

Master Development System User's Guide



This Guide Covers:

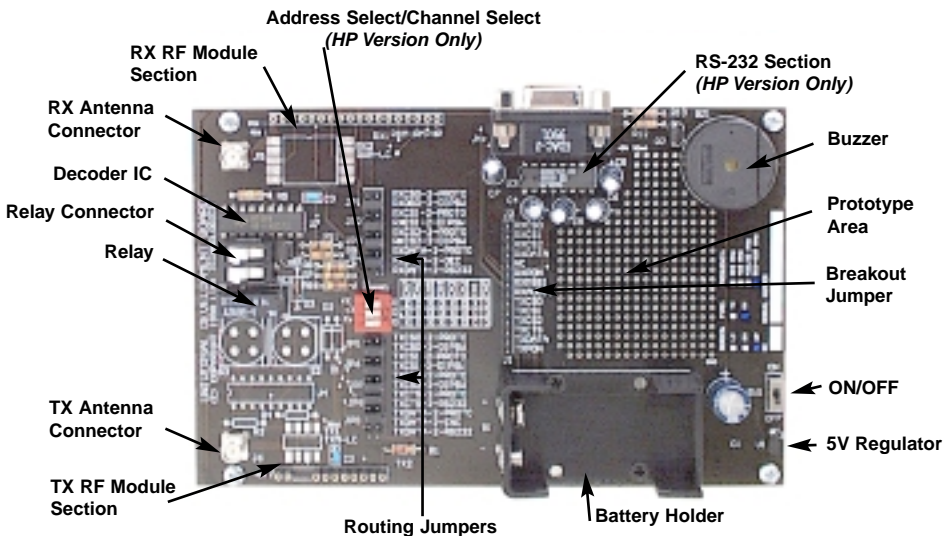
PART #	DESCRIPTION
MDEV-315-LC	Master System for LC-315 MHz
MDEV-418-LC	Master System for LC-418 MHz
MDEV-433-LC	Master System for LC-433 MHz
MDEV-418-RM	Master System for RM-418 MHz
MDEV-433-RM	Master System for RM-433 MHz
MDEV-900-HP	Master System for HP-900 MHz

INTRODUCTION:

Linx RF modules offer a simple, efficient, and cost-effective method of making a product wireless. The Master Development system is intended to give a designer all the tools necessary to correctly and legally incorporate Linx modules into an end product. The development boards themselves serve several important functions.

- **Rapid Module Evaluation** - The boards allow the performance of a Linx module family to be evaluated quickly in a user's environment.
- **Range Testing** - Using the on-board encoders and decoders, a pair of development boards can be used to evaluate the range-performance of Linx modules.
- **Design Benchmark** - During the design process of your product, the boards provide a known benchmark against which the performance of your design may be judged.
- **Application Development** - An on-board prototyping area is provided to allow a designer to develop applications directly on the development board. Using the on-board jumpers, all transmitter and receiver signals can be routed to a wire-wrap header for easy connection to the designer's circuit.
- **Protocol Development** - The MDEV-900-HP model boardset allows a designer to connect the data signals from the transmitter and receiver to an industry-standard RS-232 port to support protocol development.

The purpose of this guide is to show the designer how to take full advantage of the master development boards included with the Master Evaluation Kit.



USE AND OPERATION:

The functions of the master development board are controlled by a series of 9 jumpers (JP1-JP9) which route the transmitter and receiver signals to the appropriate circuitry.

JP1	RXCS0-2-PROTO	HP RX Channel Select 0 routed to Proto area
	RXCS0-2-DIPSW*	HP RX Channel Select 0 routed to Decoder Address DIP switch
JP2	RXCS1-2-PROTO	HP RX Channel Select 1 routed to Proto area
	RXCS1-2-DIPSW*	HP RX Channel Select 1 routed to Decoder Address DIP switch
JP3	RXCS2-2-PROTO	HP RX Channel Select 2 routed to Proto area
	RXCS2-2-DIPSW*	HP RX Channel Select 2 routed to Decoder Address DIP switch
JP4	RXDATA-2-PROTO	RX Data routed to Proto area
	RXDATA-2-DEC*	RX Data routed to Decoder
	RXDATA-2-RS232	HP RX Data routed to RS232

	HP Only
	All Modules
	HP & RM Only
	Default

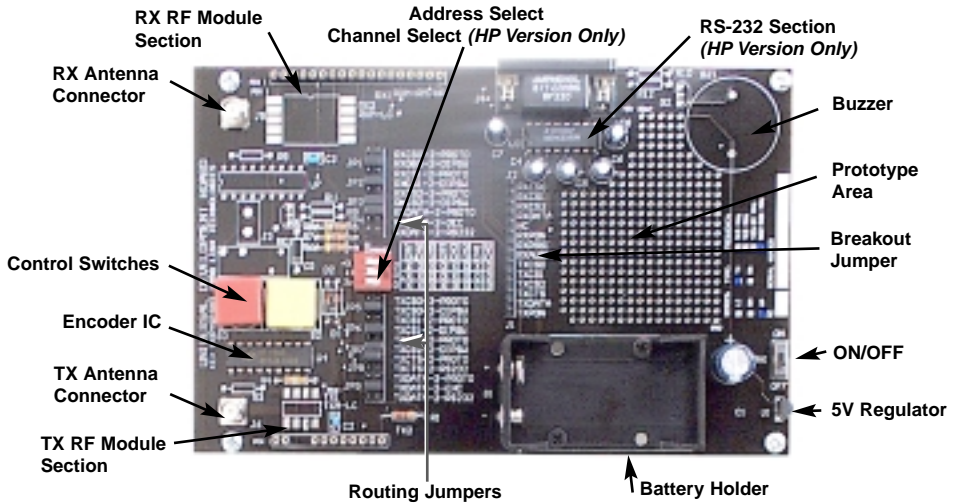
Jumper Blocks 1-4 Function

JP1-JP3 are used with Linx HP series receivers to determine how the receiver channels are selected. If JP1-JP3 are jumpered in the position labeled "RXCS-2-PROTO", the channel-select lines are routed to the prototyping area. This is the desired position if the designer is building a circuit in the prototyping area that needs control over the channel-selection lines.

If JP1-JP3 are jumpered in the position labeled "RXCS-2-DIPSW", the channel-select lines are wired to the DIP switch (S1). This is the position for range testing and protocol development. In this position, the DIP switch controls both the address of the encoder/decoder pair and the channel selection of the receiver.

JP4 is used with all module types to determine where the receiver's data output is routed. If JP4 is in the position labeled "RXDATA-2-PROTO", receiver's data output will be routed to the prototyping area for connection to a user's circuit. If JP4 is in the position labeled "RXDATA-2-DEC", the data output from the receiver is routed to the Holtek decoder chip for range testing. For the HP kit which includes RS-232-capability, placing JP4 in the position labeled "RXDATA-2-RS232", routes the data output of the receiver to the RS-232 port for protocol development.

The remainder of the receiver signals are not used by any of the circuitry on the master development board, and are routed directly to the breakout header in the prototyping area for applications development. Please note that availability of the labeled functions is dependent on the module series with which the board is populated.



JP5	<ul style="list-style-type: none"> ■ TXCS0-2-PROTO ● TXCS0-2-DIPSW* 	<ul style="list-style-type: none"> HP TX Channel Select 0 routed to Proto area HP TX Channel Select 0 routed to Encoder Address DIP switch
JP6	<ul style="list-style-type: none"> ■ TXCS1-2-PROTO ● TXCS1-2-DIPSW* 	<ul style="list-style-type: none"> HP TX Channel Select 1 routed to Proto area HP TX Channel Select 1 routed to Encoder Address DIP switch
JP7	<ul style="list-style-type: none"> ■ TXCS2-2-PROTO ● TXCS2-2-DIPSW* 	<ul style="list-style-type: none"> HP TX Channel Select 2 routed to Proto area HP TX Channel Select 2 routed to Encoder Address DIP switch
JP8	<ul style="list-style-type: none"> ■ TXCTS-2-PROTO ■ TXCTS-2-RS232 	<ul style="list-style-type: none"> HP TX CTS routed to Proto area HP TX CTS routed to RS232
JP9	<ul style="list-style-type: none"> ■ TXDATA-2-PROTO ■ TXDATA-2-ENC* ■ TXDATA-2-RS232 	<ul style="list-style-type: none"> TX Data routed to Proto area TX Data routed to Encoder TX Data routed to RS232

■	HP Only
■	All Modules
■	HP & RM Only
*	Default

Jumper Blocks 5-9 Function

JP5-JP8 are used with the HP series transmitter modules. They are identical to JP1-JP3 except that they apply to the channel-select lines of the transmitter.

JP8 routes the Clear-To-Send "CTS" output signal from the HP transmitter. If JP8 is in the position labeled "TXCTS-2-PROTO", the "CTS" signal is routed to the prototyping area to support applications development. If JP8 is in the position labeled "TXCTS-2-RS232", the "CTS" signal from the transmitter is routed to the RS-232 port for protocol development.

JP9 routes the transmitter data input signal for all module types. If JP9 is in the position labeled "TXDATA-2-PROTO", the data input to the transmitter is routed to the prototyping area to support applications development. If JP9 is in the position labeled "TXDATA-2-ENC", the data is routed to the Holtek encoder to support range testing. For the HP kit which includes RS-232 capability, placing JP9 in the position labeled "TXDATA-2-RS232", routes the transmitter's data input to the RS-232 section.

All signals routed to the prototyping area are made available at the wire-wrap header labeled "J1/J2". J1 designates the section of the header which pertains to the transmitter module, while J2 refers to the header section dealing with the receiver signals.

●	RXCS0	HP RX Channel Select 0
●	RXCS1	HP RX Channel Select 1
●	RXCS2	HP RX Channel Select 2
■	RXDATA	RX Data Output
■	PLLPROG	Not Used
■	RXPDN	HP RX Power-down
○	RXRSSI	Carrier Detect
○	RXAUDIO	HP RX Analog/Audio out
●	TXCS0	HP TX Channel Select 0
●	TXCS1	HP TX Channel Select 1
●	TXCS2	HP TX Channel Select 2
●	TXCTS	HP TX Clear-To-Send
■	TXDATA	TX Data Input
■	TXPDN	HP TX Power-down

Breakout Header Positions

RANGE TESTING

To facilitate range testing, the universal demo board features a remote-control encoder with 2 push buttons and a decoder with a relay output and a buzzer. When a button is pressed, the status of both buttons along with the address of the 3-position DIP switch is captured and encoded into a data stream for transmission.

The data recovered by the receiver is presented to the decoder IC for decoding. If the transmitted address matches that of the receiver's address setting, the decoder's pin status will be set to replicate that of the transmitter.

NOTE: The position of the address DIP switches must match on both the transmitter and receiver boards in order for the transmission to be considered valid and the decoder outputs to change.

Range testing requires two development boards. One should be populated with a transmitter, the other with a receiver. To use the master development board for range-testing purposes, set the jumpers as follows:

The address DIP switch (S1) must be set to the same setting on both development boards. When using the board with HP series modules this switch setting will also control the channel selection as shown in the HP series design guide.

To perform a range test, place the receiver board on a flat surface and turn it on. Turn on the transmitter board and press button (S3). You should hear the buzzer on the receiver board sound. You may now walk away from the receiver to determine the maximum usable range of the link in your environment.

Another simple but often overlooked range-testing method is to hold down or bridge the buzzer button so that a continuous transmission is made and then walk with the receiver side for testing.

The button (S2) activates the relay on the receiver board. The relay's SPST contacts are provided for external connection at (J3). Any device up to 5 amps at 30VDC/120VAC may be switched through the relay. Most commonly an external siren or light would be connected to aid in range testing if the on-board buzzer is not loud enough.

**NOTE* Due to the large packet structure and low data rate of the ENC/DEC IC's, it is normal for bit errors to cause the buzzer or relay to occasionally "cut out" as you move around. When you are stationary and the buzzer no longer sounds the maximum effective range of the link has been reached.*

To achieve maximum range, keep objects such as your hand away from the antenna and ensure that the antenna on the transmitter board has a clear and unobstructed line-of-sight path to the receiver board. Range-performance is determined by many interdependent factors. If the range you are able to achieve is significantly less than specified by Linx for the module type you are testing, then there is likely a problem either with the board or the ambient RF environment in which the board is operating. First, check the battery, routing of all jumpers, DIP- switch positions, and antenna positions. If the board checks out, try the test in another area or on another channel. You could be close to a high level interferer. If you are using an HP series module you can also measure the receiver's RSSI value with the transmitter turned off. If this level is higher than the baseline value indicated in the HP data guide, the link's range is likely being affected by external interference. If none of these checks reveals the source of the problem Linx technical support should be contacted.

PROTOCOL DEVELOPMENT USING RS-232 (HP ONLY)

The development board for the HP series includes an on-board RS-232 transceiver and standard D-sub 9-pin female connector. A straight-through 9-pin extension cable (not included) can be used to connect the universal development board directly to a 9-pin com: port of a personal computer. The evaluation board is considered a DCE device and as such designed to be connected using a straight-thru serial extension cable. Do not use a Null-modem cable as the boards will not function.

To use the master development board for protocol development, set the jumpers to route all signals to the RS-232 section. For one-way simplex protocol development, populate one development board with an HP receiver and the other with a transmitter. For two-way half-duplex transceiver applications, a transmitter and receiver will be populated on each board. Each board will need an additional antenna and logic circuitry will need to be added in the prototyping area in order to facilitate the power-up and -down status of the modules.

The development system is supplied with Windows-based software. This software allows for testing and illustrates basic implementation of the modules as a wireless serial link. Documentation for the software may be found in the program's readme file. Of course, user-created software or a common terminal emulation program such as Hyperterminal may also be employed. Hyperterminal is a free program that comes with Windows 95 and Windows 98. It will allow you to connect two PC's together and transfer text files.



Master Development Kit Software

Before you try wireless transfers, check to insure that both computers are successfully set up and communicating when hardwired. To do this, hook a null-modem cable directly between the two PC's. The cable should be attached to the same com: port you will be using for the evaluation boards. Use the software that will be employed to test the link. If data is successfully transferred, reconnect the development boards with straight-through cables and test the wireless link.

It is important to understand that the development boards are transparent. That is, the user's software is entirely responsible for controlling the timing and error-correction aspects of the link. The evaluation boards have no provision to check or qualify the incoming data. When designing a protocol to transfer data across a wireless link, it is very important to remember that interference is inevitable. The protocol must support error detection and correction if it is to be successful. A correctly designed protocol will provide optimum performance and throughput for product-specific applications while taking into account the timing and data-rate requirements of the Linx RF module being utilized. For further information on protocol considerations please refer to the Linx application note #00160 and your module's data guide.

If the designer needs to develop protocols using a physical implementation other than an RS-232 interface, the designer can build the custom interface circuitry in the prototyping space and change the jumpers to route the transmitter and receiver data signals to the prototyping area. See the next section for instructions for doing this.

APPLICATIONS DEVELOPMENT

A designer wishing to use the development board to develop an application directly may route the necessary signals from the transmitter and receiver to the prototyping area in order to build custom application circuits.

For HP series modules, if the user's circuit does not directly control the channel-select lines of the transmitter and receiver, the designer can route the channel-select lines to the channel-selection dip switch (S1) by setting JP1-JP3 and JP5-JP7 in the position labeled "RXCS#-2-DIPSW" and "TXCS#-2-DIPSW" to allow channel selection via the DIP switch. Set the remaining jumpers, JP4 and JP8-JP9, to route the desired signals to the prototyping area.

J1/J2 is a wire-wrap header that is provided as an easy access point to transmitter and receiver signals. All signals that have been routed to the prototyping area via their respective jumpers are available at this header. If a signal is not routed to the prototyping area header via its respective jumper, then it is not available on J1/J2, even though the silk-screen nomenclature indicates that it is.

Regulated +5 volts is available on the column of holes next to the label C8. Ground is available on the column of holes closest to the battery holder (B1).

NOTE: The on-board 5-volt regulator has approximately 30mA of headroom available for user's circuitry. If an additional current capacity is required, the user must add an additional regulator to the prototype area.

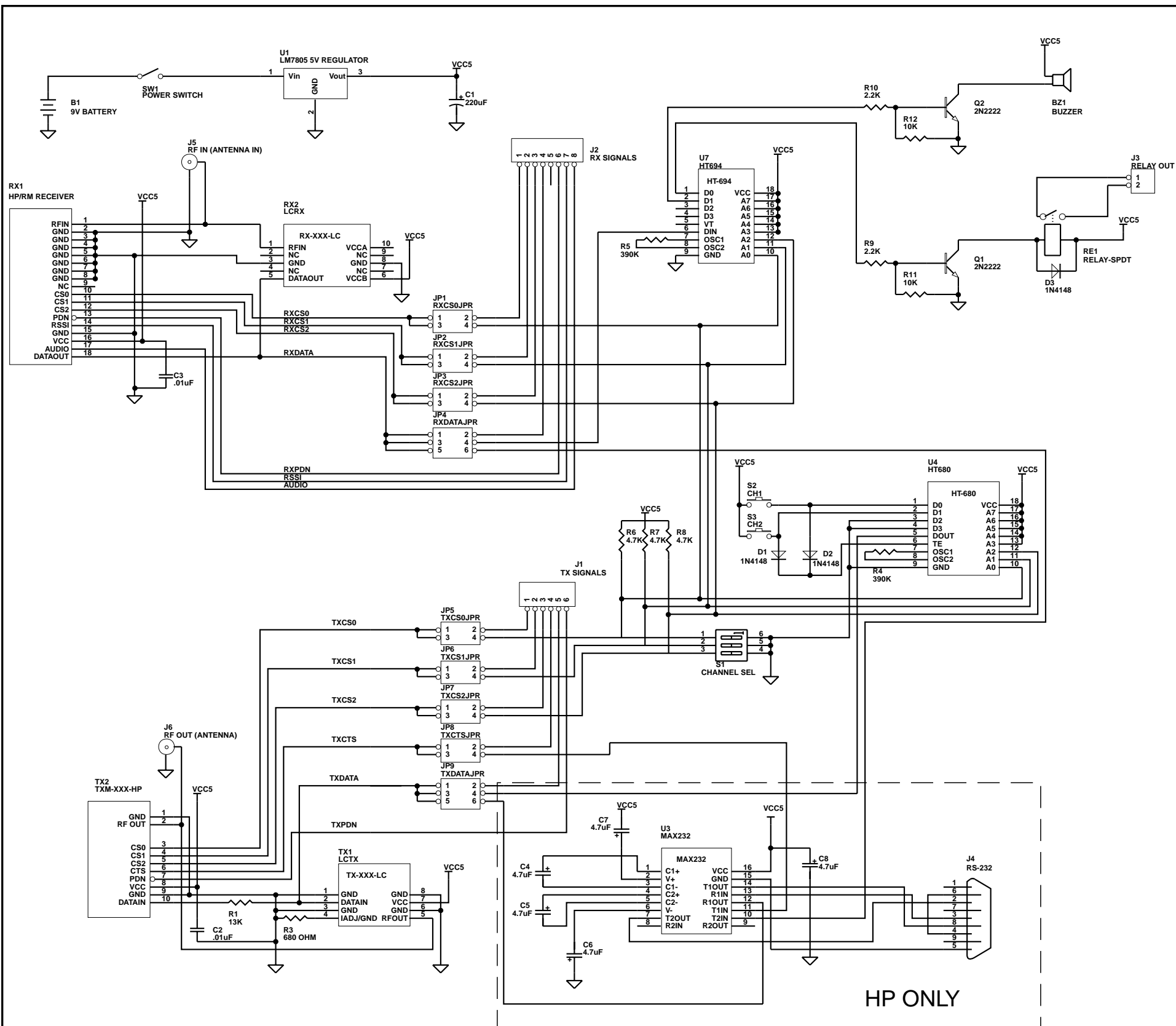
ABOUT ANTENNAS

The choice of antennas is one of the most critical and often overlooked design considerations. The range, performance, and legality of an RF link is critically dependent upon the type of antenna employed. Included with your kit are two Linx CW-series 1/4-wave connectorized whip antennas. These antennas utilize a reverse-polarity SMA connection which satisfies Part-15 requirements. They exhibit an excellent VSWR and suitably demonstrate the best practical performance that may be obtained using monopole antennas. Linx offers a wide variety of other antenna styles which you may wish to consider.

USING THE BOARDS AS A DESIGN REFERENCE

The boards demonstrate several key techniques that you may wish to incorporate into your own layout. Observe the use of a full ground-plane fill on the lower side of the board. This ground-plane serves three important purposes:

1. Since a 1/4-wave antenna is employed, the ground-plane is critical to serve as a counterpoise (read application note #00500 for additional details on how a ground-plane affects antenna function).
2. A ground-plane will suppress the transfer of noise between stages of a product as well as its unintentional radiation into free space.
3. A ground-plane allows for the use of a microstrip feed to the antenna. The term microstrip refers to a PCB trace running over a ground-plane designed to serve as a transmission line between the module and the antenna. A microstrip is implemented on these demo boards. If you are unfamiliar with microstrips you may refer to the user's guide for your Linx RF module.



TITLE
MDEV-MSCH



IN CLOSING

Here at Linx, "Wireless Made Simple" is more than just our motto, it is our commitment. A commitment to the highest caliber of product, service, and support. That is why, should you have questions or encounter any difficulties using the MDEV kit, you'll be glad to know many resources are available to assist you. First, check carefully for the obvious, then visit our website:

www.linxtechnologies.com

or call 800-736-6677 between 8AM - 4PM PST to speak with an application engineer.

Legal Notice

All Linx kits and modules are designed in keeping with high engineering standards, however; it is the responsibility of the user to insure that the products are operated in a legal and appropriate manner. The purchaser understands that legal operation may require additional permits, approvals, or certification prior to use depending on the country of operation.



WIRELESS MADE SIMPLE

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