TC-410 IFB System

System Overview

The TC-410 IFB system consists of two parts, a rack mounted “system electronics” frame and rack mounted “control head”. Connection of the control head to the system electronics is made via a user furnished multi conductor DB-15 control cable wired pin for pin. The cable contains bi-polar DC power, the balanced microphone signal and control switching logic. The frame features a UL approved, wide range, switch mode regulated power supply. The system electronics can operate from any AC mains power source between 75-260 VAC at at frequency of 47-63 Hz. The frame accepts up to four (4) mono, balanced program signals at a nominal +4 DBM level. These inputs are all balanced, bridging with typical impedance of 20 K or greater. Program inputs terminate to a removable header with compression type screw terminals. The four balanced program inputs are summed to a singular mono signal source. A front panel “pgm level” control allows the user to trim the input levels above or below system reference operating level of +4 DBM. The dim control sets the level of “dimmed” program during interrupt for all of the four output channels. The range of the dim control allows the user continuous adjustment from full program level to zero level during interrupt. The four (4) active balanced interrupt outputs provide a nominal output level of +4 DBM with a typical source impedance of 600 ohms or less.

The rack mount control head is furnished with a high quality, detachable, directional dynamic gooseneck microphone. If desired, the front panel microphone may be removed and an external balanced microphone signal at a nominal +4 DBM can my be substituted in it’s place via the rear panel removable screw terminal header. The external mic input is a balanced bridging input. An internal jumper selects which microphone signal source is active. A recessed, front panel, screwdriver adjustment is provided to set either the internal pre amp gain unto the system electronics frame or the external sources’ gain. Four momentary illuminated buttons activate each individual interrupt function. The fifth “all call button” activates all four interrupts silmutaneously. The buttons, in their idle state, are dimly illuminated. When activated, they brightly illuminate and “tally” the function activated accordingly.

The system performance can be monitored at the front panel of the system electronics frame. A five (5) position rotary switch selects which signal will be monitored by the LED bargraph display and the ¼ inch stereo headphone jack. A level control is provided for the headphone output. The first four positions monitor across the actual output terminals of each of the respective balanced IFB output. The fifth position monitors the summed program signal after gain adjustment, sourced to the four interrupts. The LED bar graph display is calibrated to the nominal system reference level of +4 DBM. Indicated by the “R” marking.

Installation, System Electronics Frame

Connection between the system electronics frame and control head is made via a user supplied cable assembly. The cable type chosen should be at least 24 AWG. Install a DB-15 female connector on the control head end and a male DB-15 connector at the system electronics frame. The cable should be wired pin number for pin number on both ends. Double check the wiring and verify connections. Improper wiring can cause serious damage to the system electronics and control head. Connect the male connector to the system electronics frame and secure it using the jackscrews. Connect the input signal (s) to the removable screw terminal header labeled “program Inputs”. Observe polarity of the input signal (s) that are connected to the frame. Assuming that the source of the input signals is indeed balanced, the ground or shield is not required. Connection of the ground, or shield, is optional and may be omitted.

Connect the IFB outputs to the removable screw terminal header labeled “IFB Outputs”, observing signal polarity. The IFB outputs are active balanced and the connection of the shield or ground wire is optional and may be omitted.

Installation, Control Head

The installer should determine if the microphone source will be the furnished dynamic, detachable goose neck microphone or if an external line level microphone signal will be used. If the front panel microphone is used, the internal jumper on the control head circuit card is set correctly as shipped. If an external source will be used , remove the rear cover from the control head by removing the phillips head screws. Locate the movable jumper on the component side of the board just under the front panel gain trim pot. The easiest way to change the jumper is to use needle nosed pliers to gently grasp and move the jumper to the other terminal. The jumper moves over one position and should connect across 2 pins with the center pin considered as the "common" pin. Connect the external signal source to the removable screw header. This external mic input is balanced and connection of the shield or ground, is optional, and up to the installer. The external mic signal source must be between – 10 and + 4 DBM as the gain trim range of the buffer amplifier circuitry within the control head is optimized for this level. Connect the female end of the DB-15 control cable assembly. The AC mains may now be connected to the system electronics frame. The buttons on the control head should all illuminate. The LED on the front of the system electronics should illuminate. Proceed to level setting.

Note : If the level of the external microphone signal is higher than +4 dbm, a resistive "pad" may be required to reduce the external signal to an acceptable level.

Setting Program Level

Although a reference +4, 1 Khz. tone may be used to roughly set system operating levels, tone does not necessarily prove to be the best way to set operating levels. The preferred method is to use actual program material where the average and peak levels are more representative of what will be experienced. We recommend that music or some other form of program material be feed to the program audio input (s) for properly setting operating levels. In many cases when actual program peaks of +4 are observed the average level will be approximately 8 to 10 DB below the peak levels. Please note that the Audio Technica microphone furnished with the TC-410 control panel is quite directional and is designed to be "close talked" at a distance of 2-3 inches. If using an external mic source, check the specifications for that microphone prior to setting mic gain on the control panel. Please keep the above factors in mind while setting operating levels.

If possible, monitor the actual IFB-1 balanced output with an extended range VU meter or other level measuring device having peak reading capability. Plug a set of stereo headphones into the ¼ " phones jack on the front panel. Start the program audio source. Select "IFB-1" on the front panel monitor selector switch. Set the program gain control somewhere between 9 and 12 O'clock. You should hear the program audio source. Set a comfort listening level in the headphones using the monitor level control. Turn down the program level control fully ccw so program is off. Also turn the program dim control fully ccw to min

NOTE: Since the microphone signal that is input to the system electronics frame becomes the basic "REFERENCE" for which the "program" must closely match, it is important that the microphone level is properly set to start with.

Have another person press the IFB-1 button on the control head and speak, at a reasonable level approximately 2-3 inches from the microphone. As shipped, the gain is set to mid range. If needed, use an "Xcelite Greenie" screwdriver to adjust the control head mic preamp gain pot (located through the small hole in the front panel) so that the LED bargraph meter just illuminates the "R" marked LED segment on voice peaks. The mic gain is now correctly set. Have the person release the IFB-1 button. Slowly raise the program level control so that the program peaks just illuminate the "R" LED segment. Once again have the person at the control panel press the IFB-1 button and speak. Now adjust the dim level to the desired setting for program "under" level during interrupt. Alternately press and release the IFB-1 button while the other person speaks. Listen to the relative balance of the

person speaking during interrupt and full program audio when the IFB-1 button is released. If it sounds out of balance, reduce or increase the program level accordingly so that a comfortable balance between the microphone signal and program audio is achieved. Check the remaining three IFB outputs. Once one channel is properly set, the others will be identical. Observe the IFB output on the peak metering device. the average level of the interrupt microphone signal as well as the average "full program" signal should be similar with peak levels being similar as well. Initial adjustments are now completed. Continue with the remaining physical installation.

Theory of operation, System Electronics Frame

Power Supply

AC Mains power enters through the fused, IEC power entry module on the rear of the system electronics frame. The mains and system electronics are protected by a 1 amp fast blow type fuse that is enclosed in the slide out section of the power entry module. For continued protection, replace only with a similar type and rating fuse. The switching power supply module furnishes bi-polar + / - 12 VDC to operate the entire system. Voltage rails are refered to as VCC+ and VCC-. The front panel power LED indicates that the power supply is operational. Should a short occur in the DB-15 control panel cable, the sacrificial 2.2 ohm resistors R-83 and 84 act as "fuses" and may vaporize protecting the system electronics frame and power supply from further damage.

Input Circuitry

Four nominal +4 DBM audio input signals may connect to the removable terminal block on the rear of the TC-410 labeled "balanced program inputs". These may be two stereo pairs or four individual sources. Polarity of the inputs is indicated on the rear panel and must be observed. Program input signals are presented to IC, U-1, A & B and U-2, A & B. These are unity gain buffer amplifiers. All the inputs are electronically balanced, bridging, and have a typical input impedance of 20 K ohms or greater. The outputs from each input buffer stage is summed by IC, U-3,A. The output of the summing amplifier U-3 A feeds program gain set potentiometer RV-1. The other half of IC, U-3, B is a buffer stage that supplies "Full" program audio to electronic crosspoints IC, U-6 and U-9. "Full Program" is also supplied to the "dim" potentiometer RV-2. The "Dim" signal is amplified by IC, U-4 B and is presented to electronic switches IC, U-5, 6, 8 and 10. The balanced interrupt microphone signal enters the DB-9 connector from the control head on pins 7 and 8 The microphone signal passes through unity gain buffer amplifier IC, U-3 B and, is presented to electronic switches IC, U- 5, 7, 8, and 10.

Switching and Output Stages

The following will describe typical function of the "IFB-1" section. In the systems' static condition, the full "summed" program audio is passed by switch IC, U-6 A which is currently in the "on" state. The output of IC, U-6 A feeds one of the three inputs of summing amplifier IC, U-11 A. Conversely, both sections of electronic switch IC, U-5 are off. One half of electronic switch IC, U-5 controls the "dimmed" program signal. The other half controls the interrupt mic signal. When interrupt button "IFB-1" is pressed on the control head, + 12 volts DC is applied to J-1, pin 1, of the DB-15 control head connector. This "high" or + 12 volt condition is fed to quad inverter / buffer IC, U-17, pin 3. Each section of IC, U-17 provides inverse logic conditions for each of its respective outputs. When input pin 3 of IC, U-17 goes high, pin 2 of IC, U-17 goes low causing IC, U-6 A, pin 2 to go low, and "full" program audio to turn off. At the same instant, pin 10 of IC, U-17 goes high, causing IC, U-5 pin 2 and 13 to go high causing both halves of U-5 to turn "on", applying the "dimmed" program and interrupt mic signal to the other inputs of summing amplifier IC, U-11 A. The output of summing amplifier IC,

U-11 A feeds the resultant switched signals to the input of IFB-1, balanced line output driver IC, U-13. The IFB-1 output signal appears at the IFB-1, L & H terminals of the "Balanced IFB Output" removable terminal block. The IFB-1 output signal is also applied to monitor selector switch SW-1, position 1, for monitoring purposes. Each IFB switching and IFB output section operates in a similar fashion.

Monitoring Circuitry

Each balanced IFB output is presented to the first four positions of the monitor selector switch. The summed "full" program source is presented to the fifth switch position. IC U-18 A buffers the balanced switch output. The output of IC, U-18A applies the signal to the LED bargraph meter as well as to the headphone amplifier via the monitor level control RV-3. The selected signal is simultaneously monitored at the headphone output jack and level is indicated on the LED meter. Headphones used for monitoring should be 600 ohms or greater. The "R" indication on the meter represents the nominal system operating level of + 4 DBM., or "0" as would be related to a typical VU meter.

Theory of operation, Control Head

Audio Circuitry

The Control head connects to the TC-410 system electronics via a user furnished pin for pin DB-15 cable male / female cable. The local goose neck microphone is connected to the front panel XLR-3 connector. The balanced microphone level signal is applied to the pre amplifier stage IC, U-1. This pre amp amplifies the microphone signal to approximately 0 DBM. An external microphone signal may be used in place of the local microphone and pre amp. A removable header is supplied for termination of an "external" balanced, line level signal of approximately. +4 DBm. The external signal is buffered by IC, U-2 A. The selection of which microphone signal will be used is made via the internal jumper. For the local mic pre amp IC, U-1 to be active, jumper JU-1 must be in the INT position. If the external signal is to be used, the jumper must be in the EXT position. the connection to the external device causes a grounding problem, the ground terminal on the external input should be "floated" and not connected. An internal "gnd lift" jumper is also provided that will accomplish the same end. A screwdriver adjustment is provided through the small hole on the front panel to adjust the mic gain, either internal or external, unto the system electronics frame. IC, U-2 B provides a small amount of gain before the signal is passed to the balanced line driver IC, U-3. The balanced output appears at the DB-15 connector on pins 7 & 8. DC Voltage to operate the control head enters the control head on the DB-15 connector + VCC on pins 9,10 and – VCC on pins11-12. The full power supply output of 24 volts is used to operate the lamps within the buttons.

Control And Lamp Circuitry

Normally in its static condition, the control head lamps are illuminated at a lower brilliance. Activating the respective buttons' function will cause the buttons' lamp to illuminate at full brightness. Each button contains a dual set of contacts. When an IFB buttons is pressed, that respective button applies + 12 volts to the proper control pin 1,2,3 or 4 of the DB-15 connector. One set of contacts is used for IFB switching logic, the other set of contacts turns on each respective lamps' transistor, that in turn completes the lamp circuit by effectively "shorting around" each lamps series dropping resistor. The first set of contacts in the "all call" button, applies + 12 volts via diodes D-5, 6, 7, and 8 to each IFB control switch / pin to activate each IFB's switching logic function. The second set of contacts in the all call button applies + 12 volts to the base of each lamps' switching transistor via diodes D-1,2,3 and 4 which causes all the lamps to illuminate to the high brilliance state when the "all call" button is pressed.

DB-15 Control Cable Pin out

Pin #	Function
1	IFB-1
2	IFB-2
3	IFB-3
4	IFB-4
5	N.C.
6	Mic Common (Gnd)
7	Mic Signal Low
8	Mic Signal High
9	+ 12 Volts VCC +
10	+ 12 Volts VCC +
11	- 12 Volts VCC -
12	- 12 Volts VCC-
13	Common (Gnd)
14	Common (Gnd)
15	Common (Gnd)

Warranty

Twecomm Inc. warrants its products to be free from defects in materials and workmanship for a period of 90 days following the date of shipment to the original purchaser. This warranty does not cover products that have been damaged by accident, disaster, abuse, neglect, misuse, improper handling, or incorrect installation. Furthermore, it does not cover products that have been altered, modified or repaired by anyone other than Twecomm Inc. This warranty does not cover products that may be damaged while in shipment to or from Twecomm Inc.

The warranty is in lieu of any other warranty, whether expressed or implied, or statutory; including but not limited to any warranty of merchantability, fitness or any particular use or purpose, or any warranty otherwise arising out of any proposal, specification, or sample. Twecomm Inc. neither assumes nor authorizes any person or organization to assume for it any other liability. All implied warranties including any warranty of merchantability and fitness for a particular purpose are hereby disclaimed. User is responsible to determine suitability of product for intended use. No liability whatsoever is assumed for consequential damages resulting from the use or failure of any Twecomm manufactured equipment. No liability whatsoever is assumed for consequential damages resulting to any equipment that a Twecomm manufactured product may be connected to or used in conjunction with.

Twecomm Inc. sole and exclusive liability will be, at it's option, to repair or replace, any such product which fails during the applicable warranty period provided that :

A Buyer promptly notifies Twecomm Inc. that such product is defective and furnishes an explanation of the deficiency.

B Such product is returned to Twecomm Inc. with shipping pre paid at Buyer's risk.

C Twecomm Inc. is satisfied that claimed deficiencies exist and was not caused by accident, misuse, neglect, alteration, modification, attempted repair or improper installation.

D If product is indeed found defective, transportation charges for the return of product to buyer within the continental United States will be paid by Twecomm Inc. For all other locations outside the continental United States, the warranty excludes all costs of shipping, customs clearance, and any other related charges. Twecomm Inc. will have a reasonable time to make repairs, or replace the defective product.

Twecomm Inc. 1631 King James Drive Pittsburgh, PA 15237 Ph 412-369-8770 fax 412-663-0049
support@twecomm.com www.twecomm.com