Control: Original controller
   Rotator: PST-51D
   Placement: Tower 1
   RX safe: NO
   Special requirement: Antenna must be able to operate in phase with either or both SteppIRs.
   Note: None

2. **SteppIR 4 EL YAGI #1**
   Frequency coverage RX/TX: 40-6m
   RX Only: NO
   Control: Original controller
   Rotator: Fixed to Rotary tower
   Placement: Tower 1
   RX safe: NO
   Special requirement: Antenna must be able to operate in phase with UltraBeam, the other SteppIR, or both. In addition, it should be able to operate out of phase with the other SteppIR.
   Note: None

3. **SteppIR 4 EL YAGI #2**
   Frequency coverage RX/TX: 40-6m
   RX Only: NO
   Control: Original controller
   Rotator: Fixed to Rotary tower in same direction as SteppIR #1
   Placement: Tower 1
   RX safe: NO
   Special requirement: Antenna must be able to operate in phase with UltraBeam, the other SteppIR, or both. In addition, it should be able to operate out of phase with the other SteppIR.
   Note: None

4. **DXE TFS-4**
   Frequency coverage RX/TX: 80m
   RX Only: NO
   Control: 12V, 2 wires for BCD direction control + 1 wire for Omni
   Rotator: 4 fixed directions + Omni
   Placement: Free
   RX safe: NO
   Special requirement: Subselection buttons control direction. Azimuth [1]=SW, [2]=NW, [3]=NE, [4]=SE, any three or more buttons selects OMNI, two buttons at once makes no change
   Note: Default (no control power) direction is NW

5. **OptiBeam OB2-80**
   Frequency coverage RX/TX: 80m, 4 segments
   RX Only: NO
   Control: 12V, 4 wires for direct segment selection
   Rotator: G-1000DXC
   Placement: Tower 2
   RX safe: NO
   Special requirement: Antenna can not be used if Shunt-feed tower is in use.
   Note: Segments 3500-3565, 3565-3725, 3725-3770, 3770-3800

6. **OptiBeam OB16-3**
   Frequency coverage RX/TX: 20, 15, 10m
   RX Only: NO
   Control: None
   Rotator: TIC RING, RT-20 controller
   Placement: Tower 2
   RX safe: NO
   Special requirement: Antenna can not be used if Shunt-feed tower is in use.
   Note: None

7. **Shunt-feed Tower**
   Frequency coverage RX/TX: 160m, 3 segments
   RX Only: NO
   Control: 12V, 2 wires for segments selection
   Rotator: None, Omni directional pattern
   Placement: Tower 2
   RX safe: NO
   Special requirement: Antenna can not be used if OB2-80 or OB16-3 is in use.
   Note: Segments 1810-1830, 1830-1880, 1900-1930, first segment is default (no control power)

8. **Two wire Beverage #1**
   Frequency coverage RX: 160-30m
   RX Only: YES
   Control: 12V, 1 wire for direction control
   Rotator: 2 fixed directions, NW, SE
   Placement: Free
   RX safe: YES
   Special requirement: LNA2
   Note: Default (no control power) direction is NW

9. Two wire Beverage #2
Frequency coverage RX: 160-30m
RX Only: YES
Control: 12V, 1 wire for direction control
Rotator: 2 fixed directions, SW, NE
Placement: Free
RX safe: YES
Special requirement: LNA3
Note: Default (no control power) direction is NE

10. INV Vee
Frequency coverage RX/TX: 1810-1850
RX Only: NO
Control: None
Rotator: None, Bidirectional NW-SE
Placement: Vertical guying wires
RX safe: YES
Special requirement: Antenna can not be used if Vertical is in use.
Note: None

11. Low Dipole
Frequency coverage RX/TX: 80m, 2 segments
RX Only: NO
Control: 12V, 1 wire for segment selection
Rotator: None, Bidirectional NW-SE
Placement: Vertical guying wires
RX safe: YES
Special requirement: A Antenna can not be used if Vertical is in use.
Note: Segments 3500-3600, 3700-3800, first segment is default (no control power)

12. Vertical
Frequency coverage RX/TX: 160, 80, 40m, 9 segments
RX Only: NO
Control: 12V, 8 wires for segments selection
Rotator: None, Omni directional pattern
Placement: Vertical
RX safe: YES
Special requirement: Antenna can not be used if INV Vee or Low Dipole is in use.
Note: Segments 1810-1830, 1830-1860, 1860-1900, 1900-1930, 3500-3600, 3600-3700, 3700-3800, 7000-7150, 7150-7300, default (no control power) is first segment

13. DXE RFS-2
Frequency coverage RX: 160-40m
RX Only: YES
Control: 12V, 2 wires for BCD direction control + 1 wire for preamplifier power
Rotator: 4 fixed directions
Placement: Free
RX safe: NO
Special requirement: LNA1
Subselection buttons control azimuth: [1]=SW, [2]=NW, [3]=NE, [4]=SE, any two or more buttons makes no change. Preamplifier must be turned off when antenna is not used and when TFS-4 or Low Dipole antenna transmits. Transmission on other antennas must have no effect to preamplifier sequencing. Antenna must be usable simultaneously by another start point (receiver) on another band.
Note: Default (no control power) direction is NW

Other parts of the setup:

1. **Automatic Power Amplifier**
   Frequency coverage: 160, 80, 40, 30, 20, 17, 15, 12, 10, 6m
   Control: Low voltage (12V) keying, active when closed to ground
   Band Data source: CI-V
   Keying output: YES, open when Inhibited
   T-R delay: 5ms
   Placement: Not shared, fixed to particular radio
   Special requirement: ON/OFF and STANDBY/OPERATE state control from SMD front panel.
   Note: None

2. **LNA #1**
   Frequency coverage: 160 - 40m
   Control: 12V, 1 wire for bypass and power
   Bypass delay: 5ms
   Bypass confirmation: No
   Placement: RFS-2
   Special requirement: BYPASS control from SMD front panel. Automatic bypass if antenna is not used and when TFS-4 or Low Dipole antenna transmits.
   Note: None

3. **LNA #2**
   Frequency coverage: 160 - 30m
   Control: 12V, 1 wire for bypass and power
   Bypass delay: 5ms
   Bypass confirmation: No
   Placement: Beverage 1
   Special requirement: BYPASS control from SMD front panel.
   Note: None

4. **LNA #3**
   Frequency coverage: 160 - 30m
   Control: 12V, 1 wire for bypass and power
   Bypass delay: 5ms
   Bypass confirmation: No
   Placement: Beverage 2
   Special requirement: BYPASS control from SMD front panel.
   Note: None

5. **Prosistel PST51D**
   Control: Own controller with RS232 port, proprietary protocol
   Sensor: Analog
   Associated antennas: UltraBeam
   Superior rotator: Rotary tower
   Special requirement: None
   Note: None

6. **Rotary Tower**
   Control: Home made rotator, 12V control to CW, CCW rotation
   Sensor: Analog
   Associated antennas: SteppIR 1, SteppIR 2
   Superior rotator: None
   Special requirement: None
   Note: Superior rotator for Prosistel

7. **Yaesu G-1000DXC**
   Control: Own controller with low voltage interface
   Sensor: Analog
   Associated antennas: OB2-80
   Superior rotator: None
   Special requirement: None
   Note: None

8. **TIC RING + RT-20**
   Control: RT-20 controller with RS232 port, Hi-Gain protocol
   Sensor: Analog
   Associated antennas: OB16-3
   Superior rotator: None
   Special requirement: None
   Note: None

Other requirements:

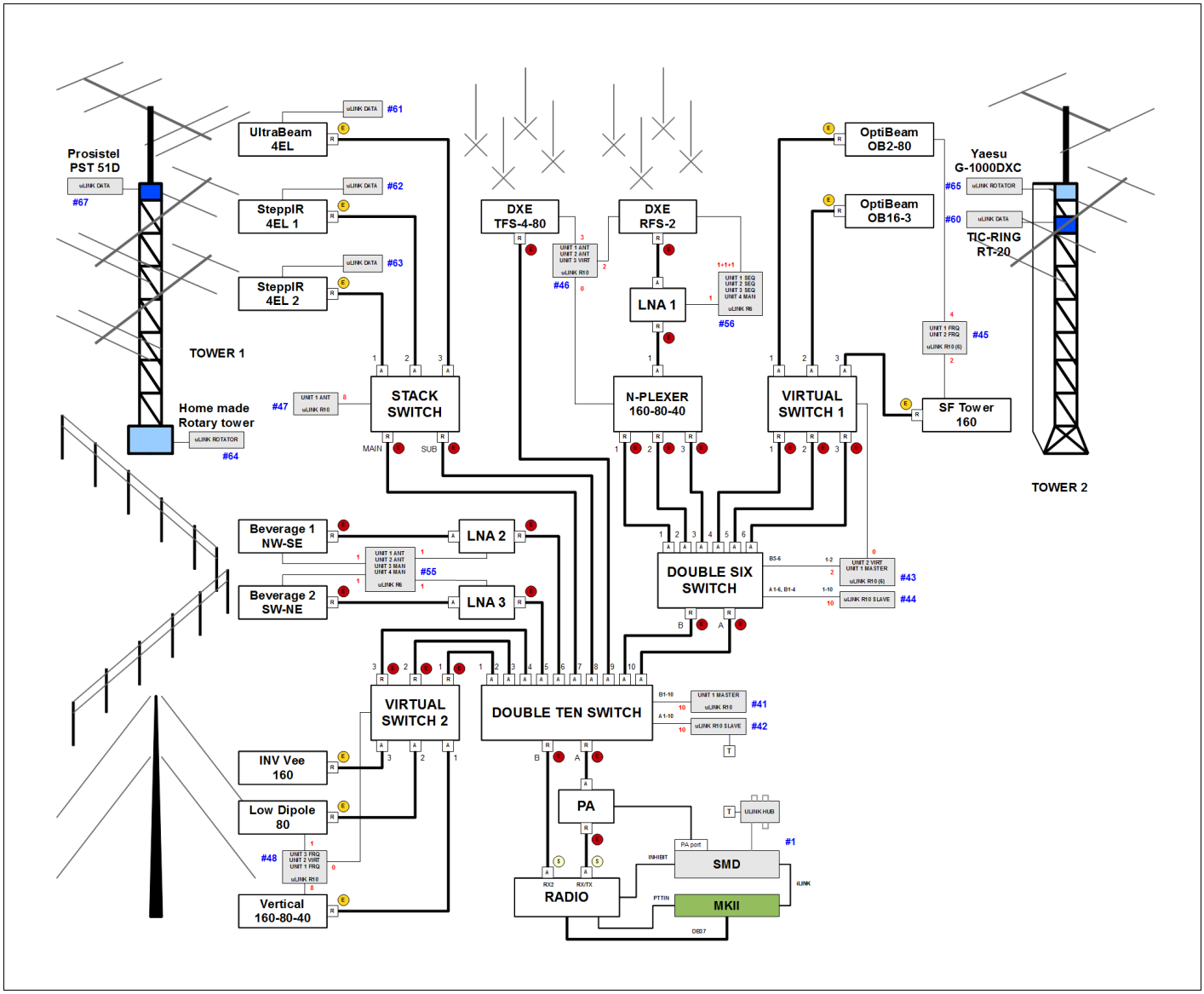
1. Ability to use any free antenna keeping safety requirement for the second receiver on the same band for diversity reception.

2. Ability to use any free antenna keeping safety requirement for the second receiver on any other band for dual reception.

Analyze Setup

Having all requirements we can start analysis.

- UltraBeam and both SteppIRs have to be phased therefore they need to be connected to the Stack Switch.
- OB2-80, OB16-3 and Shunt Fed tower have a conditional use therefore they need to be connected through virtual switch.
- Inverted-V, Low Dipole and Vertical have a conditional use therefore they need also to be connected through virtual switch.
- RFS-2 must be able to supply signal simultaneously to multiple (two) R ports therefore must be connected through N-plexer.
- Rest of connections to switches can be done many ways, there is no implicit rule or guideline and every designer will probably choose his own approach. Our example provides an optimum solution based on antenna placement. Tower 1 is relatively close to Tower 2, TFS-4 is relatively close to RFS-2 and both four squares are relatively close to both towers. Both beverages are far away from all other antennas as well as Vertical and INV Vee and Low dipole. Therefore these antennas are marked as RX safe.



The number and kind of uLINK modules used as control boxes depends on the configuration requirements and style of construction. If the control wires from all antennas, switches, and rotators go to the shack or a common "equipment room" all uLINK modules should be placed in the shack as well. If the goal is to minimize wiring a more viable solution is to place the modules in the field close to the RF boxes being controlled. In that case the wiring requirement will decreases to the uLINK cable and power. However, this approach means that the usage of outputs will not be optimal (unused outputs) and installation will need a water proof boxes to house the uLINK modules. The optimum approach will be different for each antenna farm.

Once we have a block diagram for the installation, we can assign Control boxes to the RF boxes. We need to recognize control type and whether an antenna needs DATA, ROTATOR or RELAY control. With RELAY control we need to determine what functions are to be controlled – whether we will be controlling attributes like direction (ANT type), frequency dependencies (FRQ type), PTT relationship (SEQ type), manual control (MAN type) and the number of control wires.

There is no rule for addressing uLINK modules other than address must be greater than 32 and must be unique.

- **UltraBeam**
  Original controller connected to RS232 port of uLINK DATA module. Address #61
- **SteppIR 1**
  Original controller connected to RS232 port of uLINK DATA module. Address #62
- **SteppIR 2**
  Original controller connected to RS232 port of uLINK DATA module. Address #63
- **TFS-4**
  RF box control directly connected to uLINK RELAY 10, Unit 1, 3 outputs for direction control. Address #46
- **OB2-80**
  Antenna control directly connected to uLINK RELAY 10, Unit 1, 4 outputs for band segment control. Address #45
- **OB16-3**
  No control.
- **Shunt Fed Tower**
  Antenna control directly connected to uLINK RELAY 10, Unit 2, 2 outputs for band segment control. Address #45
- **Beverage 1**
  Antenna control directly connected to uLINK RELAY 6, Unit 1, 1 output for direction control. Address #48
- **Beverage 2**
  Antenna control directly connected to uLINK RELAY 6, Unit 2, 1 output for direction control. Address #48
- **Inverted-V**
  No control
- **Low Dipole**
  Antenna control directly connected to uLINK RELAY 10, Unit 3, 1 output for band segment control. Address #49
- **Vertical**
  Antenna control directly connected to uLINK RELAY 10, Unit 1, 8 outputs for segments control. Address #49

- **RFS-2**
  RF box control directly connected to uLINK RELAY 10, Unit 2, 2 outputs for direction control. Address #46
  Preamplifiers controlled by two sequencer Units 1 and Unit 2 of uLINK RELAY 6. SEQ units assigned to R ports of colliding antennas, TFS-4 and Low Dipole. Address #56

- **Prosistel PST51D**
  Rotator controller connected to RS232 port of uLINK DATA module. Address #67

- **Rotary Tower**
  Rotator connected to uLINK ROTATOR module. Address #64

- **Yaesu G-1000DXC**
  Rotator controller connected to uLINK ROTATOR module. Address #65

- **TIC RING + RT-20**
  Rotator controller connected to RS232 port of uLINK DATA module. Address #60

- **STACK SWITCH**
  Switch directly connected to uLINK RELAY 10 module, Unit 1, 8 outputs. Address #47

- **DOUBLE SIX SWITCH**
  Switch directly connected to uLINK RELAY 10 module, Unit SLAVE, 10 outputs. Address #44 and uLINK RELAY 10, Unit 1 MASTER, 2 outputs, Address #43

- **DOUBLE TEN SWITCH**
  Switch directly connected to uLINK RELAY 10 module, Unit SLAVE, 10 outputs. Address #42 and uLINK RELAY 10, Unit 1 MASTER, 10 outputs, Address #41

- **LNA 1**
  Preamplifier control connected to uLINK RELAY 6 module, Unit 3, 1 output for sequencing. Address #56

- **LNA 2**
  Preamplifier control connected to uLINK RELAY 6 module, Unit 3, 1 output for sequencing. Address #48

- **LNA 3**
  Preamplifier control connected to uLINK RELAY 6 module, Unit 4, 1 output for sequencing. Address #48

- **VIRTUAL SWITCH 1**
  Virtually controlled by uLINK RELAY 10, Unit 2, 0 outputs. Address #43

- **VIRTUAL SWITCH 2**
  Virtually controlled by uLINK RELAY 10, Unit 2, 0 outputs. Address #49

- **N-PLEXER**
  Virtually controlled by uLINK RELAY 10, Unit 4, 0 outputs. Address #56

For better reading and easier editing in Router we now make a list of Control boxes stating all units, their outputs, and uLINK addresses.

- uLINK DATA ADR=60, 61, 62, 63, 67

- uLINK ROTATOR ADR=64, 65

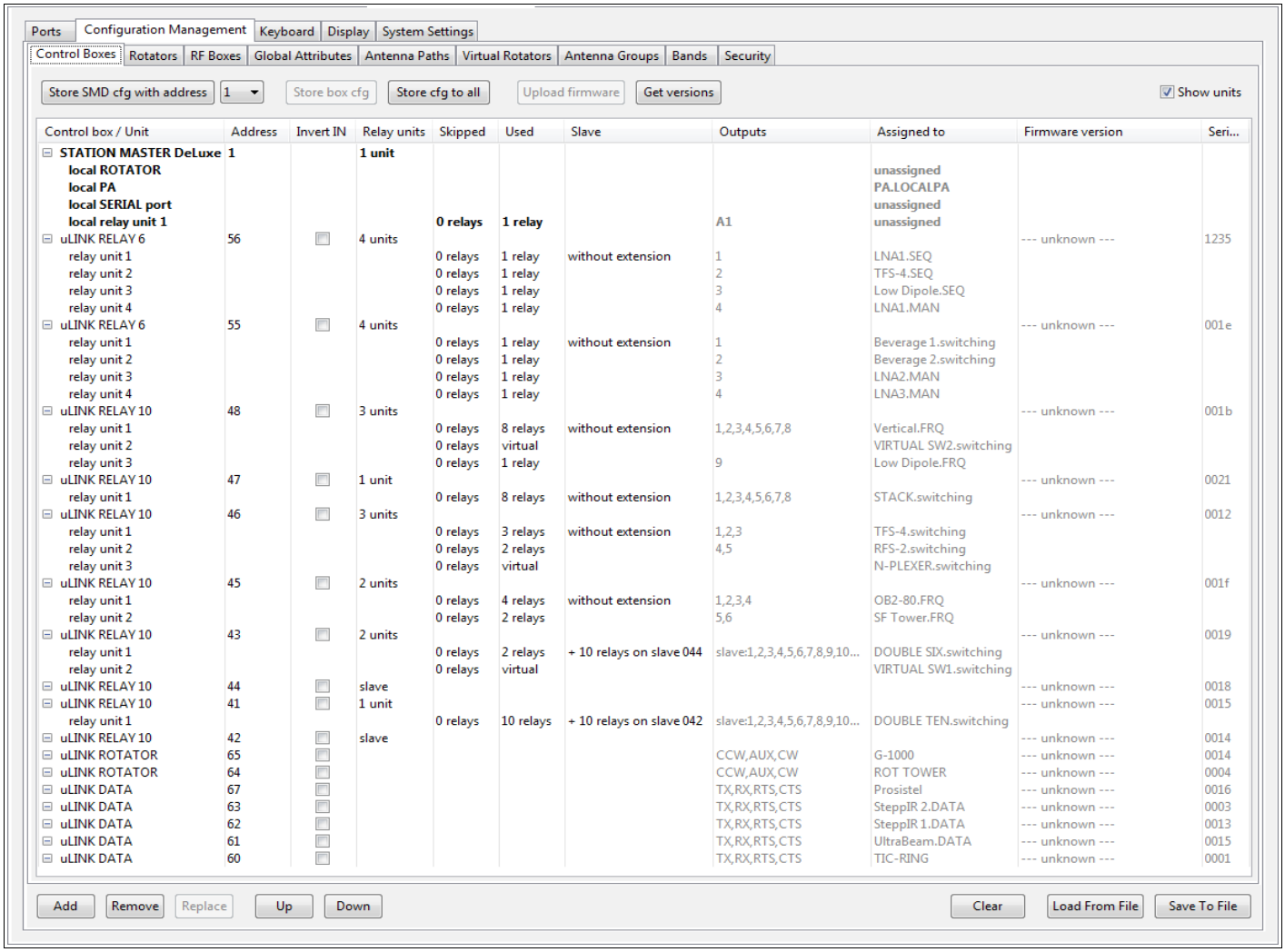
- uLINK RELAY 10 ADR=41 Relay Units=1
  Unit=1, 2 outputs + 10 on Slave #42

- uLINK RELAY 10 ADR=42 Relay Units=Slave

- uLINK RELAY 10 ADR=43 Relay Units=2
  Unit=1, 2 outputs + 10 on Slave #44
  Unit=2, virtual
- uLINK RELAY 10 ADR=44 Relay Units=Slave
- uLINK RELAY 10 ADR=45 Relay Units=2
  Unit=1, 4 outputs
  Unit=2, 2 outputs
- uLINK RELAY 10 ADR=46 Relay Units=2
  Unit=1, 3 outputs
  Unit=2, 2 outputs
- uLINK RELAY 10 ADR=47 Relay Units=1
  Unit=1, 8 outputs
- uLINK RELAY 10 ADR=48 Relay Units=3
  Unit=1, 8 outputs
  Unit=2, virtual
  Unit=3, 1 output
- uLINK RELAY 6 ADR=55 Relay Units=4
  Unit=1, 1 output
  Unit=2, 1 output
  Unit=3, 1 output
  Unit=4, 1 output
- uLINK RELAY 6 ADR=56 Relay Units=4
  Unit=1, 1 output
  Unit=2, 1 output
  Unit=3, 1 output
  Unit=4, virtual
- SMD ADR=1

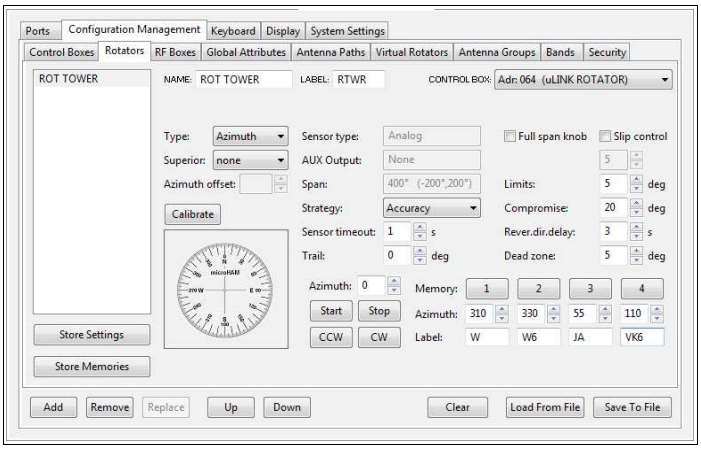
Setup configuration

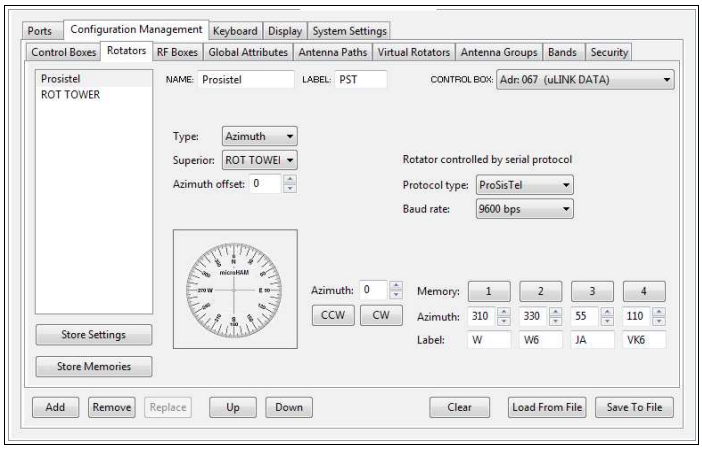
Now we have all information and can start making configuration. The first step is to add all the control boxes to Router. Then for each uLINK RELAY module we set the number of units, number of relays per unit and assign Slave units to their Masters.

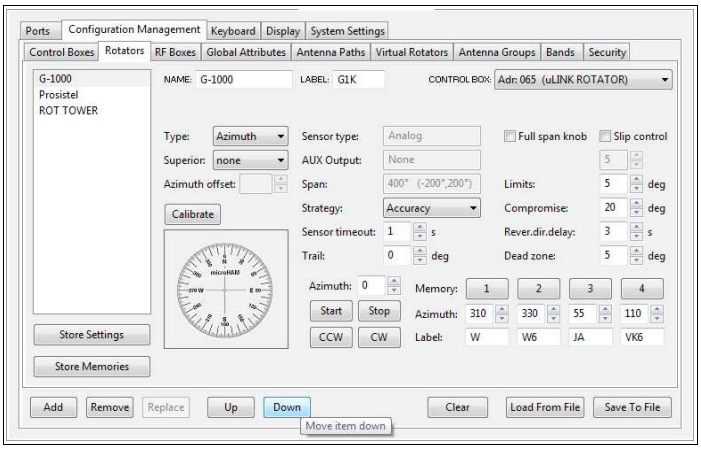


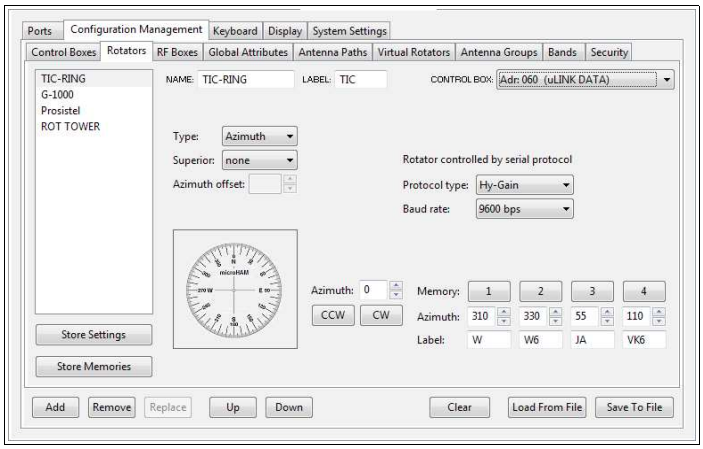
Control box / Unit	Address	Invert IN	Relay units	Skipped	Used	Slave	Outputs	Assigned to	Firmware version	Seri...
STATION MASTER DeLuxe	**1**		**1 unit**							
local ROTATOR								**unassigned**		
local PA								**PA.LOCALPA**		
local SERIAL port								**unassigned**		
local relay unit 1				**0 relays**	**1 relay**		A1	**unassigned**		
uLINK RELAY 6	56		4 units						--- unknown ---	1235
relay unit 1				0 relays	1 relay	without extension	1	LNA1.SEQ		
relay unit 2				0 relays	1 relay		2	TFS-4.SEQ		
relay unit 3				0 relays	1 relay		3	Low Dipole.SEQ		
relay unit 4				0 relays	1 relay		4	LNA1.MAN		
uLINK RELAY 6	55		4 units						--- unknown ---	001e
relay unit 1				0 relays	1 relay	without extension	1	Beverage 1.switching		
relay unit 2				0 relays	1 relay		2	Beverage 2.switching		
relay unit 3				0 relays	1 relay		3	LNA2.MAN		
relay unit 4				0 relays	1 relay		4	LNA3.MAN		
uLINK RELAY 10	48		3 units						--- unknown ---	001b
relay unit 1				0 relays	8 relays	without extension	1,2,3,4,5,6,7,8	Vertical.FRQ		
relay unit 2				0 relays	virtual			VIRTUAL SW2.switching		
relay unit 3				0 relays	1 relay		9	Low Dipole.FRQ		
uLINK RELAY 10	47		1 unit						--- unknown ---	0021
relay unit 1				0 relays	8 relays	without extension	1,2,3,4,5,6,7,8	STACK.switching		
uLINK RELAY 10	46		3 units						--- unknown ---	0012
relay unit 1				0 relays	3 relays	without extension	1,2,3	TFS-4.switching		
relay unit 2				0 relays	2 relays		4,5	RFS-2.switching		
relay unit 3				0 relays	virtual			N-PLEXER.switching		
uLINK RELAY 10	45		2 units						--- unknown ---	001f
relay unit 1				0 relays	4 relays	without extension	1,2,3,4	OB2-80.FRQ		
relay unit 2				0 relays	2 relays		5,6	SF Tower.FRQ		
uLINK RELAY 10	43		2 units						--- unknown ---	0019
relay unit 1				0 relays	2 relays	+ 10 relays on slave 044	slave:1,2,3,4,5,6,7,8,9,10...	DOUBLE SIX.switching		
relay unit 2				0 relays	virtual			VIRTUAL SW1.switching		
uLINK RELAY 10	44		slave						--- unknown ---	0018
uLINK RELAY 10	41		1 unit						--- unknown ---	0015
relay unit 1				0 relays	10 relays	+ 10 relays on slave 042	slave:1,2,3,4,5,6,7,8,9,10...	DOUBLE TEN.switching		
uLINK RELAY 10	42		slave						--- unknown ---	0014
uLINK ROTATOR	65						CCW,AUX,CW	G-1000	--- unknown ---	0014
uLINK ROTATOR	64						CCW,AUX,CW	ROT TOWER	--- unknown ---	0004
uLINK DATA	67						TX,RX,RTS,CTS	Prosistel	--- unknown ---	0016
uLINK DATA	63						TX,RX,RTS,CTS	SteppIR 2.DATA	--- unknown ---	0003
uLINK DATA	62						TX,RX,RTS,CTS	SteppIR 1.DATA	--- unknown ---	0013
uLINK DATA	61						TX,RX,RTS,CTS	UltraBeam.DATA	--- unknown ---	0015
uLINK DATA	60						TX,RX,RTS,CTS	TIC-RING	--- unknown ---	0001

After assigning the control units, Rotators can be added. Note the settings for each of them. At the same time, we can be set memories for quick azimuth calls.









Now we can add the RF Boxes.

1. **UltraBeam** is added as a Simple Antenna. The Direction tab is set to Rotator=Prosistel. The Switching tab needs no entry. Frequency range is set to 7000-54000kHz for RX and each band is set explicitly for TX on the Rules tab. The control box (ADR: 061 uLINK DATA) is selected using “Add Control” and the serial port function is set for UltraBeam.

2. **SteppIR 1** is added as a Simple Antenna. The Direction tab is set to Rotator=Rotary Tower (ROT TOWER). The other parameters are the same as for UltraBeam except for the control box (ADR: 062 uLINK DATA) and the serial port function is set for SteppIR.

3. **SteppIR 2** is added as a Simple Antenna. The other settings are the same as those for SteppIR 1 except for the control box (ADR: 063 uLINK DATA).

4. **TFS-4** is added as a Vertical Antenna Array using the built in template for TFS-4. Fixed azimuth is set at 315 degrees on the Directions tab to define the default direction. The frequency range is set to 3500-4000kHz for RX, and 3500-3800kHz for TX at Rules tab (Region 1 band plan). ADR: 046, Unit 1 (uLINK RELAY 10) is selected for direction control on the Switching tab. ADR: 056, Unit 2 (uLINK RELAY 6) is selected using Add Control as a sequencer unit to control RFS-2 and LNA 1 when TFS-4 is used for transmit. Hold and Invert are checked, Lead time is set to 0, Tail delay to 10ms, switching delay to 5ms, and Frequency range set to 3500-4000kHz.

5. **OB2-80** is added as a Simple Antenna. The Directions tab is set to Rotator=G-1000. Frequency range is set to 3500-4000kHz for RX, and 3500-3800kHz for TX at the Rules tab. ADR: 045, Unit 1 (uLINK RELAY 10) is added for frequency control with Output count set to 4. Follow is set to TX frequency and the four band segments edited according to specifications.

6. **OB16-3** is added as a Simple Antenna. The Directions tab is set to Rotator=TIC RING. Frequency range is set for three individual segments for 20, 15 and 10m to prevent the antenna from being used on the WARC bands. No other settings are required.

7. **SF Tower** is added as a Simple Antenna. Directionality is set to Omni-directional on the Directions tab. Frequency range is set for total three segments, first to 1800-2000kHz for RX only (TX not allowed) and then two separate segments, 1810-1880kHz, and 1900-1930kHz respectively for TX. Using Add Control, ADR: 045, Unit 2 (uLINK RELAY 10) is added for frequency control. Output count set to 2, Follow set to TX frequency and the thee band segments are edited for antenna matching.

8. **Beverage 1** added as Vertical Antenna Array using built in template for “Vertical Array Antenna, Other without Omni type.” Direction is set for Fixed azimuth to 315 deg (NW default direction) and set as RX safe. Control box at Switching tab is set to ADR: 055, Unit 1 (uLINK RELAY 6) is selected on the Switching tab. Frequency range is set to 1800-10200kHz, RX only on the Rules tab. The Fit mask is changed to XX in order for each direction to be listed as a separate Antenna Selection.

9. **Beverage 2** is added as a Vertical Antenna Array using built in template for "Vertical Array Antenna, Other without Omni type." Except for the Control box (ADR: 055 Unit 2 (uLINK RELAY 6)) and Fixed Azimuth (45 degrees), the other parameters are identical to **Beverage 1**.

10. **INV Vee**, is added as a Simple Antenna. Directionality is set to Bi-directional, Fixed azimuth to 315 deg on the Directions tab. Frequency range is set to 1800-2000kHz for RX, and 1810-1850kHz for TX. No other settings required.

11. **Low Dipole** is added as a Simple Antenna. It is marked Bi-directional with 315 degree Fixed azimuth on the Directions tab. Frequency range is set on the Rules tab to 3500-4000kHz for RX with two separate segments, 3500-3600kHz, and 3700-3800kHz for TX. Frequency control is configured with Add Control to select ADR: 048, Unit 3 (uLINK RELAY 10) with Output Count = 1, frequency range is set for two segments based on TX frequency.

    Since we must bypass the preamps in RFS-2 and LNA 1 when transmitting on the Low Dipole, we need to add another control. Using Add Control we select ADR: 056, Unit 3 (uLINK RELAY 6) as a sequencer unit. Hold and Invert are checked, Lead time is set to 0, Tail delay to 10ms, switching delay to 5ms, and Frequency range 3500-4000kHz.

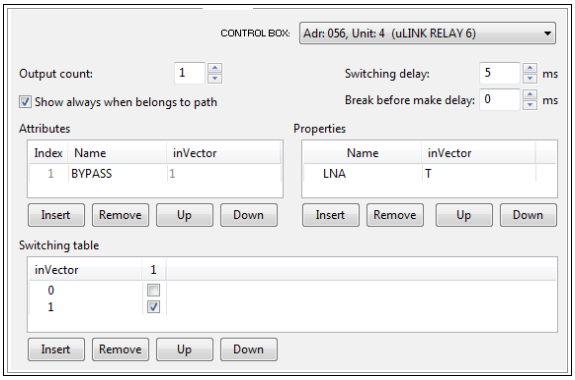
12. **Vertical** is added as Simple Antenna and set to Omni-directional. Frequency range is set to 1800-7300kHz for RX with three separate segments for RX/TX. Frequency Control Using Add control added uLINK RELAY unit for frequency control. Output count set to 8, Follow set to TX frequency and entered nine band segments for antenna matching. Control box is set to ADR: 048, Unit 1 (uLINK RELAY 10).

13. **RFS-2**, added as Vertical Antenna Array using built in template for RFS-2. Direction is set to for Fixed azimuth to 315 deg (NW default direction). Control box is set to ADR: 046, Unit 2 (uLINK RELAY 10), Output count 2. Frequency range is set for 1800-7300kHz as RX only range.

14. **Radio** assignment is set to SMD ADR=001.

15. **Power Amplifier** is added as Two-Port Device. Because PA is controlled from local PA port of SMD the default uLINK DATA control is removed and local PA control is added. Frequency range is set for 1800-54000kHz. CI-V function set to TX frequency, KeyIn checked and KeyIn timeout set to 5ms according to PA specifications. Control box is set to address, ADR=001, (local PA).

16. **LNA 1** is added as Two-Port Device. Frequency range is set for 1800-7300kHz, RX only. Using Add control we add a uLINK RELAY sequencer unit to provide power to the RFS-2 and LNA 1 when antenna is in use. Invert checked, Lead time is set to 0, Tail delay to 10ms, and switching delay to 5ms. Frequency range 1800-7300kHz and control box is set to ADR: 056, Unit 1 (uLINK RELAY 6).

    In order to allow the PATH properties button to manually bypass LNA 1, we add a uLINK Relay manual control. The units is configured set as shown in the picture. The button is labeled LNA. The control box is set to ADR: 056, Unit 4 (uLINK RELAY 6).

17. **LNA 2** is added as Two-Port Device. Frequency range is set for 1800-10200kHz, RX only. Again, to allow bypassing the LNA using the PATH properties we add a uLINK RELAY manual control. The MAN control is set exactly same as for LNA 1. The Control box is set to ADR: 055, Unit 3 (uLINK RELAY 6).

18. **LNA 3**, added as Two-Port Device. Frequency range is set for 1800-10200kHz, RX only. Like LNA 2, to allow bypassing the LNA using the PATH properties we add a uLINK RELAY manual control. The MAN control is set exactly same as for LNA 1. The Control box is set to ADR: 055, Unit 4 (uLINK RELAY 6).

19. **Virtual SW 1** is added as a “Special Box, Virtual Exclusivity Box” with 3 R ports. The switching tab is configured with the InVector 000 010 001 to support the special conditions (R ports 2 and 3 can be used at the same time when R port 1 is not used). Since this is a virtual switch, Switching delay is set to 0. The Control box is set to ADR: 043, Unit 2 (uLINK RELAY 10).

20. **Virtual SW 2** is added as a “Special Box, Virtual Exclusivity Box” with 3 R ports. At switching tab is configured with the InVector 100 010 000 to support the special conditions (R ports 1 and 2 can be used at the same time when R port 3 is not used). Since this is a virtual switch, Switching delay is set to 0. The Control box is set to ADR: 048, Unit 2 (uLINK RELAY 10).

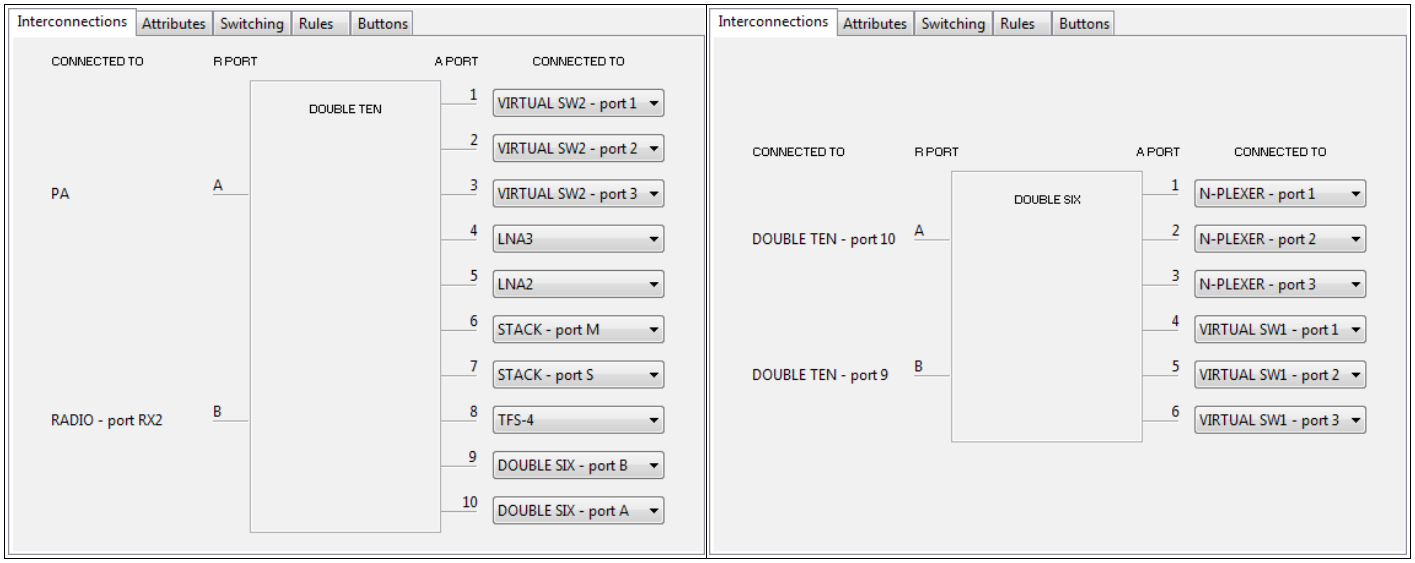
21. **N-Plexer** added as a “Special Box, N-Plexer” with 3 R ports. The Frequency range is set individually for each R port: R1 = 1800-2000kHz RX only, R2 = 3500-4000kHz, RX only, and R3 = 7000-7300kHz, RX only. Switch delay is set to 0. Control box is set to address, ADR=056, Unit 4 (uLINK RELAY 6). In addition, a “Special Box, N-Plexer, N-Plexer termination” named RFS-2' is added to provide a mirror for the RFS-2.

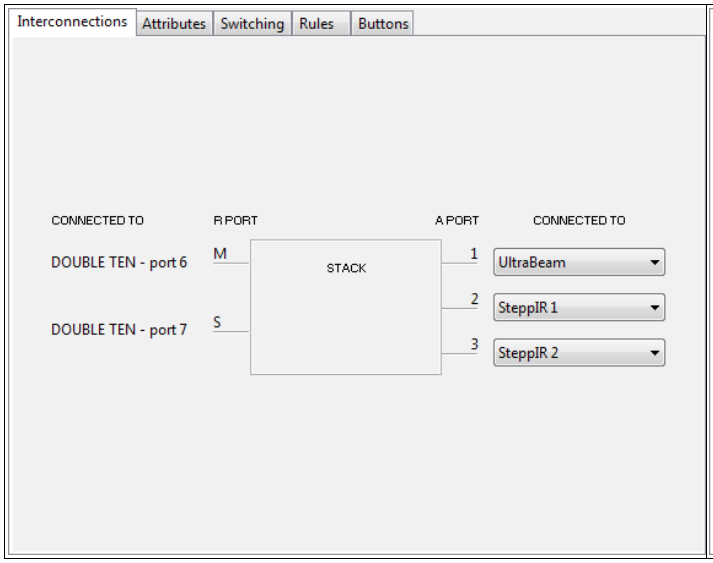
22. **Stack** is added as a microHAM Stack Switch. Frequency ranges are set to 7000-54000kHz for both R ports. Include to selection is selected for both R ports to allow alternative group containing both antenna paths for the MAIN and SUB R ports to allow Stack selection from both RX and RX2 Antenna Selections. BOP12 (top/middle) and FULL (all three) were removed from properties and BOP23 renamed to BOP based on the requirements to operate SteppIR 1 and SteppIR 2 out of phase. The Control box is set to ADR: 047, Unit 1 (uLINK RELAY 10).

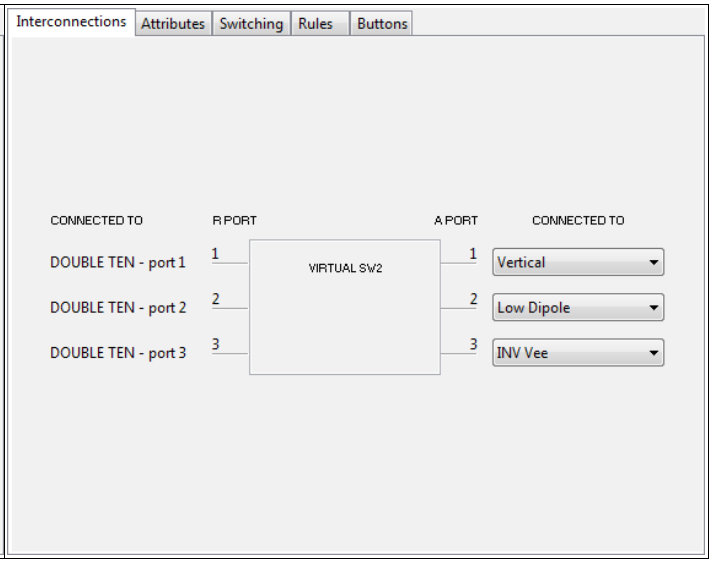
23. **Double Six** is added as microHAM Double Six Switch. No settings required. The Control box is set to ADR: 043, Unit 1 (uLINK RELAY 10).

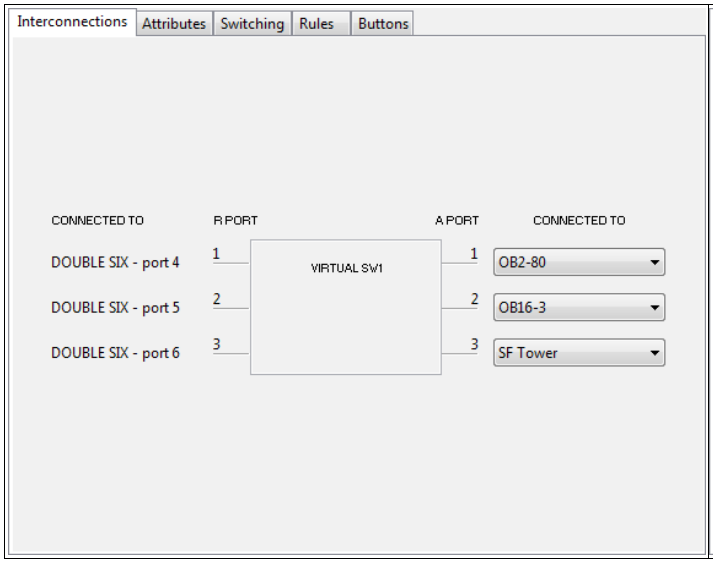
24. **Double Ten** is added as microHAM Double Ten Switch. No settings required. The Control box is set to ADR: 041, Unit 1 (uLINK RELAY 10).

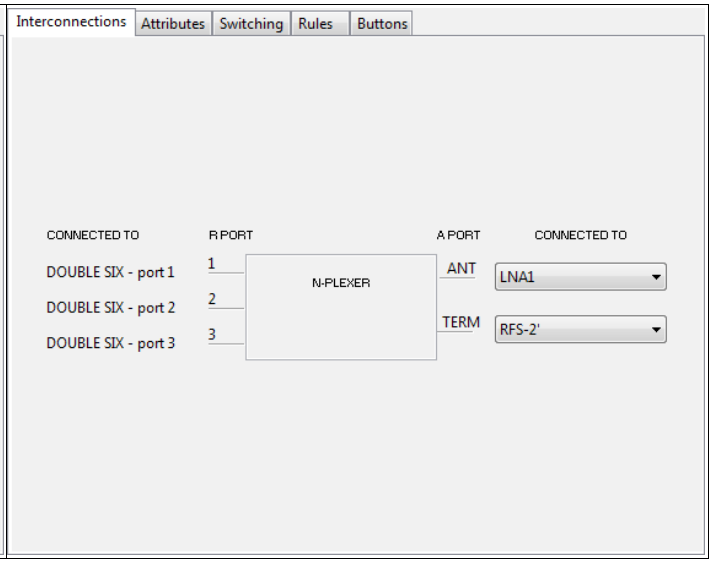
Once all the RF boxes have been added and configured, they can be interconnected based on the block diagram using the Interconnections tabs of all RF boxes except the antennas as shown below.

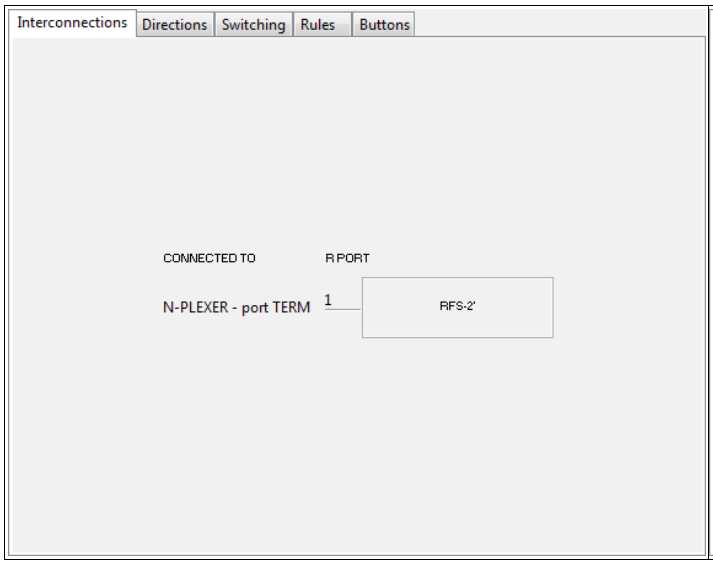


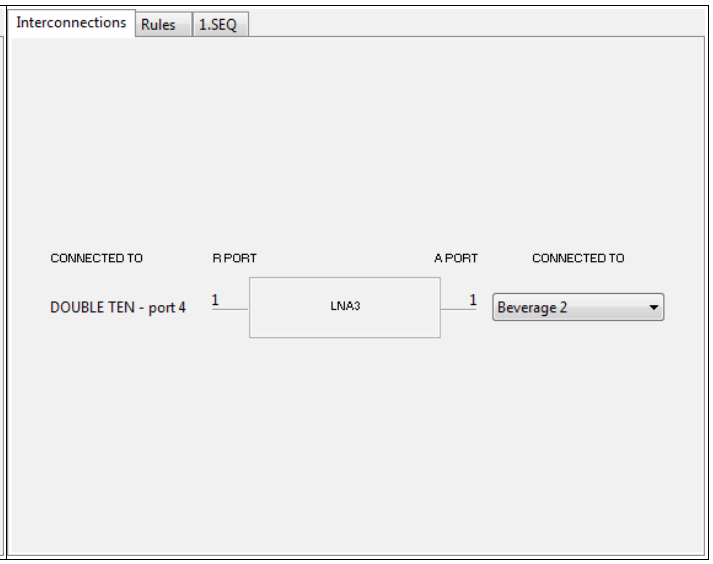

Interconnections
Attributes
Switching
Rules
Buttons
CONNECTED TO
R PORT
A PORT
CONNECTED TO
DOUBLE TEN - port 6
M
STACK
1
UltraBeam
2
SteppIR 1
DOUBLE TEN - port 7
S
3
SteppIR 2

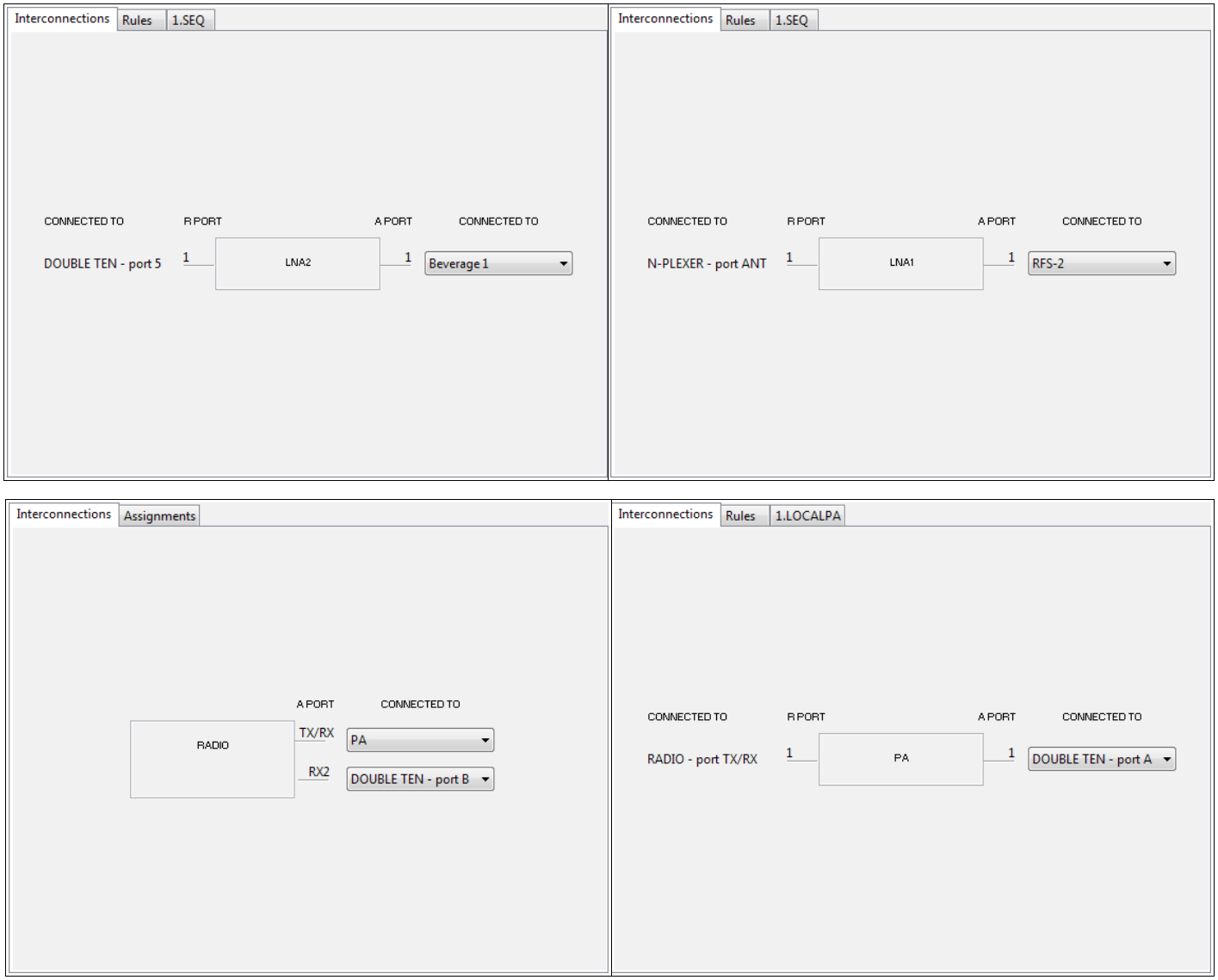

Interconnections
Attributes
Switching
Rules
Buttons
CONNECTED TO
R PORT
A PORT
CONNECTED TO
DOUBLE TEN - port 1
1
VIRTUAL SW2
1
Vertical
DOUBLE TEN - port 2
2
2
Low Dipole
DOUBLE TEN - port 3
3
3
INV Vee


Interconnections
Attributes
Switching
Rules
Buttons
CONNECTED TO
R PORT
A PORT
CONNECTED TO
DOUBLE SIX - port 4
1
VIRTUAL SW1
1
OB2-80
DOUBLE SIX - port 5
2
2
OB16-3
DOUBLE SIX - port 6
3
3
SF Tower


Interconnections
Attributes
Switching
Rules
Buttons
CONNECTED TO
R PORT
A PORT
CONNECTED TO
DOUBLE SIX - port 1
1
N-PLEXER
ANT
LNA1
DOUBLE SIX - port 2
2
TERM
RFS-2'
DOUBLE SIX - port 3
3

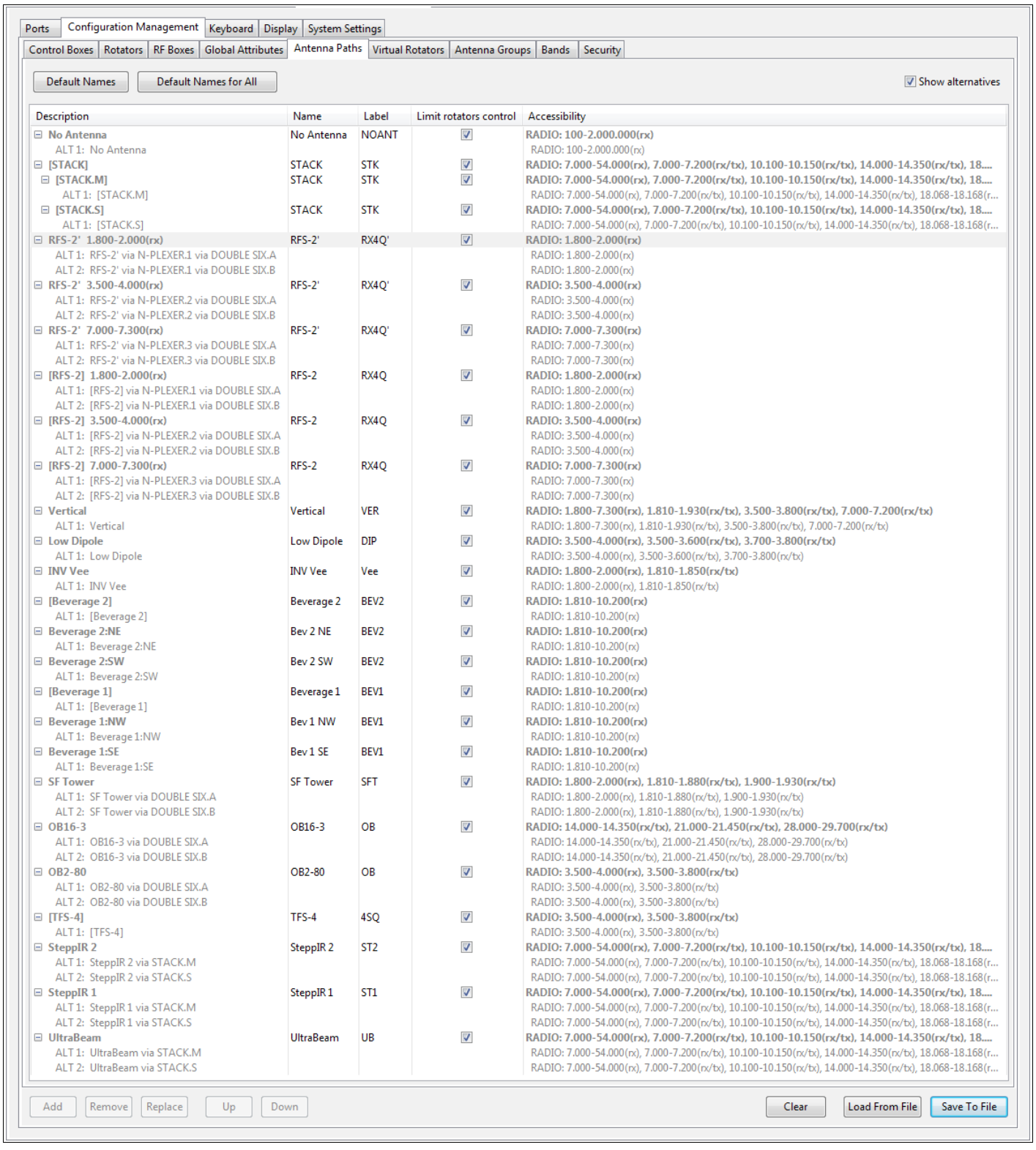

Interconnections
Directions
Switching
Rules
Buttons
CONNECTED TO
R PORT
N-PLEXER - port TERM
1
RFS-2'


Interconnections
Rules
1.SEQ
CONNECTED TO
R PORT
A PORT
CONNECTED TO
DOUBLE TEN - port 4
1
LNA3
1
Beverage 2

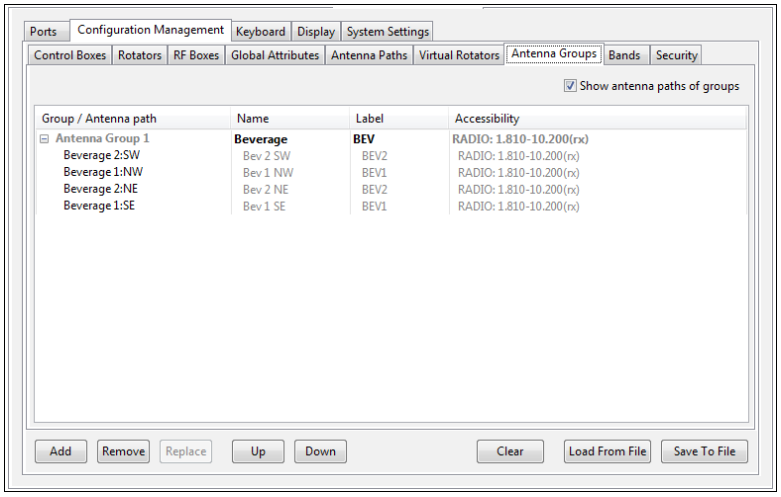


At this point about 95% of configuration work is already done. Clicking on any tab will cause Router to compile the configuration.

Setup has no Global Attributes, therefore this tab is empty. On Antenna Paths Router shows all Antenna Paths and their alternatives as defined on the previous tabs. The automatically generated Names and Labels can be edited to be more understandable if needed. These names and labels will be used to identify the Antenna Paths in the remaining configuration tabs and on the SMD display.



Description	Name	Label	Limit rotators control	Accessibility
No Antenna	No Antenna	NOANT	☑	RADIO: 100-2.000.000(rx)
ALT 1: No Antenna				RADIO: 100-2.000.000(rx)
[STACK]	STACK	STK	☑	RADIO: 7.000-54.000(rx), 7.000-7.200(rx/tx), 10.100-10.150(rx/tx), 14.000-14.350(rx/tx), 18....
[STACK.M]	STACK	STK	☑	RADIO: 7.000-54.000(rx), 7.000-7.200(rx/tx), 10.100-10.150(rx/tx), 14.000-14.350(rx/tx), 18....
ALT 1: [STACK.M]				RADIO: 7.000-54.000(rx), 7.000-7.200(rx/tx), 10.100-10.150(rx/tx), 14.000-14.350(rx/tx), 18.068-18.168(r...
[STACK.S]	STACK	STK	☑	RADIO: 7.000-54.000(rx), 7.000-7.200(rx/tx), 10.100-10.150(rx/tx), 14.000-14.350(rx/tx), 18....
ALT 1: [STACK.S]				RADIO: 7.000-54.000(rx), 7.000-7.200(rx/tx), 10.100-10.150(rx/tx), 14.000-14.350(rx/tx), 18.068-18.168(r...
RFS-2' 1.800-2.000(rx)	RFS-2'	RX4Q'	☑	RADIO: 1.800-2.000(rx)
ALT 1: RFS-2' via N-PLEXER.1 via DOUBLE SIX.A				RADIO: 1.800-2.000(rx)
ALT 2: RFS-2' via N-PLEXER.1 via DOUBLE SIX.B				RADIO: 1.800-2.000(rx)
RFS-2' 3.500-4.000(rx)	RFS-2'	RX4Q'	☑	RADIO: 3.500-4.000(rx)
ALT 1: RFS-2' via N-PLEXER.2 via DOUBLE SIX.A				RADIO: 3.500-4.000(rx)
ALT 2: RFS-2' via N-PLEXER.2 via DOUBLE SIX.B				RADIO: 3.500-4.000(rx)
RFS-2' 7.000-7.300(rx)	RFS-2'	RX4Q'	☑	RADIO: 7.000-7.300(rx)
ALT 1: RFS-2' via N-PLEXER.3 via DOUBLE SIX.A				RADIO: 7.000-7.300(rx)
ALT 2: RFS-2' via N-PLEXER.3 via DOUBLE SIX.B				RADIO: 7.000-7.300(rx)
[RFS-2] 1.800-2.000(rx)	RFS-2	RX4Q	☑	RADIO: 1.800-2.000(rx)
ALT 1: [RFS-2] via N-PLEXER.1 via DOUBLE SIX.A				RADIO: 1.800-2.000(rx)
ALT 2: [RFS-2] via N-PLEXER.1 via DOUBLE SIX.B				RADIO: 1.800-2.000(rx)
[RFS-2] 3.500-4.000(rx)	RFS-2	RX4Q	☑	RADIO: 3.500-4.000(rx)
ALT 1: [RFS-2] via N-PLEXER.2 via DOUBLE SIX.A				RADIO: 3.500-4.000(rx)
ALT 2: [RFS-2] via N-PLEXER.2 via DOUBLE SIX.B				RADIO: 3.500-4.000(rx)
[RFS-2] 7.000-7.300(rx)	RFS-2	RX4Q	☑	RADIO: 7.000-7.300(rx)
ALT 1: [RFS-2] via N-PLEXER.3 via DOUBLE SIX.A				RADIO: 7.000-7.300(rx)
ALT 2: [RFS-2] via N-PLEXER.3 via DOUBLE SIX.B				RADIO: 7.000-7.300(rx)
Vertical	Vertical	VER	☑	RADIO: 1.800-7.300(rx), 1.810-1.930(rx/tx), 3.500-3.800(rx/tx), 7.000-7.200(rx/tx)
ALT 1: Vertical				RADIO: 1.800-7.300(rx), 1.810-1.930(rx/tx), 3.500-3.800(rx/tx), 7.000-7.200(rx/tx)
Low Dipole	Low Dipole	DIP	☑	RADIO: 3.500-4.000(rx), 3.500-3.600(rx/tx), 3.700-3.800(rx/tx)
ALT 1: Low Dipole				RADIO: 3.500-4.000(rx), 3.500-3.600(rx/tx), 3.700-3.800(rx/tx)
INV Vee	INV Vee	Vee	☑	RADIO: 1.800-2.000(rx), 1.810-1.850(rx/tx)
ALT 1: INV Vee				RADIO: 1.800-2.000(rx), 1.810-1.850(rx/tx)
[Beverage 2]	Beverage 2	BEV2	☑	RADIO: 1.810-10.200(rx)
ALT 1: [Beverage 2]				RADIO: 1.810-10.200(rx)
Beverage 2:NE	Bev 2 NE	BEV2	☑	RADIO: 1.810-10.200(rx)
ALT 1: Beverage 2:NE				RADIO: 1.810-10.200(rx)
Beverage 2:SW	Bev 2 SW	BEV2	☑	RADIO: 1.810-10.200(rx)
ALT 1: Beverage 2:SW				RADIO: 1.810-10.200(rx)
[Beverage 1]	Beverage 1	BEV1	☑	RADIO: 1.810-10.200(rx)
ALT 1: [Beverage 1]				RADIO: 1.810-10.200(rx)
Beverage 1:NW	Bev 1 NW	BEV1	☑	RADIO: 1.810-10.200(rx)
ALT 1: Beverage 1:NW				RADIO: 1.810-10.200(rx)
Beverage 1:SE	Bev 1 SE	BEV1	☑	RADIO: 1.810-10.200(rx)
ALT 1: Beverage 1:SE				RADIO: 1.810-10.200(rx)
SF Tower	SF Tower	SFT	☑	RADIO: 1.800-2.000(rx), 1.810-1.880(rx/tx), 1.900-1.930(rx/tx)
ALT 1: SF Tower via DOUBLE SIX.A				RADIO: 1.800-2.000(rx), 1.810-1.880(rx/tx), 1.900-1.930(rx/tx)
ALT 2: SF Tower via DOUBLE SIX.B				RADIO: 1.800-2.000(rx), 1.810-1.880(rx/tx), 1.900-1.930(rx/tx)
OB16-3	OB16-3	OB	☑	RADIO: 14.000-14.350(rx/tx), 21.000-21.450(rx/tx), 28.000-29.700(rx/tx)
ALT 1: OB16-3 via DOUBLE SIX.A				RADIO: 14.000-14.350(rx/tx), 21.000-21.450(rx/tx), 28.000-29.700(rx/tx)
ALT 2: OB16-3 via DOUBLE SIX.B				RADIO: 14.000-14.350(rx/tx), 21.000-21.450(rx/tx), 28.000-29.700(rx/tx)
OB2-80	OB2-80	OB	☑	RADIO: 3.500-4.000(rx), 3.500-3.800(rx/tx)
ALT 1: OB2-80 via DOUBLE SIX.A				RADIO: 3.500-4.000(rx), 3.500-3.800(rx/tx)
ALT 2: OB2-80 via DOUBLE SIX.B				RADIO: 3.500-4.000(rx), 3.500-3.800(rx/tx)
[TFS-4]	TFS-4	4SQ	☑	RADIO: 3.500-4.000(rx), 3.500-3.800(rx/tx)
ALT 1: [TFS-4]				RADIO: 3.500-4.000(rx), 3.500-3.800(rx/tx)
SteppIR 2	SteppIR 2	ST2	☑	RADIO: 7.000-54.000(rx), 7.000-7.200(rx/tx), 10.100-10.150(rx/tx), 14.000-14.350(rx/tx), 18....
ALT 1: SteppIR 2 via STACK.M				RADIO: 7.000-54.000(rx), 7.000-7.200(rx/tx), 10.100-10.150(rx/tx), 14.000-14.350(rx/tx), 18.068-18.168(r...
ALT 2: SteppIR 2 via STACK.S				RADIO: 7.000-54.000(rx), 7.000-7.200(rx/tx), 10.100-10.150(rx/tx), 14.000-14.350(rx/tx), 18.068-18.168(r...
SteppIR 1	SteppIR 1	ST1	☑	RADIO: 7.000-54.000(rx), 7.000-7.200(rx/tx), 10.100-10.150(rx/tx), 14.000-14.350(rx/tx), 18....
ALT 1: SteppIR 1 via STACK.M				RADIO: 7.000-54.000(rx), 7.000-7.200(rx/tx), 10.100-10.150(rx/tx), 14.000-14.350(rx/tx), 18.068-18.168(r...
ALT 2: SteppIR 1 via STACK.S				RADIO: 7.000-54.000(rx), 7.000-7.200(rx/tx), 10.100-10.150(rx/tx), 14.000-14.350(rx/tx), 18.068-18.168(r...
UltraBeam	UltraBeam	UB	☑	RADIO: 7.000-54.000(rx), 7.000-7.200(rx/tx), 10.100-10.150(rx/tx), 14.000-14.350(rx/tx), 18....
ALT 1: UltraBeam via STACK.M				RADIO: 7.000-54.000(rx), 7.000-7.200(rx/tx), 10.100-10.150(rx/tx), 14.000-14.350(rx/tx), 18.068-18.168(r...
ALT 2: UltraBeam via STACK.S				RADIO: 7.000-54.000(rx), 7.000-7.200(rx/tx), 10.100-10.150(rx/tx), 14.000-14.350(rx/tx), 18.068-18.168(r...



This Setup has no Virtual Rotator requirement, but using an Antenna Group for Beverage selection would be a useful control enhancement. By adding each beverage direction as a separate antenna in one Antenna Group, SMD can select each direction in a same way it does for the RFS-2 or TFS-4 four squares and the Beverages can be selected using the rotary encoder or Subselection buttons. An Antenna Group is added as shown on picture.

On the Bands tab it is a good approach to start by clicking the **Default Bands** button which fills the band map based in ITU region. Clicking on the **Fill Bands** button will cause Router to insert all possible antenna selections from the Antenna Paths tab into the appropriate band. Since all of the antenna paths are not useful as final selections, the list will need to be edited. Antenna selections can be freely reorganized, moved up and down, copied, removed and enabled/disabled for a particular start point.

In our example the list is edited to include only the useful antenna selections. Antenna Selections displayed in square brackets have more combinations available to be chosen by the Subselection buttons.

Only assignment customization is that uncontrolled receiving four square antenna (RFS-2) mirror is removed from selection for main RX because is useless to have it for both main and sub RX listed.

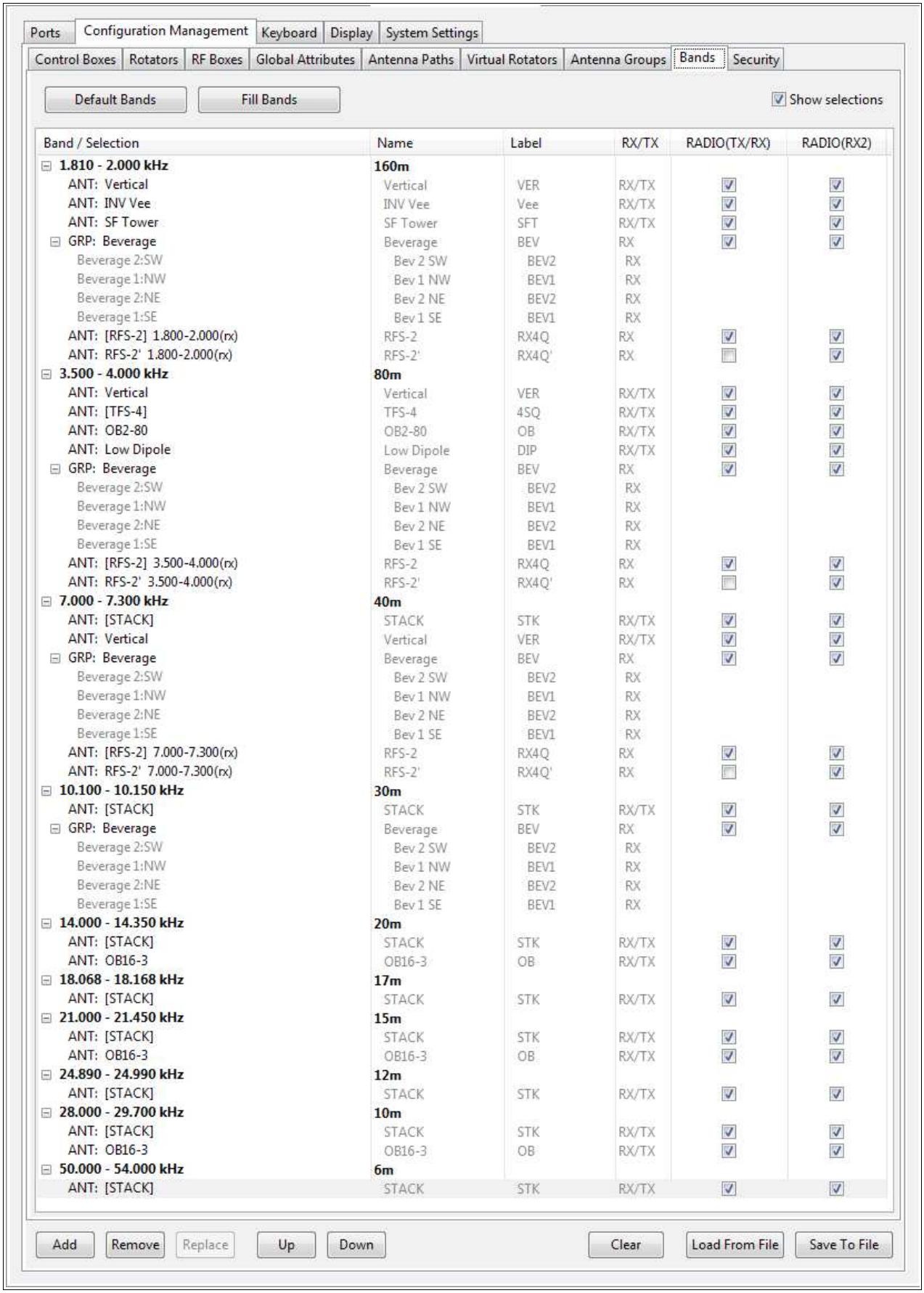
The last step is to set protection level on **Security** tab. Since we are using only one radio, the easiest strategy is to define only one frequency range from lowest to highest possible frequency and select "**Detach RX antenna on PTT**". This setting will protect the RX2 input of the transceiver against damage if the transceiver transmits while and RX2 is connected to an antenna that is not **RX safe**.

The configuration is finalized on the Control Boxes tab.

1. Save the setup to File using the Save To File button.
2. Store the configuration to all modules (assuming uLINK network is operational and modules powered).
3. Store the configuration to SMD (assuming SMD is connected to Router and turned on).

IMPORTANT: Don't forget to update the configuration in the uLINK modules in addition to the configuration in all SMDs after any change in configuration except changing names (SMD only).

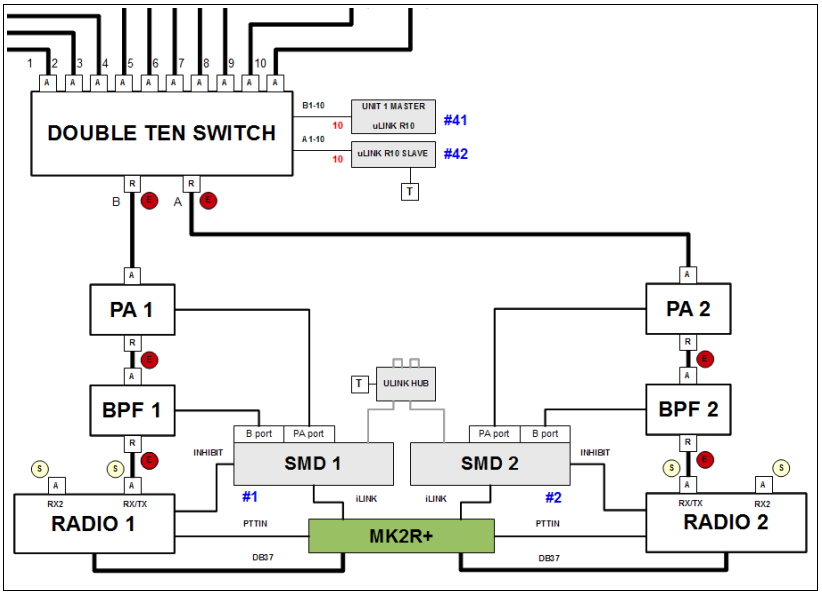
NOTE: This configuration file (SMD_Single_Radio_cfg_example.uad) is installed with Router.


Ports
Configuration Management
Keyboard
Display
System Settings
Control Boxes
Rotators
RF Boxes
Global Attributes
Antenna Paths
Virtual Rotators
Antenna Groups
Bands
Security
Default Bands
Fill Bands
Show selections
Band / Selection
Name
Label
RX/TX
RADIO(TX/RX)
RADIO(RX2)
1.810 - 2.000 kHz
160m
ANT: Vertical
Vertical
VER
RX/TX
ANT: INV Vee
INV Vee
Vee
RX/TX
ANT: SF Tower
SF Tower
SFT
RX/TX
GRP: Beverage
Beverage
BEV
RX
Beverage 2:SW
Bev 2 SW
BEV2
RX
Beverage 1:NW
Bev 1 NW
BEV1
RX
Beverage 2:NE
Bev 2 NE
BEV2
RX
Beverage 1:SE
Bev 1 SE
BEV1
RX
ANT: [RFS-2] 1.800-2.000(rx)
RFS-2
RX4Q
RX
ANT: RFS-2' 1.800-2.000(rx)
RFS-2'
RX4Q'
RX
3.500 - 4.000 kHz
80m
ANT: Vertical
Vertical
VER
RX/TX
ANT: [TFS-4]
TFS-4
4SQ
RX/TX
ANT: OB2-80
OB2-80
OB
RX/TX
ANT: Low Dipole
Low Dipole
DIP
RX/TX
GRP: Beverage
Beverage
BEV
RX
Beverage 2:SW
Bev 2 SW
BEV2
RX
Beverage 1:NW
Bev 1 NW
BEV1
RX
Beverage 2:NE
Bev 2 NE
BEV2
RX
Beverage 1:SE
Bev 1 SE
BEV1
RX
ANT: [RFS-2] 3.500-4.000(rx)
RFS-2
RX4Q
RX
ANT: RFS-2' 3.500-4.000(rx)
RFS-2'
RX4Q'
RX
7.000 - 7.300 kHz
40m
ANT: [STACK]
STACK
STK
RX/TX
ANT: Vertical
Vertical
VER
RX/TX
GRP: Beverage
Beverage
BEV
RX
Beverage 2:SW
Bev 2 SW
BEV2
RX
Beverage 1:NW
Bev 1 NW
BEV1
RX
Beverage 2:NE
Bev 2 NE
BEV2
RX
Beverage 1:SE
Bev 1 SE
BEV1
RX
ANT: [RFS-2] 7.000-7.300(rx)
RFS-2
RX4Q
RX
ANT: RFS-2' 7.000-7.300(rx)
RFS-2'
RX4Q'
RX
10.100 - 10.150 kHz
30m
ANT: [STACK]
STACK
STK
RX/TX
GRP: Beverage
Beverage
BEV
RX
Beverage 2:SW
Bev 2 SW
BEV2
RX
Beverage 1:NW
Bev 1 NW
BEV1
RX
Beverage 2:NE
Bev 2 NE
BEV2
RX
Beverage 1:SE
Bev 1 SE
BEV1
RX
14.000 - 14.350 kHz
20m
ANT: [STACK]
STACK
STK
RX/TX
ANT: OB16-3
OB16-3
OB
RX/TX
18.068 - 18.168 kHz
17m
ANT: [STACK]
STACK
STK
RX/TX
21.000 - 21.450 kHz
15m
ANT: [STACK]
STACK
STK
RX/TX
ANT: OB16-3
OB16-3
OB
RX/TX
24.890 - 24.990 kHz
12m
ANT: [STACK]
STACK
STK
RX/TX
28.000 - 29.700 kHz
10m
ANT: [STACK]
STACK
STK
RX/TX
ANT: OB16-3
OB16-3
OB
RX/TX
50.000 - 54.000 kHz
6m
ANT: [STACK]
STACK
STK
RX/TX
Add
Remove
Replace
Up
Down
Clear
Load From File
Save To File

BASIC DUAL RADIO (SO2R) CONFIGURATION EXAMPLE

Setup requirements

This example configuration shows configuring a system for two radios. The same antenna farm and restrictions are used as in the initial example. Converting for two radios is very simple with the only change in front of the Double Ten Switch R ports as shown in the partial schematic below.



SMD's local relay outputs need to be grouped into two units - port A and port B. Port B will be used to control Band Pass Filters for each SMD. To add the second radio requires that addition of a second SMD, BPF 1, BPF 2, and PA 2 be added to the list of RF Boxes and the Interconnections tab as shown on the plan.

SMD will control PA 2 via its local PA port the same way as SMD1 controls PA 1.

The Security Tab Frequency table will need to be modified from the simple case; each band will need to be listed separately because in SO2R we want to be able to listen on one radio while transmitting on the other.

"Detach RX antenna on PTT" is preferred if "in-band" SO2R operation is desired and it is possible that the receiving radio will be connected to an antenna that is not RX safe. If in band operation is not contemplated, "**Prevent TX"** will provide the classic style of "same band" lockout.

This configuration is the most common used by SO2R operators. However, it lacks the very useful ability to utilize the second receiver connected to separate antennas for diversity or "in band" split. The next example will examine how to get both two radio operation and dual receive.

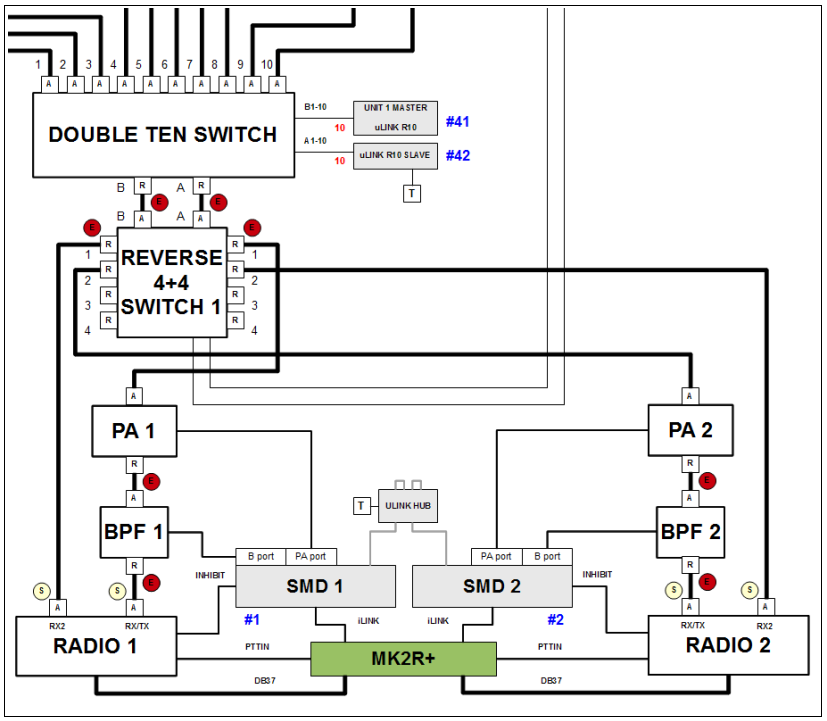
ADVANCED DUAL RADIO (SO2R) CONFIGURATION

Setup requirements

This configuration expands on the basic SO2R configuration to support dual receive or in-band split using the second RX input ("sub-receiver") on both radios. Again, we use the same antenna farm and RF boxes as in the first two examples. The additions are done in front of the Double Ten Switch as shown below.

Since "dual receive" is generally accomplished with stereo audio, this solution is based on a switching condition, which disconnects antenna from one radio and connects both R ports of Double Ten Switch to the other radio for dual receive, or diversity reception using separate antenna for each receiver. This solution is essentially a combination of the first two examples. The necessary switching can be accomplished by using "steering" with a safety reverse switch like the microHAM Four + Four 4+4 switch or two Top-Ten A/BSS switches. Using the microHAM switch, one half of the 4+4 switch steers B port of the Double Ten switch between RX2 input of R1 and RX/TX port of R2 while the other half steers A port of the Double Ten switch between RX2 input of R2 and RX/TX port of R1. Using this arrangement all necessary combinations of ports assignment are possible; R1 RX/TX + R2 RX/TX, R1 RX/TX + R1 RX2, R2 RX/TX + R2 RX2 and R1 RX2 + R2 RX2. All assignments and switching are done automatically simply by releasing the antenna path on one SMD and enabling RX antenna split on the other SMD.

As with the conventional SO2R configuration, SMD's local relay outputs need to be grouped into two units - port A and port B. Port B will be used to control Band Pass Filters for each SMD. To add the second radio requires that addition of a second SMD, BPF 1, BPF 2, and PA 2 be added to the list of RF Boxes and the Interconnections tab as shown on the plan. Unused outputs on uLINK Relay 10, ADR: 043 can be used in two units to control the 4+4 switch.



SMD 2 will control PA 2 via its local PA port the same way as SMD1 controls PA 1.

"Detach RX antenna on PTT" is preferred if "in-band" SO2R operation is desired and it is possible that the receiving radio will be connected to an antenna that is not RX safe. If in band operation is not contemplated, "**Prevent TX"** will provide the classic style of "same band" lockout.

The Security tab frequency table needs to be set the same as with conventional SO2R; each band must be listed separately since we want to be able to listen on one radio while transmitting on the other.

Although the design of the 4+4 switch does not allow connecting the TX/RX port on one radio at the same time as the RX2 port on the other radio, RX2 is not protected against RF generated by same radio on another band because the protection strategy now considers each band separately. Many conflicts can be solved using Virtual Exclusivity Switches as in the example. In any case, special care should be taken to measure the isolation in all cases to be sure that there are no hazardous conflicts.

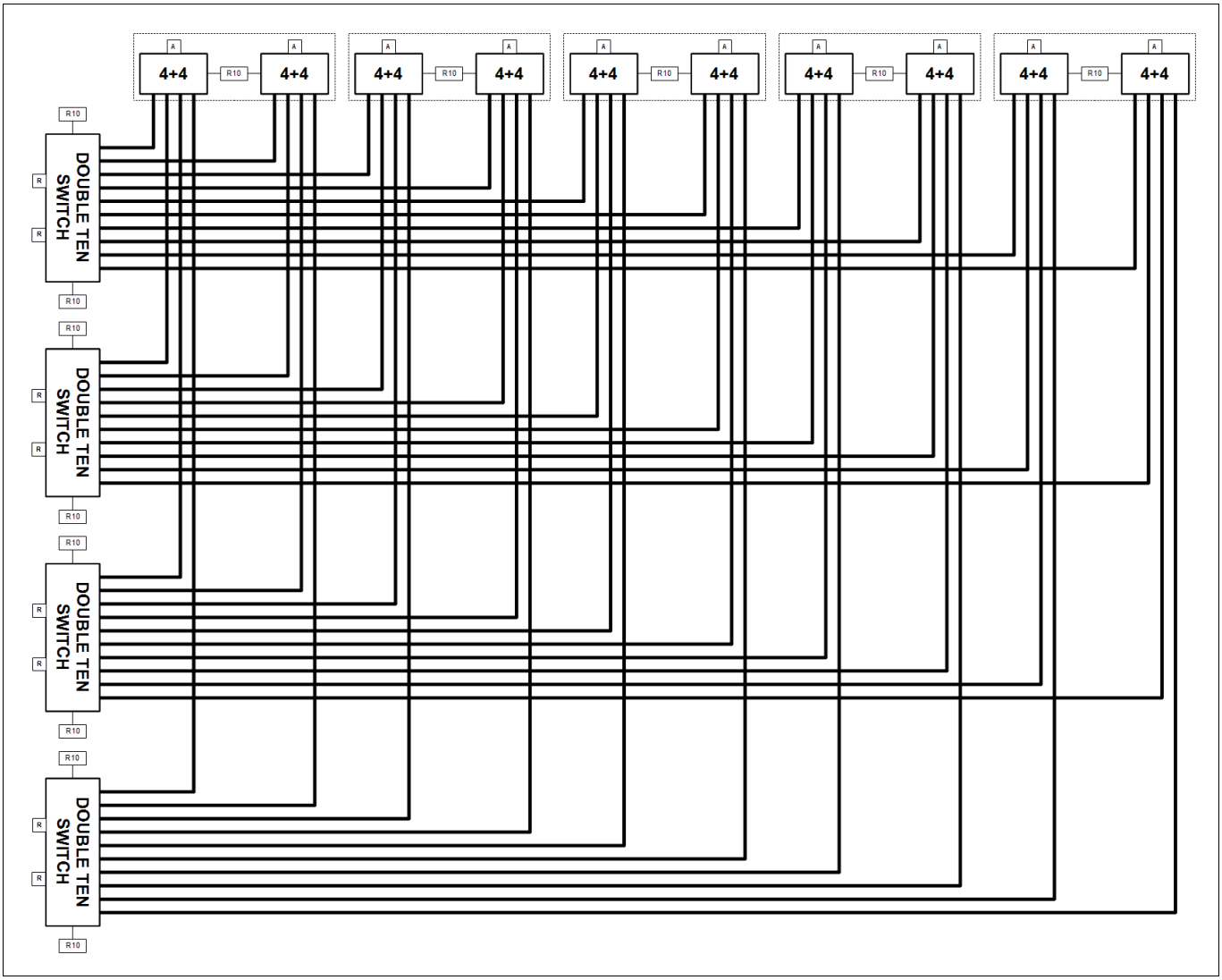
IMPORTANT: If you are unsure about isolation between antennas and intend to use RX2 ports in your setup, add Band Pass Filters for the RX2 ports of your radios!

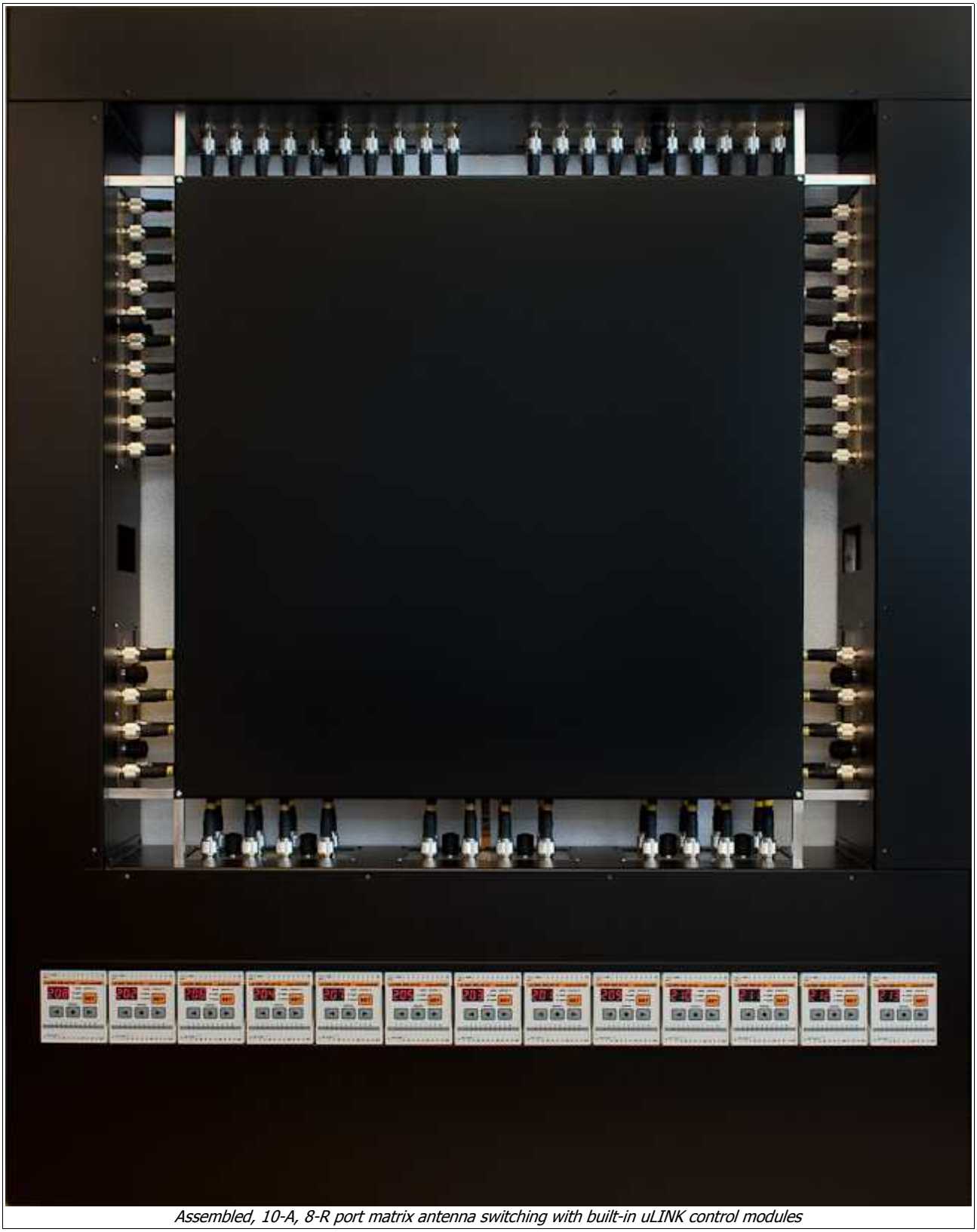
MULTI RADIO CONFIGURATION EXAMPLE

Setup requirements

So far we have examined configurations for one or two radios using the Double Ten Switch as an antenna path "expander" between the radio and antenna farm. However, since there is no fail safe commercial antenna switch with more than two radio ports, when moving to a multi-radio installation the "expander" must be constructed as a matrix. microHAM have developed the Four + Four (4+4) Switch as a building block for matrix applications; five 4+4 switches and four Double Ten Switches creates matrix switch containing ten (10) A ports and eight (8) R ports.

The matrix switch is a necessary part of any multi-radio installation and can be built using individual 4+4, and Double Ten switches or microHAM can provide a packaged matrix. Connections towards radios and antennas are no different than the non-matrix setups as explained in previous examples. If an installation requires more than eight R ports (one or more SO2R positions along with several single radio, dual RX positions) and there is no need to have more than 8 R ports connected to the radios at the same time, additional "steering" switches can be connected to the R ports of the matrix as in the advanced SO2R setup example. This allows configurations with up to 32 R ports for connecting transceivers dynamically to ten A ports. In addition, configurations capable of handling more A ports can be built using additional 4+4 and cascaded Double Ten switches.





Assembled, 10-A, 8-R port matrix antenna switching with built-in uLINK control modules

11 – SYSTEM CONSIDERATIONS

Station Master Deluxe can be used in a with variety of configurations. Your ability to use the advanced features of Station Master Deluxe will be determined entirely by the capability of your station hardware. *micro*HAM have attempted to implement these features in a way that they can be used in most installations. However, some transceivers lack the capacity (e.g., an inhibit input or "early" PTT) to safely use some of the more advanced capabilities.

The application software used with Station Master Deluxe will be the primary factor in determining the minimum computer configuration needed with Station Master Deluxe. When used with Windows based contest software like CTWin, N1MM Logger, Win-Test, and WriteLog or Windows based general purpose loggers like DXBase 2007, DXLab Suite, DX4WIN, Logger 32 and others, the *micro*HAM control and interface application "*micro*HAM Router" must run at the same time as the application program. Since both the logging programs and microHAM Router are real-time applications, system performance will be dependent on CPU speed, the amount of available RAM, and any other programs running at the same time.

Although *micro*HAM Router will run on slower computers, the minimum tested system is a 1.5 GHz processor with Windows Vista, 1GB RAM, CD-ROM, and USB 1.1 port. Whether Router can run as designed on slower machines or those with less memory and leave enough resources for application programs has not been determined. It has not been, and won't be a priority, to make it run on clunkers or discontinued operating systems.

The recommended system is at least a 2 GHz dual core processor, 2 GB of RAM, USB 2.0 port located on the motherboard, transceiver with supported control protocol and logging and/or control program.

Station Master Deluxe can be used in stand-alone mode (without a connected computer or logging software) but a computer running *micro*HAM Router will be required to configure Station Master Deluxe for proper operation.

12 – HARDWARE SPECIFICATIONS
SMD: Hardware Specifications & Connectors

USB:	USB 2.0 Full speed, USB 1.1 compatible
Power consumption:	USB – less than 100mA Power supply – max.1.8A at +13.8V (max. +16V)
CAT:	RxD, TxD – max. 57600 Baud, RTS fixed level output max.1mA Levels: TTL, inverted TTL, open collector bus, RS232
Serial:	RS232 levels, RTS fixed level output max.1mA, up to 9600 baud
PA CI-V:	open collector bus max.40mA, up to 9600 baud
All relay outputs:	30VDC, 48VAC, max.2A
External PORT A power:	max. +24V/1.3A
External PORT B power:	max. +24V/400mA
PS/2 consumption:	max. 200mA at +5V
Rotator analog input:	10K ohm, max. +/-12V
Rotator pulse input:	active when grounded, max. +24V/5mA
Rotator reference output:	9V, max. 20mA
PA Keying output:	open collector, max.+45V/800mA
PA Keying input:	active when grounded, max.+24V/5mA
PA ON/OFF control:	+12V, max.100mA
Dimensions:	**W** 305mm (12") x **H** 90mm (3.54") x **D** 132mm (5.20")
Weight:	1.8 kg (4 lbs)

PORT A, DB25F

Pin #	Label	Description
1	EXT PWR IN	External power input for PORT A, max. +24V*
2	NC	Not connected
3	NC	Not connected
4	NC	Not connected
5	NC	Not connected
6	NC	Not connected
7	NC	Not connected
8	NC	Not connected
9	NC	Not connected
10	PORT A7	PORT A7 output
11	PORT A8	PORT A8 output
12	PORT A9	PORT A9 output
13	PORT A10	PORT A10 output
14	NC	Not connected
15	NC	Not connected
16	NC	Not connected
17	NC	Not connected
18	EXT PWR GND	Power ground. Connect return of external PORT A common power to this pin.*
19	CONTROL GND	Power ground. Connect control cable shield to this pin.
20	PORT A1	PORT A1 output
21	PORT A2	PORT A2 output
22	PORT A3	PORT A3 output
23	PORT A4	PORT A4 output
24	PORT A5	PORT A5 output
25	PORT A6	PORT A6 output
SHELL	GND	Connected to the system ground and case.

* When using an external power supply, connect the positive terminal to pin 1, the negative terminal to pin 18 and move the Port A jumpers to EXT/SRC. Never exceed +24V and do not reverse polarity!

PORT B, DB25F

Pin #	Label	Description
1	EXT PWR IN	External power input for PORT B, max. +24V*
2	NC	Not connected
3	NC	Not connected
4	COM	Common output. Output depends on jumpers configuration.
5	NC	Not connected
6	PORT B7-COM	PORT B7 common**
7	PORT B8-COM	PORT B8 common**
8	PORT B9-COM	PORT B9 common**
9	PORT B10-COM	PORT B10 common**
10	PORT B7-NO	PORT B7 output, Normally Open
11	PORT B8-NO	PORT B8 output, Normally Open
12	PORT B9-NO	PORT B9 output, Normally Open
13	PORT B10-NO	PORT B10 output, Normally Open
14	NC	Not connected
15	NC	Not connected
16	NC	Not connected
17	NC	Not connected
18	EXT PWR GND	Power ground. Connect return of external PORT B common power to this pin.*
19	CONTROL GND	Power ground. Connect control cable shield to this pin.
20	PORT B1	PORT B1 output
21	PORT B2	PORT B2 output
22	PORT B3	PORT B3 output
23	PORT B4	PORT B4 output
24	PORT B5	PORT B5 output
25	PORT B6	PORT B6 output
SHELL	GND	Connected to the system ground and case.

* When using an external power supply, connect the positive terminal to pin 1, the negative terminal to pin 18 and move the Port B jumpers to EXT/SRC. Never exceed +24V and do not reverse polarity!

** If PORTs 7-10 need to share a common with PORTs 1-6, connect this pin to pin 4.

PA, DB15F

Pin #	Label	Description
1	BAND DATA A	TTL level BCD band data output bit 0
2	BAND DATA B	TTL level BCD band data output bit 1
3	BAND DATA C	TTL level BCD band data output bit 2
4	BAND DATA D	TTL level BCD band data output bit 3
5	CI-V	CI-V port
6	KEYIN	Keying Input, connect to the PA KEY Output
7	KEYOUT	Keying Output, max.+45V/800mA
8	+12 OUT	+12V output, max.200mA. Output depends on main SMD power
9	POWER SW	+12V output, max.100mA. Output for remote PA ON/OFF control
10	NC	Not connected
11	GND	Connected to the system ground and case.
12	GND	Connected to the system ground and case.
13	GND	Connected to the system ground and case.
14	GND	Connected to the system ground and case.
15	GND	Connected to the system ground and case.
SHELL	GND	Connected to the system ground and case.

ROTOR, DB15F

Pin #	Label	Description
1	+12 OUT	+12V output, max.200mA. Output depends on main SMD power.
2	CW-NC	Relay output for CW direction, normally closed
3	CW-COM	Relay output for CW direction, common
4	AUX-NO	Relay output for AUX output, normally open
5	CCW-NC	Relay output for CCW direction, normally closed
6	CCW-COM	Relay output for CCW direction, common
7	REF	+9V reference output, max. 20mA (450 ohm)
8	ANALOG GND	Analog return for ANALOG IN input
9	GND	Connected to the system ground and case.
10	CW-NO	Relay output for CW direction, normally open
11	AUX-NC	Relay output for AUX output, normally closed
12	AUX-COM	Relay output for AUX output, common
13	CCW-NO	Relay output for CCW direction, normally open
14	PULSE IN	Discrete input, max.5V/5mA
15	ANALOG IN	Analog input, Rin = 10K ohm, max +/-12V
SHELL	GND	Connected to the system ground and case.

IMPORTANT: The CW, CCW and AUX relays are rated at 24V AC/DC, 3A maximum. If your rotator will exceed these values, use external 12V power relays. Power for these relays can be supplied from pin 1, +12V OUT.

SERIAL, DB9F

Pin #	Label	Description
1	NC	Not connected
2	RXD	RS232 level data input to SM
3	TXD	RS232 level data output from SM
4	NC	Not connected
5	GND	Connected to the system ground and case.
6	NC	Not connected
7	RTS	+12V output, max.1mA. Connected to input power via 10K ohm resistor.
8	NC	Not connected
9	NC	Not connected
SHELL	GND	Connected to the system ground and case.

iLINK, MINIDIN6

Pin #	Label	Description
1	DATA	TTL iLINK DATA line
2	IC	Internally connected to pin.2 of another iLINK jack
3	GND	Connected to the system ground and case.
4	+5V OUT	+5V output, max.200mA.
5	CLOCK	TTL iLINK CLOCK line
6	IC	Internally connected to pin.6 of another iLINK jack
SHELL	GND	Connected to the system ground and case.

PS/2, MINIDIN6

Pin #	Label	Description
1	DATA	TTL PS/2 DATA line
2	RESPAD	Input for resistive keypad, max.+5V/1mA
3	GND	Connected to the system ground and case.
4	+5V OUT	+5V output, max.200mA.
5	CLOCK	TTL PS/2 CLOCK line
6	NC	Not connected
SHELL	GND	Connected to the system ground and case.

CAT, 4 pole 3.5mm phone jack

Pin #	Label	Description
TIP	TXD	CAT DATA output from SM
RING1	RXD	CAT DATA input to SM
RING2	RTS	+12V output, max.1mA. Connected to input power via 10K ohm resistor.
SLEEVE	GND	Connected to the system ground and case.

IMPORTANT: Don't forget to configure the CAT jumper matrix as required for your transceiver.

uLINK HUB: Hardware Specifications & Connectors

Power consumption: Power supply – max. 500mA at +13.8V (max. +15V)

Bus: Two wire differential RS-485, max. 7V at 120 ohm

Dimensions: **W** 100mm (3.9") x **H** 75mm (2.9") x **D** 110mm (4.3")

Weight: 250 g (9 oz)

Terminals description:

Top row from left	Description	Bottom row from left	Description
SH	uLINK CAT5 cable shield - SMD #3	Earth	Grounding terminal
R	uLINK return - SMD #3	-	Return for power supply
+	uLINK power output - SMD #3, max. 100mA	+	Positive Power input +12-15V
B	uLINK data B - SMD #3	B	uLINK data B
A	uLINK data A - SMD #3	A	uLINK data A
B'	uLINK data B - SMD #3	SH	uLINK CAT5 cable shield - SMD #1
A'	uLINK data A - SMD #3	R	uLINK return - SMD #1
SH	uLINK CAT5 cable shield - SMD #4	+	uLINK power output - SMD #1, max. 100mA
R	uLINK return - SMD #4	B	uLINK data B - SMD #1
+	uLINK power output - SMD #4, max. 100mA	A	uLINK data A - SMD #1
B	uLINK data B - SMD #4	B'	uLINK data B - SMD #1
A	uLINK data A - SMD #4	A'	uLINK data A - SMD #1
B'	uLINK data B - SMD #4	SH	uLINK CAT5 cable shield - SMD #2
A'	uLINK data A - SMD #4	R	uLINK return - SMD #2
SH	uLINK CAT5 cable shield	+	uLINK power output - SMD #2, max. 100mA
R	uLINK return	B	uLINK data B - SMD #2
+	N/C	A	uLINK data A - SMD #2
B	uLINK data B	B'	uLINK data B - SMD #2
A	uLINK data A	A'	uLINK data A - SMD #2

uLINK RELAY10: Hardware Specifications & Connectors

Power consumption: Power supply – max. 1.5A at +13.8V (max. +15V)

Bus: Two wire differential RS-485, max. 7V at 120 ohm

Outputs: 10 isolated SPST contacts, shared common
Contacts rating: 3A/125VAC/30VDC

Dimensions: **W** 70mm (2.7") x **H** 75mm (2.9") x **D** 110mm (4.3")

Weight: 400 g (9 oz)

uLINK RELAY10 terminals description:

Top row from left	Description	Bottom row from left	Description
+12 OUT	Power output, internally connected to bottom plus terminal, max. 1.3A	Earth	Grounding terminal
C	Relays contact common pole	-	Return for power supply
GND	Power ground, internally connected to bottom minus and Earth terminal	+	Positive Power input +12-15V, max. 1.5A
1	Relay 1 contact pole, Normally open	G	Return for tamper input, internally connected to minus and Earth terminal
2	Relay 2 contact pole, Normally open	IN	Tamper input, max. +12V, 3mA
3	Relay 3 contact pole, Normally open	R	uLINK return, internally connected to R'
4	Relay 4 contact pole, Normally open	B	uLINK data B, internally connected to B'
5	Relay 5 contact pole, Normally open	A	uLINK data A, internally connected to A'
6	Relay 6 contact pole, Normally open	SH	uLINK CAT5 cable shield, isolated from SH'
7	Relay 7 contact pole, Normally open	R'	uLINK return, internally connected to R
8	Relay 8 contact pole, Normally open	B'	uLINK data B', internally connected to B
9	Relay 9 contact pole, Normally open	A'	uLINK data A', internally connected to A
10	Relay 10 contact pole, Normally open	SH'	uLINK CAT5 cable shield

uLINK RELAY6: Hardware Specifications & Connectors

Power consumption: Power supply – max. 150mA at +13.8V (max. +15V)

Bus: Two wire differential RS-485, max. 7V at 120 ohm

Outputs: 6 isolated SPST contacts
Contacts rating: 3A/125VAC/30VDC

Dimensions: **W** 70mm (2.7") x **H** 75mm (2.9") x **D** 110mm (4.3")

Weight: 350 g (9 oz)

uLINK RELAY6 terminals description:

Top row from left	Description	Bottom row from left	Description
GND	Power ground, internally connected to bottom minus and Earth terminal	Earth	Grounding terminal
1	Relay 1 contact pole 1, Normally open	-	Return for power supply
1'	Relay 1 contact pole 2, Normally open	+	Positive Power input +12-15V, max. 1.5A
2	Relay 2 contact pole 1, Normally open	G	Return for tamper input, internally connected to minus and Earth terminal
2'	Relay 2 contact pole 2, Normally open	IN	Tamper input, max. +12V, 3mA
3	Relay 3 contact pole 1, Normally open	R	uLINK return, internally connected to R'
3'	Relay 3 contact pole 2, Normally open	B	uLINK data B, internally connected to B'
4	Relay 4 contact pole 1, Normally open	A	uLINK data A, internally connected to A'
4'	Relay 4 contact pole 2, Normally open	SH	uLINK CAT5 cable shield, isolated from SH'
5	Relay 5 contact pole 1, Normally open	R'	uLINK return, internally connected to R
5'	Relay 5 contact pole 2, Normally open	B'	uLINK data B', internally connected to B
6	Relay 6 contact pole 1, Normally open	A'	uLINK data A', internally connected to A
6'	Relay 6 contact pole 2, Normally open	SH'	uLINK CAT5 cable shield

uLINK ROTATOR: Hardware Specifications & Connectors

Power consumption: Power supply – max. 150mA at +13.8V (max. +15V)

Bus: Two wire differential RS-485, max. 7V at 120 ohm

Outputs: 3 isolated SPDT contacts CW, AUX, CCW
Contacts rating: 16A/250VAC/30VDC

Reference output 9V, max.20mA

Inputs: Analog, Rin = 10kohm, max. +/- 12V
Pulse, max. 24V/5mA

Dimensions: **W** 70mm (2.7") x **H** 75mm (2.9") x **D** 110mm (4.3")

Weight: 400 g (9 oz)

uLINK ROTATOR terminals description:

Top row from left	Description	Bottom row from left	Description
GND	Power ground, internally connected to bottom minus and Earth terminal	Earth	Grounding terminal
S	Analog input, Rin = 10K ohm, max +/-12V	-	Return for power supply
REF	+9V reference output, max. 20mA (450 ohm)	+	Positive Power input +12-15V, max. 1.5A
P	Pulse input, max. 24V/5mA	G	Return for tamper input, internally connected to minus and Earth terminal
CCW NC	Relay output, CCW direction, normally closed	IN	Tamper input, max. +12V, 3mA
CCW COM	Relay output, CCW direction, common	R	uLINK return, internally connected to R'
CCW NO	Relay output, CCW output, normally open	B	uLINK data B, internally connected to B'
AUX NC	Relay output, AUX direction, normally closed	A	uLINK data A, internally connected to A'
AUX COM	Relay output, AUX direction, common	SH	uLINK CAT5 cable shield, isolated from SH'
AUX NO	Relay output, AUX output, normally open	R'	uLINK return, internally connected to R
CW NC	Relay output, CW direction, normally closed	B'	uLINK data B', internally connected to B
CW COM	Relay output, CW direction, common	A'	uLINK data A', internally connected to A
CW NO	Relay output, CW output, normally open	SH'	uLINK CAT5 cable shield

uLINK DATA: Hardware Specifications & Connectors

Power consumption: Power supply – max. 200mA at +13.8V (max. +15V)

Bus: Two wire differential RS-485, max. 7V at 120 ohm

Outputs: **OPT** Collector and emitter of internal PC817 opto-coupler, max. 10mA
O1, O2 Open collector output, max. +45V/800mA
BAND DATA, TTL outputs, max. 5mA
Serial port, RS232 levels, max 5mA
CI-V bus, open collector driver, less than 1mA input current, max. 20mA load

Inputs: **I1, I2** max. 24V/5mA

Dimensions: **W** 70mm (2.7") x **H** 75mm (2.9") x **D** 110mm (4.3")

Weight: 300 g (9 oz)

uLINK DATA terminals description:

Top row from left	Description	Bottom row from left	Description
+	12V power output, internally connected to fused power input, max. 100mA	Earth	Grounding terminal
C	Collector of the opto-coupler, max. 10mA	-	Return for power supply
E	Emitter of the opto-coupler, max. 10mA	+	Positive Power input +12-15V, max. 1.5A
O1	Open collector output, max. +45V/800mA	G	Return for tamper input, internally connected to minus and Earth terminal
I1	Input, max. +24V, 5mA	IN	Tamper input, max. +12V, 3mA
O2	Open collector output, max. +45V/800mA	R	uLINK return, internally connected to R'
I2	Input, max. +24V, 5mA	B	uLINK data B, internally connected to B'
CI-V	CI-V bus port	A	uLINK data A, internally connected to A'
GND	Return, internally connected to bottom minus and Earth terminal	SH	uLINK CAT5 cable shield, isolated from SH'
TX/A	Data TX output/Band data output, bit A, max. 5mA	R'	uLINK return, internally connected to R
RX/B	Data RX input/Band data output, bit B, max. 5mA	B'	uLINK data B', internally connected to B
RTS/C	Data RTS output/Band data output, bit C, max. 5mA	A'	uLINK data A', internally connected to A
CTS/D	Data CTS input/Band data output, bit D, max. 5mA	SH'	uLINK CAT5 cable shield

13 - PACKAGE CONTENTS

The product includes STATION MASTER Deluxe, USB cable, miniDIN 6 to miniDIN 6 cable, RCA to RCA cable, coaxial 2.1mm/5.5mm power plug and CD-ROM containing the microHAM USB Device Router program and documentation.

If the shipment is incomplete, please contact your supplier or us at the following address:

E-mail: support@microham.com

fax : +421 2 4594 5100

by Post: **microHAM s.r.o.**
Nadrazna 36
90028 Ivanka pri Dunaji
SLOVAKIA

14 – WARRANTY

microHAM warrants STATION MASTER Deluxe and uLINK modules for three (3) years. The product must not be modified in any way except configuration, or the warranty is voided. The warranty does not cover damage caused by improper or abnormal use, failure to follow instructions, improper installation, lightning, or excessive voltage. The product will be either repaired or replaced, at our discretion. The only cost will be the cost of return shipping.

Cables are warranted against defects in materials and workmanship for a period of 60 days.

*micro*HAM USB Device Router (the software) is provided “as is” without guarantee of compatibility with any specific operating system, computer, hardware or accessory.

*micro*HAM assumes no liability or responsibility for damage to other devices or injuries to persons as a consequence of using our products.

If the terms of the above warranty are not acceptable, return the unit, all associated documents and accessories in the original package, prepaid, to microHAM or to your supplier for refund less shipping and restocking fee.

DECLARATION OF CONFORMITY

Federal Communications Commission Statement (USA)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

European Union Declaration of Conformity

***micro*HAM, s.r.o. declares that the products:**

Product Name: STATION MASTER Deluxe

Conforms to the following Product Specifications:

EN 55022: 1998 Class B following the provisions of the Electromagnetic Compatibility Directive 89/336/EEC