PG.ectronics

OPERATOR'S MANUAL

PCS BIDIRECTIONAL AMPLIFIER

MODEL A238

P/N 001-0238-003 (LOCAL POWERED)

AUGUST 2004

Weston, Ontario

GUARANTEE

This unit is guaranteed for a period of one year from the date of shipment against failure due to defective parts or improper assembly.

This guarantee is limited to replacement of defective material and does not cover damages or other costs resulting from the use of this material whether used correctly or otherwise.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDIX A

SECTION 1. GENERAL INFORMATION

1.1 INTRODUCTION

1.1.1 Scope of Manual - This manual is intended to familiarize service personnel working on the PCS Bidirectional Amplifier A238 with all pertinent aspects of the amplifier. Included in this manual are a brief physical description, a technical summary, installation information and operating data.

1.1.2 Purpose of Equipment - The A238 amplifier is used as a drop-in booster for PCS signals. It will simultaneously amplify signals in the PCS transmit band in one direction and the PCS receive band in the opposite direction. A typical use of the A238 is to provide wireless phone coverage in underground installations.

1.1.3 Physical Description - The bidirectional amplifier, shown in Figure 3-1, is designed to be mounted on a flat vertical surface. The unit has two N connectors for external electrical connection and two BNC test ports to check RF signals. Color coded indicators provide visual display of the unit's operating status.

1.1.4 Electrical Description - The bidirectional amplifier provides approximately 20 dB of gain for signals in the 1850 - 1910 MHz band in the direction of J1 to J2 (antenna to base) and the same amount of gain for signals in the 1930 - 1990 MHz band in the opposite direction (J2 to J1).

1.1.4.1 The unit is locally powered through a 5-pin DIN receptacle. The P.G. Electronics PS293 power source should be used to power the unit. The unit provides DC continuity from J1 to J2 to allow powering of downstream amplifiers from upstream power sources such as PS212 and PS213. Local power is isolated from J1 and J2.

1.1.4.2 The unit monitors bias conditions of active devices in the RF path and monitors downlink power. If one of these devices draws more or less than a predetermined limit, or if the RF downlink power is low then the FAULT indicator will go on. Under normal operating condition only the green NORMAL indicator will be on.

1.1.4.3 If a FAULT condition is detected the unit transmits a low frequency identification code along the cable center conductor. The burst transmission is repeated at approximately 80 second intervals while a fault condition exists.

1.1.4.4 If a NORMAL condition exists in the amplifier a low frequency OK identification code will be transmitted on the cable at intervals of approximately 80 minutes.

1.1.4.5 The unit has an adjustable attenuator to allow operation at reduced gain. The attenuator is settable in 1 dB steps up to 15 dB either manually or by using an optional AUTOSET control board.

1.2 TECHNICAL SUMMARY

TABLE 1-1.

Performance Characteristics and Salient Features of the A238 PCS Bidirectional Amplifier

Parameter	Specification	
1. Input Power:	24 to 28 VDC @ 2 A Max (use PS 293)	
2. Frequency Range*:	Uplink: 1850-1910 MHz	Downlink: 1930-1990 MHz
3. Gain:	20 dB ±2 dB	
4. Impedance (Input and Output):	50 Ohms	
5. VSWR:	2:1 Typical, 3:1 Maximum	
6. Composite output power rating**:	Uplink: +4dBm	Downlink: +24dBm
7. 1dB Compression:	Uplink: +12 dBm	Downlink: +33 dBm
8. 3rd Order Output IP:	Uplink: +27 dBm	Downlink: +45 dBm
9. Attenuator Range	0 to 15 dB (1 dB steps) (optional Autoset PCB)	
10. Environmental Limits:		
(a) Temperature Range:	-30°C to 60°C operating	
(b) Relative Humidity:	to 90%	
11. Dimension and Weight:		
(a) Overall Dimensions:	9.8” L x 6.7” W x 6.7” H	
(b) Mounting Hole Dims:	9” x 5”	
(c) Weight:	5.8 lb (2.6 kg)	
12. Connectors:		
RF Input/Output:	Type N Female	
RF Test Input/Output:	Type BNC Female	
DC supply:	DC power jack	

***NOTE:** Specifications apply only across the customer’s actual bands, not across the whole PCS spectrum.

****NOTE:** Refer to TABLE 1-2 for definition of composite output power rating.

NOTE IMPORTANT RATING INFORMATION

Manufacturer's rated output power of this equipment is for single carrier operation. For situations when multiple carrier signals are present, the rating would have to be reduced as per Table 1-2, especially where the output signal is re-radiated and can cause interference to adjacent band users. This output power reduction is to be achieved by reduction of input power or by gain reduction and not by an attenuator at the output of the device.

TABLE 1-2

Rated Power Output for Linear Operation

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. This holds true for any number of carriers with total average power adding up to the composite output power rating listed below.

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

SECTION 2. THEORY OF OPERATION

2.0 GENERAL

As explained in Section 1, the A238 is a bidirectional amplifier, which provides 20dB of gain in the PCS wireless transmit and receive bands. The block diagram of the A238 is shown in Figure 2-1.

2.1 DESCRIPTION

2.1.1 The unit is composed of band pass diplexers, amplifier stages and alarm and voltage regulation circuits.

2.1.2 The bias conditions of amplifier stages are monitored. If the bias changes outside certain limits a fault condition is indicated. The downlink RF output power is also monitored. If the power 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 3.2. While a NORMAL condition exists the amplifier transmits an OK code at intervals of approximately 80 minutes.

2.1.3 The voltage regulators take 24 - 28 VDC input and provide 20 VDC and 12 VDC outputs. A zener diode provides transient protection against voltage spikes on the cable.

2.1.4 The unit requires external DC power to be supplied through the 5-pin DIN receptacle. The unit should be powered locally by the PS293 external power source. The local power source is isolated from J1 and J2.

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.

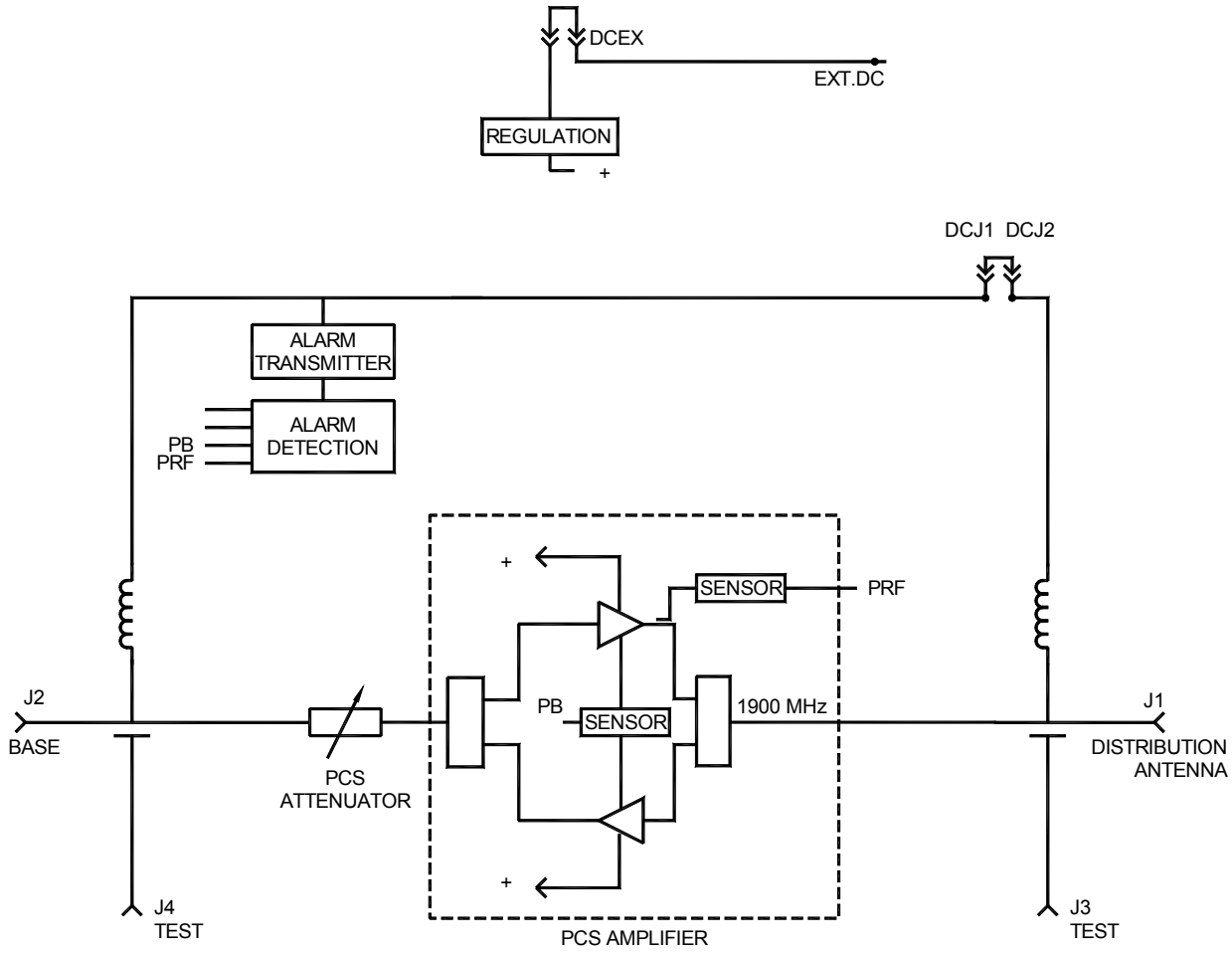


Figure 2-1 A238 Bidirectional Amplifier - Block Diagram

2.2 FAULT REPORTING

2.2.1 General - The A238 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 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. 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 PG 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 PG bidirectional amplifiers such as the A181 or A188 transmitted only fault codes, but are compatible with the fault codes transmitted by the A238. When used with a PS212 Monitor they should be entered in the ID list as "FAULT ONLY" (TFO) type units. If the A238 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 fault circuitry monitors two separate parameters in the unit. These are (a) the bias conditions of active devices in the amplifier and (b) the presence of downlink RF output power. 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 deviates outside predetermined high or low limits.

The downlink RF output power is monitored by a detector and a FAULT condition is triggered if the level 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 may be less than +7 dBm then the RF monitor circuit should be disabled as described in Section 4 herein.

The local fault indicators indicate specific faults as follows:

PCS

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

NOTE: There is a certain situation in which the red “FAULT” indicator will be on even though none of the “BIAS” or “PWR” indicators are on. This situation occurs when the unit is receiving local power and downlink RF powers are normal but the cable power is not present. This indicates that the cable power source located upstream has been switched off or has shut down.

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

   DC Continuity: - J1 connected to J2
   Alarm options: - Bias and RF engaged.
   Alarm Code: - Consecutive numbers assigned.
   (Check for duplication if two lots used).
   Attenuation: - Set to zero attenuation (if autoset board not used).

   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 perform the steps below as required.

5. If DC continuity, 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 or downstream amplifier status signals, then it is recommended that the "DCJ1 DCJ2" be 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 attenuator 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.

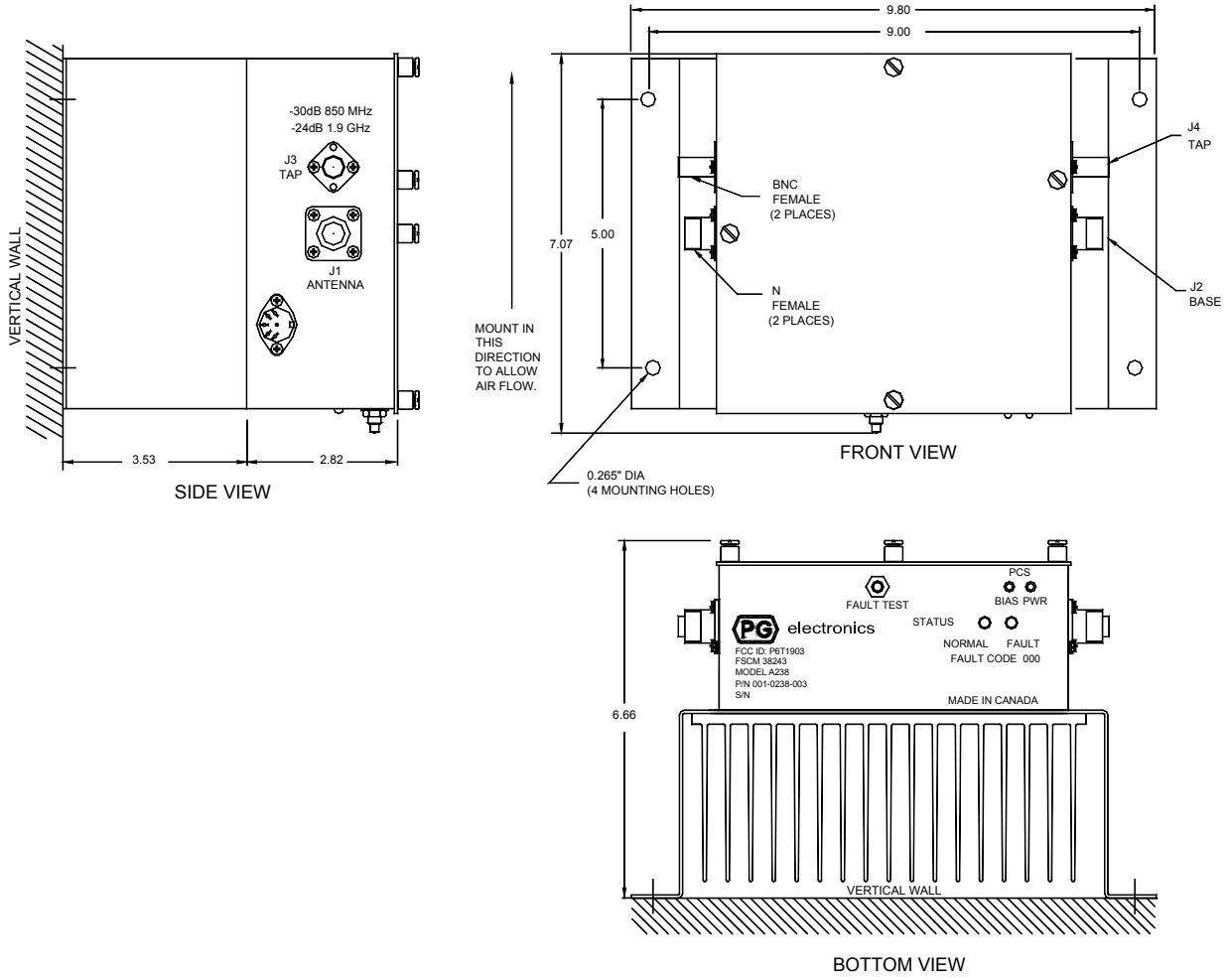


Figure 3-1 Installation Data

3.3 OPERATING INSTRUCTIONS

The bidirectional amplifier has no external controls. When powered the unit will amplify signals 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 is above the minimum preset limit. The red FAULT light goes on whenever active devices in the RF paths have failed or the downlink output power is too low. Corrective action is to check if the input power 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. Two 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 24 dB at PCS frequencies. If the RF fault option is enabled a fault will occur if the RF power falls below approximately +5 dBm.

By measuring the RF input power at J4 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. This condition mandates replacement of the amplifier.

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 PG 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 the DC if there is NO need for downstream power or downstream amplifier status signals 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 (AP)

The amplifier has a nominal overall gain of 20 dB in the PCS frequency band, but this gain may be reduced by a built-in attenuator. The attenuator is installed on the uplink side of the amplifier and hence does not have significant impact on the uplink system noise figure.

The attenuator 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. 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 jumpers for the fault options allows disabling of tests by removing the appropriate jumper.

The jumper to monitor downlink RF power is labelled PRF.

The jumper to disable amplifier bias current monitoring is labelled PB.

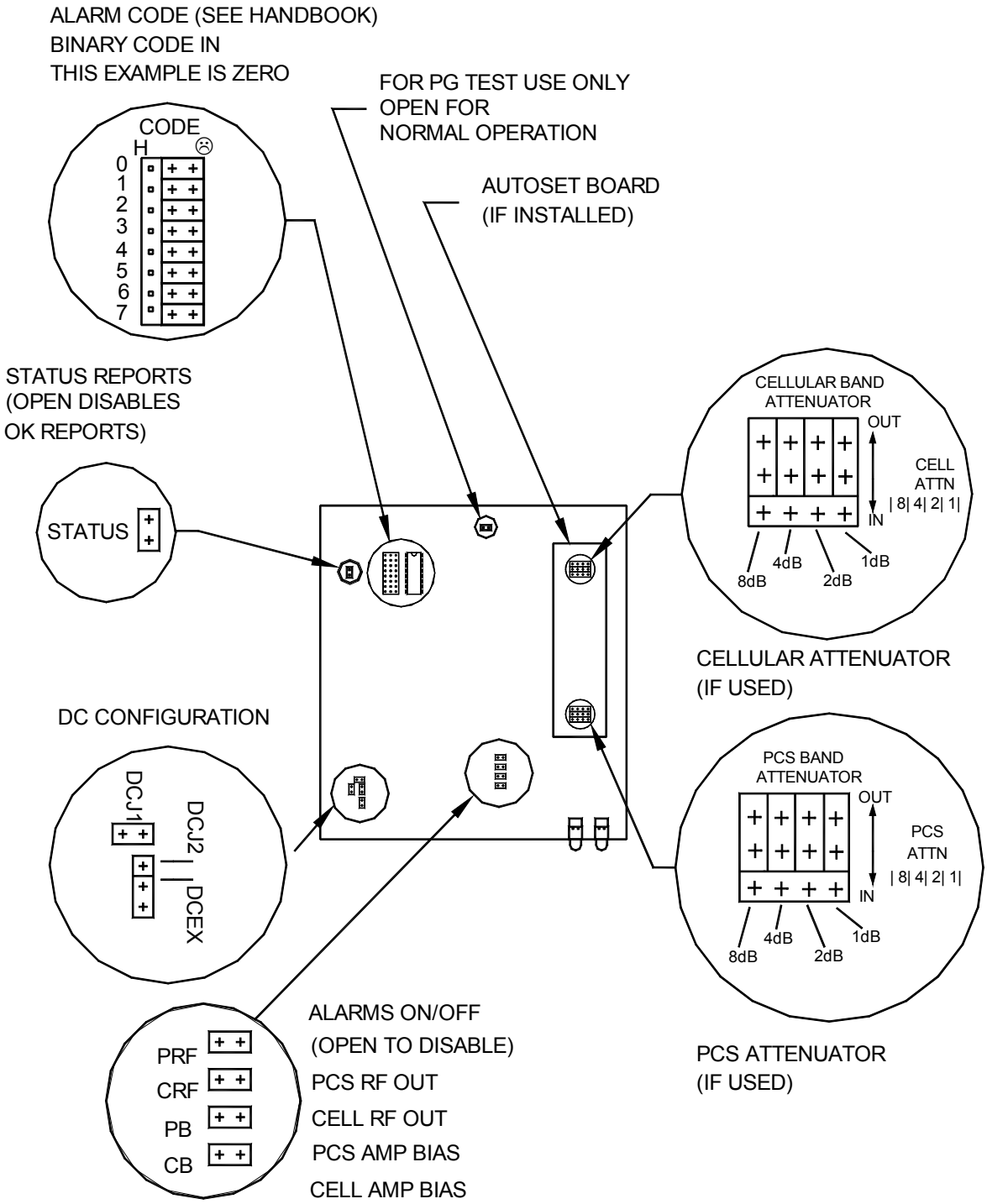


Figure 4-1 A238 Programming Options - Jumper Locations

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:

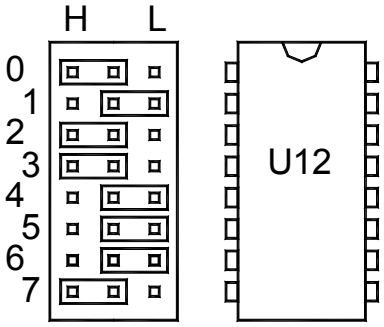
1. Refer to the jumper field with a block of eight jumpers labelled 0 to 7 in Figures 4-1 and 4-2.

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.

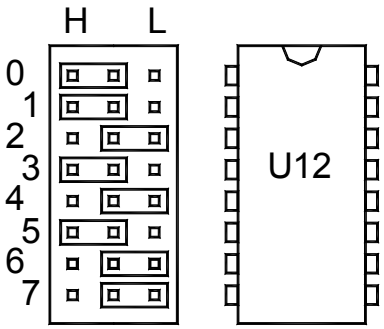
EXAMPLE 1:



$2^0 \times 1 = 1$
$2^1 \times 0 = 0$
$2^2 \times 1 = 4$
$2^3 \times 1 = 8$
$2^4 \times 0 = 0$
$2^5 \times 0 = 0$
$2^6 \times 0 = 0$
$2^7 \times 1 = 128$
code = 141

H = HIGH OR IN
L = LOW OR OUT

EXAMPLE 2:



$2^0 \times 1 = 1$
$2^1 \times 1 = 2$
$2^2 \times 0 = 0$
$2^3 \times 1 = 8$
$2^4 \times 0 = 0$
$2^5 \times 1 = 32$
$2^6 \times 0 = 0$
$2^7 \times 0 = 0$
code = 43

H = HIGH OR IN
L = LOW OR OUT

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

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 to the maximum composite level compatible with low intermodulation performance.

A-2 INSTALLATION

The AUTOSET board has three 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 an AGC mode where it tracks the composite output power and adjusts the attenuator to maintain maximum output power. This mode continues for approximately 90 minutes until the system achieves temperature stability.

At this point 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 a LIMITED mode.

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

AUTOSET SHUNT POSITIONS

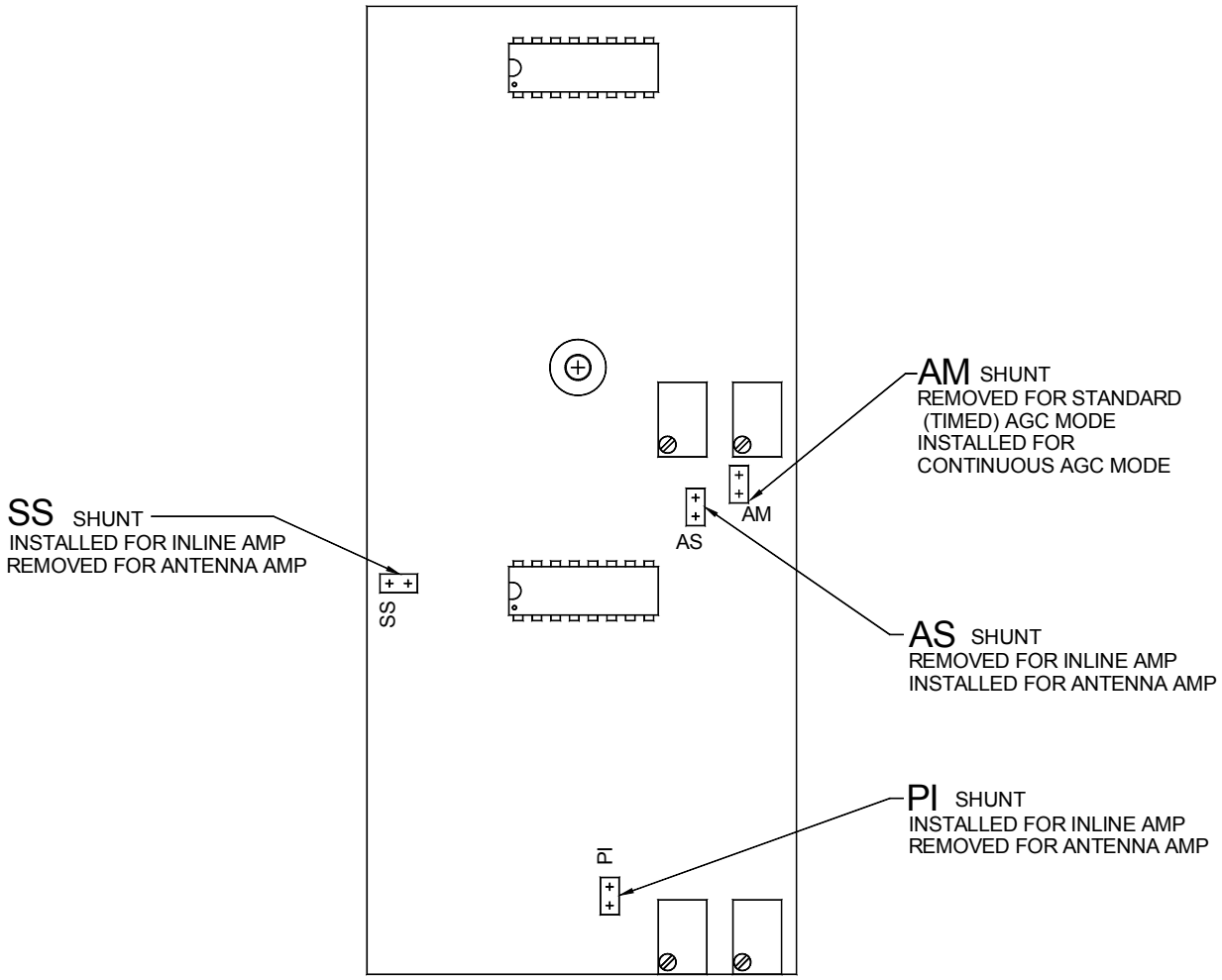


Figure A-1 Autoset Shunt Positions.

TABLE A-1

Shunt Installation

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

Note: I = Shunt installed
R = Shunt removed