XTL5000 Mobile Conversion to W3 HHCH and Dual-Radio System by N3OC
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Overview

The older W3 HHCH is more available than the O3 HHCH and the W3 is the exact same HHCH that was used with the older Astro Spectra, making it easier to find and far less expensive and is supported on the XTL5000 mobile radio.

The display is not as nice as an O3 HHCH, but it is fully functional otherwise. It looks and operates much like an XTS5000 portable display. I have noticed a firmware bug in the XTL5000 software where the W3 HHCH side buttons are not correct unless the multi-radio G474 option is enabled (even if you don't use it). If that option is not enabled, the W3 HHCH will work, however the side buttons will be offset by one position and the top orange button will not be accessible. Side button upper will map to the top orange (emergency) button, side button middle will map to the top side button, side button bottom will map to the middle side button, and the bottom side button will be lost.

XTL5000 allows the user to change the head type with CPS without a flash code change, which is an improvement over the Astro Spectra. If you have a radio with a W-series TIB and you have a W3 HHCH, simply change the control head type using CPS to W3 and ignore the warnings, and connect the ignition sense lead as described in the below sections and you are done.

Keep in mind the W-series heads use the SB9600 bus, while the O-series heads use the GCAI bus. So, once you change from an O-series head, using the round USB programming cable, it will switch to the SB9600 bus and require a W-series programming cable and RS-232 port on your PC to talk to the radio again, and vice-versa.

A word about TIBs – there is a lot of information out there that you MUST have the special W3 TIB in order to use a W3 HHCH. This is NOT true. Yes, there are some implications concerning ignition switching and VIP if you use a W5/7/9 TIB with a W3 HHCH, but it CAN be done. You can run the W3 HHCH directly connected to the radio without a control cable, you can use the stock Motorola W3 HHCH control cable, or you can build your own control cable.

Radio TIB

The W3 head normally uses a special TIB (HLN6915A), which is still available from Motorola but when existing inventory is depleted, it will no longer be available. It is a bit pricey. You can also use a W5/7/9 TIB by using some alternate connections for switched ignition and loss of on-off control from the HHCH (turns on and off by ignition only).

The reason for this is the W3 TIB has additional circuitry in it for on/off and ignition lead control of SW B+ from the TIB itself. On all other types of control heads, the control head itself turns the SW B+ power on and off. This circuitry is not present in the W3 HHCH so it is moved to the W3 TIB instead. The W3 TIB also contains the VIP circuitry that is in a W5/7/9 control head, so you will not be able to use radio VIPs unless you have a real W3 TIB. But for ham use, this is really never the case so lack of VIPs should not present a problem.

The W3 TIB and the W5/7/9 TIBs have identical circuit boards, however the W3 TIB has the additional parts for on/off control placed on the board itself. This means it would be possible to convert a W9 TIB to a W3 TIB if you could manage to add all the missing surface-mounted components.

The W9 TIB can be used by directly connecting the ignition lead to the SW B+ (22) pin of the control cable connector or pin 24 of the rear accessory connector. How safe this is remains to be seen, and I am not sure if there is any surge protection on the SW B+ line directly. The radio will turn on when the ignition provides power directly to SW B+ and will turn off when it is removed. The on/off button on the HHCH will not function. But this gives a work-around if you can't get a W3 TIB or don't want to spend the money on one.

A note about XTL5000 vulnerabilities on the control head interface. You will be messing around in the area of the radio that connects the control head to the main board. This area is prone to getting blown up if you mis-wire something, resulting in the dreaded FAIL 01/90 message. Be very careful in your wiring so you don't have to make repairs to the SMD components on the main board to fix things again, such as the SB9600 bus multiplexer chip and the Zener diode packs. You have been warned, be careful. The XTL5000's are vulnerable here.

Control Cable

The original Motorola HKN6096B W3 HHCH control cable is a big thick cable, which is available and is the same one that the Astro Spectra used, so they are available.

If you don't need the VIP functions (most people don't) it is very easy to make your own cable out of Belden 8878 wire, a DB-25M and a DB-25F connector. You really only need eight connections to make the HHCH work (see table below).

In a dual-radio system two cables can be made as a Y-cable using two DB-25M, with one connector going to each radio. Easier yet, if you have a TIB with two connectors on it (most do) then you can simply make a very short cable out of the 8878 wire and connect the second control head port (P6) if the primary radio to the first control head port (P5) of the auxiliary radio with those same eight wires connected (see table below).

If you have a real W3 TIB and you really need the VIPs to function, then you need more than eight wires and you will have to find the Motorola cables or use a different cable than 8878 and make your own cables with more wires connected.

The pinouts for the control cable using 8878 cable are listed here:

P1 TO RADIO (DB25-M)	**J1 TO HHCH (DB25-F)**	**FUNCTION**	**CABLE FOIL COLOR**	**CABLE WIRE COLOR**	**NOTES**
4	4	RESET B+	RED	BLK	TURNS OFF W3 TIB IF NOT GROUNDED BY HHCH
5	5	BUS +	BLU	BLU	SB9600 BUS +
11	11	MIC LO	GRN	BLK	
12	12	MIC HI	GRN	WHT	
14	14	BUS -	BLU	BLK	SB9600 BUS -
18	18	DIG GND	ALL	DRAIN	SINGLE GROUND FOR EVERYTHING
22	22	W3 TIB REG OUT	RED	RED	POWER TO HHCH FROM RADIO
23	23	BUS BUSY	BLU	YEL	SB9600 BUS BUSY
IGNITION LEAD:					
3	N/C	TO IGNITION LEAD VIA 4A FUSE			SWITCHED IGNITION TO **W3 TIB** (or use rear accessory connector pin 25)
OR					
22	N/C	TO IGNITION LEAD VIA 4A FUSE			SWITCHED IGNITION TO **W5/7/9 TIB** (direct to SW B+)
SPEAKER:					
24	N/C	SPEAKER HI			Or rear accessory connector pin 20
25	N/C	SPEAKER LOW			Or rear accessory connector pin 26

Accessory Connector

The W3/W9 TIBs use the W-series remote control cables (standard or HHCH). These cables use the ignition sense on the DB-15 in the front using the Astro Spectra style DB-15 accessory connector. You can use three possible sources for your ignition lead, depending on your TIB:

- If using a real W3 TIB, the rear accessory connector pin 25, the “normal” location for the XTL5000 ignition lead
- If using a real W3 TIB, the control cable old-style accessory connector DB-15 pin 5, the “normal” location for W-series remote-mount head ignition lead
- If using a W9 TIB, you must connect your ignition lead directly to switched B+ in the radio. If you are connecting the HHCH directly to the radio, or you are using the stock Motorola remote-mount control cable, you must move the ignition lead in the rear accessory connector from pin 25 (ignition) to 24 (SW B+) or if using a remote mount cable you can connect ignition to SW B+ at the DB-15 accessory cable pin 4
- If using a W9 TIB and you are making your own control cable, you can connect the ignition lead either to pin 24 of the rear accessory connector or directly to pin 22 of the control cable connector on the front of the radio – just run that red wire alongside your Belden cable and solder it to pin 22

For the speaker, you can either use the rear accessory connector or connect it directly to your front control head connector DB-25 depending on your cable situation.

- If you are connecting the HHCH directly to the radio, you will have to connect your speaker using the rear accessory connector pins 20 & 26
- If you are using the stock Motorola remote-mount control cable, you can connect your speaker to either the rear accessory connector pins 20 & 26 or the remote-mount cable accessory connector DB-15 pins 6 & 7
- If you have made your own cable, you can connect your speaker to either the rear accessory connector pin 20 & 26 or alternatively run the speaker wire into the front control head DB-25 hood and connect it to pins 24 & 25

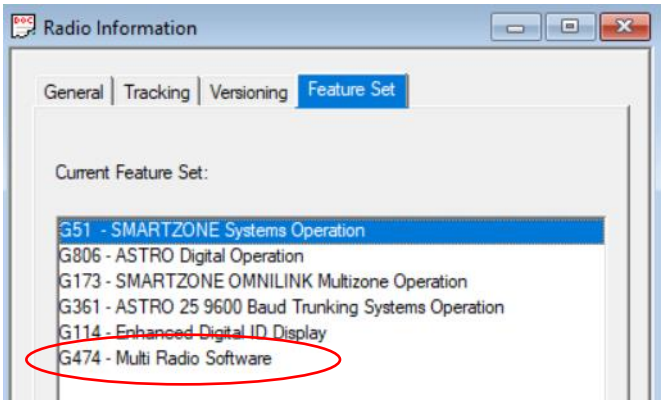
When making my own cable with the Belden wire, I prefer to use the rear accessory connector for both ignition lead and speaker connection as it is a little cleaner as only the Belden wire enters the DB-25 hood to the radio control head connector.

The above applies to a single radio system and a dual radio system. There are a couple small differences for the dual radio system which will be pointed out below.

Dual-Radio System

The only software difference in a dual-radio system is the radio flash codes have to have G474 multi radio system enabled. This allows them to recognize the AUX button on the HHCH for switching from the main to auxiliary radio, and allows for a radio alias of each radio to be entered in CPS. It also seems to straighten out the HHCH side button mis-mapping that occurs in mid-power radios.

The required flashcode option is in the first group, the third digit, and bit 3 (decimal 4) must be turned on. The flash code will have to include 004000-000000-0, i.e., 504008-00480-2 or something like that. You will have to figure out on your own how to change the flashcode, or find a radio that already has this option as Motorola no longer provides flash upgrades for XTL5000 radios (and this particular option wasn't field-orderable anyway for some reason). 504008-000480-2 is a great flash code for both radios in this situation (544008-000480-8 if encryption is present with multikey.)

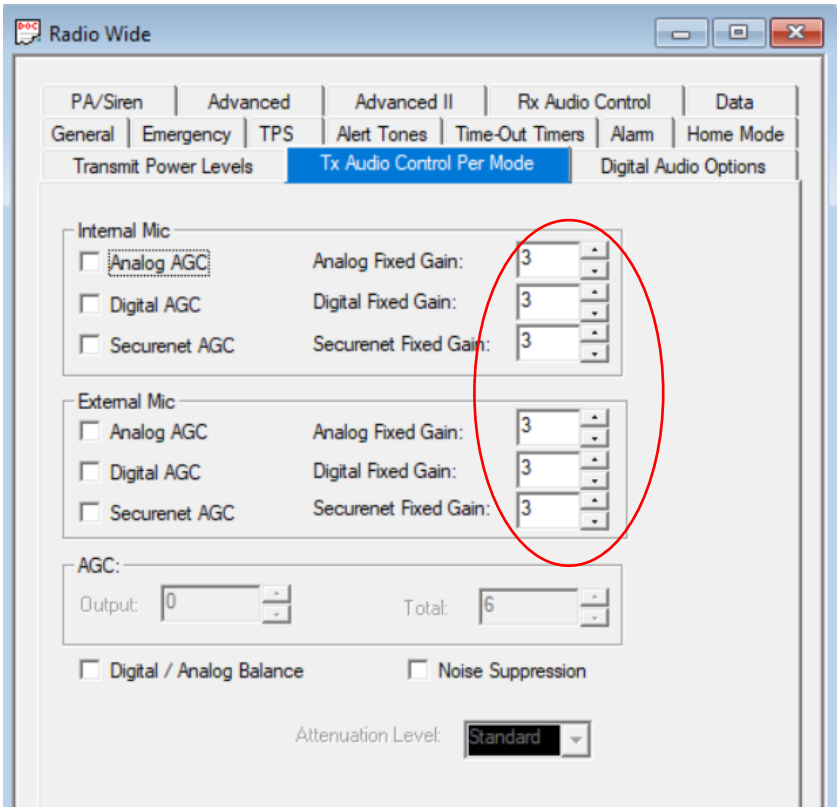


The control cable needs to either be a Y-cable or a short jumper cable from J6 on the main radio to J5 on the auxiliary radio, as mentioned above.

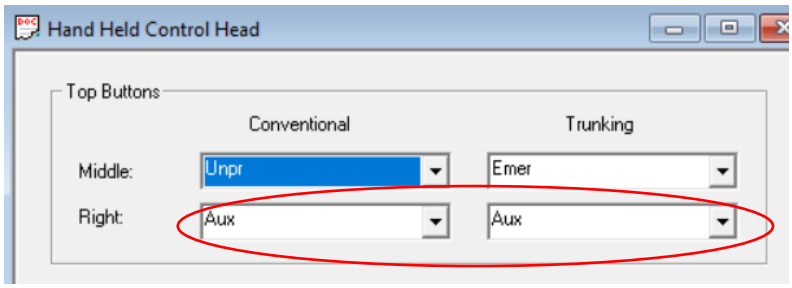
If using your own Belden cable, you need to make some adjustments depending on which TIB you have.

- W5/7/9 TIB – do not connect pin 22 between the two radios on the short jumper cable. This cable will only have seven wires connected. Make sure you move the switched ignition wire on both radios from ignition to SW B+ and the ignition lead will force power-on both radios by directly energizing SW B+. You will NOT be able to turn off the radios using the power button on the HHCH.
- W3 TIB – only connect the ignition lead to the primary radio. Do not connect ignition lead to the auxiliary radio. DO connect pin 22 between the two radios on the short jumper control cable and the auxiliary radio will receive its SW B+ from the main radio and will turn on and off correctly in sync with the main radio

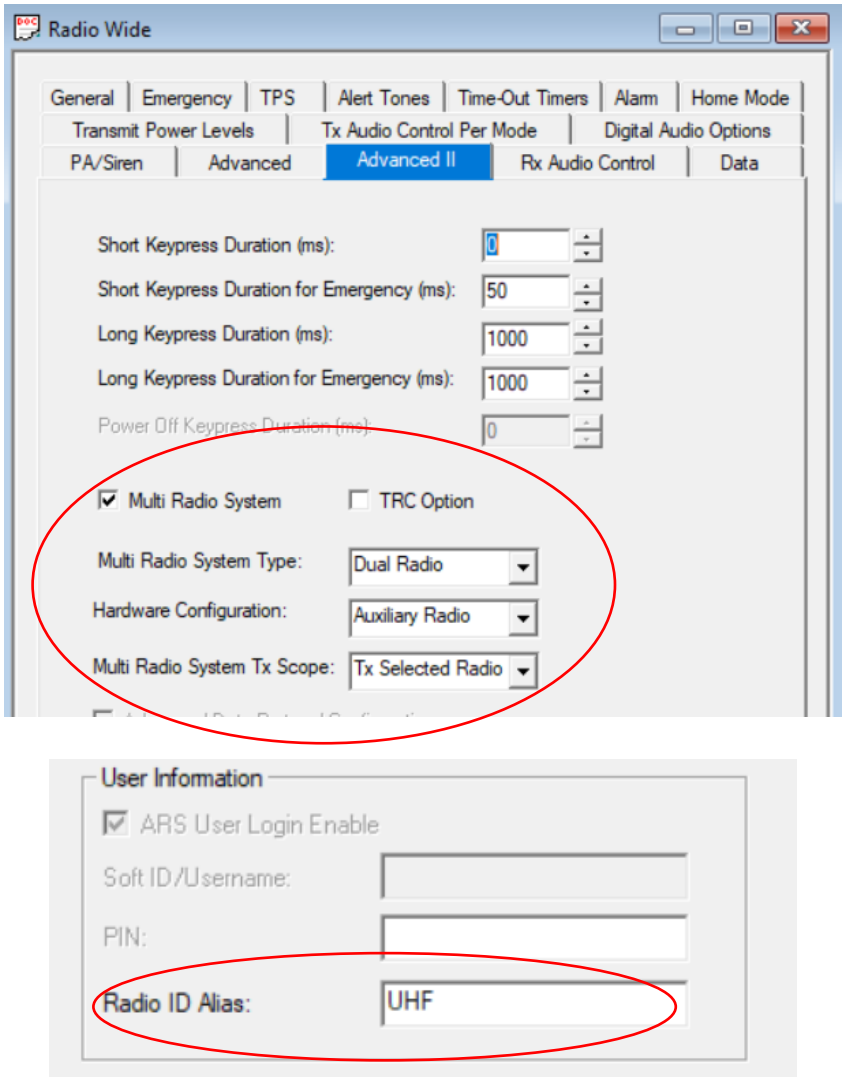
In addition, when programming the radios, the transmit audio gain should be increased by 3db in the CPS to account for the double termination on the mic hi lead.



You need to program the right top HHCH button to the AUX function to be able to switch from the main to the auxiliary radio.



And lastly, you need to enable multi radio system and define if the radio is the primary radio or auxiliary radio, and enter a radio alias for each radio in CPS.


Radio Wide
General
Emergency
TPS
Alert Tones
Time-Out Timers
Alarm
Home Mode
Transmit Power Levels
Tx Audio Control Per Mode
Digital Audio Options
PA/Siren
Advanced
Advanced II
Rx Audio Control
Data
Short Keypress Duration (ms):
0
Short Keypress Duration for Emergency (ms):
50
Long Keypress Duration (ms):
1000
Long Keypress Duration for Emergency (ms):
1000
Power Off Keypress Duration (ms):
0
Multi Radio System
TRC Option
Multi Radio System Type:
Dual Radio
Hardware Configuration:
Auxiliary Radio
Multi Radio System Tx Scope:
Tx Selected Radio

User Information
ARS User Login Enable
Soft ID/Username:
PIN:
Radio ID Alias:
UHF