Operating Instructions

2nd Generation

Frequency and Mode Switch Box for TIMTER™ Transmitters

P/N: QSX-AC-DSWBX

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Specifications subject to change without notice.

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1 Introduction

The 2nd Generation Quasonix switch box provides six 7 segment LED displays used to display the mode and frequency. This includes a total of five digits of frequency, in MHz, and one digit of mode selection, using Quasonix standard transmitter mode numbers. In addition, the switch box can send the LDPC code for each channel (for LDPC enabled transmitters).

A channel selector identifies which of two sets of mode, frequency, and LDPC settings is displayed.

Channel selection only works when connected to a Quasonix Dual Telemetry Transmitter. Single output transmitters default to Channel 1. Included with the switch box is an 18" MDM-9 to MDM-9 cable harness.
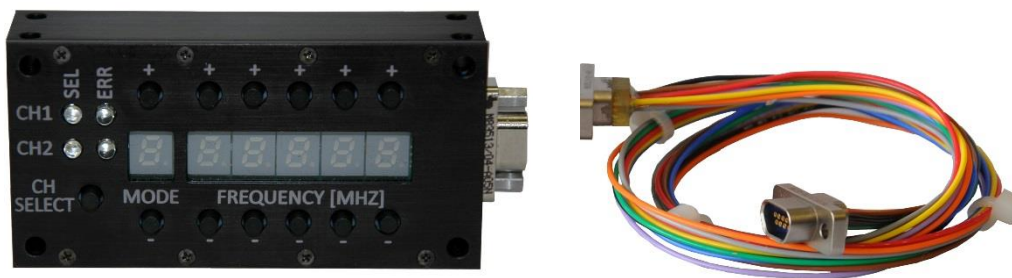
Figure 1: Frequency and Mode Switch Box for TIMTER™ Transmitters with Cable Harness

1.1 Sync to Transmitter

If a Quasonix 2nd Generation Digital Switch Box is attached to a dual transmitter, or to a single channel transmitter (some legacy transmitters excluded), and the digital switch box option is present (check the part/model number of the transmitter for DSWBX), all changes made to mode, frequency, or LDPC selections on the transmitter are sent to the switch box. This ensures the switch box settings always match those of the transmitter.

The Switch Box remembers its current settings when power is removed. When the switch box is queried on power up, it returns those settings. If the switch box is connected to a different type of transmitter (but one that supports the digital switch box) it will be reconfigured for that transmitter. This includes valid modes, frequency bands, and LDPC options, as well as single/dual operation.

2   Configuration of Channel Display

When the switch box is attached to a Dual Telemetry Transmitter, the user may toggle the display between CH1 and CH2 mode/frequency/LDPC settings using the CH Select button, as shown in Figure 2. The CH1 or CH2 LED indicator illuminates to show which channel is selected. Only one channel displays at a time.

The channel selector identifies which of two sets of mode, frequency, and LDPC settings is being displayed, as shown in Table 1.

Standard single channel transmitters default to CH1. If a user attempts to set a single channel transmitter to CH2, the word "single" is briefly displayed on the character displays, and the channel remains set to CH1.

Figure 2: 2nd Generation Switch Box Channel Selection

Table 1: Example of Two Sets of Switch Box Settings

	Mode	Frequency	LDPC
CH1	0	1435.5	1 ldpc 2
CH2	1	4440.0	2 ldpc d

The Channel Select button only changes which set of values (channel 1 or channel 2) is currently being displayed on the switch box. It does not affect, or reflect, the Dual Transmitter channel setting in any way.

Figure 3: Channel 1 Settings Example

Figure 4: Channel 2 Settings Example

3 Mode

The mode buttons allow the user to scroll up or down through the available modes on the connected transmitter, as shown in Figure 5. Numbers corresponding to Mode zero through 15 (hex F) (0-9 and A-F) may be selected. The top button (+) scrolls up from 0-F, while the bottom button (-) scrolls down from F-0. The up and down buttons wrap at zero (0) and hex 15 (F).

Valid modes are determined by the modes available on the attached transmitter. Presently, modes 0 through 14 (hex E) are supported. Invalid mode numbers are skipped as the user scrolls up or down. The digits equate to mode number, as shown below:

- 0 = ARTM Tier 0, PCM/FM

- 1 = ARTM Tier I, SOQPSK

- 2 = ARTM Tier II, ARTM (Multi-h) CPM

- 3 = BPSK (requires PSK option)

- 4 = QPSK (requires PSK option)

- 5 = AQPSK (requires PSK option)

- 6 = Carrier

- 7 = OQPSK (requires PSK option)

- 8 = UQPSK (requires PSK option)

- *9 = AUQPSK (requires PSK option)

- *10 = STDN (requires STDN option)

- *11 = SQPN (requires SQPN option)

- *12 = AFM (requires FM option)

- **13 = STC (requires STC option)

- *14 = DPM

Unless Independent mode is supported on a Dual Transmitter, the modes for CH1 and CH2 must match, or the Error LEDs blink.

* Not currently available on the Quasonix Dual Transmitter

* Not available on a single transmitter

Figure 5: 2nd Generation Switch Box Mode Selection

4   Frequency

Each of the five (5) frequency digits is selected independently using the push buttons above or below each digit, as shown in Figure 6. Numbers between zero and nine (0-9) may be selected. The top buttons (+) scroll up from 0-9, while the bottom buttons (-) scroll down from 9-0. The up and down buttons wrap at zero (0) and nine (9).The last frequency digit is 0.5 MHz, and only toggles between 0 and 5.

Figure 6: 2ⁿᵈ Generation Switch Box Frequency Selection

If the switch box is used with a transmitter that has the FO (frequency offset) option enabled, offsets CANNOT be entered via the switch box. Offset frequencies CANNOT be viewed by the switch box. The transmitter frequency rounds to the nearest 0.5 MHz within one of the allowed bands.

If the frequency is outside of the allowed range for the unit, the transmitter will not retune, but will report an error to the user and turn on the channel error LED. Note that transmitters may allow up to 10 MHz of frequency overflow outside the allowed range. In this case, the error LED on the switch box illuminates, and the frequency sent to the transmitter updates the transmitter. For example, if the switch box is set to 2200.0, the error LED is set, and the transmitter frequency is set to 2200.0, which is outside the S band range. However, attempting to set the frequency to 2190.0, results in an error LED on the switch box, and a Frequency Invalid/Frequency Not Set message on the transmitter.

5 LDPC

Note: The attached transmitter must have the LDPC option installed for the switch box LDPC Select mode to affect the transmitter settings. If LDPC is not installed on the transmitter, the switch box still functions as described in this section, but the transmitter indicates LDPC is not available.

Since only six characters are available on the switch box, the Mode and Frequency characters are also used for LDPC.

1. Enter LDPC Select mode by pressing the Channel Select button and the last + (plus) button at the same time.

    LDPC Select mode times out after four (4) seconds with no button presses. It also exits if any OTHER button is pressed on the switch box. In either case, the display reverts to Mode/Frequency. Pressing the Channel Select or Up/Down buttons to select the LDPC code resets the four second timer.

Figure 7: Select LDPC Key Press Example

When in LDPC Select mode, the switch box display shows the channel, the letters LDPC, and the current value of the LDPC code as a numerical value from 0-5, or "d" for disable, as shown in Figure 8.

Figure 8: Labeled LDPC Display Example, Channel 2, LDPC Code 2

2. Increment or decrement the LDPC code by pressing the UP (plus sign) or DOWN (minus sign) buttons corresponding to the last digit (0.1 position).

   The transmitter decides whether the LDPC mode is valid (LDPC option enabled, etc.), and how it should behave. If the LDPC selection is changed, the new value is sent to the transmitter.

   The display shows 'd' for Disable (Off), as shown in Figure 9, and 0-5 (zero through five) for LDPC codes 0-5, as shown in Figure 8. This ensures code consistency with the transmitter user interface LD command.

The available LDPC codes are:

d	Disabled
0	k=4096, r=1/2
1	k=1024, r=1/2
2	k=4096, r=2/3
3	k=1024, r=2/3
4	k=4096, r=4/5
5	k=1024, r=4/5

Transmitters with the LD option, but NOT LD6, only support codes d and 2. However, the switch box doesn't know this as it allows all settings. It is the user's responsibility to choose an allowed LDPC code and verify proper operation.
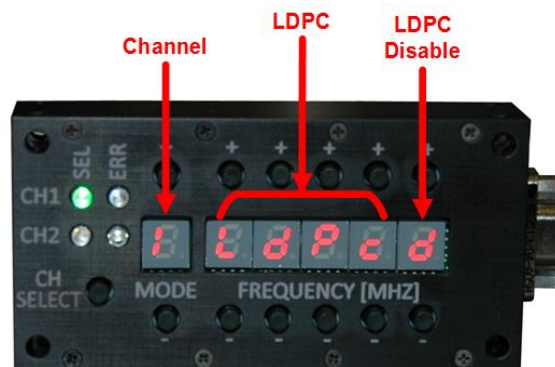

Figure 9: Labeled LDPC Display Example, LDPC Disabled

To display LDPC information for the other channel on a dual transmitter, press the Channel Select button.

6 Error LEDs

Invalid frequency or mode selections result in an error condition, illustrated by two Error LEDs. If channel frequency or mode is outside of the allowable range, the channel Error LED illuminates (Figure 10). The Error LED remains on until the error is corrected, even if the user switches channels. For example, if the user is looking at, or setting, channel 1, they will know if there is an error on channel 2 that must be corrected.

Note: Currently, dual transmitters do not support independent modulations on the two channels (coming soon). Therefore, if the modes for the two channels are not the same, BOTH Error LEDs blink (Figure 11) until the problem is corrected, regardless of other errors.

Figure 10: 2ⁿᵈ Generation Switch Box Error LEDs, One Glowing Red

Figure 11: 2ⁿᵈ Generation Switch Box Error LEDs, Two Blinking Red

7   Pinouts

The Switch Box has one external connector—a female MDM-9—shown in Figure 12 with pin locations labeled.

Figure 12: Female MDM-9 Connector

The pin assignments for the switch box MDM-9 connector are listed in Table 2.

Table 2: Switch Box Pinout

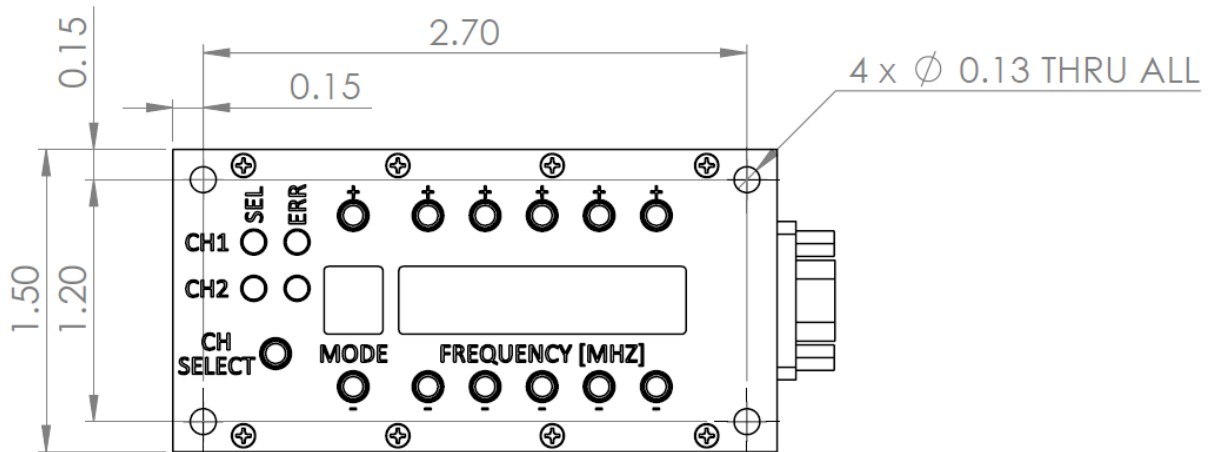| Pin	Function
1	Ground
2	I/O 1
3	SPI SCLCK
4	SPI MISO
5	Transmitter Commands to Switch Box
6	3.3 V+ Output
7	SPI MOSI
8	SPI CS
9	Switch Box Response to Transmitter

8   Drawing

Figure 13: 2ⁿᵈ Generation Switch Box Drawing

9   Switch Box Display Brightness Adjustments

The following special button combinations are used to brighten or dim LEDs or character displays.

All buttons *must be pressed at the same time*.

- LED PWM percentage increase: (CH_SEL | UP_MODE | DN_MODE)   (Figure 14)

   This button combination increases the PWM percentage for the LEDs to make them brighter. The default is 1%.

Figure 14: Increase LED Display Brightness Key Press Example

- LED PWM percentage decrease: (CH_SEL | UP_0_1 | DN_0_1)

   This button combination decreases the PWM percentage for the LEDs to make them dimmer.

- 7 segment display PWM percentage increase: (CH_SEL | UP_1000 | DN_1000)

   This button combination increases the PWM percentage for the 7 segment displays to make them brighter. The default is 20%.

- 7 segment display PWM percentage decrease: (CH_SEL | UP_1 | DN_1)

   This button combination decreases the PWM percentage for the 7 segment displays to make them dimmer.

10 Switch Box Display Parameters

This button combination enters a special mode which cycles through the current settings and switch box configuration data on the 7 segment display. Pressing any other single button exits the loop and returns the switch box to normal operation. The parameters are displayed in order, as shown in Table 3.

All four buttons *must be pressed at the same time*.

- Display system parameters: (UP_100 | DN_100 | UP_10 | DN_10)

Figure 15: Display System Parameters Example

Table 3: Internal Display Parameters for the 7 Segment Displays

Parameter	Parameter Number	Example Display	Description
FW_VERSION	0	F1.013	Firmware version
SERIAL_NUMBER	1	102435	Serial number
SWBX_CONFIG	2	dual	0=legacy, 1=dual, 2=single
CUR_CHAN	3	ch1 (ch2)	Current channel
CH1_MODE	4	0 [ch1]	Channel 1 mode
CH2_MODE	5	0 [ch2]	Channel 2 mode
CH1_FREQ	6	1 2200.5	Channel 1 frequency (MHz)
CH2_FREQ	7	1 2304.5	Channel 2 frequency (MHz)
CH1_LDPC	8	1 ldpc 1	Channel 1 LDPC code
CH2_LDPC	9	2 ldpc 1	Channel 2 LDPC code
ALLOWED_MODES	10	- 2047	Allowed modes
LED_PWM_PERCENT	11	led001	LED 1% PWM
CHAR_PWM_PERCENT	12	dsp020	Displays 20% PWM
INDEP_MODES	13	notind	Independent mode or not

11 Maintenance Instructions

The Switch Box requires no regular maintenance, and there are no user-serviceable parts inside. Please consult Quasonix for any maintenance, upgrade, or repair requirements.

12 Product Warranty

The 2nd Generation Switch Box carries a standard parts and labor warranty of one (1) year from the date of delivery.

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The customer is responsible for all costs associated with packaging and shipping of the defective Products to Quasonix's facility and clearly marking or affixing the given RMA number on the shipping label. Quasonix is not responsible for any loss or damage during shipment to Quasonix's facility. Following repair or replacement of covered Products, Quasonix will assume responsibility for the costs associated with the return of the material to the customer to an address provided by the customer. Notwithstanding the foregoing, items returned to Quasonix's facility and found to be operational or otherwise not covered by this Limited Warranty shall be returned to the customer at the customer's expense.

This Limited Warranty does not apply to expendable parts, such as cables, lamps, fuses, connectors, etc. This Limited Warranty does not extend to any Products which have been damaged or rendered defective (a) as a result of accident, misuse, abuse, or external causes; (b) by operation outside the usage parameters stated in the user documentation that shipped with the Products; (c) as a result of a failure to follow the instructions in the Operations & Maintenance Manual (d) by the use of parts not manufactured or sold by Quasonix; or (e) by modification or service by anyone other than (i) Quasonix, (ii) an Quasonix authorized service provider, or (iii) your own installation of end-user replaceable Quasonix or Quasonix approved parts if available for the Products in the servicing country.

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12.1.1 Extended Warranties

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THE REMEDIES SET FORTH IN THIS LIMITED WARRANTY STATEMENT SHALL BE THE BUYER'S SOLE AND EXCLUSIVE REMEDY AND SELLER'S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTY SET FORTH HEREIN.

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13 Technical Support and RMA Requests

In the event of a product issue, customers should contact Quasonix via phone (1-513-942-1287) or email (support@quasonix.com) to seek technical support. If the Quasonix representative determines that the product issue must be addressed at Quasonix, a returned materials authorization (RMA) number will be provided for return shipment.

Authorized return shipments must be addressed in the following manner:

<div align="center">

Quasonix, Inc.
ATTN: Repair, RMA #
6025 Schumacher Park Drive
West Chester, OH 45069

</div>

To ensure that your shipment is processed most efficiently, please include the following information with your product return:

- Ship To – Company name, address, zip code, and internal mail-drop, if applicable
- Attention/Contact person – Name, Title, Department, Phone number, email address
- Purchase Order Number – If applicable
- RMA Number – provided by the Quasonix representative

Please note that Quasonix reserves the right to refuse shipments that arrive without RMA numbers.