3686–00 15kHz Transmit and 3687–00 15kHz Receive Program Channel Units

CONTENTS PAGE

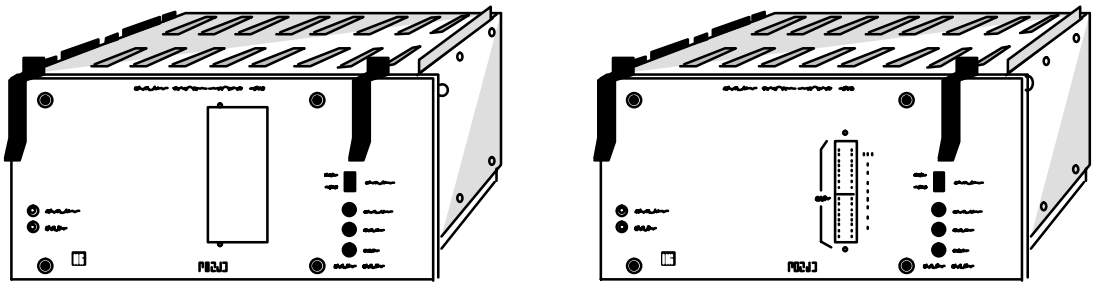


Figure 1. 3686–00 15kHz Transmit and 3687–00 15kHz Receive Program Channel Units

1. GENERAL

1.1 Document Purpose

This document provides information on the Charles Industries 3686–00 15kHz Transmit Program Channel Unit and the 3687–00 15kHz Receive Program Channel Unit. The units are shown in Figure 1.

1.2 Document Status

This document is reprinted to include a general editorial update.

1.3 Equipment Function

The 3686–00 and 3687–00 units provide the capability for remote high-quality transmission of broadcast FM and TV audio via the Charles Industries 360 and 363 D4 Channel Banks.

1.4 Equipment Location/Mounting

Each 3686–00 or 3687–00 program channel unit occupies six channel slots of a 360 or 363 Terminal. The units provide two insert/eject levers. The insert/eject levers ensure positive connection of a unit's card-edge connector to the backplane connector when the unit is installed. The levers also enable easy removal of the unit.

1.5 Equipment Features

The 3686–00/3687–00 program channel units provide the following features:

- Front-panel-mounted lifting jacks provide access to the line and drop sides of each channel unit; a front-panel-mounted monitor jack provides access to the program signals.
- One front-panel-mounted green LED is on when a signal is present. One front-panel-mounted red LED turns on when a signal overload condition exists.
- Both units have a front-panel-mounted emphasis switch, which switches emphasis in or out. The use of program pre-emphasis (3686–00) and de-emphasis (3687–00) may improve the signal-to-noise ratio, depending on the application. However, all specifications are guaranteed without emphasis.
- The 3687–00 has a front-panel-mounted attenuator which provides 0 to 26.5dB of gain or attenuation in 0.1dB increments.
- For the 3686–00, gain can be provided by the optional 3686–90 Equalizer Amplifier (EA) Subassembly, or via an external equalizer amplifier. The EA mounts into the front of the 3686–00 through a spring-loaded flap.
- Error mitigation circuitry minimizes the effects of PCM line bit errors. Refer to Figure 2 for an approximation of this effect.
- The 3687–00 provides a sealing current option which allows the selection of either –48V, GRD, or an external lead.
- The 3687–00 provides an impedance matching option which allows the selection of either 150 or 600 ohms. Sealing current capability is provided for both 150 and 600 ohm operation.
- The 3686–00 requires the use of the optional 3686–90 EA subassembly to provide a sealing current option and a 150 ohm impedance matching option. Without the EA, the unit provides 600 ohms input impedance.

The program signal level point to the 3686–00 is adjusted to the optimum level for encoding via either the EA subassembly or via an external equalizer amplifier. The attenuator on the 3687–00 is used to provide loss between the transmit input on the 3686–00 and the receive output of the 3687–00.

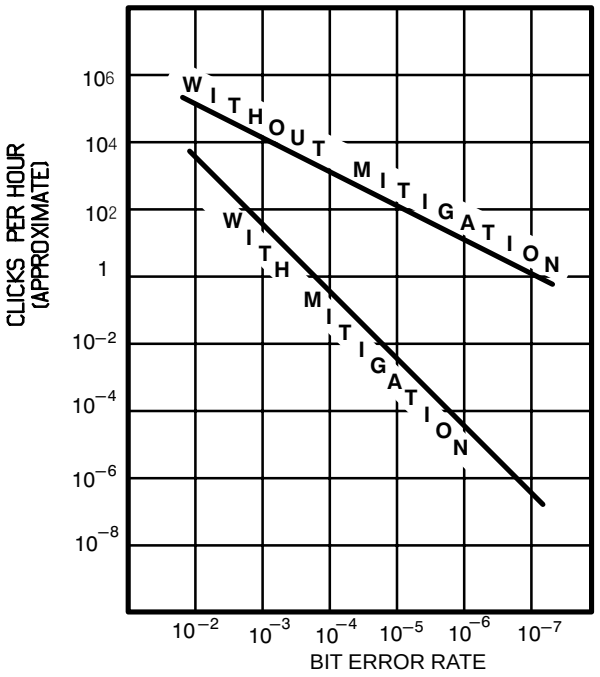


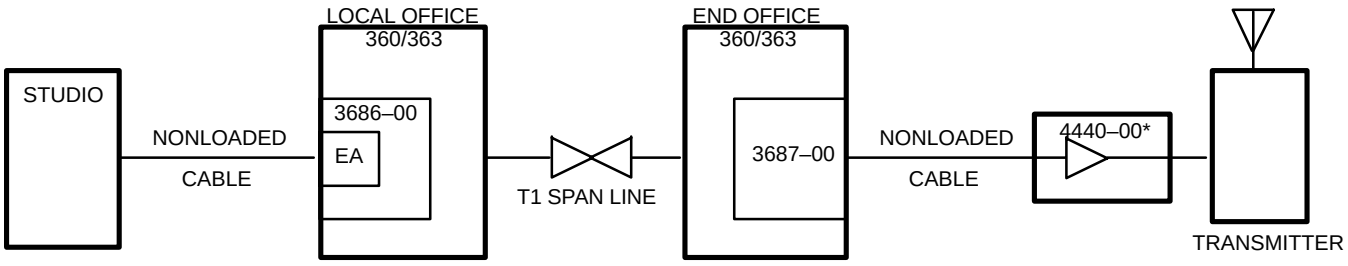
Figure 2. Effect of Error Mitigation

2. APPLICATION GUIDELINES

Three typical applications of the 3686–00 and 3687–00 are as follows: studio to transmitter links, as shown in Figure 3; remote pickup to studio links, as shown in Figure 4; and network feed (via external equalizer amplifier) to studio links, as shown in Figure 5. The applications shown are all unidirectional. For all mono channel applications, one 3686–00 is required at the transmitting terminal, and one 3687–00 is required at the receiving terminal. Stereo applications require two 3686–00s and two 3687–00s. The two channels of the stereo pair must be transmitted over the same T-carrier line and be optioned the same at each end.

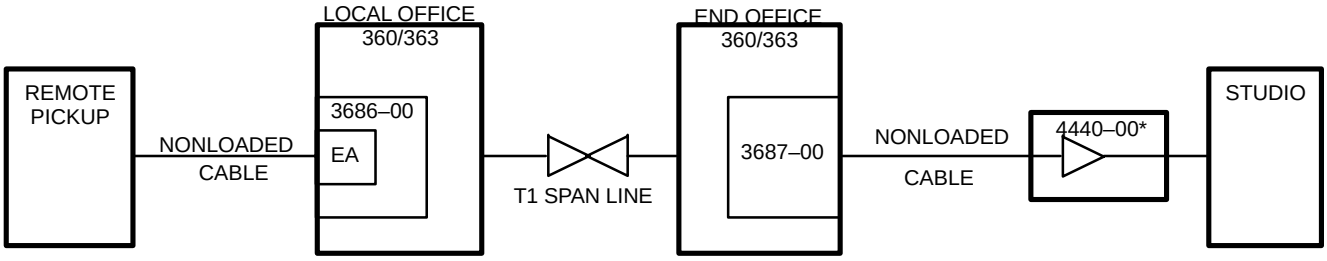
The optional 3686–9X Equalizer Amplifier (EA) Subassembly provides gain and equalization; this function can also be provided by an external equalizer amplifier, such as the Wescom 4440. Figure 6 illustrates this point: if an external equalizer amplifier is not readily available, the optional EA subassembly can provide this function. The optional EA subassembly must be used to provide the following functions:

- 150 or 600 ohms for impedance matching; the 150 ohm option gives more flexibility to equalize the line. On long lines that are hard to equalize, driving the line at 150 ohms will give the effect of pre-equalization.
- Provides gain and equalization.
- Provides sealing current lead options.
- Provides secondary lightning protection.



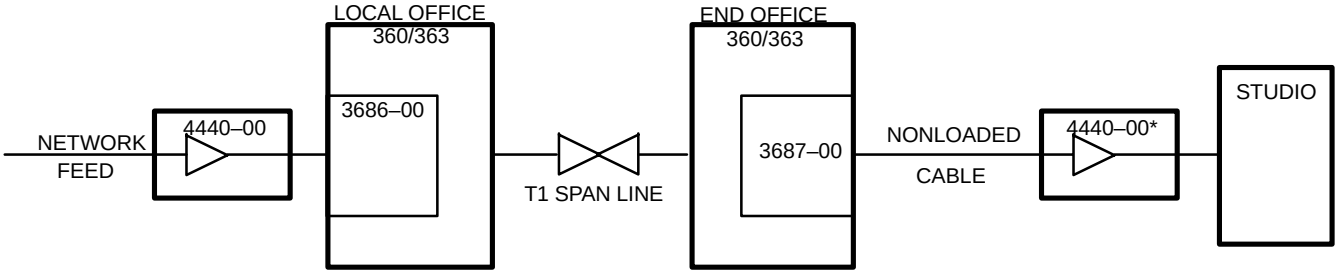
*In applications where the connecting cable length is short, the 4440–00 module may not be required.

Figure 3. Studio To Transmitter Link



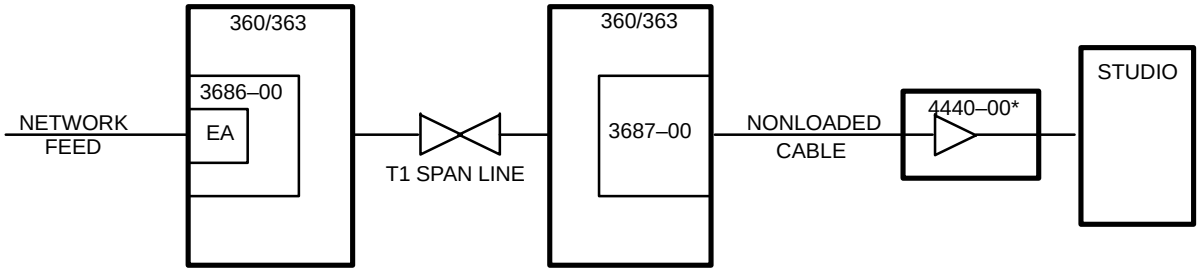
*In applications where the connecting cable length is short, the 4440–00 module may not be required.

Figure 4. Remote Pickup To Studio Link



*In applications where the connecting cable length is short, the 4440–00 module may not be required.

Figure 5. Network Feed (Via External Equalizer Amplifier) To Studio



*In applications where the connecting cable length is short, the 4440–00 module may not be required.

Figure 6. Network Feed (Via EA) To Studio

Bi-directional applications are possible for the 3686–00 and 3687–00. Figure 7 shows a normal duplex application which requires two T1 (or one T1C) span lines per channel bank (four duplex channels per channel bank). A modified duplex application which requires a special channel bank is available. This application requires only one T1 span line per channel bank (four duplex channels per channel bank). This system can be utilized for 15kHz program channels only.

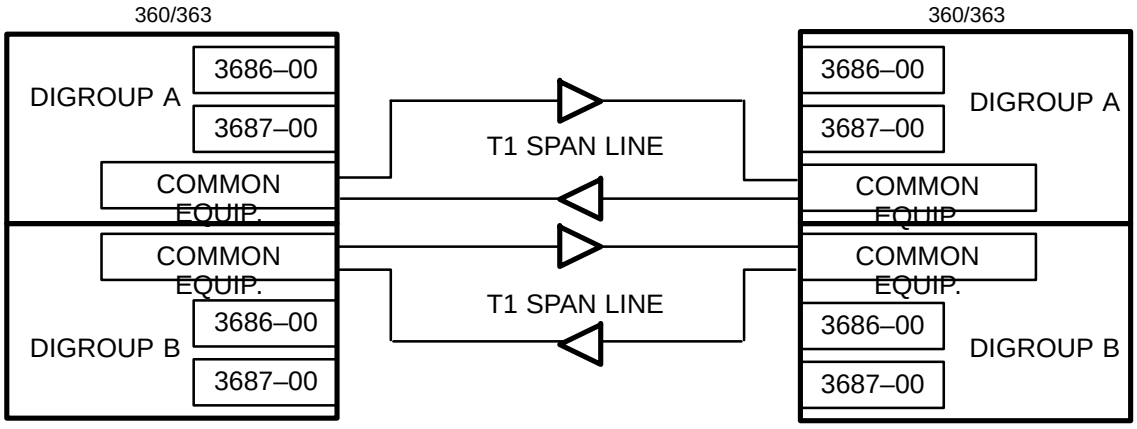


Figure 7. Normal Duplex Application

Several sealing current lead configurations are possible for the 3686–00 (when equipped with the EA subassembly) and 3687–00. Figure 8 shows the recommended configuration for stereo applications and one possible configuration for mono channel applications. When no sealing current is used, it is recommended that one sealing current lead of each channel be grounded (at either the near end or the far end), with the other end open.

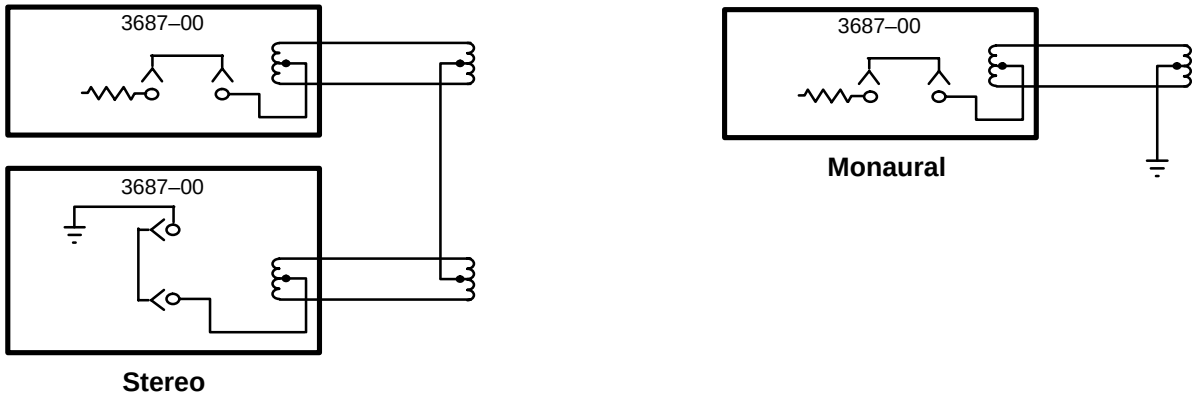


Figure 8. Sealing Current Lead Configurations

DC sealing current is used to prevent contact deterioration and thus reduce contact noise in nonsoldered cable connections. It is intended for use on metallic lines carrying data, carrier, or other services employing low-level AC signals not superimposed on DC.

3. CIRCUIT DESCRIPTION

The basic function of the 3686–00 and 3687–00 program channel units is to convert a 15kHz audio program to a digital signal at the transmitting end, and then convert the transmitted digital signal back into the audio program at the receiving end. This is accomplished by sampling the audio program at a 32kHz rate, and then coding each sample into a 1o-bit program channel word. The higher sampling rate is necessitated by the wider bandwidth and higher signal-to-noise ratio required for program transmission (compared to a voice channel).

In each T1 frame, a total of 48 bits are transmitted; there are four 10-bit words, plus zero-code-suppression and parity bits. The zero-code suppression bits ensure that remotely-located repeaters will regenerate the signals. The parity bit is used to detect bit errors, the effects of which are lessened via the error mitigation circuitry.

After encoding within the 3686–00, the program channel words are routed to the 360 or 363 common equipment where they are multiplexed into the PCM bit stream along with coded information from the other channels in the terminal. At the far-end terminal, the 3687–00 reverses the coding process to decode the program channel words into the audio program.

3.1 3686–00 15kHz Transmit Program Channel Unit

Refer to Figure 9, the 3686–00 block diagram, while reading the 3686–00 circuit description. Audio program information enters the 3686–00 on the T and R leads. With no 3686–90 subassembly installed, the audio signals are applied directly to the 600 ohm resistive termination and the DIFFERENTIAL AMP, which provides balanced to single-ended conversion. When the 3686–90 subassembly is installed, the following additional functions can be provided: gain, cable post-equalization, 150 ohm input, sealing current, and secondary lightning protection.

The DIFFERENTIAL AMP output can be monitored at the front-panel-mounted MONITOR jack. The BUFFER allows the use of either terminated or bridging meters, without affecting service. Without a 3686–9X EA Subassembly, the MONITOR jack output is identical to the signal at the T and R leads. With a 3686–90 installed, the MONITOR jack output is the amplified and equalized output of the 3686–90.

The PRE-EMPHASIS circuit emphasizes high frequencies per CCITT Recommendation J.17, when S1 is set to the IN position. Refer to Figure 10, for the graph showing the pre-emphasis relative to 1kHz. An extra 4dB headroom (at 1kHz) is automatically provided when emphasis is selected, without affecting end-to-end gain. Not all applications require pre-emphasis; refer to Part 6., OPTIONS, for recommendations. All specifications for the circuitry are guaranteed without pre-emphasis.

The XMT FILTER provides a very sharp roll-off above 15kHz to prevent aliasing. The A/D CONVERTER samples the analog program signal at a 32kHz rate, and converts each sample to a digital signal. The digital output is monitored by the MAINTENANCE AIDS which drive front-panel-mounted SIGNAL and OVERLOAD LEDs. The

green SIGNAL LED turns on when the signal exceeds –24dBm, and will turn off if the signal level drops below this nominal level for more than two seconds. The red OVERLOAD LED turns on if program peaks exceed the maximum encodable level (+18dBm).

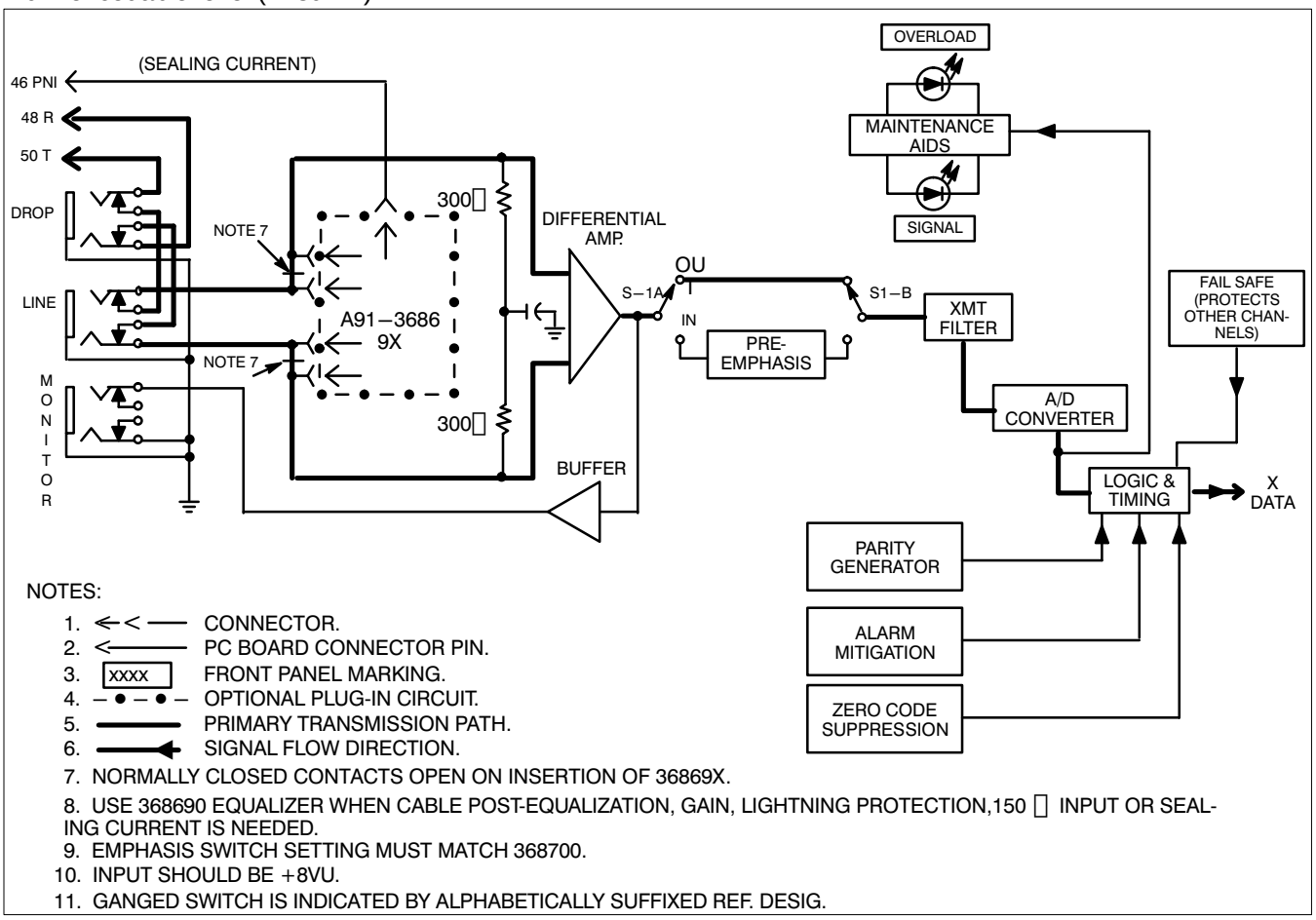


Figure 9. 3686–00 15kHz Transmit Program Channel Unit) Block Diagram

The LOGIC & TIMING circuit generates all internal timing signals and clocks, and processes the digital output of the A/D CONVERTER. The FAIL SAFE circuit prevents a malfunction within the 3686–00 from interfering with other channels in the bank. When a reverse alarm condition exists, the ALARM MITIGATION circuit will maintain a program channel with less than one percent distortion. The PARITY GENERATOR circuit provides the parity bits used within the system for error detection. One parity bit is generated per 10-bit sample. The ZERO CODE SUPPRESSION circuit guarantees that for any mix of voice, data, and program channels, no more than 15 consecutive zeroes will be transmitted. This is a requirement of the T1 line repeaters.

3.2 3687–00 15kHz Receive Program Channel Unit

Refer to Figure 11, the 3687–00 block diagram, while reading the 3687–00 circuit description. The transmitted digital data enters the LOGIC & TIMING circuit via the R DATA lead. The LOGIC & TIMING circuit generates all internal timing signals and clocks, and in conjunction with the ERROR MITIGATION circuit, minimizes the effects of bit errors arising from transmission on the T1 span line. When a reverse alarm condition exists, the ALARM MITIGATION circuit will maintain a program channel with less than one percent distortion. The output from the LOGIC & TIMING circuit is monitored by the MAINTENANCE AIDS which drive front-panel-mounted SIGNAL and OVERLOAD LEDs. The green SIGNAL LED turns on when the signal exceeds –24dBm, and will turn off if the signal level drops below the nominal level for more than 2 seconds. The red OVERLOAD LED turns on if the signal exceeds +18dBm.

The D/A CONVERTER converts the digital data back to an analog wave form. The RCV FILTER is a low-pass filter which reconstructs the original analog program material.

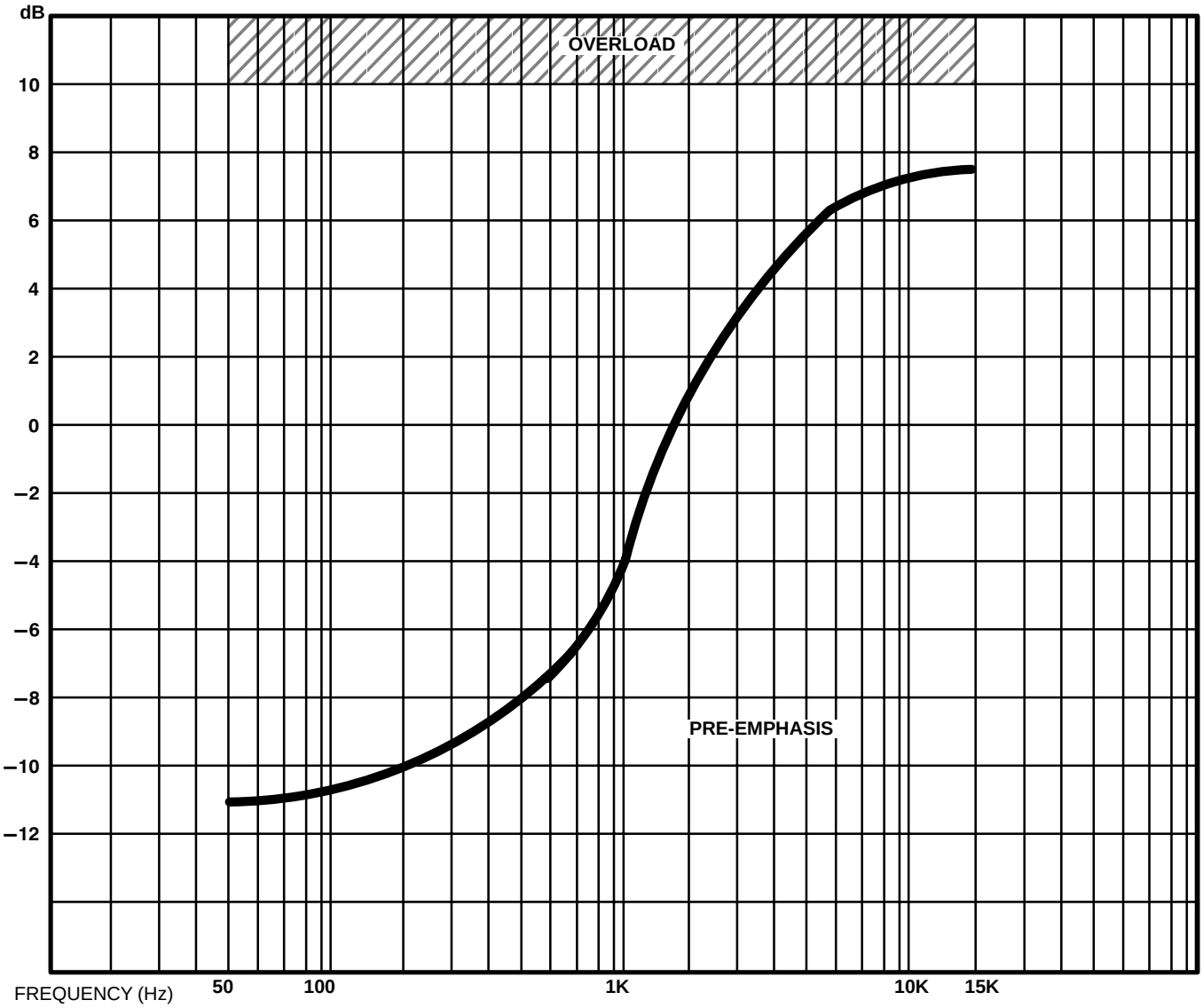


Figure 10. Pre-Emphasis and De-Emphasis Per CCITT Recommendation J.17

The DE-EMPHASIS circuit provides gain at different frequencies of the audio program in order to improve the signal-to-noise ratio, for some applications. The circuit de-emphasizes the high frequencies, per CCITT Recommendation J.17, when S1 is set to the IN position. The amount of de-emphasis at frequencies between 50Hz and 15kHz is given in Table 1. The DE-EMPHASIS circuit should be switched in whenever the PRE-EMPHASIS circuit is switched in on the 3686–00. This provides flat end-to-end gain and frequency response. Not all applications require emphasis; refer to Part 6., OPTIONS, for recommendations. To use de-emphasis, set switch S1 to IN; if de-emphasis is not required, set the switch to OUT. All specifications for the circuitry are met without de-emphasis.

Table 1. 3687—00 De-Emphasis

FREQUENCY (Hz)	DE-EMPHASIS (dB)	PRE-EMPHASIS (dB)
50	+10.970	–10.970
200	+10.332	–10.332
500	+7.893	–7.983
700	+6.193	–6.193
1k	+3.993	–3.993

FREQUENCY (Hz)	DE-EMPHASIS (dB)	PRE-EMPHASIS (dB)
1.5k	+1.235	–1.235
2k	–0.177	+0.177
3k	–3.186	+3.186
5k	–5.491	+5.491
10k	–7.055	+7.055
15k	–7.422	+7.422

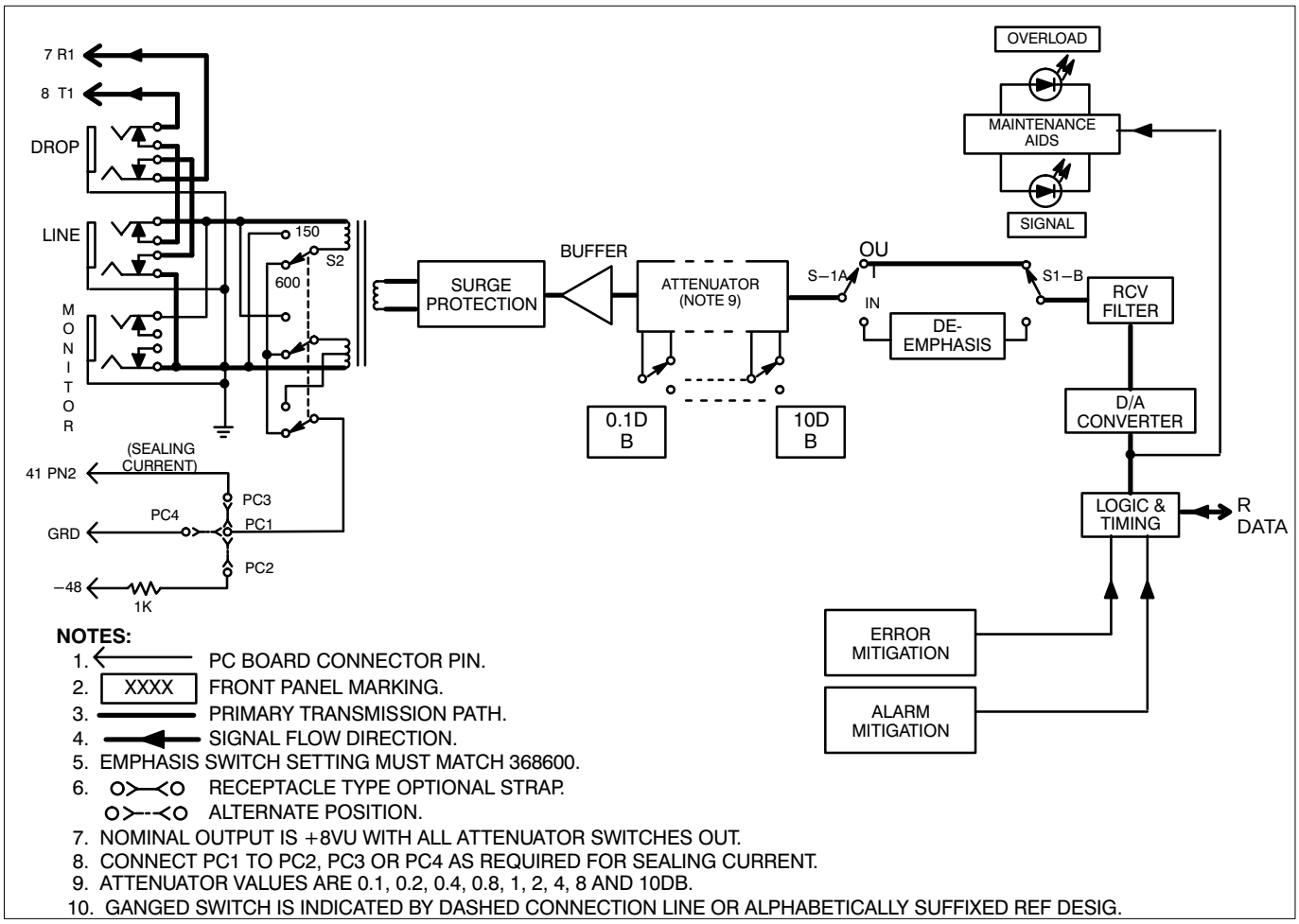


Figure 11. 3687–00 15kHz Receive Program Channel Unit (Issue 1) Block Diagram

The ATTENUATOR is used to attenuate the receive output below the nominal +8VU. Attenuation may be required to preclude crosstalk in external equipment. The front-panel-mounted ATTENUATOR is a nine-position switch which operates in an additive fashion; attenuation values are as follows: 0.1, 0.2. 0.4, 0.8, 1, 2, 4, 8, and 10dB. The total attenuation possible is thus +26.5dB.

The ATTENUATOR output passes through the BUFFER and the SURGE PROTECTION circuit, and is applied to the output transformer. The output transformer can be set to 150 or 600 ohms via switch S2, for impedance matching. The analog output of the transformer is transmitted via the T1 and R1 leads. The output can be checked via a bridging meter at the MONITOR jack on the front panel. The DROP and LINE jacks on the front panel are used to break connection to the T1 and R1 leads, for testing purposes.

The output transformer provides a sealing current lead. This lead can be optioned for –48V, GRD, or an external lead (PN2) via a three-position push-on jumper (PC 1, 2, 3, and 4).

4. MOUNTING

The 3686–00 and 3687–00 channel units occupy six channel slots of the 360 or 363 Terminals. The 3686–00 and 3687–00 channel units may be plugged into any six adjacent channel slots, the only restriction being that the 3686–00 and 3687–00 units must be in corresponding channel slots in their end-to-end respective terminals.

5. INSTALLER CONNECTIONS

The 3686–00/3687–00 channel units make connection to the channel bank backplane via two 50-pin, card-edge connectors. Installer connections are made to wire-wrap pins on the channel bank backplane. All installer connections to the 3686–00/3687–00 channel units are made to the highest channel slot occupied by the unit. For example, if the unit occupies channel slots one though six, make the installer connections to channel slot six. The only connections required to the 3686–00 unit are to the T, R, and PN1 leads. The only connections required to the 3687–00 unit are to the T1, R1, and PN2 leads. Refer to Table 2, and Figure 12 for 3686–00 installer connections; refer to Table 2 and Figure 13 for 3687–00 installer connections.

Various configurations are available for the 360/363 D4 Trunk Carrier Terminals. Refer to Section 36X–000–150 for ordering information and Section 36X–000–200 for installation instructions for the 360/363 channel bank assemblies.

Table 2. 3686–00/3687–00 Installer Connections

PCU	DESIGNATION	PIN
3687–00	T1 R1 PN2	8 7 41
3686–00	T R PN1	50 48 46

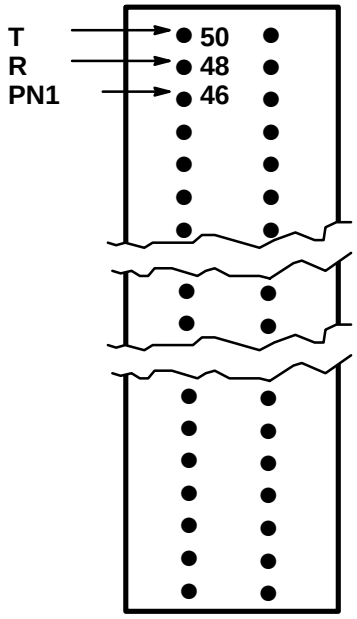


Figure 12. 3686–00 Installer Connections

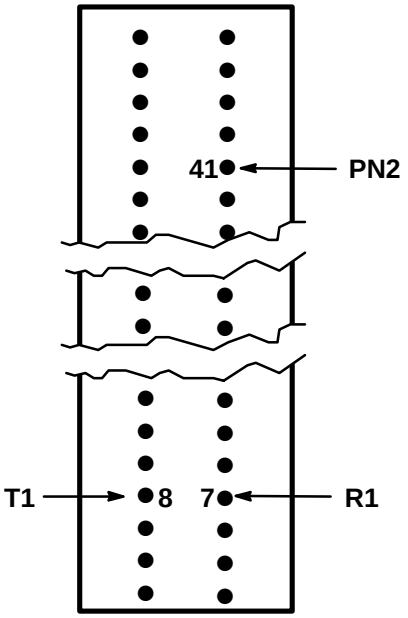


Figure 13. 3687–00 Installer Connections

6. OPTIONS

Options on the 3686–00/3687–00 channel units are selected by push-on jumpers, slide switches, and DIP switches. The push-on jumpers are easily removed with a needle-nose pliers. The push-on jumpers are then set on the desired pair of male terminals and pushed down to make contact with the printed circuit board. Slide-switch options are selected by placing the switch in the desired position. DIP-switch options are selected by placing the individual segments in the desired positions (IN or OUT).

All optioning of the 3686–00/3687–00 channel units can be done without removing the top covers. All the options and their locations are detailed in the descriptions that follow.

6.1 3686–00 Options

The 3686–00 channel unit has one option. Refer to Figure 14 for the option location. It is a front-panel-mounted slide switch (S1) used to either select or bypass pre-emphasis. Place S1 to IN to select program pre-emphasis; place S1 to OUT to bypass program pre-emphasis.

Additional features can be provided by inclusion of the optional 3686–90 Equalizer Amplifier (EA) Subassembly. The EA is installed through the movable flap on the front panel of the 3686–00, if required. The EA provides the following circuit functions: gain, sealing current leads, 150 or 600 ohm impedance, post-equalization, and secondary lightning protection.

6.2 3687–00 Options

The 3687–00 has four options: de-emphasis, attenuation, line impedance selection, and sealing current. Refer to Figure 15 for front-panel-mounted option locations.

6.2.1. De-emphasis (S1)

Slide switch S1 is a front-panel-mounted option used to either select or bypass de-emphasis. Place S1 to IN to select program de-emphasis; place S1 to OUT to bypass program de-emphasis. The S1 setting on the 3687–00 must match the S1 setting on the 3686–00.

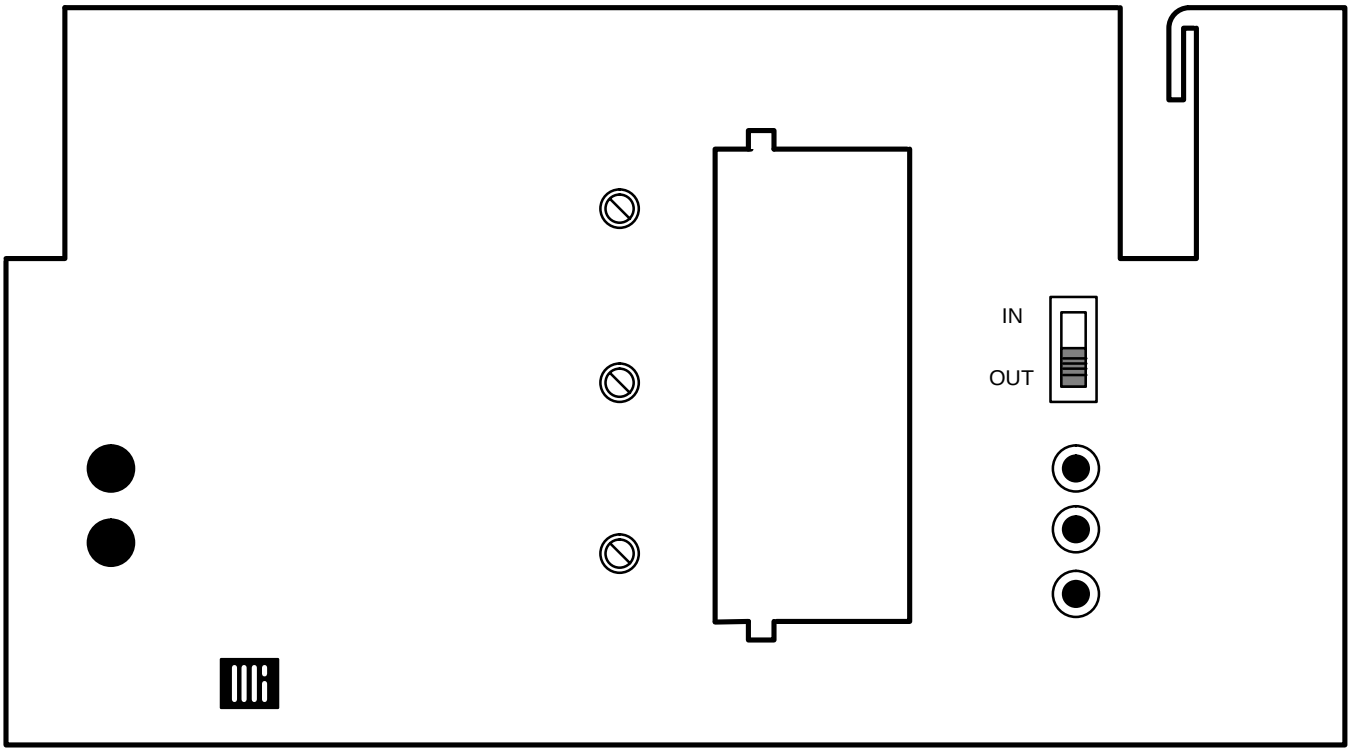


Figure 14. 3686–00 Option Location

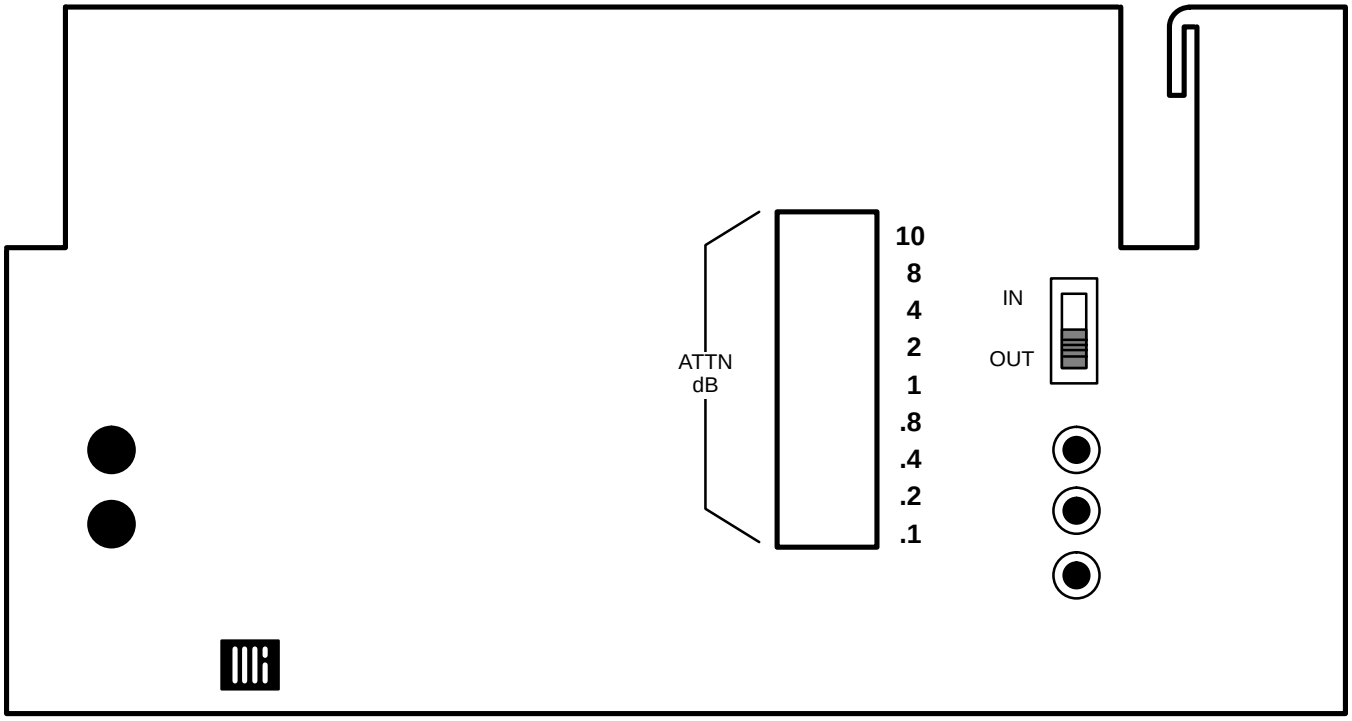


Figure 15. 3687–00 Front-Panel-Mounted Option Locations

6.2.2. Attenuation

The attenuator is a front-panel-mounted DIP switch used to select the desired value of attenuation. The attenuator has nine values, as follows: 0.1, 0.2, 0.4, 0.8, 1, 2, 4, 8, and 10. Placing the respective DIP switch segment to

IN enables that value of attenuation; placing the respective DIP switch segment to OUT disables that value of attenuation. The switch is set in an additive fashion, which allows a total range of 0 to 26.5dB.

6.2.3. Line Impedance Selection (S2)

The line impedance option (S2) is a slide switch used to select either 150 or 600 ohms impedance. Refer to Figure 16 for the location of switch S2. Set the switch to the 150 position for 150 ohms; set the switch to the 600 position for 600 ohms. On long lines that are difficult to equalize, set the switch to 150 ohms; this will give the effect of pre-equalization.

6.2.4. Sealing Current Lead Selection (PC1, 2, 3, 4)

Sealing current lead selection is done via a push-on jumper located inside the unit. The push-on jumper is accessible from the rear of the unit without removing the cover. Refer to Figure 17 for the location of this option. This is a three-position option which utilizes PC1 as the common pin. The unit has a current limiting resistor that limits current to less than 50mA. The three sealing current lead options are as follows:

- PC1 to PC3: Routed to external pin (PN2).
- PC1 to PC4: GRD.
- PC1 TO PC2: –48V.

6.3 Recommendation on Use of Emphasis

Not every application will require the use of emphasis. Without emphasis, 10dB of headroom and 46dB of signal-to-distortion ratio (S/D) are guaranteed from 50Hz to 15kHz. When emphasis is used, there is no net effect on the signal, but both the headroom and the distortion become dependent upon signal frequency.

Headroom is 21dB at 50Hz, 14dB at 1kHz, and 2.5dB at 15kHz, resulting in signal-handling capability equivalent to 10dB of nonemphasized headroom for typical program signals. In applications requiring the transmission of predominantly high-frequency signals, headroom adequacy should be considered before using emphasis.

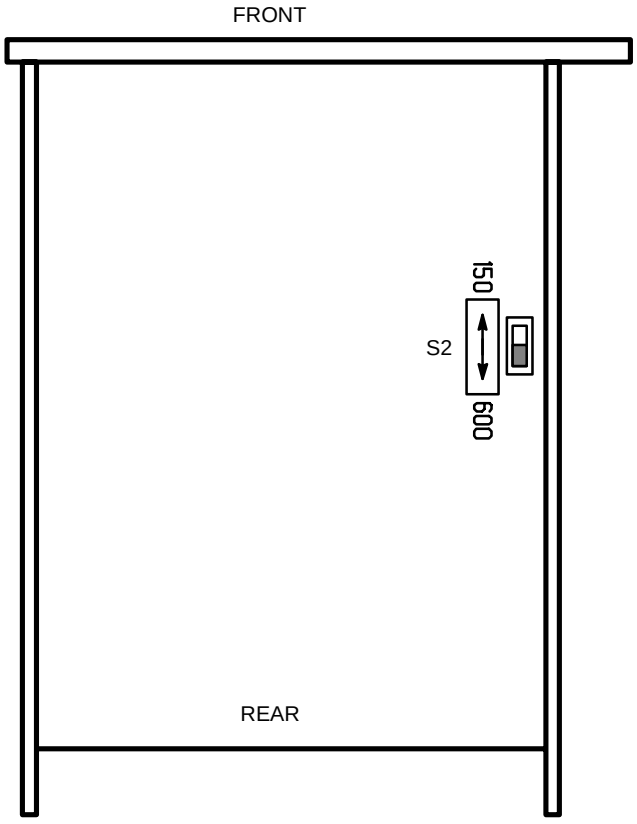


Figure 16. Bottom-Panel-Mounted Impedance Option Location (S2)

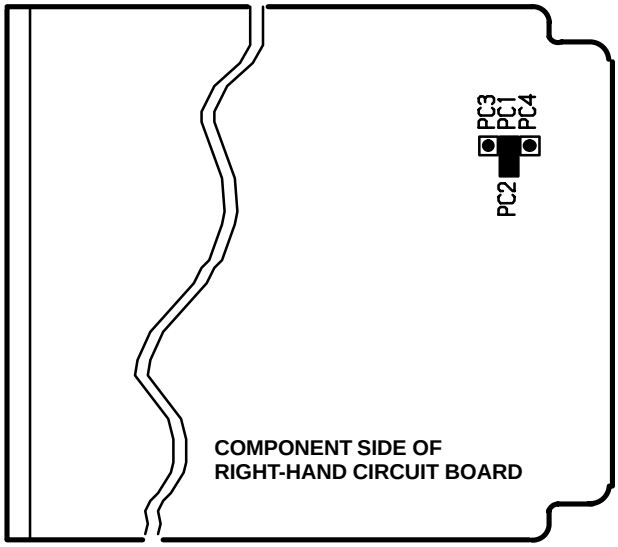


Figure 17. Printed-Circuit-Board-Mounted Sealing Current Lead Selection Option (PC1/PC2/PC3/PC4)

The use of emphasis can be expected to improve S/D for signal frequencies below 2kHz, and to degrade S/D above 2kHz. In applications requiring the transmission of predominantly low-frequency signals (up to 1kHz), the use of emphasis may significantly improve S/D (as much as 6dB). However, PCM transmission is free from the high–frequency noise, distortion, and crosstalk which plagues physical pair and FDM systems. Therefore, the use of emphasis will not provide the vast improvements that past experience may indicate. It should be noted that all specifications are met without emphasis.

7. ALIGNMENT

The alignment of the 3686–00/3687–00 channel units consists of adjusting the input level and equalization to obtain the desired transmission level between the 3686–00 and 3687–00 units. Input amplification and equalization can be performed by an external program amplifier such as the Wescom 4440, or within the 3686–00 by using the optional 3686–90 Equalizer Amplifier Subassembly. Either method allows replacement of the 3686–00 without realignment (the 3686–90 can be removed and plugged into a spare 3686–00, with the EA carrying all the alignment information). The 3687–00 attenuator DIP switches are then set, based on the input level to the 3686–00, to obtain the desired gain or loss between the two units. It may be desirable to attenuate the 3687–00 output level to preclude the possibility of crosstalk in external equipment.

There are two methods to set the input level; either the program signal method or the sinewave method can be used. The output of the 3687–00 unit should also be checked and adjusted, if required. Use the following steps to align the channel units:

7.1 Program Signal Method

Step	Action
1.	Connect a VU meter to the MONITOR jack on the front panel of the 3686–00.
2.	Adjust the program amplifier or EA for a reading of +8VU on the loudest passages.

7.2 Sinewave Method

Step	Action
1.	Connect a 600 ohm bridging or terminated AC level meter to the MONITOR jack on the front panel of the 3686–00.
2.	Use an oscillator to send a sinewave signal from the originating end (such as the studio), at a level 10dB below the 100 percent modulation point. Typically, this will be +8dBm.
3.	Adjust the program amplifier or EA such that the AC level meter reads +8dBm at 1000Hz, with flat frequency response from 30Hz to 15kHz.

7.3 3687–00 Output

Note: The terms VU and dBm can be considered equivalent, for sinewave signals. However, a VU meter will damp peaks on non-sinewaves.

Step	Action
1.	Connect a bridging meter to the MONITOR jack. The output should be +8VU or +8dBm (depending on meter used).
2.	To attenuate this output level, set the required DIP switch segments to IN to equal the attenuation required. **Example:** If the desired output level is +3dBm, subtract the desired output level from +8dBm (+8 – +3 = +5). Set the 1 and 4dB segments to IN, to give 5dB. *Note: Do not adjust internal potentiometers.*

8. TESTING

After completing the installation, optioning, and alignment procedures, testing should be performed to verify proper operation. Some tests are required (test tone, frequency response, and idle noise), and some are optional (distortion and tracking).Use the following procedures and refer to Figure 14 and Figure 15 (for jack locations) to test the 3686–00/3687–00 Program Channel Units.

The following equipment is recommended to test the 3686–00/3687–00 Program Channel Units:

- HEWLETT-PACKARD 3551A Transmission Test Set (TTS), or equivalent.
- HEWLETT-PACKARD 333A Distortion Analyzer, or equivalent.
- Miscellaneous test cords with bantam plugs.

If trouble is encountered, verify that all installer connections have been properly made according to Part 5. Make certain that all options have been properly conditioned according to Part 6., and that the alignment procedure was completed according to Part 7. If the installation, optioning, and alignment procedures were completed correctly, replace the channel unit with a spare. Check system operation with the new unit installed. If a 3686–00 with a 3686–90 EA Subassembly is replaced, the EA can be installed in the other 3686–00 unit. This will make realignment of the unit unnecessary.

8.1 Required Tests

8.1.1. Test Tone

Step	Action
1.	Connect a balanced 600 ohm oscillator to the LINE jack of the 3686–00.
2.	Connect a 600 ohm bridging or terminated AC level meter to the MONITOR jack of the 3686–00.

Step	Action
3.	Adjust the oscillator level for +8dBm at 1020Hz (measured at the MONITOR jack).
4.	Connect a 600 ohm terminated AC level meter to the LINE jack of the 3687–00. The meter should read +8dBm, minus the receive attenuator setting ±0.2dB (±0.4dB if emphasis is used). Allowance must be made for the accuracy of the meter. *Note: If a +8dBm oscillator is not available, 0dBm can be used; in this case the meter should read 0dBm, minus the attenuator setting.*

8.1.2. Frequency Response

Step	Action
1.	Retain the connections used for the Test Tone procedure.
2.	Repeat Steps 3 and 4 of the Test Tone procedure with the frequency set at 30Hz and then at 14,980Hz. The meter readings should be the same as at 1020Hz, ±0.5dB.

8.1.3. Idle Noise

Step	Action
1.	Terminate the 3686–00 LINE jack with 600 ohms.
2.	Connect a 600 ohm terminated meter to the 3687–00 LINE jack. With 15kHz flat weighting the meter should read 30dBrn (–60dBm) minus the receive attenuator setting or less. Note that this is 68dB below nominal signal level, even if a test tone of 0dBm must be used because of test equipment limitations.

8.2 Optional Tests

8.2.1. Distortion

Step	Action
1.	Connect a balanced 600 ohm oscillator to the LINE jack of the 3686–00.
2.	Connect a distortion analyzer to the LINE jack of the 3687–00.
3.	With signal inputs of 50, 1020, and 14,980Hz at +8dBm, the signal-to-distortion ratio should be 46dB (0.5 percent) or better.

8.2.2. Tracking

Step	Action
1.	Retain the 600 ohm oscillator at the LINE jack of the 3686–00.
2.	Record the meter reading with an input level of +8dBm at 1020Hz.
3.	Connect a TTS to the LINE jack of the 3687–00.
4.	With inputs of –2, –12, –22, and –32dBm, the meter reading should drop 10, 20, 30, and 40dB, respectively, ±0.25dB. Make allowance for the accuracy of the meter.

9. TECHNICAL ASSISTANCE

9.1 Technical Assistance — U.S.

If technical assistance is required, contact Charles Industries' Technical Services Center at:

847–806–8500
847–806–8556 (FAX)
800–607–8500
techserv@charlesindustries.com (e-mail)

9.2 Technical Assistance — Canada

Canadian customers contact:

905–821–7673 (Main Office)
905–821–3280 (FAX)

10. WARRANTY & CUSTOMER SERVICE

10.1 Warranty

Charles Industries, Ltd. offers an industry-leading, 5-year warranty on products manufactured by Charles Industries. Contact your local Sales Representative at the address or telephone numbers below for warranty details. The warranty provisions are subject to change without notice. The terms and conditions applicable to any specific sale of product shall be defined in the resulting sales contract.

Charles Industries, Ltd.
5600 Apollo Drive
Rolling Meadows, Illinois 60008–4049

Telephone: 847–806–6300 (Main Office)
847–806–6231 (FAX)

10.2 Field Repairs (In-Warranty Units)

Field repairs involving the replacement of components within a unit are not recommended and may void the warranty and compatibility with any applicable regulatory or agency requirements. If a unit needs repair, contact Charles Industries, Ltd. for replacement or repair instructions, or follow the *Repair Service Procedure* below.

10.3 Advanced Replacement Service (In-Warranty Units)

Charles Industries, Ltd. offers an "advanced replacement" service if a replacement unit is required as soon as possible. With this service, the unit will be shipped in the fastest manner consistent with the urgency of the situation. In most cases, there are no charges for in-warranty repairs, except for the transportation charges of the unit and for a testing and handling charge for units returned with no trouble found. Upon receipt of the advanced replacement unit, return the out-of-service unit in the carton in which the replacement was shipped, using the preaddressed shipping label provided. Call your customer service representative at the telephone number above for more details.

10.4 Standard Repair and Replacement Service (Both In-Warranty and Out-Of-Warranty Units)

Charles Industries, Ltd. offers a standard repair or exchange service for units either in- or out-of-warranty. With this service, units may be shipped to Charles Industries for either repair and quality testing or exchanged for a replacement unit, as determined by Charles Industries. Follow the *Repair Service Procedure* below to return units and to secure a repair or replacement. A handling charge applies for equipment returned with no trouble found. To obtain more details of this service and a schedule of prices, contact the CI Service Center at 217–932–5288 (FAX 217–932–2943).

Repair Service Procedure

1. Prepare, complete, and enclose a purchase order in the box with the equipment to be returned.

2. Include the following information:

– Company name and address
– Contact name and phone number
– Inventory of equipment being shipped
– Particulars as to the nature of the failure
– Return shipping address

3. Ship the equipment, purchase order, and above-listed information, transportation prepaid, to the service center address shown below.

   CI Service Center
   Route 40 East
   Casey, IL 62420–2054

4. Most repaired or replaced units will be returned within 30 or 45 days, depending on the product type and availability of repair parts. Repaired units are warranted for either 90 days from the date of repair or for the remaining unexpired portion of the original warranty, whichever is longer.

11. SPECIFICATIONS

The electrical and physical characteristics of the 3686–00 and 3687–00 program channel units are as follows:

11.1 Electrical (End–To-End)

(a) FREQUENCY RESPONSE (RELATIVE TO 1kHz): ±0.5dB in the range of 30Hz to 15kHz; below –50dB at 16kHz; below –65dB ultimate value.

(b) TEST TONE LEVELS AND ATTENUATION RANGE: Input = +8dBm at 1kHz maximum. Output = +8 to –18.5dB, in 0.1dB increments (Total attenuation = 26.5dB).

(c) OVERLOAD POINT: +18dBm, which gives 10dB of head room for program peaks.

(d) PRE–/DE-EMPHASIS: CCITT recommendation J.17. Refer to Figure 10.

(e) TOTAL HARMONIC DISTORTION: Less than or equal to 0.5 percent (46dB) at +8dBm point, from 50Hz to 15kHz.

(f) IDLE NOISE: Less than or equal to 30dBrn with 15kHz flat weighting.

(g) TRACKING: ±0.25dB at 1kHz, from +18dBm to –32dBm.

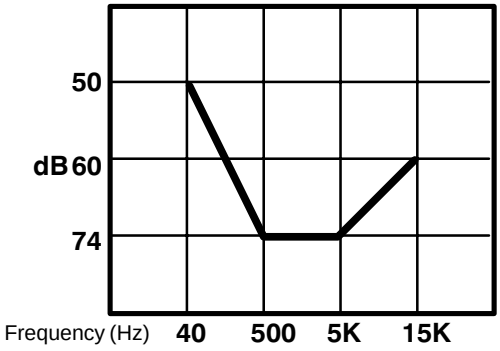
(h) INPUT IMPEDANCE (3686–00 ONLY): 600 ohms balanced.

(i) OUTPUT IMPEDANCE (3687–00 ONLY): 150 OR 600 ohms balanced, with sealing current lead option.

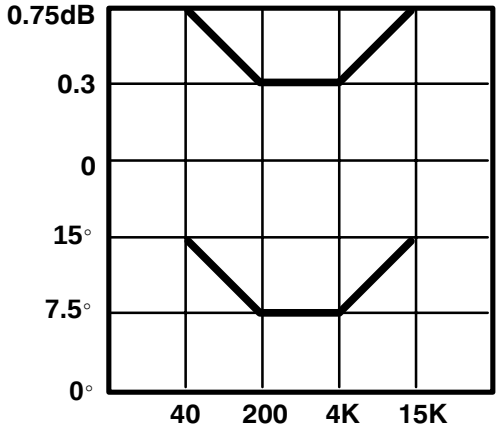
(j) LONGITUDINAL BALANCE: 50dB minimum, from 50Hz to 15kHz.

(k) RETURN LOSS: Greater than or equal to 26dB, from 50Hz to 15kHz.

(l) CROSSTALK: CCITT recommendation J.21.



(m) STEREO TRACKING:



(n) SURGE PROTECTION: Per REA PE–60 (for 3687–00 only).

(o) SAMPLING RATE: 32kHz 10–bit A–law companding.

(p) ERROR MITIGATION: One parity bit per word.

(q) ZERO CODE SUPPRESSION: No more than 15 consecutive zeros in the output data stream.

(r) SEALING CURRENT: 50mA maximum.

(s) SEALING CURRENT UNBALANCE: 1mA maximum.

(t) POWER (MAXIMUM):

Unit	Voltage	Watts	Amps
3686–00	–48VDC	10	200mA
3687–00	–48VDC	10	200mA

11.2 Physical

(u) PLUG-IN SIZE: Each unit occupies six channel slots in the 360/363 CBA. Provision for card extraction.

(v) MAINTENANCE FEATURES: One green LED to indicate program signal transmission. One red LED turns on if program peaks exceed +18dBm. Monitor jacks provide test points to check input/output levels. Line and drop jacks are provided. All jacks are bantam type.

(w) PROVISION FOR 3686–90 EQUALIZER AMPLIFIER (EA) SUBASSEMBLY: A space is provided in the 3686–00 unit to mount the optional 3686–90 EA subassembly. Shorting contacts are provided so that the EA can be removed/inserted without optioning. When removed, tip and ring are connected to the card-edge connector of the 3686–00.