TABLE 1-2

Rated Power Output for Linear Operation (for intermodulation products 50 dB down)

The total composite output power in multiple tone or wideband signals shall NOT exceed the following level or else it may result in improper operation of the device and cause interference. The composite output power rating is defined as the total average RMS output power of all inband signals. The unit should be operated at or below this level to ensure linear operation with low distortion. At this level, intermodulation products will be typically 50 dB below the carrier signals. This holds true for any number of carriers with total average power adding up to the composite output power rating listed in the table below.

Cellular Base Transmit (Downlink)	+ 24 dBm
Cellular Portable Transmit (Uplink)	+ 9 dBm
PCS Base Transmit (Downlink)	+ 24 dBm
PCS Portable Transmit (Uplink)	+ 4 dBm

SECTION 2. THEORY OF OPERATION

2.0 GENERAL

As explained in Section 1, the A289 is a bidirectional amplifier, which provides 20 dB of gain in both the cellular and PCS wireless transmit and receive bands. The block diagram of the amplifier is shown in Figure 2-1.

2.1 DESCRIPTION

2.1.1 - The unit is composed of two diplexers, two independent bidirectional amplifiers and alarm and voltage regulation circuits.

2.1.2 - The diplexers U1 and U2 combine the cellular and PCS bidirectional amplifiers. In each bidirectional amplifier additional bandpass diplexers separate signals for the uplink and downlink amplifiers.

2.1.3 - The bias condition of devices in the amplifiers is monitored. If the bias changes outside certain limits a fault condition is indicated. The downlink RF output power in each band is also monitored. If the power in either band drops below established limits a FAULT condition is indicated.

When a FAULT condition occurs the unit transmits the unit identification (or "Fault Code") by two level amplitude modulation of a low frequency carrier placed on the cable center conductor. The signal is transmitted as a short burst repeated at approximately 80 second intervals while the fault condition persists. The fault code can be reprogrammed as described in Section 4.6. While a NORMAL condition exists the amplifier transmits an OK code at intervals of approximately 80 minutes.

2.1.4 - The voltage regulators take 15 - 24 VDC input and provide 12 VDC and 10 VDC outputs. A zener diode provides transient protection against voltage spikes.

2.1.5 - The unit provides DC continuity from J1 to J2 to allow downstream cable powered amplifiers to receive their power from upstream power sources such as the PS212 and PS213. In addition, status signals from downstream cable powered amplifiers are passed through the amplifier from J1 to J2.

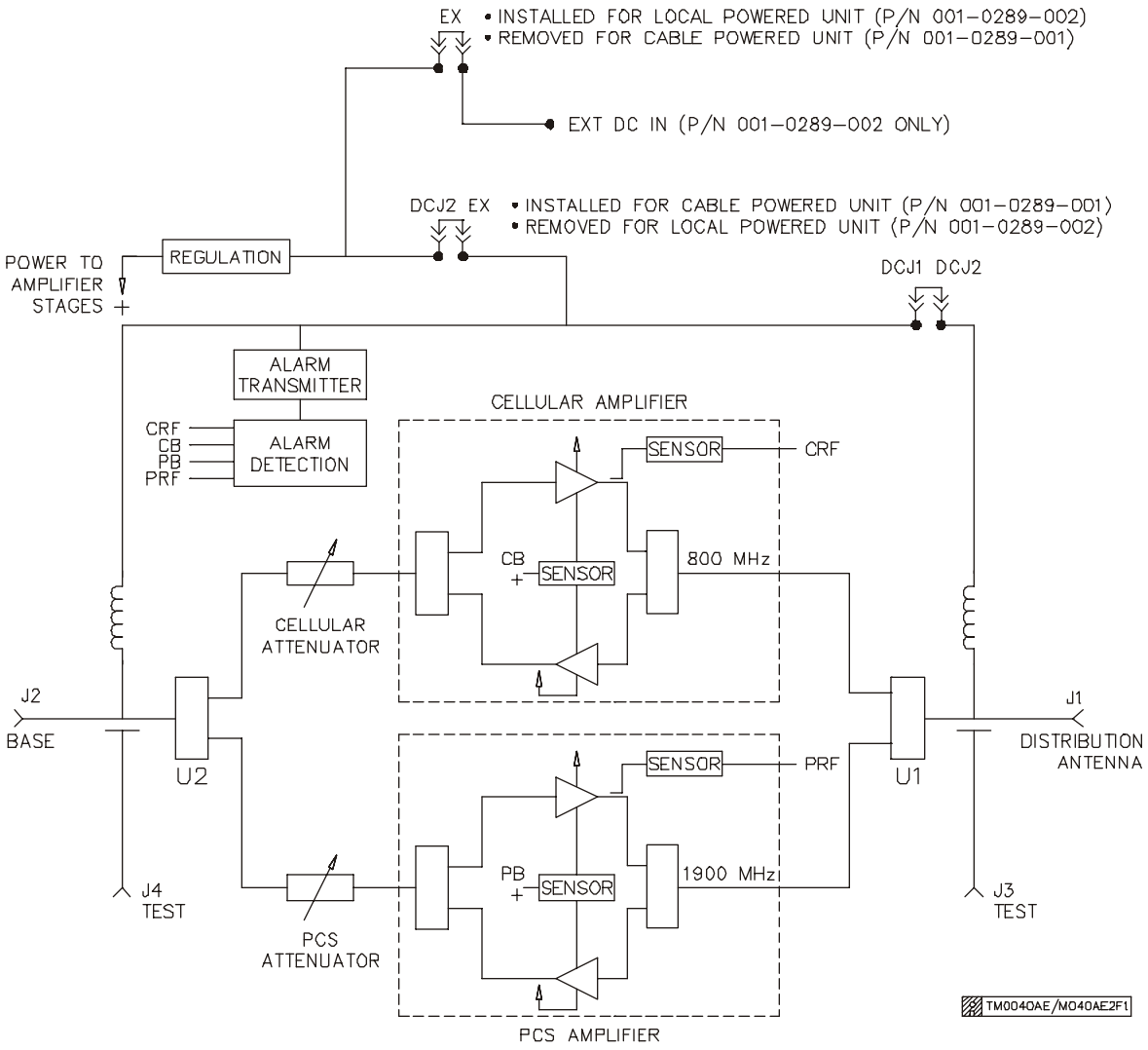


Figure 2-1 A289 Dual Band Bidirectional Amplifier - Block Diagram

2.2 FAULT REPORTING

2.2.1 General - The amplifier incorporates a number of circuits to detect deviations in important performance parameters. The unit reports alarm conditions to a remote Monitor unit such as the Model PS212.

The various functions are described in this section and may also be referenced in Section 4 where the programming of amplifier options is discussed.

2.2.2 Report Types - The unit generates two types of reports depending on the status of the amplifier as determined by the built in monitor circuits. Each type consists of a numeric code sent as low frequency tones along the coaxial cable for decoding at the monitor unit.

Under normal operation the unit will transmit an "OK" code at intervals of approximately 80 minutes. This enables the system monitoring unit to keep track that the whole system is connected and operational. In this mode a local green NORMAL LED lamp is illuminated on the side of the amplifier.

In the event that a fault is detected in the amplifier, as described later, a "FAULT" code is transmitted on the cable at intervals of approximately 80 seconds. In this mode a local red FAULT LED is illuminated on the amplifier. Four LEDs on the side of the unit indicate which specific local condition is causing the overall FAULT condition as described in the next section.

In each case the code transmitted identifies the transmitting amplifier by the FAULT CODE programmed in that particular amplifier as described later in Section 4.6. Before shipment P.G. programs each amplifier with an arbitrary code from 1 to 199 which is also shown by a label on the outside of the unit.

NOTE: Older models of P.G. bidirectional amplifiers such as the A181 or A188 transmitted only fault codes, but are compatible with the fault codes transmitted by the A289. When used with a PS212 Monitor, the A181 or A188 codes should be entered in the ID list as "FAULT ONLY" (TFO) type units. If the A289 is used with a PS200 PS/Monitor the OK code transmission (STATUS option) should be disabled (section 4.4) as it will cause the PS200 to display a FAULT alarm. Fault codes above 199 should not be set on any amplifiers since they may be incorrectly interpreted by the newer PS212.

2.2.3 Fault Conditions - The A289 circuitry monitors four separate parameters in the unit. These are: (a) the bias currents drawn by devices in the cellular and PCS amplifiers and, (b) the presence of downlink RF output power in each amplifier band. Each function can be disabled as described in Section 4, if the unit is being used in a restricted operational mode.

The DC current monitoring triggers a fault condition if the DC bias current deviates outside predetermined high or low current limits.

The downlink RF output power from each frequency band is monitored by separate detectors and a FAULT condition is triggered if the level in either band drops below a nominal level of + 5 dBm. If the amplifier is to be installed at a point in the system where the output power in either band may be less than + 7 dBm, then the RF monitor circuit for the appropriate band should be disabled as described in Section 4 herein.

The local fault indicators indicate specific faults as follows:

CELL
- BIAS Bias fault in the Cellular amplifier
- PWR Low downlink RF power from the Cellular amplifier.

PCS
- BIAS Bias fault in the PCS amplifier
- PWR Low downlink RF power from the PCS amplifier

SECTION 3. INSTALLATION, OPERATING AND MAINTENANCE INSTRUCTIONS

3.1 UNPACKING AND INSPECTION

The following checks are recommended after receipt of the equipment from shipping agent:

1. Check for any external damage that could have occurred in transit. If damage is found, report to the shipping agent and to the supplier immediately.

2. Check that all items on the packing slip are present. If any are missing, report to the supplier immediately.

3. The standard amplifiers all have been programmed at the factory with the following settings.

   DC Continuity: - J1 and J2 connected for through power.
   Alarm options: - DC and RF engaged for both bands.
   Alarm Code: - Consecutive numbers assigned.
   (Check for duplication if two lots used)
   Attenuation: - Set to zero attenuation in both bands

   It is suggested that known changes required to these settings be made on the bench before the units are installed at the site. Consult section 4.0 for more information on this task.

3.2 INSTALLATION

The bidirectional amplifier is designed for mounting on a flat vertical surface. The unit is mounted with the indicator side down for adequate air circulation. Proceed as follows:

1. Locate a suitable mounting location, allow a clearance of at least 5 inches (13 cm) to route mating cable and connectors to the unit. Drill four pilot holes on 9 x 5 inch centers for No.10 fasteners.

2. Mount the amplifier ensuring there is good air circulation around the amplifier.

3. Connect J2, "BASE" to the cable leading to the base transmitter.

4. Connect J1, "ANTENNA" to the cable leading to the distribution antenna(s).

   If it is known that the programming has been correctly preset as required by the system plan then this completes the installation. It is recommended the alarm code, alarm option settings and attenuation settings for each amplifier be recorded on the system "as-built" drawing. Otherwise:-

5. If attenuation, alarm options or alarm code must be changed, remove the cover plate from the amplifier to provide access to the programming jumpers.

   NOTE: Section 4.0 of this manual describes programming details. For convenience a reduced size copy of diagram Figure 4-1 is provided on the inside of the amplifier cover as a reference.

6. If the unit is NOT required to pass DC down the line to another amplifier then check that the “DCJ1 DCJ2” jumper has been removed to provide DC isolation at J1. See Section 4.1.

7. If certain fault alarms should be disabled then reprogram the appropriate jumpers as described in Section 4.3.

8. If it is required to change the factory set alarm code then program the appropriate jumpers as described in Section 4.6.

9. If the cellular and/or PCS attenuators must be set then refer to section 4.2. If the optional AUTOSET control board is fitted, skip this step.

10. Replace the amplifier cover. **NOTE:** It must be correctly oriented to fit properly.

This completes the installation.

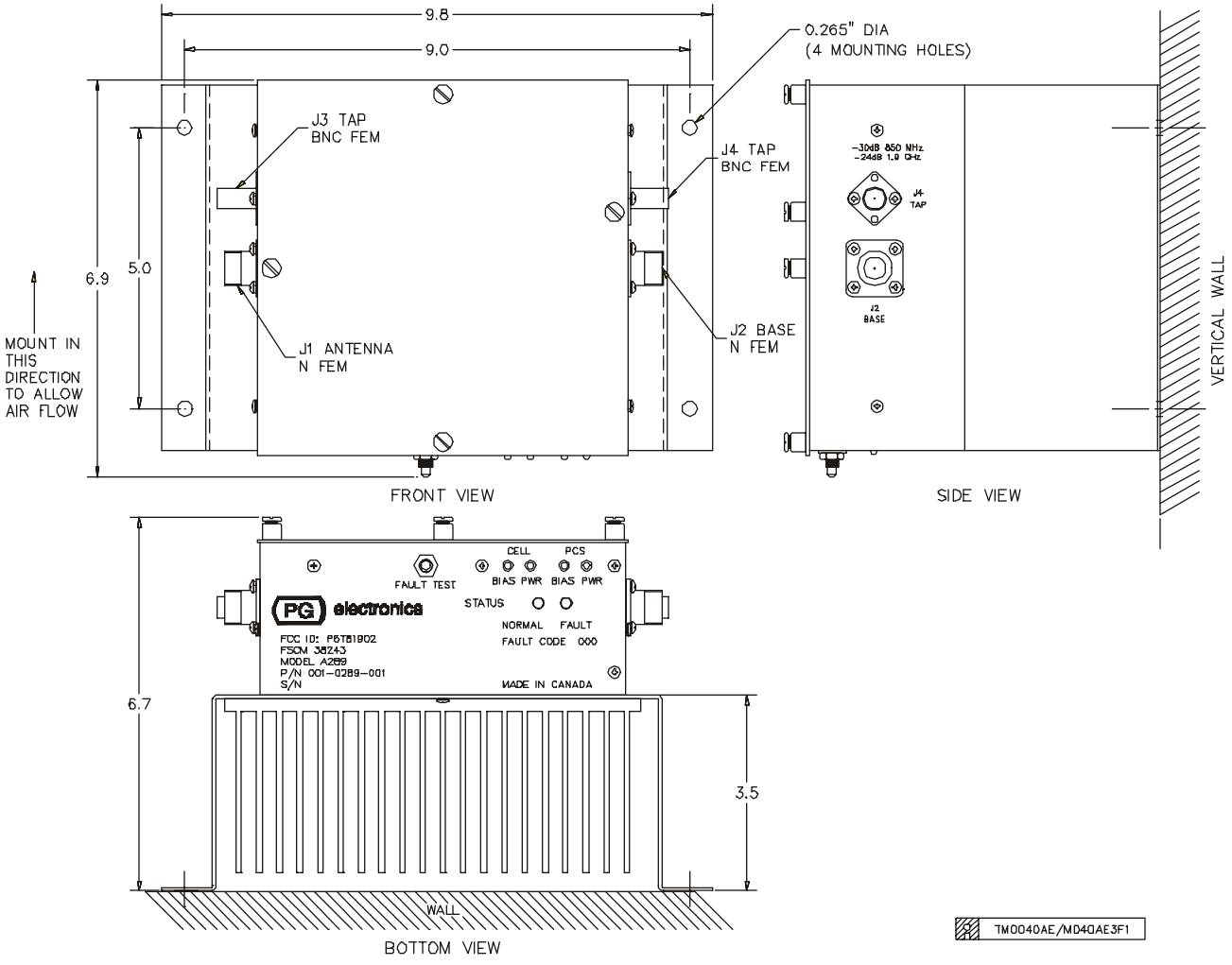


Figure 3-1 Installation Data (P/N 001-0289-001 shown)

3.3 OPERATING INSTRUCTIONS

The A289 dual band bidirectional amplifier has no external controls. When powered the unit will amplify signals in each band and in each direction.

When the green light is on, bias conditions of active devices in all the RF paths are within specifications and the downlink power in each band is above the minimum preset limit. The red FAULT light goes on whenever a monitored active device in the RF paths has failed or the downlink output power is too low. Corrective action is to check if the input power in each band is correct and then to check the fault conditions as indicated below.

3.4 FAULT CONDITIONS

If the FAULT light is illuminated it indicates that one of the following conditions have occurred. Four LEDs on the side of the unit show the status of the RF and DC bias alarms and indicate the source of the fault conditions.

3.4.1 Low RF power ("PWR" LED on) - Check the level of RF power out of the amplifier by connecting a meter or spectrum analyzer to the Test Port J3. The actual level is higher than the measured level by 30 dB at cellular and 24 dB at PCS frequencies. If the RF fault option is enabled a fault will occur if the RF power in either band falls below approximately +5 dBm.

By measuring the RF input power at J4 in each band the correct functioning of the amplifier can be checked. The gain should be approximately 20 dB minus the inserted attenuation.

3.4.2 DC Bias Change ("BIAS" LED on) - A DC bias alarm indicates a fault in the amplifier for the particular frequency band indicated. This condition mandates replacement of the amplifier except as noted below.

NOTE: The cellular uplink amplifier will show a DC bias alarm if the amplifier is driven into saturation by excessive RF power levels. A true DC bias fault will persist when RF carriers have been reduced in level.

SECTION 4. PROGRAMMING OPTIONS

4.0 PROGRAMMING OPTIONS

The amplifier contains a number of options which are programmed before the unit is installed, or may be adjusted during system installation or modification. They are set in a default setting by P.G. before shipment. A summary diagram of these jumpers is affixed to the inside of the removable amplifier cover for use in the field, but a larger view is shown herein (Fig 4-1) together with the following description of these settings.

It is suggested that when jumpers are removed to break a circuit, that they be reinstalled on one pin at the same location to keep them readily available if the option is reselected at a later date.

4.1 DC CONTINUITY (DC)

A DC jumper is provided to permit the amplifier to isolate J1 from DC if there is NO need for downstream power and particularly if a DC grounded device is installed in series with the amplifier. Removing the jumper breaks the DC connection from connector J2 to J1, and is a recommended practice. The jumper is labelled “DCJ1 DCJ2”. The jumper provides DC continuity between J1 and J2 connectors.

NOTE: Breaking the DC connection also disconnects the low frequency FAULT code from being transmitted along the cable from a downlink amplifier or power supply.

4.2 ATTENUATION (AC AND AP)

The A289 has a nominal overall gain of 20 dB in both the cellular and PCS frequency bands, but this gain may be reduced by built-in attenuators included in each frequency band. The attenuators are installed on the uplink side of the amplifier and hence do not have significant impact on the uplink system noise figure.

The attenuator for each band is set for values from 0 to 15 dB by four jumpers in a binary sequence. Setting the jumpers to the "IN" position inserts, 1, 2, 4 or 8 dB attenuation in the circuit for that band. Refer to the label attached to the inside of the cover for an enlarged view of these jumpers and their setting positions.

NOTE: The jumpers must be set to either the IN or OUT positions for correct attenuator operation. Do not leave open. If the optional AUTOSET control board is fitted, see Appendix A for further information.

4.3 FAULT OPTIONS (F)

The block of four jumpers for the fault options allows disabling of each of four tests by removing the appropriate jumper.

The jumpers to monitor downlink RF power are labelled CRF for the cellular band and PRF for the PCS band.

The jumpers to disable amplifier bias current monitoring are labelled CB for the cellular amplifier and PB for the PCS amplifier.

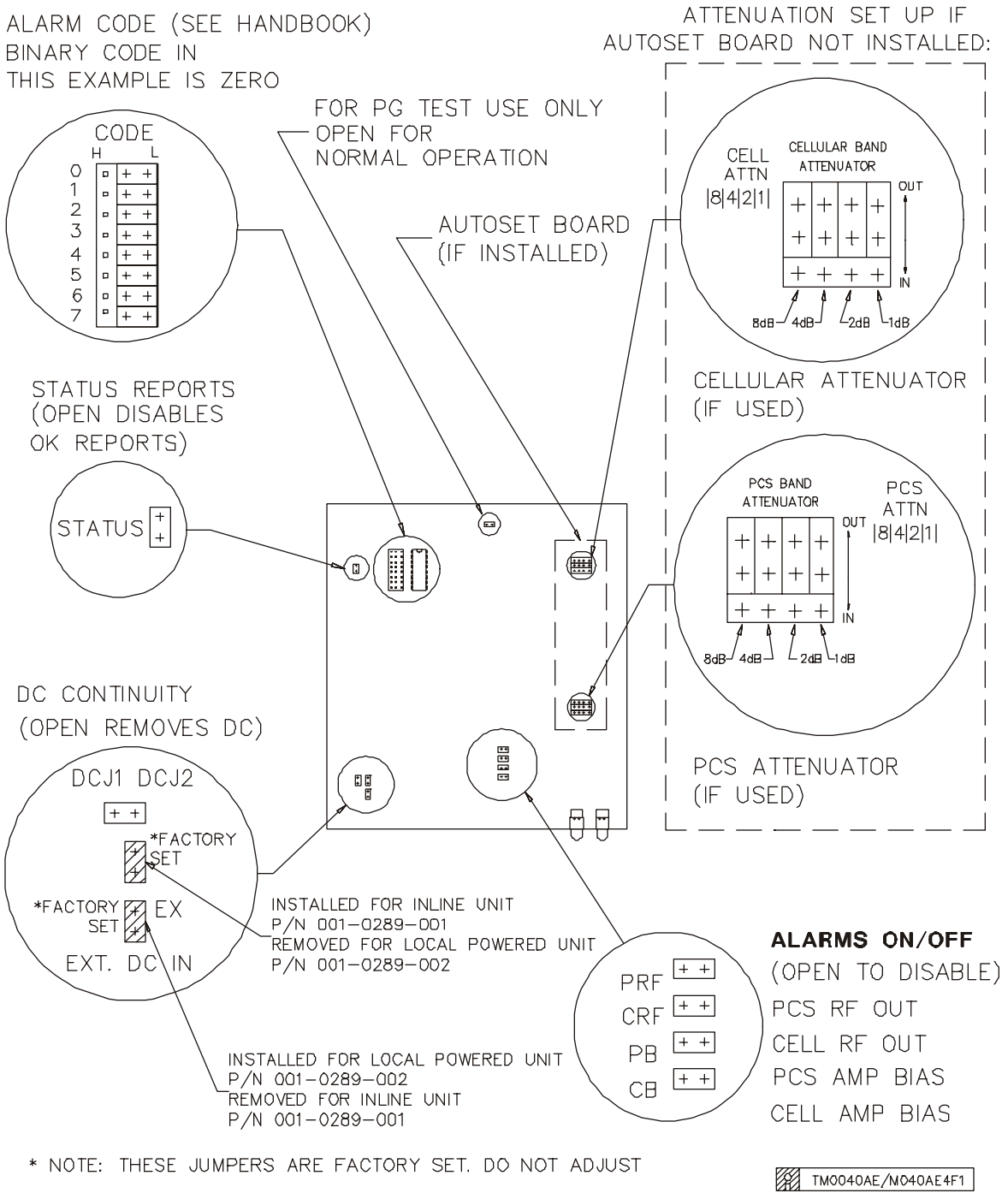


Figure 4-1 A289 Programming Options - Jumper Locations

4.4 STATUS OPTION (S)

If it is desired to use the amplifier in a system which has "Fault only" monitoring such as is provided by the PS200 unit, then the "OK" reports may be disabled by removing the STATUS jumper.

4.5 TEST (T)

The test jumper location does not have any function in normal system operation. It is provided for use in FAT testing in the factory by speeding up the rate of OK code reporting. It should be open for normal operation.

4.6 FAULT CODE (C)

If it is required to change the factory set Fault Code to the operator's custom plan then follow the following steps:

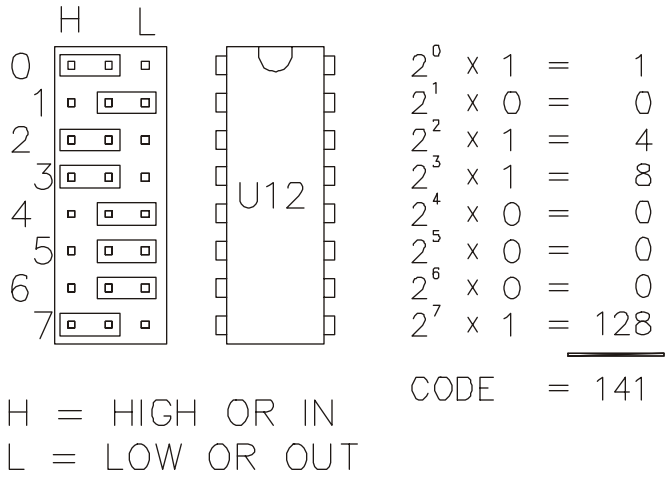
1. Refer to the jumper field with a block of eight jumpers labelled 0 to 7 in Figures 4-1 and 4-2.

2. The code is programmable in binary with the numbers 0 to 7 representing the power of 2, i.e., the jumper is $2^3 = 8$. When the jumper is on the H side the count is included. When the jumper is on the L side the count is zero for that binary digit.

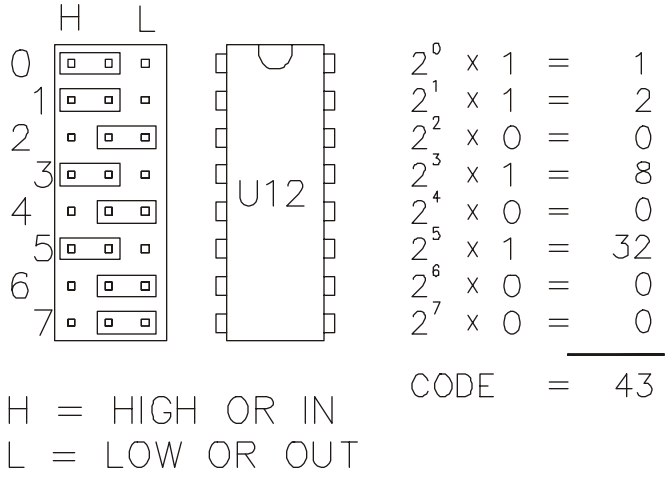
3. Before reprogramming check the examples, Figure 4-2, and examine the factory set code as a starting point.

NOTE: The center pin “C” MUST be jumpered to EITHER the “H” or “L” side for a correct code to be sent. Do not leave open.

EXAMPLE 1:



EXAMPLE 2:



NOTE: DO NOT SET FAULT CODE ABOVE 199.
FAULT CODES ABOVE 199 ARE RESERVED

TM0040AE/M040AE4F2

Figure 4-2 Fault Code Setting Examples

APPENDIX A

AUTOSET ATTENUATION OPTION (IF INSTALLED)

A-1 GENERAL

The AUTOSET optional gain control board installs on the jumper pins normally used for manual setting of the gain control attenuators referred to in Paragraph 4.2.
When installed the AUTOSET board automatically limits the amplifier output power in each band to the maximum composite level compatible with low intermodulation performance.

A-2 INSTALLATION

The AUTOSET board has four jumpers which are set depending on whether the amplifier is being used as an IN-LINE or ANTENNA amplifier. An IN-LINE amplifier normally passes power to downlink amplifiers and is set to a slightly lower power level to minimize cascading of IM products. The jumpers are set in accordance with Figure A-1.

A-3 OPERATION

The AUTOSET controls each individual amplifier on a stand-alone basis. The AUTOSET system has two modes of operation.

When initially powered the AUTOSET goes into a timed AGC mode where it tracks the composite output power in each band and adjusts the attenuators to maintain maximum output power. This mode continues for approximately 90 minutes until the system achieves temperature stability.

At this time the AUTOSET switches to a LIMITER mode in which it only adds attenuation if the power input increases above the final setting value. This eliminates the system hunting which might interact with system power control or cause near/far loss of signal.

If however power in the systems is increased by the addition of more channels the gain will adjust downward to avoid distortion products.

The AUTOSET system can be configured to operate in a continuous AGC mode by installing the “AM” shunt. In this mode, the AUTOSET operates in AGC mode indefinitely and will not switch to limiter mode.

Each time the system (or amplifier) is repowered the setting cycle is repeated.

AUTOSET SHUNT POSITIONS

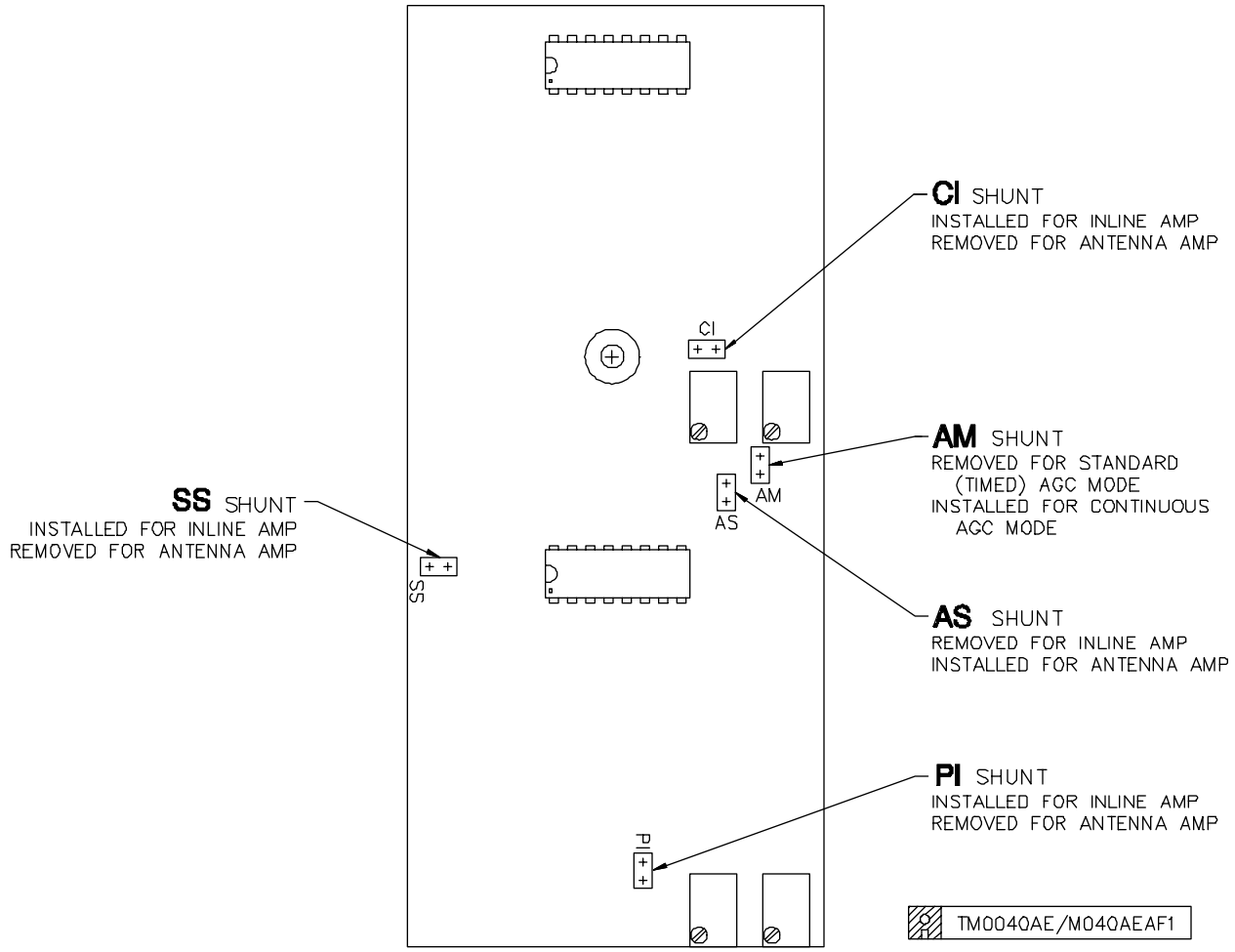


Figure A-1 Autoset Shunt Positions

TABLE A-1

Shunt Installation

UNIT TYPE	SHUNT				
	CI	AS	PI	SS	DCJ1 DCJ2 (mainboard)
INLINE AMPLIFIER	I	R	I	I	I
ANTENNA AMPLIFIER	R	I	R	R	R

Note: I = Shunt installed
R = Shunt removed