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FMi 703 and 1405 Series Transmitters

"On the Fly" Mode Switching Application Guide
Enable Switching between IBOC Only and FM + IBOC

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FMi 703 and 1405
Series Transmitters
“On the Fly” Mode Switching Application Guide
Enable Switching between IBOC Only and FM + IBOC

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1 Purpose of this Document

The purpose of this document is to describe the necessary steps to properly setup an **FMi 703** or **1405 Series Transmitter** to switch between **IBOC ONLY** and **FM + IBOC (Hybrid)** modes of operation.



CAUTION!! PLEASE READ CAREFULLY!

FMi 703 and 1405 Transmitters may NOT be switched between FM ONLY and the other two modes of operation "On the Fly"! Attempting to do so WILL result in serious damage to the Transmitter and Exciter!

2 Tools / Items Needed

- ☐ Personal Computer with Windows HyperTerminal Communication Program installed
- ☐ Null Modem Cable

3 Estimated Setup Time

Providing that you have the tools listed above, it will take approximately 15 minutes to complete the setup for **IBOC ONLY** to **FM + IBOC (Hybrid)** mode switching. Please note that the transmitter will be off of the air momentarily during this procedure.



4 Setting the AGC Scale Factor in the FXi 60/250 Exciter

The purpose of this section is to describe the necessary steps to set the Maximum Scale Factor (Automatic Gain Control – AGC) in the FXi 60/250 Exciter. Before switching back and forth between **IBOC ONLY** and **FM + IBOC** Modes of Operation, the Maximum Scale must be set in each of these Modes to prevent overdriving PA Modules in the Transmitter. If your System shipped after May 3rd, 2005, the Maximum Scale Factor is already setup using the following procedure.

Step 1 – Ensure that your Transmitter is currently operating in either **IBOC ONLY** or **FM + IBOC** mode.

Step 2 – Ensure that the Transmitter is operating at the Transmitter's RF Power Output (TPO) level that you would normally operate it at.

Step 3 – Next, go to the FXi Exciter GUI Main Menu and select **OPER MODE**.

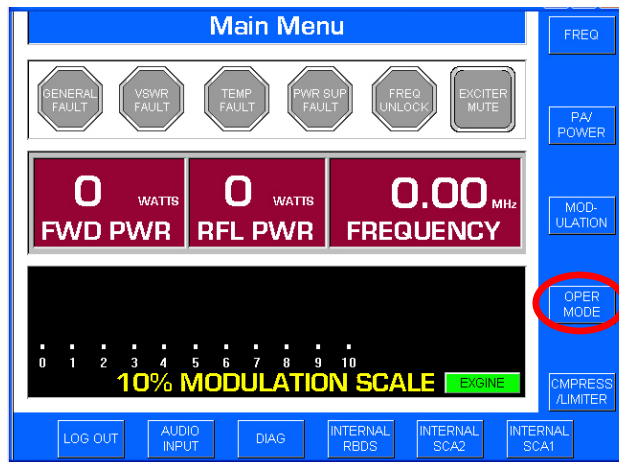


Figure 1 – FXi Main Menu

Step 4 – Select **IBOC MENU**.

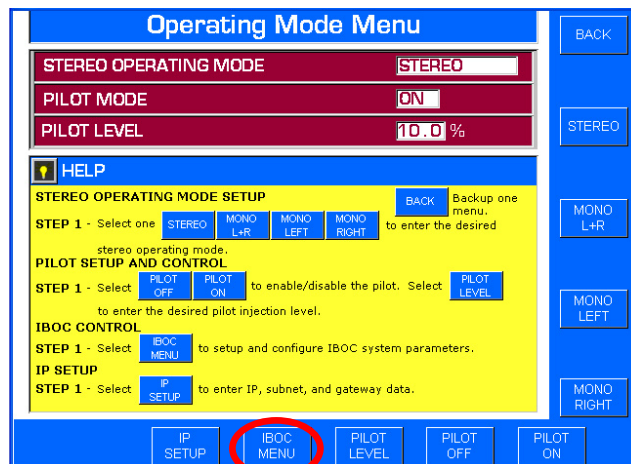


Figure 2 – Operating Mode Menu



Step 5 – Record the **IBOC OPERATING MODE** and the present **AGC SCALE** reading.

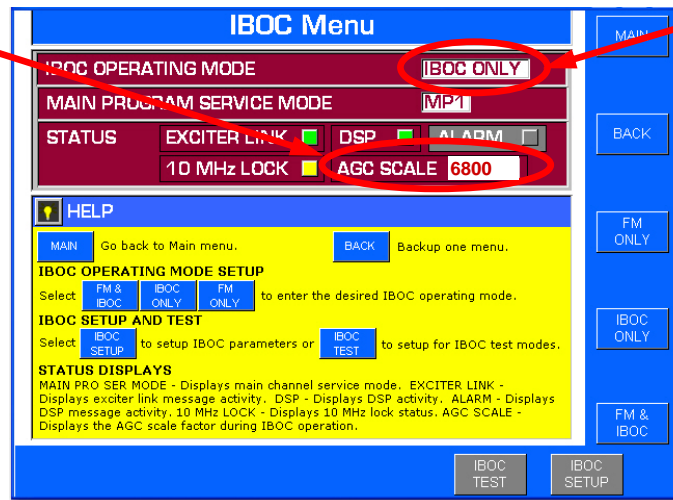
Remember, the Transmitter must be operating at the TPO level that you would normally operate it at!

Record the present AGC Scale reading.

Note: The present AGC Scale reading will appear here if the FXi 60/250 Exciter is running software v2.0.35 or newer.

If running an older version, you will need to use Hyperterminal's "e" command to see the present Scale Factor reading.

See Steps 10-21 for Hyperterminal connection instructions and 25 for the "e" command.



Note the present IBOC Operating Mode

Figure 3 – Record the AGC SCALE at Normal Operating RF Output Power

Step 6 – Increase the RF output of the transmitter in the range of 5% (minimum) to 15% (maximum) above the current TPO level of your transmitter.

Note that the smaller the increase, such as 5%, may ultimately inhibit the transmitter's ability to automatically compensate for environmental temperature variations. If your transmitter is subject to outside variations in ambient room temperature, then this may require a setting near the upper end, such as 15%, of the range.

Units shipped from the BE factory now are preset with a Max scale factor 15% above the TPO on your order. This is set at an ambient room temperature of 21C.

Step 7 – Go back to the FXi Exciter GUI Main Menu and select **OPER MODE**.

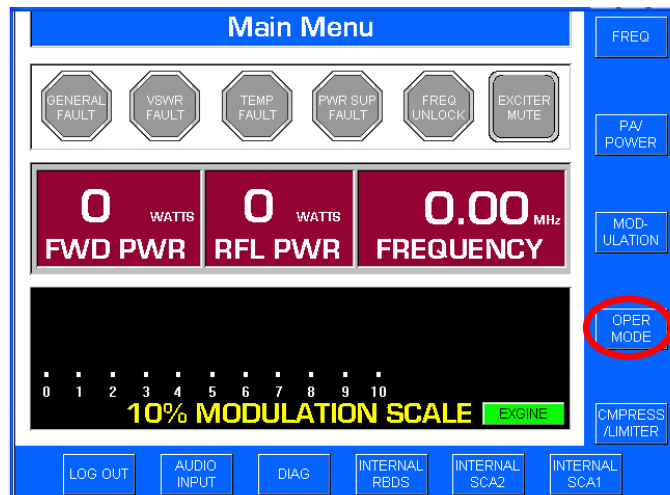


Figure 4 – FXi Main Menu

Step 8 – Select IBOC MENU.

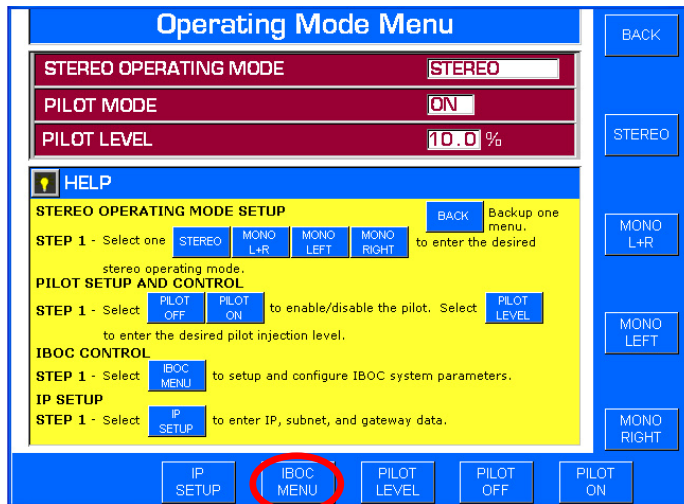
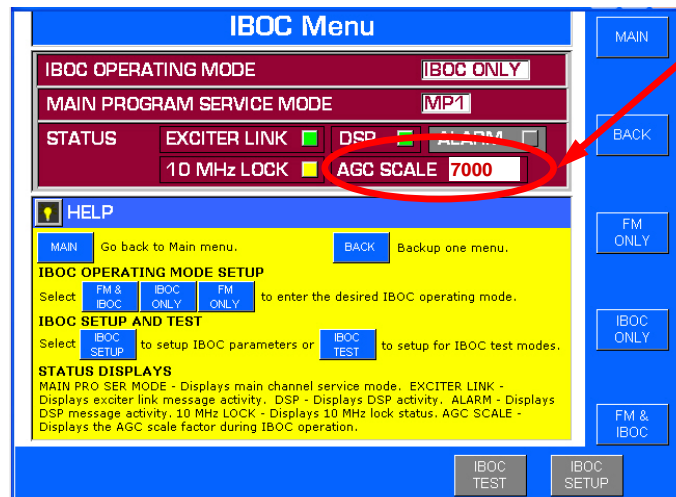


Figure 5 – Operating Mode Menu

Step 9 – Record the present AGC SCALE reading.

Remember, the transmitter must now be operating in the range of 5 - 15% above the TPO level that you would normally operate it at!



Record the present AGC Scale reading (this number should be slightly larger than the number recorded in Step 5 at Normal TPO)

Note: The present AGC Scale reading will appear here if the FXi 60/250 Exciter is running software v2.0.35 or newer.

If running an older version, you will need to use Hyperterminal's "e" command to see the present Scale Factor reading.

See Steps 10-21 for Hyperterminal connection instructions and 25 for the "e" command.

Figure 6 – Record the AGC SCALE at "5 -15% above" Normal Operating RF Output Power



Step 10 – Connect a null modem cable from a PC to the Exciter's Serial Port J10.

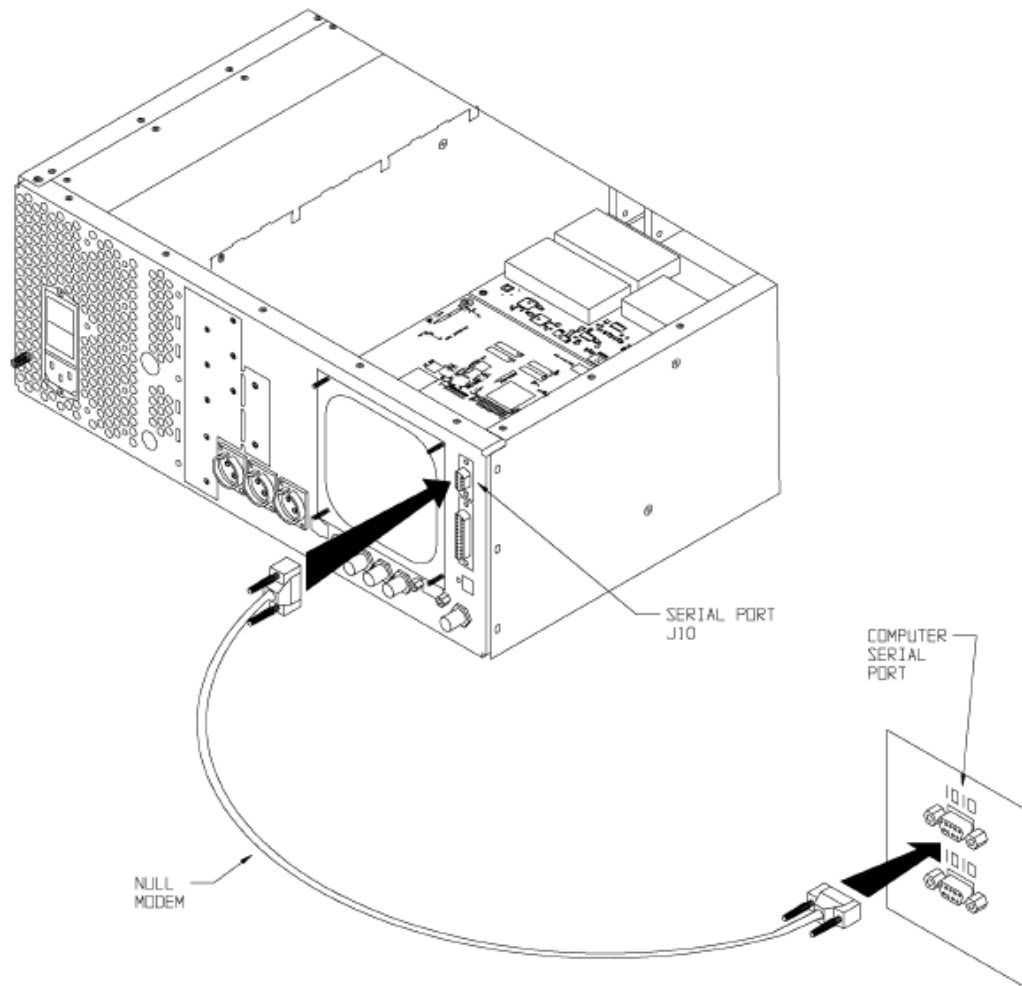


Figure 7 – PC to FXi Serial Port Null Modem Cable Connection

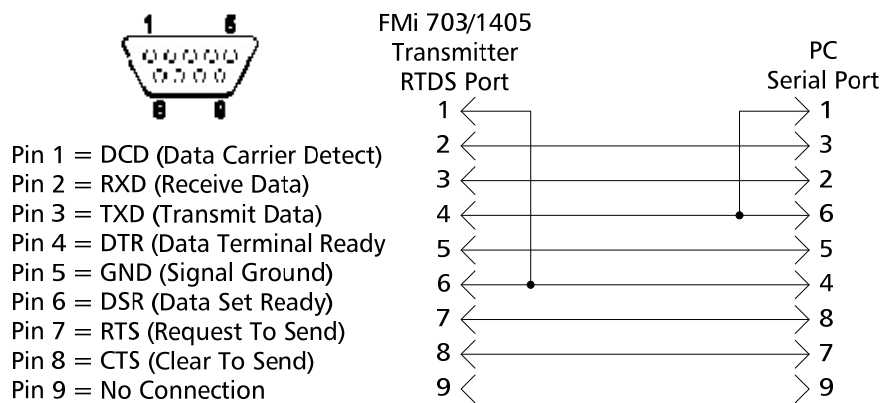


Figure 8 – Serial Cable / Null Modem Adapter Pinout

- Step 11** – From the Desktop go to: **START-> ALL PROGRAMS-> ACCESSORIES-> COMMUNICATION-> HYPERTERMINAL** and click the mouse.
- Step 12** – The HyperTerminal dialog box should now be displayed. In the **CONNECTION DESCRIPTION** box, enter the name of the shortcut that you want to be created such as *FXi Connection*.
- Step 13** – Select and click **OK**.
- Step 14** – The **CONNECT TO** dialog box will now appear. In the **CONNECT USING** dialog box, ensure that the correct COM Port is selected (typically **COM 1** is used) and then click **OK**.
- Step 15** – The **COM1 PROPERTIES** dialog box will appear. Move the cursor to the **BITS PER SECOND** dialog box and select **19200**.
- Step 16** – Move the cursor to the **DATA BITS** dialog box and select **8**.
- Step 17** – Move the cursor to the **PARITY** dialog box and select **NONE**.
- Step 18** – Move the cursor to the **STOP BITS** dialog box and select **1**.
- Step 19** – Move the cursor to the **FLOW CONTROL** dialog box and select **NONE**.
- Step 20** – Select **OK** and the HyperTerminal communication window will appear.
- Step 21** – Type “?” and the **Supplemental Command Menu** will then appear..

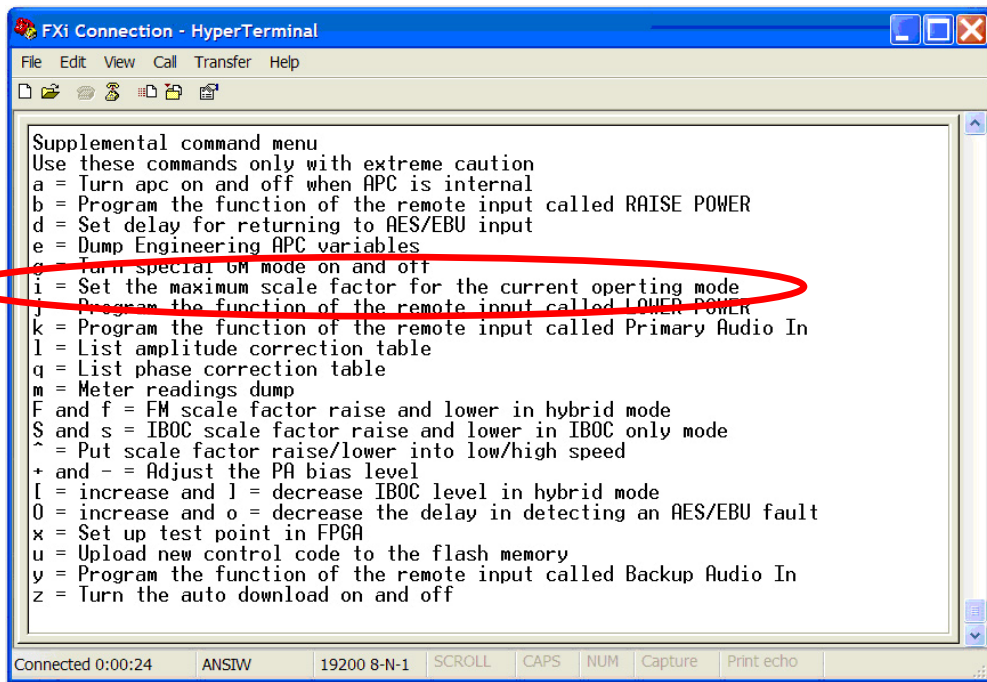


Figure 9 – HyperTerminal Supplemental Command Menu

- Step 22** – Press “i” (lower case) on the keyboard of the PC to change the scale factor of the “current” IBOC Operating Mode.

Step 23 – After pressing “i”, the following command prompt will appear. Enter the AGC Scale setting recorded in **Step 9** (7000 for this example) and press **Enter**.

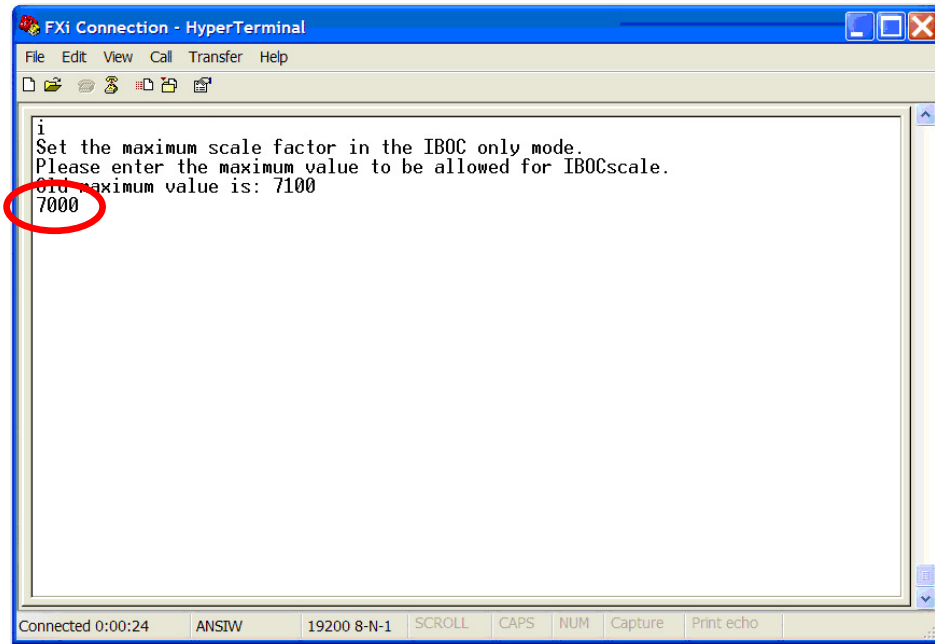


Figure 10 – “i” Command to Change Maximum Scale Factor

Step 24 – Lower the transmitter’s RF Output Power level back to where you would normally operate it at.

Step 25 – To verify that the scale factor was changed, press “e” (lower case) on the keyboard.

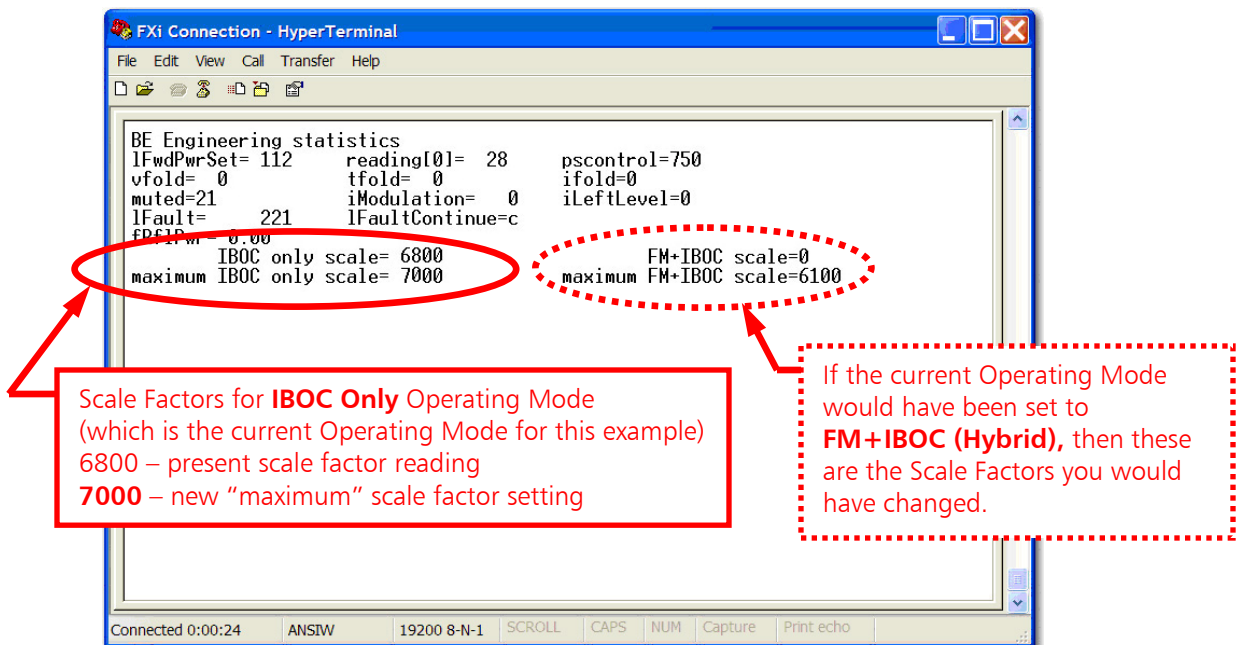


Figure 11 – “e” Command to Review Engineering Statistics

5 Switching from IBOC ONLY to FM + IBOC (Hybrid) Mode

5.1 Ensure that the Maximum Scale Factors Have Been Set

Ensure that the **Maximum Scale Factor** was set in both **IBOC ONLY** and **FM + IBOC** Modes of Operation (see Section 4 of this document).

5.2 Verify that the Current Mode of Operation is IBOC ONLY

Step 1 – From the FXi Exciter GUI Main Menu, select **OPER MODE**.

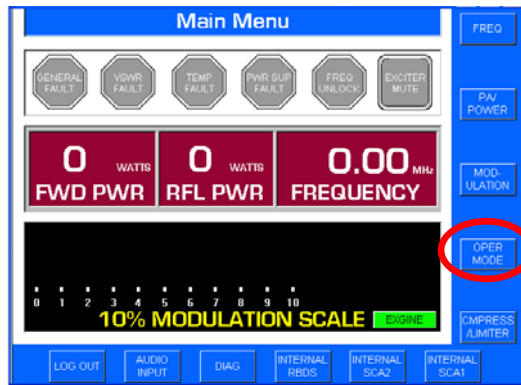


Figure 12 – FXi Main Menu

Step 2 – Select **IBOC MENU**.

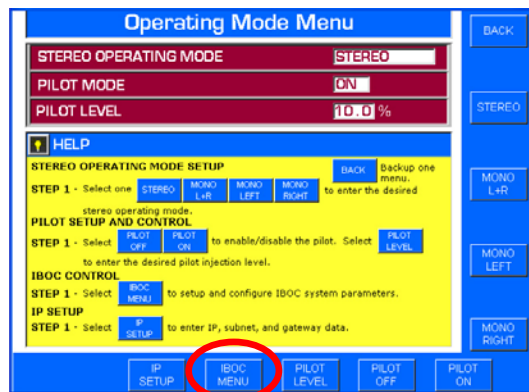
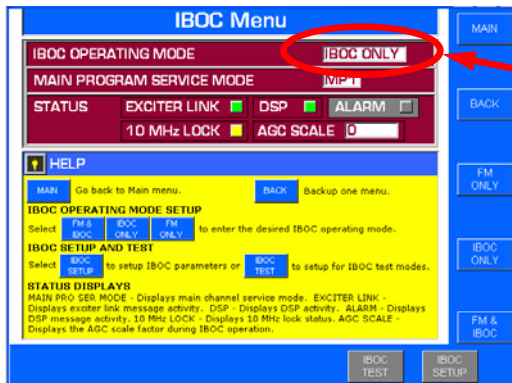


Figure 13 – Operating Mode Menu

Step 3 – Verify that the IBOC Operating Mode is set to **IBOC ONLY** mode.



Verify that the current Operating Mode is **IBOC ONLY**.

Figure 14 – FXi IBOC Menu

5.3 Turn the Transmitter's RF Output OFF

Step 1 – Press the **OFF** switch on the Front Panel of the transmitter (leave AC on).



Figure 15 – Turn the Transmitter's RF Output Power OFF

5.4 Switch the FMi 703/1405 Transmitter to FM + IBOC (Hybrid) Mode

Step 1 – Establish communication from the PC to the transmitter using Hyperterminal. Connect a Null Modem Cable from the serial port of a PC to the RTDS Port on the front of the FMi 703/1405 Transmitter as shown below. See **Figure 17** for cable construction.

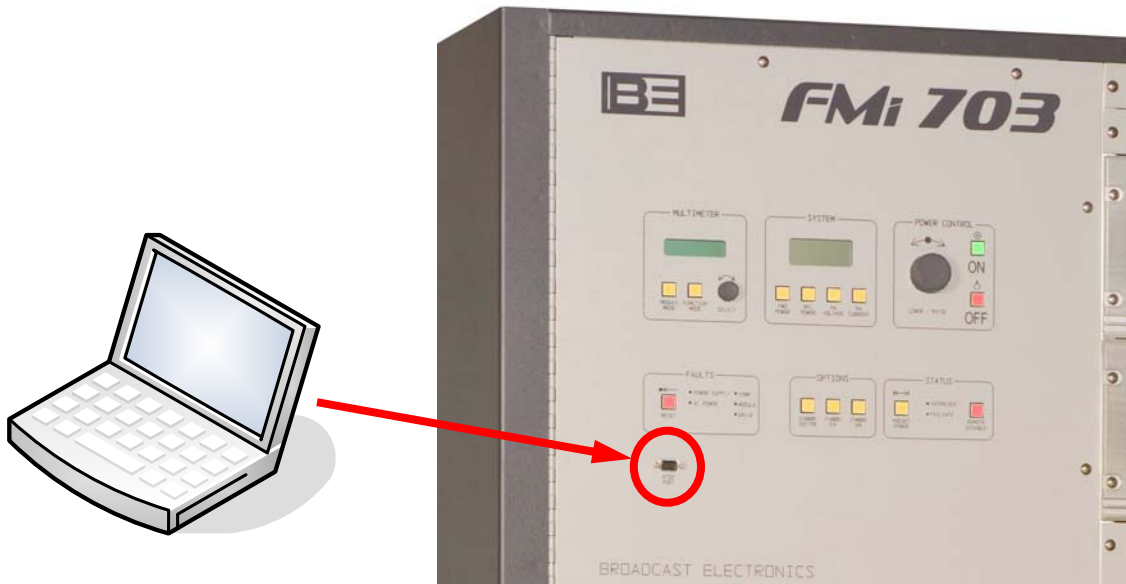


Figure 16 – PC to FMi 703/1405 Transmitter Connection

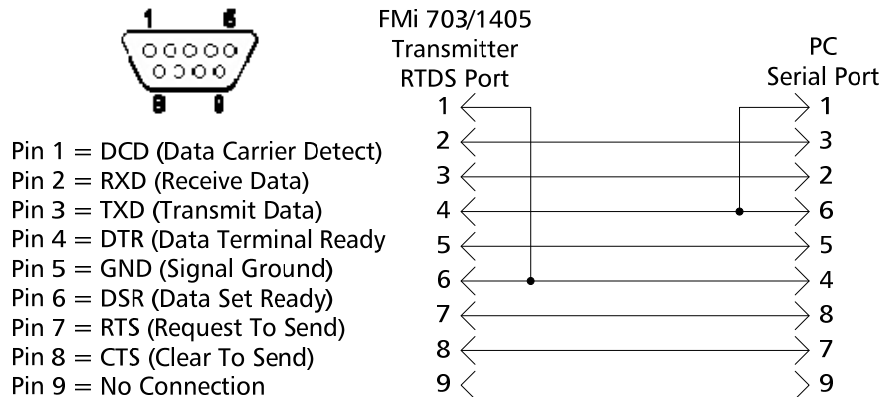


Figure 17 – Null Modem Cable Pinout

- Step 2** – Ensure that AC is applied to the FMi 703/1405 Transmitter and the RF Output is OFF.
- Step 3** – On the PC go to: **START-> ALL PROGRAMS-> ACCESSORIES-> COMMUNICATION-> HYPERTERMINAL** and click the mouse.
- Step 4** – The HyperTerminal dialog box should now be displayed. In the **CONNECTION DESCRIPTION** box, enter the name of the shortcut that you want to be created such as *FMi Mode of Operation Change*.
- Step 5** – Select and click **OK**.
- Step 6** – The **CONNECT TO** dialog box will now appear. In the **CONNECT USING** dialog box, ensure that the correct COM Port is selected (typically **COM 1** is used) and then click **OK**.
- Step 7** – The **COM1 PROPERTIES** dialog box will appear. Move the cursor to the **BITS PER SECOND** dialog box and select **9600**.
- Step 8** – Move the cursor to the **DATA BITS** dialog box and select **8**.
- Step 9** – Move the cursor to the **PARITY** dialog box and select **NONE**.
- Step 10** – Move the cursor to the **STOP BITS** dialog box and select **1**.
- Step 11** – Move the cursor to the **FLOW CONTROL** dialog box and select **NONE**.
- Step 12** – Select **OK** and the HyperTerminal communication window will appear.

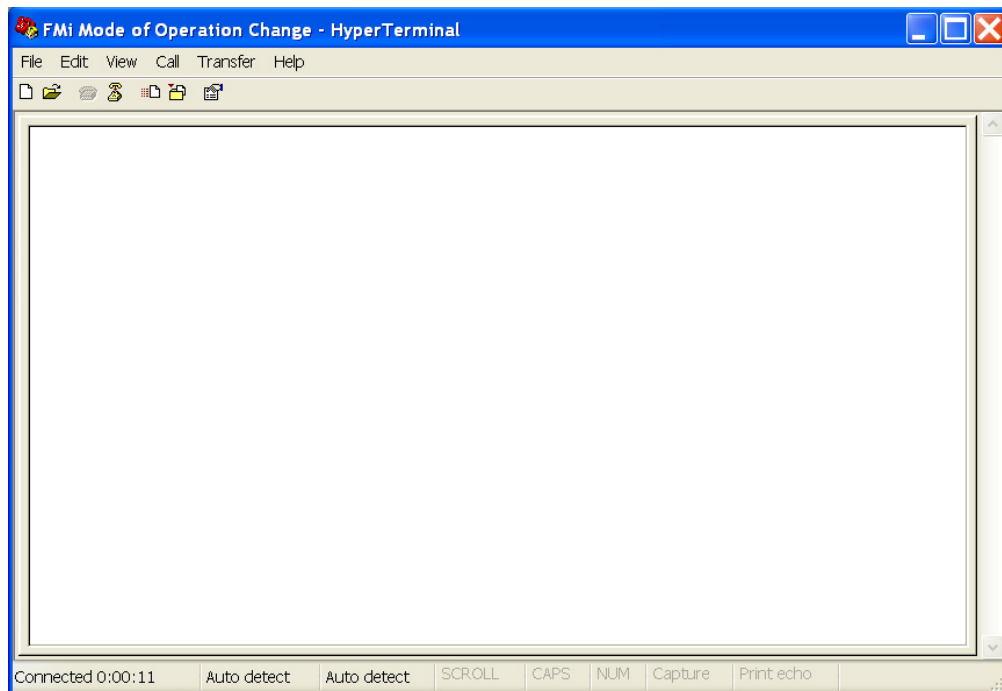
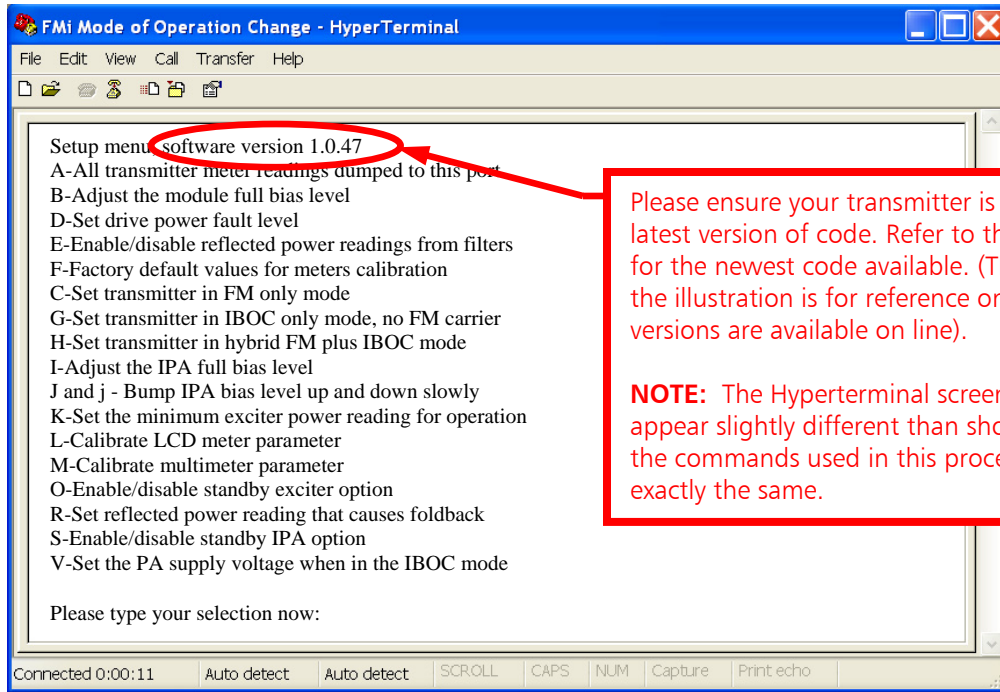


Figure 18 – Initial Hyperterminal Screen

Step 13 – Press the **ENTER** key and the FMi 703/1405 Utility Program Main Menu will appear.

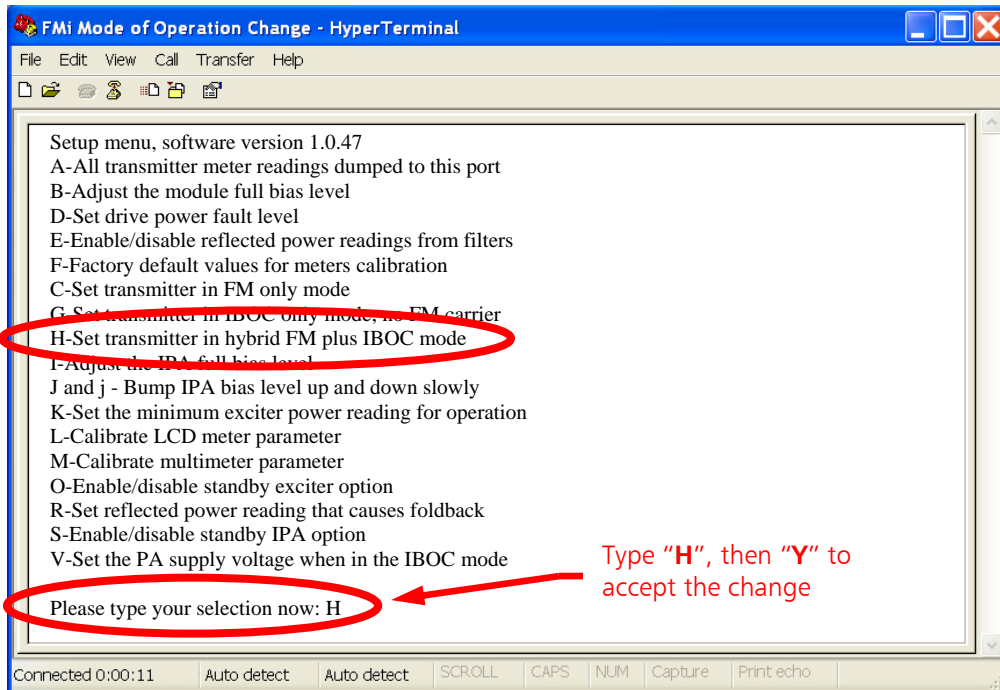


Please ensure your transmitter is updated to the latest version of code. Refer to the B.E. website for the newest code available. (The version in the illustration is for reference only and newer versions are available on line).

NOTE: The Hyperterminal screen for 2.1.16 will appear slightly different than shown here but the commands used in this procedure are exactly the same.

Figure 19 – FMi 703/1405 Utility Program Main Menu

Step 14 – Next, press “H” on the keyboard of the PC to put the transmitter in **FM + IBOC (Hybrid)** mode. Press “Y” to accept the change.



Type “H”, then “Y” to accept the change

Figure 20 – Put the Transmitter in FM + IBOC (Hybrid) Mode



5.5 Switch the FXi Exciter to FM + IBOC (Hybrid) Mode

Step 1 – From the FXi Exciter GUI Main Menu, select **OPER MODE**.

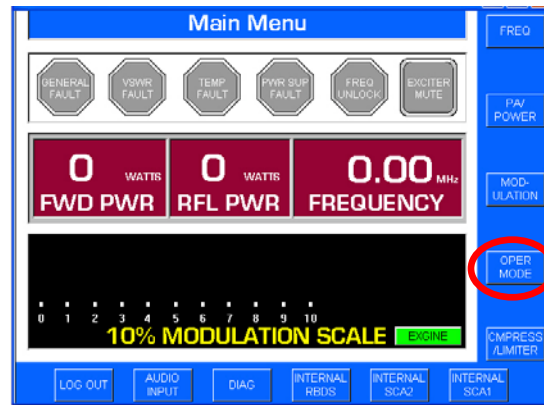


Figure 21 – FXi Main Menu

Step 2 – Select **IBOC MENU**.

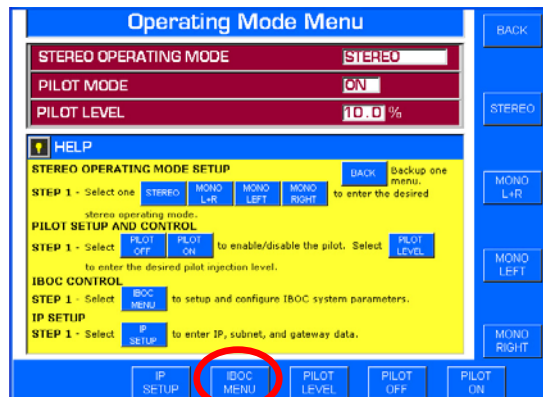


Figure 22 – Operating Mode Menu

Step 3 – Select **FM + IBOC** mode.

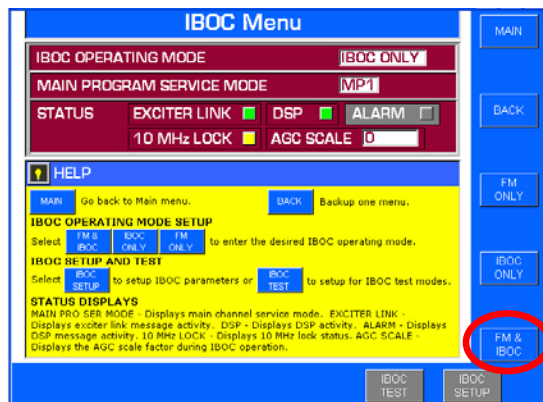


Figure 23 – FXi IBOC Menu

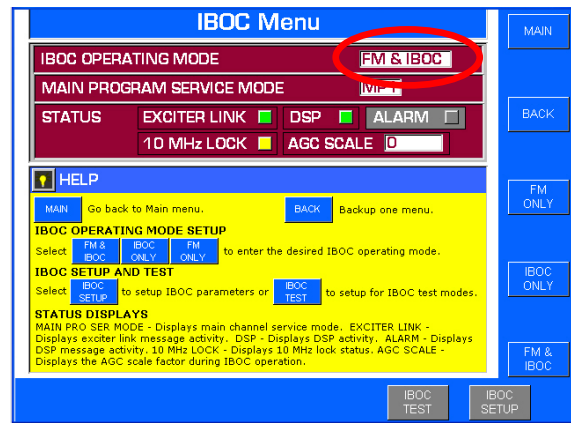


Figure 24 – FM + IBOC (Hybrid) Mode Now Selected

5.6 Turn the Transmitter's RF Output ON

Step 1 – Press the **ON** switch on the Front Panel of the transmitter.



Figure 25 – Turn the Transmitter's RF Output Power ON

Step 2 – If necessary, adjust Power to desired level.



6 Switching from FM + IBOC (Hybrid) to IBOC ONLY Mode

6.1 Ensure that the Maximum Scale Factors Have Been Set

Ensure that the **Maximum Scale Factor** was set in both **IBOC ONLY** and **FM + IBOC** Modes of Operation (see Section 4 of this document).

6.2 Verify that the Current Mode of Operation is FM+IBOC

Step 1 – From the FXi Exciter GUI Main Menu, select **OPER MODE**.

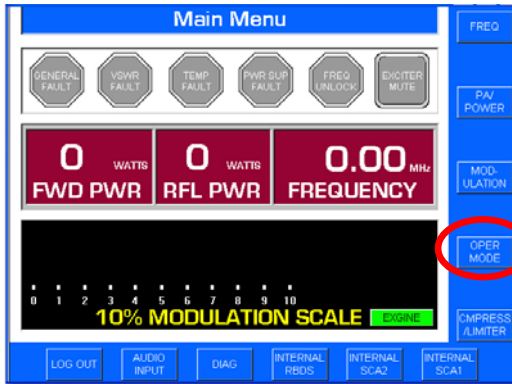


Figure 26 – FXi Main Menu

Step 2 – Select **IBOC MENU**.

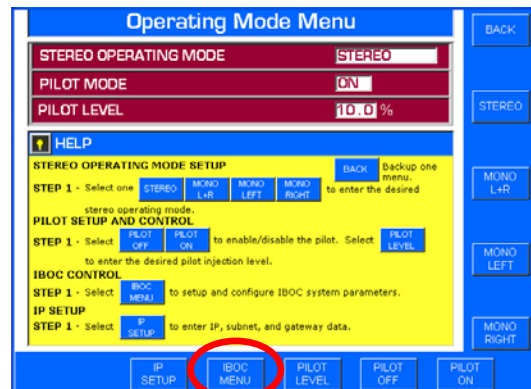
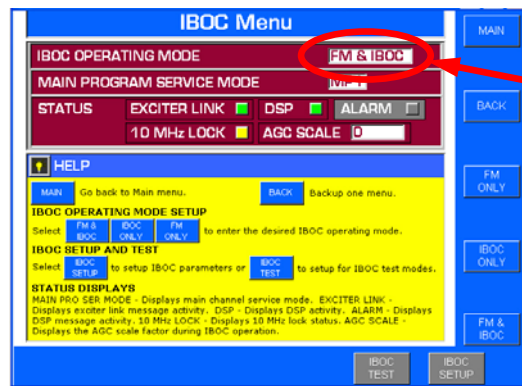


Figure 27 – Operating Mode Menu

Step 3 – Verify that the IBOC Operating Mode is set to **FM + IBOC** mode.



Verify that the current
Operating Mode is
FM + IBOC

Figure 28 – FXi IBOC Menu

6.3 Turn the Transmitter's RF Output OFF

Step 1 – Press the **OFF** switch on the Front Panel of the transmitter (leave AC on).



Figure 29 – Turn the Transmitter's RF Output Power OFF

6.4 Switch the FMi 703/1405 Transmitter to IBOC ONLY Mode

Step 1 – Establish communication from the PC to the transmitter using Hyperterminal. Connect a Null Modem Cable from the serial port of a PC to the RTDS Port on the front of the FMi 703/1405 Transmitter as shown below. See **Figure 31** for cable construction.

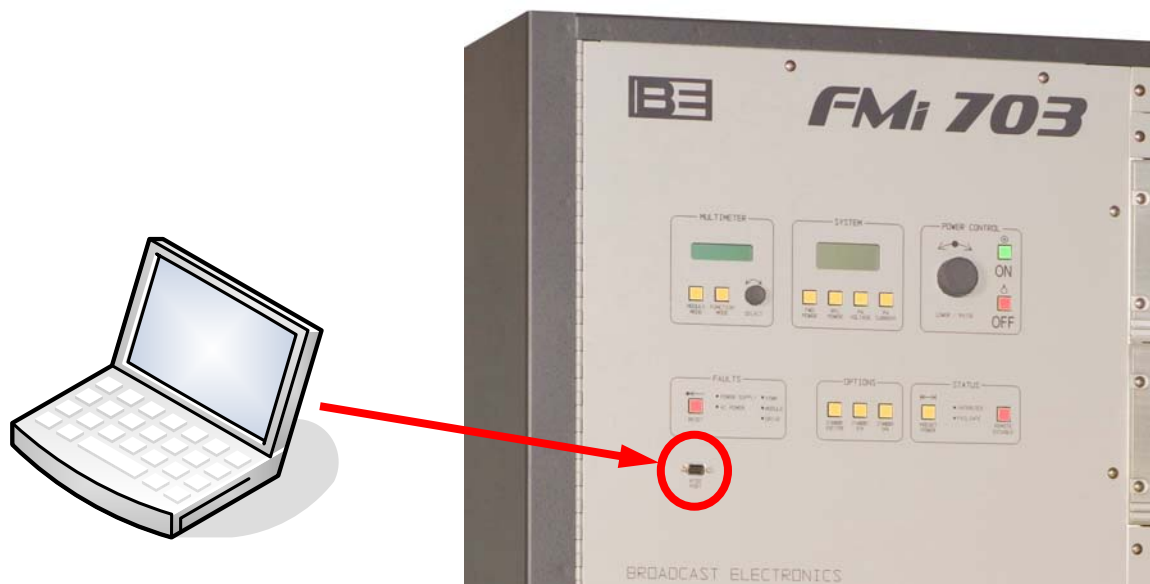


Figure 30 – PC to FMi 703/1405 Transmitter Connection

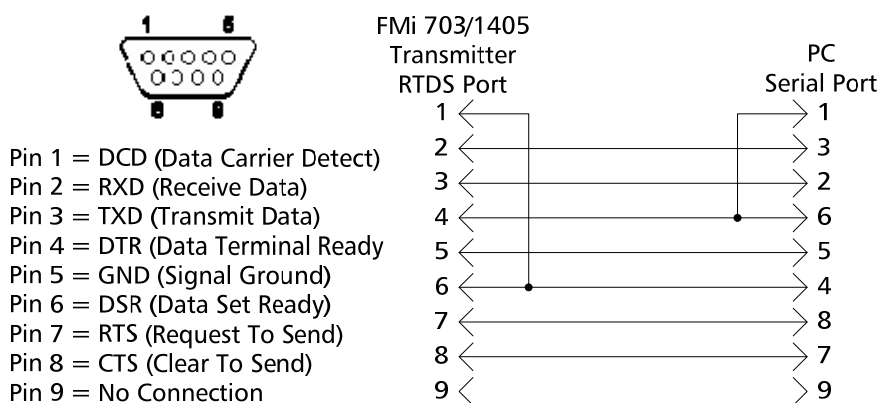


Figure 31 – Null Modem Cable Pinout

- Step 2** – Ensure that AC is applied to the FMi 703/1405 Transmitter and the RF Output is OFF.
- Step 3** – On the PC go to: **START-> ALL PROGRAMS-> ACCESSORIES-> COMMUNICATION-> HYPERTERMINAL** and click the mouse.
- Step 4** – The HyperTerminal dialog box should now be displayed. In the **CONNECTION DESCRIPTION** box, enter the name of the shortcut that you want to be created such as *FMi Mode of Operation Change*.
- Step 5** – Select and click **OK**.
- Step 6** – The **CONNECT TO** dialog box will now appear. In the **CONNECT USING** dialog box, ensure that the correct COM Port is selected (typically **COM 1** is used) and then click **OK**.
- Step 7** – The **COM1 PROPERTIES** dialog box will appear. Move the cursor to the **BITS PER SECOND** dialog box and select **9600**.
- Step 8** – Move the cursor to the **DATA BITS** dialog box and select **8**.
- Step 9** – Move the cursor to the **PARITY** dialog box and select **NONE**.
- Step 10** – Move the cursor to the **STOP BITS** dialog box and select **1**.
- Step 11** – Move the cursor to the **FLOW CONTROL** dialog box and select **NONE**.
- Step 12** – Select **OK** and the HyperTerminal communication window will appear.

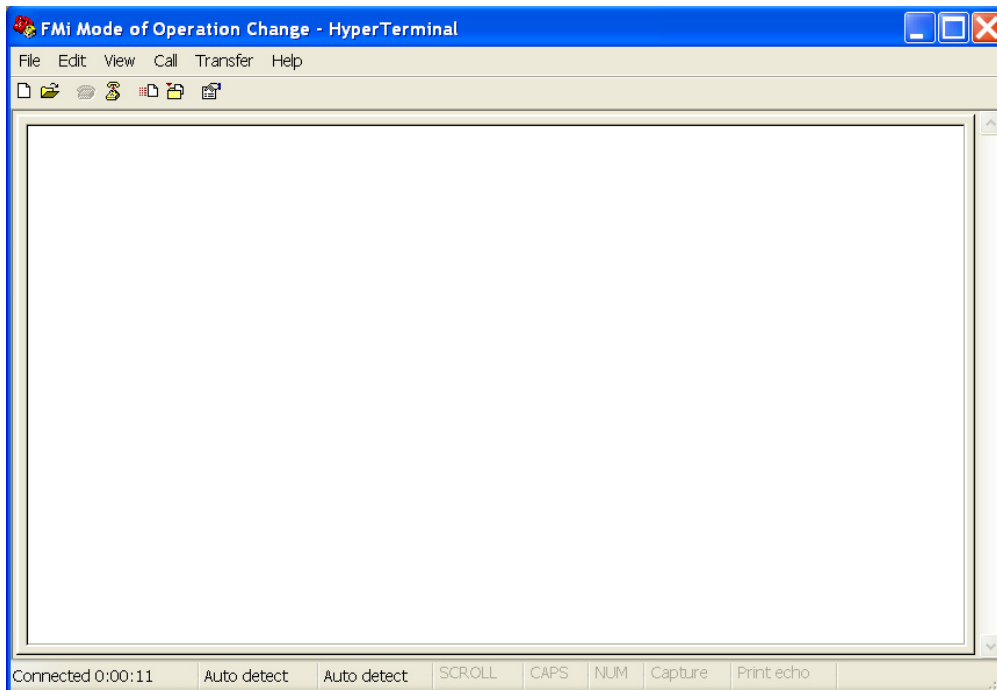


Figure 32 – Initial Hyperterminal Screen

Step 13 – Press the **ENTER** key and the FMI 703/1405 Utility Program Main Menu will appear.

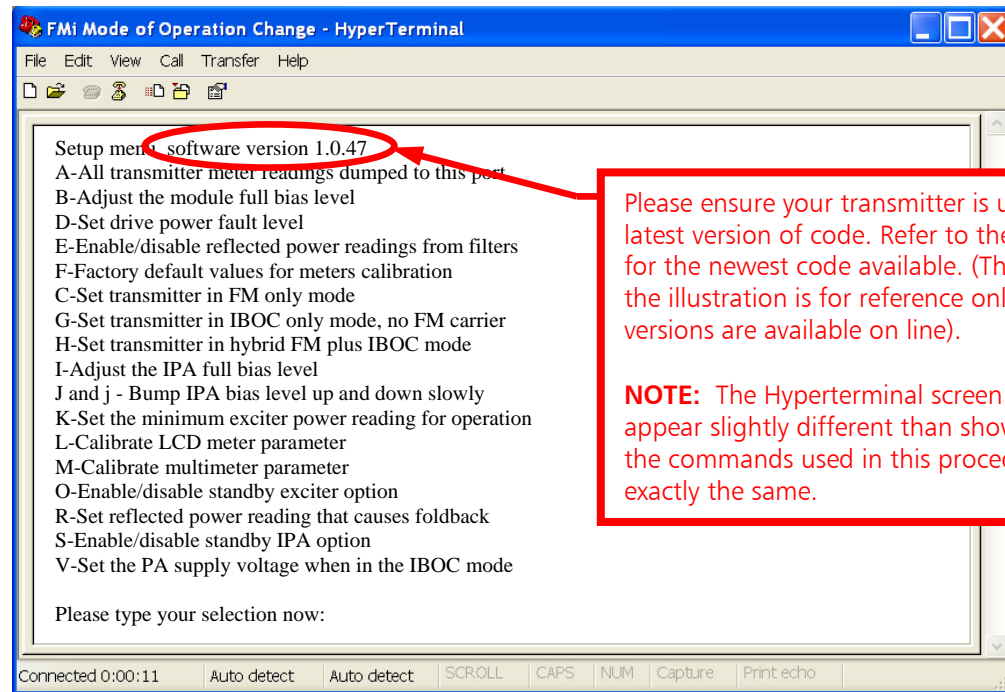


Figure 33 – FMI 703/1405 Utility Program Main Menu

Step 14 – Next, press “G” on the keyboard of the PC to put the transmitter in **IBOC ONLY** mode. Press “Y” to accept the change.

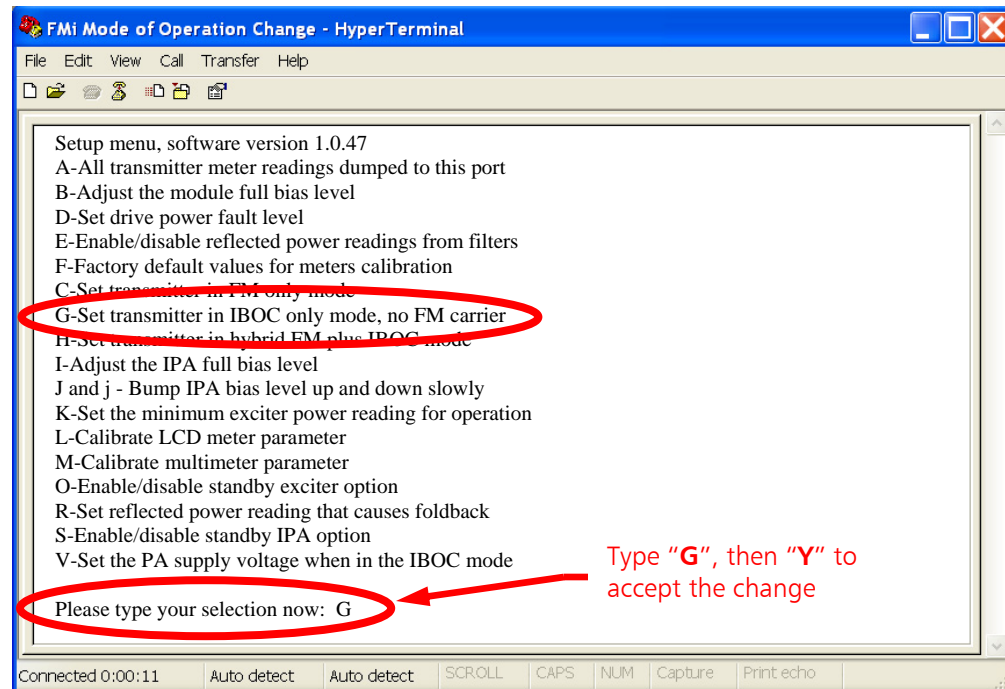


Figure 34 – Put the Transmitter in IBOC ONLY Mode

6.5 Switch the FXi Exciter to IBOC ONLY Mode

Step 1 – From the FXi Exciter GUI Main Menu, select **OPER MODE**.

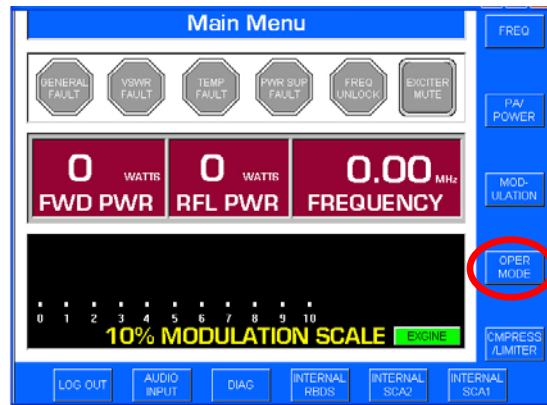


Figure 35 – FXi Main Menu

Step 2 – Select **IBOC MENU**.

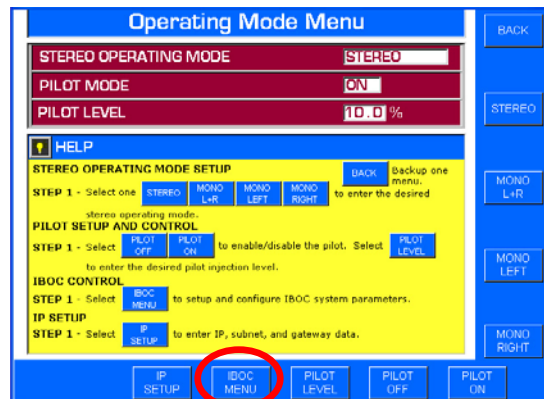
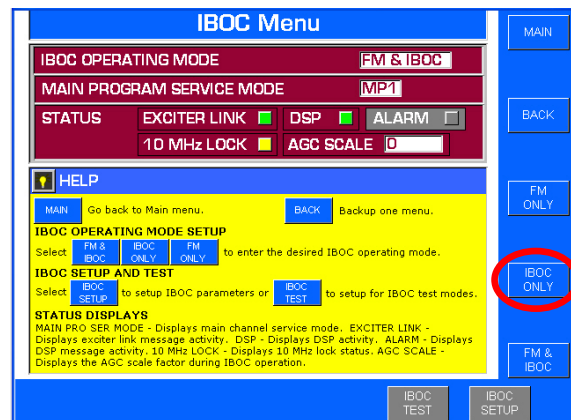


Figure 36 – Operating Mode Menu

Step 3 – Select **IBOC ONLY** mode.



Select **IBOC ONLY**

Figure 37 – FXi IBOC Menu



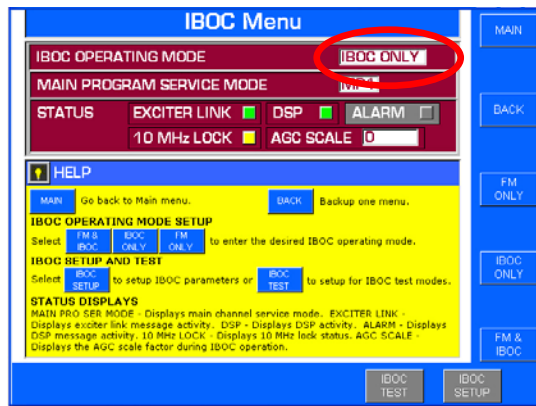


Figure 38 – IBOC ONLY Mode Now Selected

6.6 Turn the Transmitter's RF Output ON

Step 1 – Press the **ON** switch on the Front Panel of the transmitter.



Figure 39 – Turn the Transmitter's RF Output Power ON

Step 2 – If necessary, adjust Power to desired level.

7 Switching between IBOC ONLY and FM + IBOC Modes “On The Fly” Via the Exciter’s Remote Control Connector J3

7.1 Ensure that the Maximum Scale Factors Have Been Set

Ensure that the **Maximum Scale Factor** was set in both **IBOC ONLY** and **FM + IBOC** Modes of Operation (see Section 4 of this document).

7.2 Programming J3 Pin 11

To enable “On The Fly” mode switching via remote control, J3 Pin 11 or J3 Pin 12 must be re-programmed. The default operation of J3 Pin 11 is for “remote raise power” and J3 Pin 12 is for “remote lower power” on the FXi Exciter. Since the output power of the FXi Exciter (in IBOC ONLY or FM + IBOC mode) is controlled by the FMi transmitter, either of these pins may be programmed and used to switch between IBOC ONLY and FM + IBOC modes of operation.

Please note that when switching from IBOC ONLY to FM+IBOC via the remote control connector (J3), the maximum Transmitter RF Output Power will be limited to $\approx 3\text{kW}$ in a FMi 703 ($\approx 5\text{kW}$ in a FMi 1405) or to the FM+IBOC Scale Factor if it is set at a lower value. It is also important to note that the meters on the front panel of the transmitter will not be calibrated.

A positive voltage is required to activate the commands, if the factory default jumper has not been changed from providing ground to the remote common. J3 Pins 6 or 7 may be used for the positive voltage required to activate the command.

In this section J3 Pin 11 will be programmed to switch the Exciter from IBOC ONLY to FM + IBOC mode of operation.

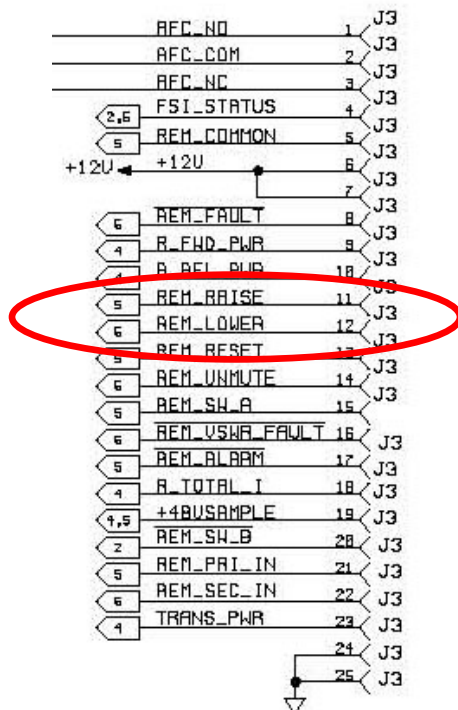


Figure 40 – FXi Remote Control Port Pinout (J3 on rear of the FXi)

Step 1 – Connect a null modem cable from a PC to the Exciter's Serial Port J10.

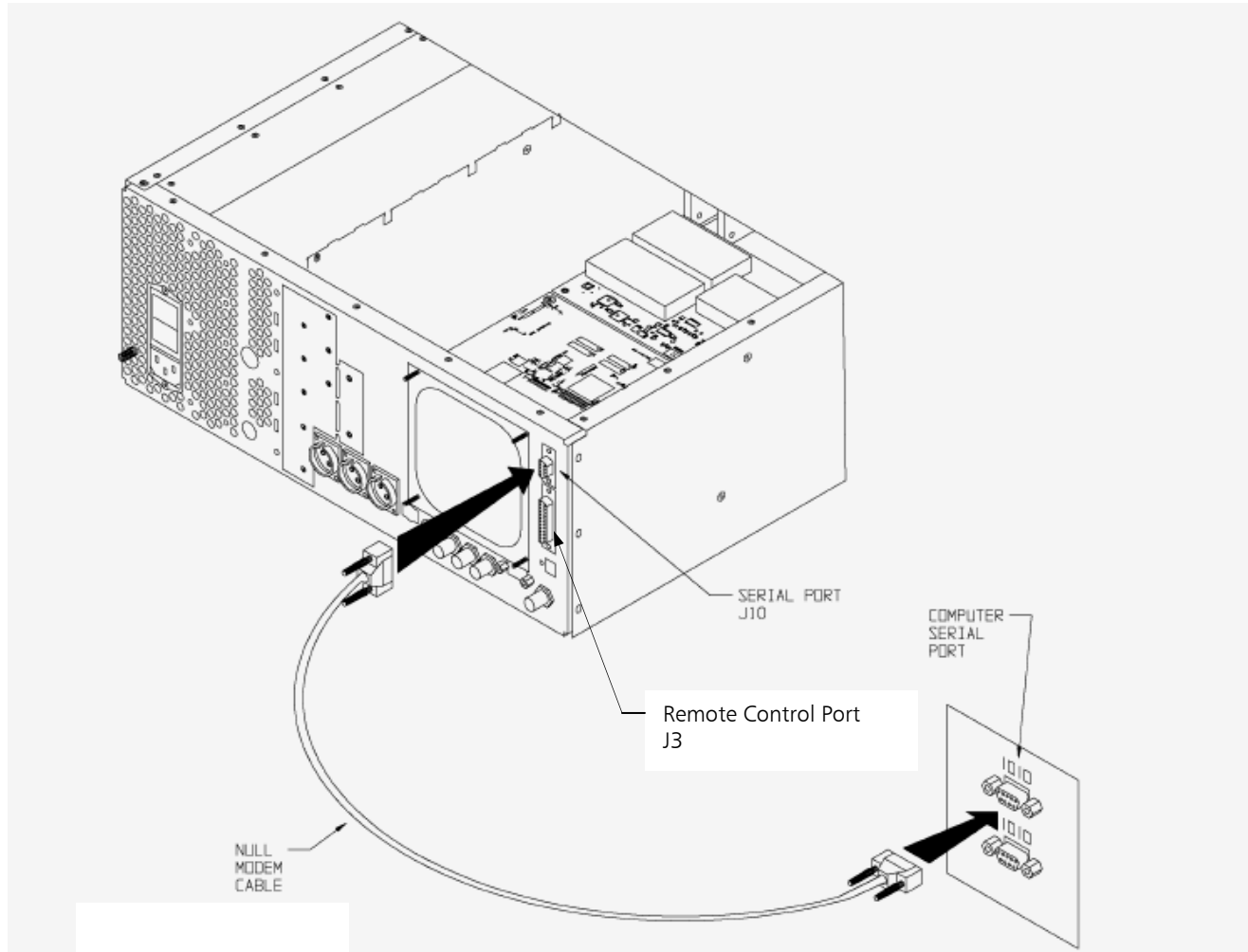


Figure 41 – PC to FXi Serial Port Null Modem Cable Connection

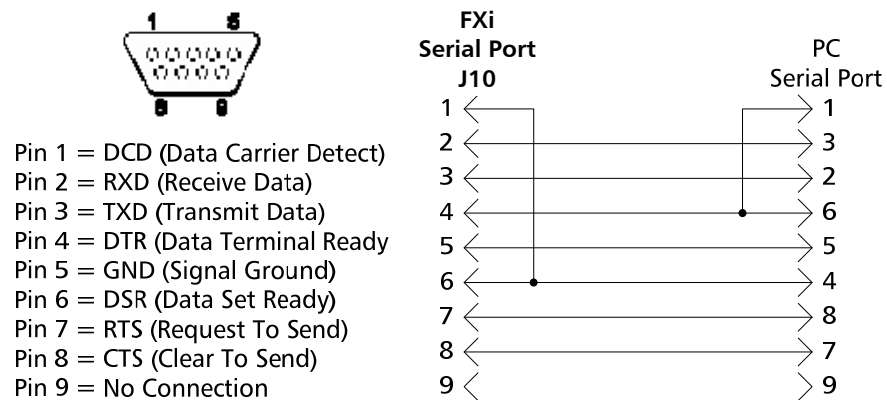


Figure 42 – Serial Cable / Null Modem Adapter Pinout

- Step 2** – From the Desktop go to: **START-> ALL PROGRAMS-> ACCESSORIES-> COMMUNICATION-> HYPERTERMINAL** and click the mouse.
- Step 3** – The HyperTerminal dialog box should now be displayed. In the **CONNECTION DESCRIPTION** box, enter the name of the shortcut that you want to be created such as *FMI Mode Change*.
- Step 4** – Select and click **OK**.
- Step 5** – The **CONNECT TO** dialog box will now appear. In the **CONNECT USING** dialog box, ensure that the correct COM Port is selected (typically **COM 1** is used) and then click **OK**.
- Step 6** – The **COM1 PROPERTIES** dialog box will appear. Move the cursor to the **BITS PER SECOND** dialog box and select **19200**.
- Step 7** – Move the cursor to the **DATA BITS** dialog box and select **8**.
- Step 8** – Move the cursor to the **PARITY** dialog box and select **NONE**.
- Step 9** – Move the cursor to the **STOP BITS** dialog box and select **1**.
- Step 10** – Move the cursor to the **FLOW CONTROL** dialog box and select **NONE**.
- Step 11** – Select **OK** and the HyperTerminal communication window will appear.
- Step 12** – Enter **Shift+?** to bring up the Supplemental command menu list as shown in **Figure 43**. Press “b” on the keyboard to program the function of the remote input called RAISE POWER (J3 Pin 11).

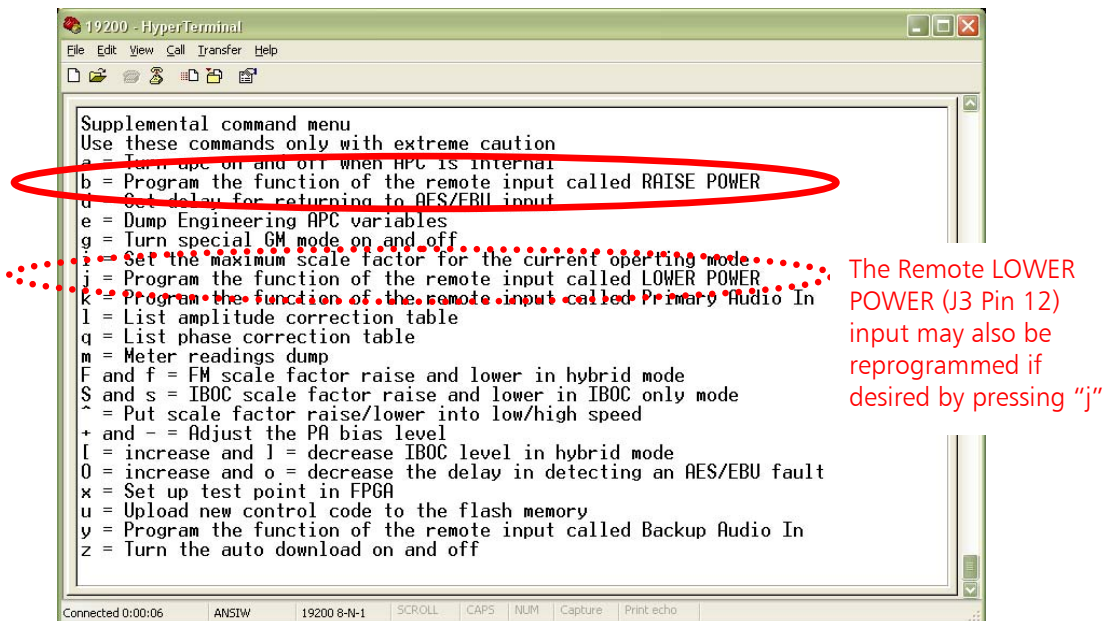


Figure 43 – HyperTerminal Supplemental Command Menu

Step 13 – There are four programming options for this remote control pin (J3 Pin 11):

1. Raise Power (factory default setting)
2. FM only mode
3. IBOC only mode
4. FM + IBOC mode

Press the “4” key on the keyboard to program this pin to be used for FM + IBOC operation.

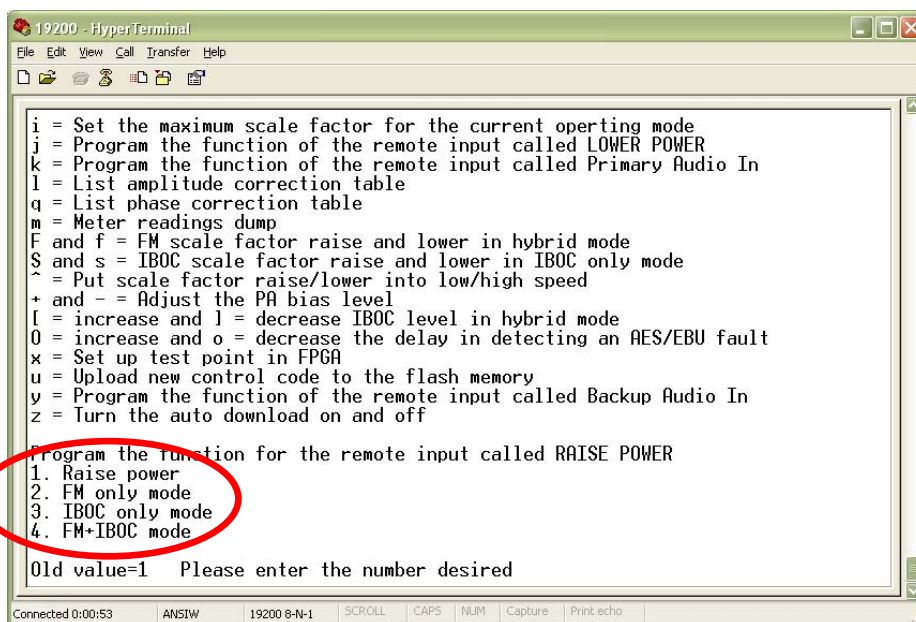


Figure 44 – HyperTerminal Supplemental Command Menu

Remote control J3 Pin 11 has now been programmed to tell the FXi Exciter to switch to FM + IBOC mode when activated. A positive voltage is required to activate the command if the factory default jumper has not been changed from providing ground to the remote common. J3 Pins 6 or 7 may be used for the positive voltage required to activate the command (see **Figure 40**).

Since FMi Transmitters would be normally operating in IBOC ONLY mode, providing a contact closure to this remote input pin on the Exciter will change the transmitter to operate in FM + IBOC mode. Once the contact closure is released, the transmitter will go back to IBOC ONLY mode of operation.

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