

cc 209

INSTRUCTION & SERVICE BULLETIN

DESK TOP RECEIVER

P/N 70070

WARNING

PRODUCT MUST BE USED, MAINTAINED AND INSTALLED IN STRICT ACCORDANCE WITH GEMS TECHNICAL BROCHURE, AND INSTALLATION, OPERATION AND MAINTENANCE BULLETINS. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN SERIOUS INJURIES OR DAMAGES.



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D. Stetson
June 1984

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SECTION I

Desk Top Level Receiver Description

The level receiver is used to monitor the liquid level of sixteen tanks and signal when alarm points have been reached. The status of all sixteen tanks are updated every second.

A 37 pin connector on the back panel is used to connect the level transmitters to the receiver.

Auxiliary alarm relay contacts are provided on a terminal block on the rear panel. The contacts are form C with a rating of 1 Amp. @ 120 V. resistive.

The RS-232 connector on the back panel can be used for sending level data to a computer. The computer can be connected directly or through a modem. Baud rates can be selected from 150 to 19200 baud. Connections are provided for DTE (Data Terminal Equipment) or DCE (Data Communications Equipment).

Operational power is derived from 120 VAC 50/60 Hz.. A battery is used to maintain the alarm and delay settings in memory when the power is shut off. The battery is automatically recharged when the power is on. The battery can hold enough charge to maintain the memory for up to six months.

Front panel components:

- 32 Alarm indicating lamps (16 high and 16 low)
- 1 Digital display
- 1 16 key keypad
- 1 Horn
- 1 Self-test push button
- 1 Switch lock
- 1 Enter number lamp

The digital display can show the level of any tank one at a time. The display is also used to show the settings of alarm trip points and the slosh delay.

The alarm lamps indicate alarm status by being off for non-alarm conditions, flashing for an unacknowledged alarm, or continuously on for an acknowledged alarm.

The horn and the relay contacts are activated when any alarm is tripped. This condition continues until it is acknowledged.

The alarms can be delayed from being tripped, and the acknowledgments can be delayed from being reset from zero to ninety-nine seconds. This is to inhibit false alarms caused by sloshing in the tank.

The self-test push button is used to check operating conditions of the lamps, display, and electronics.

The switch lock is to keep unauthorized personnel from changing alarm settings, delay settings, and inhibits the self-test function.

The enter number lamp indicates when to enter tank numbers during use of tank select or acknowledge functions.

SECTION II

Keypad and Display Operation

Tank Select

The desired tank level to be displayed is selected by depressing "TK SEL". Two dashes are displayed indicating the tank select function. Enter a two digit tank number. Tanks 1 - 9 must be entered with a zero prefix, i.e. tank number one = 01. If a tank number is entered that does not exist, "HELP" will be displayed. The correct number can then be entered. If a function key is depressed, the tank select function will end and the level of the previously selected tank will be displayed. Depressing "TK SEL" two times will cause the level of the next sequential tank to be displayed.

Alarm Setting

To display and/or change an alarm setting of any tank, first select the desired tank and then depress "HI ALM" for high alarm or "LO ALM" for low alarm. "H" or "L" is shown in the center of the display for high or low. To change the alarm setting depress four digits to get the desired alarm setting. The numbers will roll in the display so that mistakes can be easily corrected. The horn and the alarm indicating lamps are automatically acknowledged if a new selected alarm setting causes an alarm.

Leak Detection

The low alarm can be used for leak detection. Before the unit is left for the night set the low alarms for each tank a few digits below the current level readings. Be sure the slosh delay is set appropriately; typically 10 seconds. If the liquid level in the

Leak Detection (Cont'd)

tank drops below the low alarm setting, an alarm will be triggered. The next morning any tanks with flashing lamps can be checked for loss of liquid. Select the tank with the flashing lamp. The amount of liquid lost can be determined by subtracting the current level reading from the previous level reading.

Alarm Acknowledge

The "ACK" key acknowledges the horn and lamps after an alarm. The first time the acknowledge key is depressed, the horn is shut off. Depress the acknowledge key a second time to acknowledge flashing lamps. "-- LP" is shown on the display indicating lamp acknowledge. Enter the appropriate tank number. Tank numbers 1 - 9 must be entered with a zero prefix. If an unacceptable number or a function is entered, the acknowledge function will end.

Slosh Delay

To display and/or change the setting of the slosh, depress "DLY". The delay for all the tanks will be displayed. "SL" is shown in the center of the display to indicate slosh delay. The settings can be changed by entering delay values from zero to ninety-nine seconds. The slosh delay is the same for all tanks. The numbers will roll in the display so that mistakes can be easily corrected.

Self Test

To start the self test, depress the self-test switch. All lamps will light, the horn will sound for approximately one second and then the lamps will flash. The test will end with the previously selected tank's level displayed if there are no errors found. Error codes and "HELP" will be displayed if a problem is found.

Error codes: 01 - Memory error
 02 - A/D converter error (card 1)
 04 - RS-232C failure (slave option only)

Keyboard Lock

The keyboard lock is to inhibit use of the following functions:

1. Alarm setting.
2. Slosh delay setting.
3. Self test function.

To stop unauthorized personnel using these functions, turn the key to locked position and remove the key. The alarm and delay settings can be displayed but the settings cannot be changed. The self test function cannot be started.

The tank select, horn acknowledge, and lamp acknowledge functions operate normally.

SECTION III

Receiver Specifications

1. Operating voltage: 120 VAC, 50/60 Hz.
2. Operating temperature range: $25^{\circ}\text{C.} \pm 10^{\circ}\text{C.}$
3. Control function specifications:
 - A. Slosh delay: 0 - 99 seconds ± 1 second adjustable.
 - B. LED alarm flashing: 60 CPM $\pm 10\%$ non-adjustable.
 - C. Alarms are adjustable from 0 - 100% of tank level indication.
4. Remote alarm relay contacts are provided on a terminal block.
Contact rating: 1 amp @ 120 V. resistive.
5. Maximum power consumption: Total VA = 40 @ 115 VAC with 16 tank stations.
6. Instrument accuracy: $\pm 1\%$.
7. Battery backup for user programmable memory:
 - A. Rechargeable Ni-Cad. Automatically recharged with power on.
 - B. Data retention for up to six months with power off.

SECTION IV

Calibration Procedure for Receivers with 0 - 200 ua Input Option

The card used for calibration is located on the left side of the cabinet behind a sliding panel. Loosen the retaining screw at the rear of the side panel; slide the panel back to expose the meter adjust card. Thirty two trim pots and eight switches are located on the meter adjust card. (See Figure 4-1)

The trim pots are in four separate rows and function as described below:

Top row trim pots: Offset adjustments for tanks 1 - 8 counting right to left.

Second row trim pots: Top scale adjustments for tanks 1 - 8 counting right to left.

Third row trim pots: Top scale adjustments for tanks 9 - 16 counting left to right.

Fourth row trim pots: Offset adjustments for tanks 9 - 16 counting left to right.

The slide switches are moved up for top scale adjustments, center for normal, and down for offset adjustments. Each switch controls two tanks. The switches are counted right to left.

Switch 1 -- Tanks 1 and 16.
Switch 2 -- Tanks 2 and 15.
Switch 3 -- Tanks 3 and 14.
Switch 4 -- Tanks 4 and 13.
Switch 5 -- Tanks 5 and 12.
Switch 6 -- Tanks 6 and 11.
Switch 7 -- Tanks 7 and 10.
Switch 8 -- Tanks 8 and 9.

Adjustment Procedure (Repeat for Tanks 1 - 16):

1. Move the slide switch to the up position. Adjust the top scale trim pot so that the digital display indicates the level when the tank is full.

Adjustment Procedure (Cont'd)

2. Move the slide switch to the down position. Adjust the offset trim pot so that the digital display indicates the level when the float is all the way down.
3. Recheck top scale readings and repeat steps 1 and 2 if necessary.

Notes:

When the digital display is over-ranged, maximum level is displayed. The top scale trim pot can be backed off to check for an over-range condition.

To inhibit the horn from sounding during calibration, set the slosh delay to 99 seconds.

Be sure all switches are in the center or normal position before closing the side panel.

Remember to set the slosh delay to the proper value when calibration is complete.

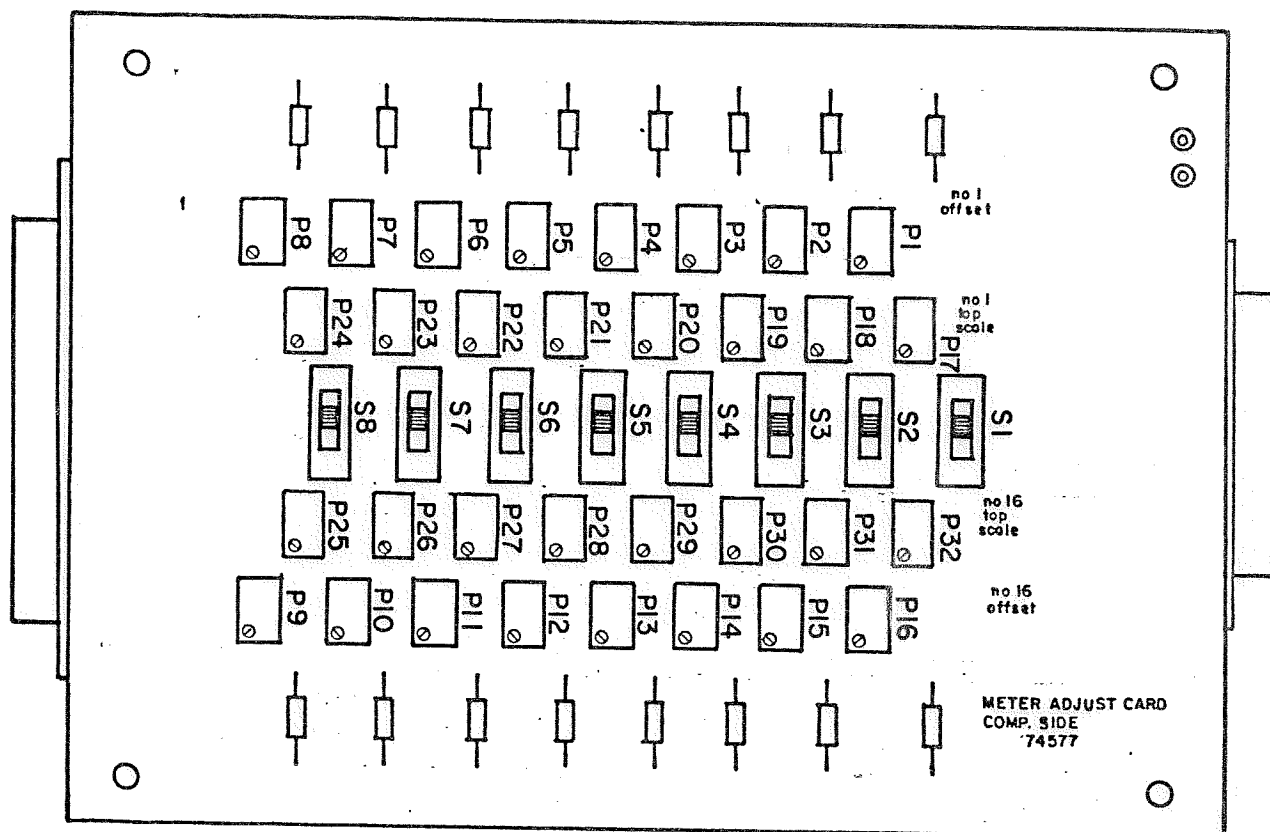


FIGURE 4-1

Meter Adjust Card

Potentiometer Numbering

SECTION V

Calibration Procedure for Receivers with 4-20 ma Input Option

The card used for calibration is located on the left side of the cabinet behind a sliding panel. Loosen the retaining screw at the rear of the side panel. Slide the panel back to expose the meter adjust card; thirty-two trim pots are located on the meter adjust card. (See Figure 5-1)

The trim pots are in four separate rows and function as described below:

Top row trim pots: Offset adjustments for tanks 1 - 8 counting right to left.

Second row trim pots: Top scale adjustments for tanks 1 - 8 counting right to left.

Third row trim pots: Top scale adjustments for tanks 9 - 16 counting left to right.

Fourth row trim pots: Offset adjustments for tanks 9 - 16 counting left to right.

The offset trim pots are factory adjusted to 250 ohms to drop 1 V. - 5 V. with a 4 - 20 ma input.

A reference signal must be input into the 37 pin connector for calibration. The pin out of the connector is listed below: (See Figure 5-2)

Pins 1 - 16 -- inputs for tanks 1 - 16 respectively.

Pin 20 -- signal common.

Pin 36 -- +12 VDC (This supply can be used to develop 20 ma.)

Adjustment Procedure (Repeat for Tanks 1 - 16):

1. Input 20 ma into the appropriate pin on the 37 pin connector.
2. Adjust the top scale trim pot so that the digital display indicates the level when the tank is full.

Notes:

When the digital display is over-ranged, maximum level is displayed. The top scale trim pot can be backed off to check for an over-range condition.

To inhibit the horn from sounding during calibration, set the slosh delay to 99 seconds.

Remember to set the slosh delay to the proper value when calibration is complete.

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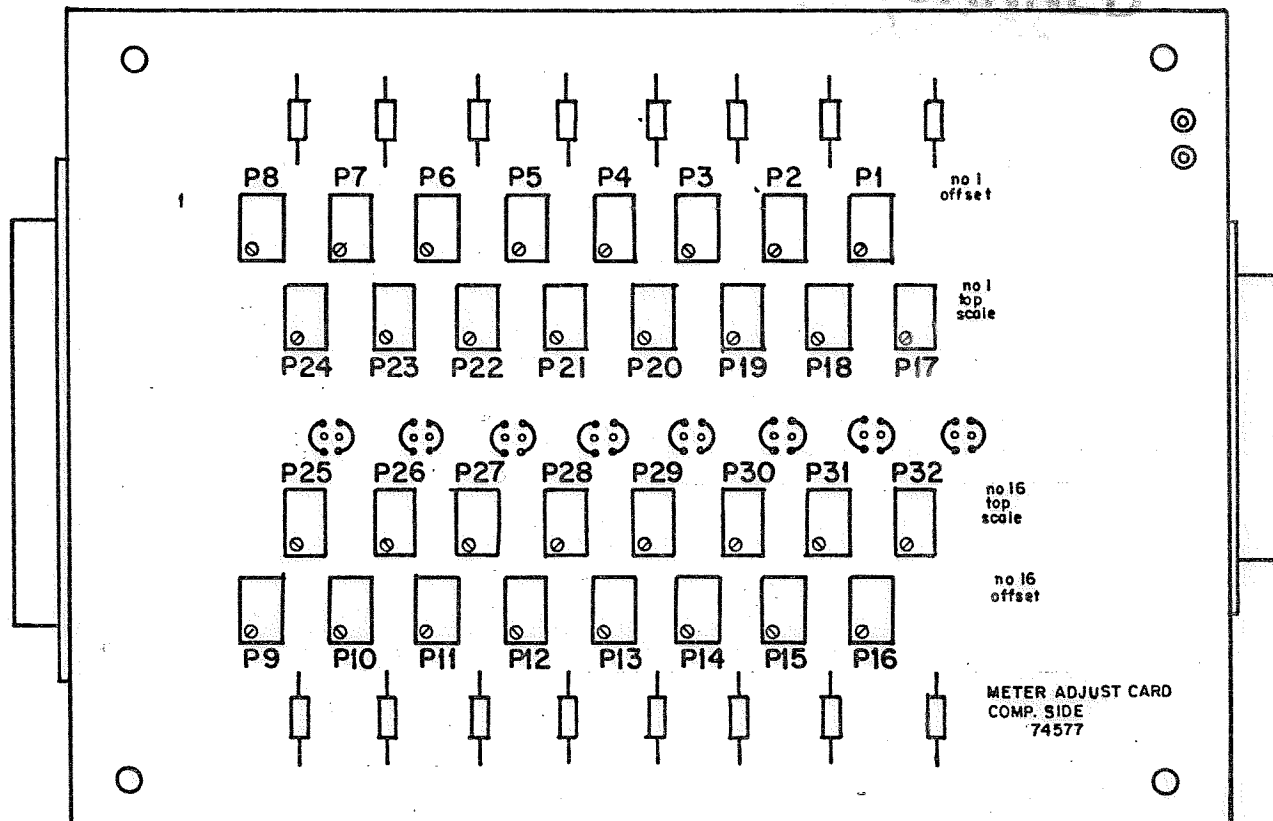


FIGURE 5-1

Meter Adjust Card

Potentiometer Numbering

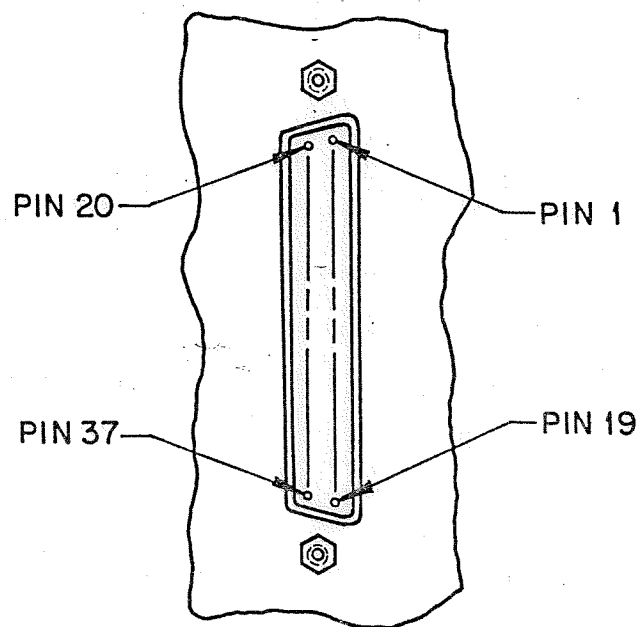


FIGURE 5-2

37 Pin Male "D" Connector
On Rear Panel

SECTION VI

Calibration Procedure for Receivers with 1 - 5 V. Input Option

The card used for calibration is located on the left side of the cabinet behind a sliding panel. Loosen the retaining screw at the rear of the side panel; slide the panel back to expose the meter adjust card; sixteen trim pots are located on the meter adjust card. (See Figure 6-1)

The trim pots are in two separate rows and function as described below:

Top row trim pots: Top scale adjustments for tanks 1 - 8 counting right to left.

Bottom row trim pots: Top scale adjustments for tanks 9 - 16 counting left to right.

A reference signal must be input into the 37 pin connector for calibration. The pin out of the connector is listed below: (See Figure 6-2)

Pins 1 - 16 -- inputs for tanks 1 - 16 respectively.
Pin 20 -- signal common.
Pin 36 -- +12 VDC (This supply can be used to develop 5 V.)

Adjustment Procedure (Repeat for Tanks 1 - 16):

1. Input 5 V. into the appropriate pin on the 37 pin connector.
2. Adjust the top scale trim pot so that the digital display indicates the level when the tank is full.

Notes:

When the digital display is over-ranged, maximum level is displayed. The top scale trim pot can be backed off to check for an over-range condition.

To inhibit the horn from sounding during calibration, set the slosh delay to 99 seconds.

Remember to set the slosh delay to the proper value when calibration is complete.

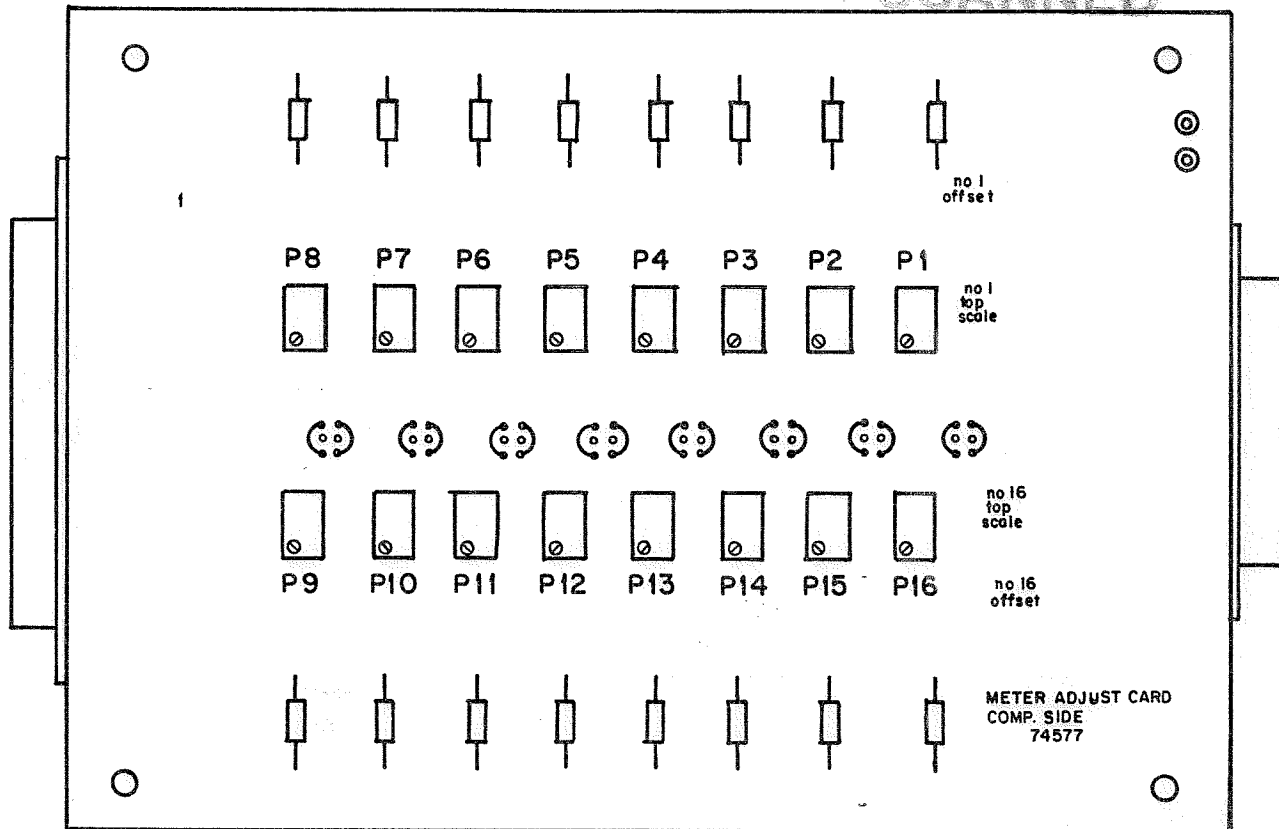


FIGURE 6-1

Meter Adjust Card
Potentiometer Numbering

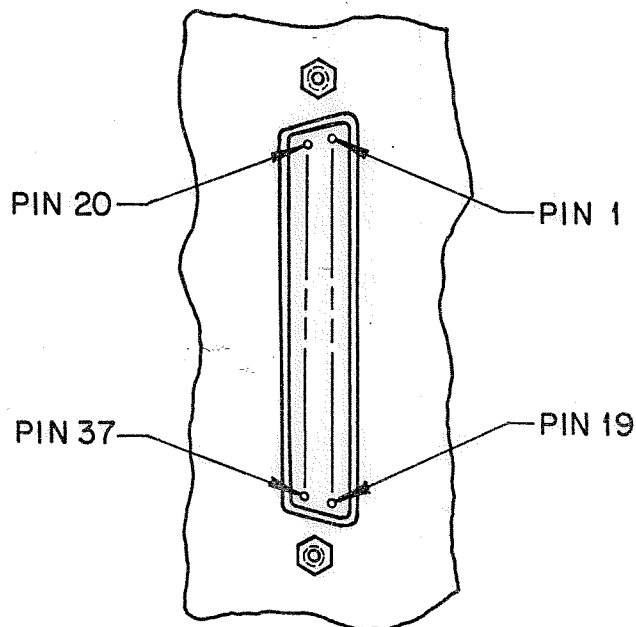


FIGURE 6-2

37 Pin Male "D" Connector
On Rear Panel

SECTION VII

Serial I/O Description

The RS-232 connector on the back panel of the level receiver can be used for sending level data to a computer. The computer may be connected directly or through a modem. Baud rates can be selected from 150 to 19200 baud. Connections are provided for DTE (Data Terminal Equipment) or DCE (Data Communications Equipment).

RS-232C is an EIA (Electronics Industries Association) standard used for transmitting data between digital equipment. The data to and from the equipment is coded in ASCII (American Standard Code For Information Interchange).

The 20 MA loop is similar to RS-232C except it is a current signal instead of a voltage signal. It is used when the data must be transmitted more than 50 or 100 feet. The 20 MA loop has the advantage of better noise immunity but is not as widely used as RS-232C.

A computer can read level data from the level receiver's RS-232C interface. The computer requests level data from the level receiver by sending commands over the RS-232C interface. The level receiver responds by sending the level data of the tanks requested.

The command and level data format is intended to be compatible with any type of computer, operating with assembly language or any higher level language.

Level Receiver Serial Data Format

"A" Command

In response to the "A" command the level receiver sends the level data for all tanks in numerical order.

Format: A *

* -- The end of transmission must be a carriage return, a line feed, or both.

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Level Receiver Serial Data Format (Cont'd)

"D" Command

In response to the "D" command the level receiver sends the level data for only the tanks that were asked for and in the order that they were asked for.

Example Format: D 1 2 03 7,5 8*
(Send data for tanks 1,2,3,7,5,8)

* -- The end of transmission must be a carriage return, a line feed, or both.

The character D may, or may not, be followed by a carriage return and/or line feed.

Notes: Delimiters between tank numbers can be 1 or more spaces, commas, or both.

Leading zeros on tank numbers are accepted.

Data strings longer than 80 characters are rejected.

Notes: The level data is sent in 4 digits with no decimal points.

The data for each tank is followed by a carriage return.

Upper or lower case letters for the commands are accepted.

If a new command is received during the output of the last command, the level receiver will end the last command and execute the new command.

Data is transmitted with even parity.

The parity of received data is not checked.

Error codes are sent as negative numbers made up of 4 characters followed by a carriage return.

Error codes:

- 001 -- Tank requested does not exist.
- 002 -- Command does not exist.
- 003 -- Improper carriage return or line feed.
- 004 -- Input string is too long.
- 005 -- Transmission error detected.

SECTION VIII

Serial I/O Specifics

The RS-232C connector on the rear panel (see Figure 8-1) is connected internally to the serial I/O card. There are baud rate switches and a jumper plug on this card. (See Figure 8-2)

The baud rate switches are numbered 1 - 8. To select a particular baud rate, set the desired switch to the "ON" position. Set all other switches to "OFF".

<u>Switch Number</u>	<u>Baud Rate</u>
1	----- 150
2	----- 300
3	----- 600
4	----- 1200
5	----- 2400
6	----- 4800
7	----- 9600
8	----- 19200

There are two types of jumper plugs which can be plugged into two different sockets two different ways which will configure the RS-232C connector for different applications. The jumper plugs and sockets are sixteen pin dual-in-line style. These four items are listed below:

1. JP-A is a standard jumper plug which is used when handshaking with the external equipment is not needed. (See Figure 8-3)
2. JP-B is a jumper plug which is used when handshaking with the external equipment is needed. (See Figure 8-4)
3. Socket 232 is used when the standard RS-232C interface is needed.
4. Socket 20 ma is used when a 20 ma loop is needed.

The jumper plug can be inserted into a socket for DTE (Data Terminal Equipment) or DCE (Data Communications Equipment). Pin 1 of the jumper plug is indicated by the notch in the end of the plug.

The pin outs from the rear RS-232C connector for four different arrangements are described below:

Pinout 1 -- DTE/RS-232C.

Pin 1 of the jumper plug matches pin 1 of socket 232.

Connector pins 6 and 20 are not used if JP-A is used.

<u>Connector Pin No.</u>	<u>Description</u>	<u>Data Direction</u>
2	Transmitted data	From level receiver
3	Received data	To level receiver
4	Request to send	Jumpered to pin 5
5	Clear to send	Jumpered to pin 4
6	Data set ready	To level receiver
7	Signal ground	
20	Data terminal ready	From level receiver

Pinout 2 -- DCE/RS-232C.

Pin 1 of the jumper plug is opposite pin 1 of socket 232.

Connector pins 6 and 20 are not used if JP-A is used.

<u>Connector Pin No.</u>	<u>Description</u>	<u>Data Direction</u>
2	Transmitted data	To level receiver
3	Received data	From level receiver
4	Request to send	Jumpered to pin 5
5	Clear to send	Jumpered to pin 4
6	Data set ready	From level receiver
7	Signal ground	
20	Data terminal ready	To level receiver

Pinout 3 -- DTE/20 ma loop.

Pin 1 of the jumper plug matches pin 1 of socket 20 ma.

Connector pins 6 and 20 are not used if JP-A is used.

<u>Connector Pin No.</u>	<u>Description</u>	<u>Data Direction</u>
25	Transmitted data	From level receiver
24	Received data	To level receiver
4	Request to send	Jumpered to pin 5
5	Clear to send	Jumpered to pin 4
6	Data set ready	To level receiver
7	Signal ground	
20	Data terminal ready	From level receiver

Pinout 4 -- DCE/20 ma loop.

Pin 1 of the jumper plug is opposite pin 1 of socket 20 ma.

Connector pins 6 and 20 are not used if JP-A is used.

<u>Connector Pin No.</u>	<u>Description</u>	<u>Data Direction</u>
25	Transmitted data	To level receiver
24	Received data	From level receiver
4	Request to send	Jumpered to pin 5
5	Clear to send	Jumpered to pin 4
6	Data set ready	From level receiver
7	Signal ground	
20	Data terminal ready	To level receiver

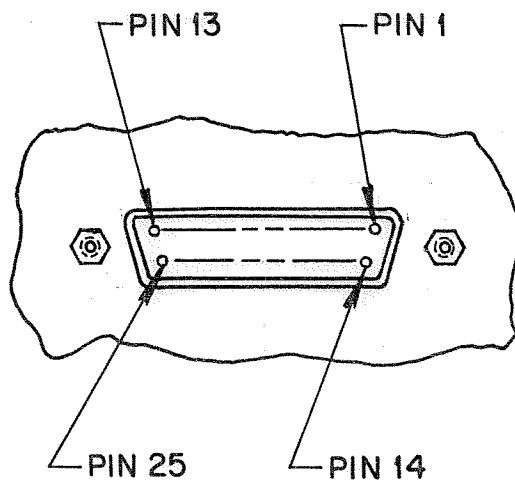


FIGURE 8-1

RS-232C Connector
25 Socket Female
Located on Rear Panel

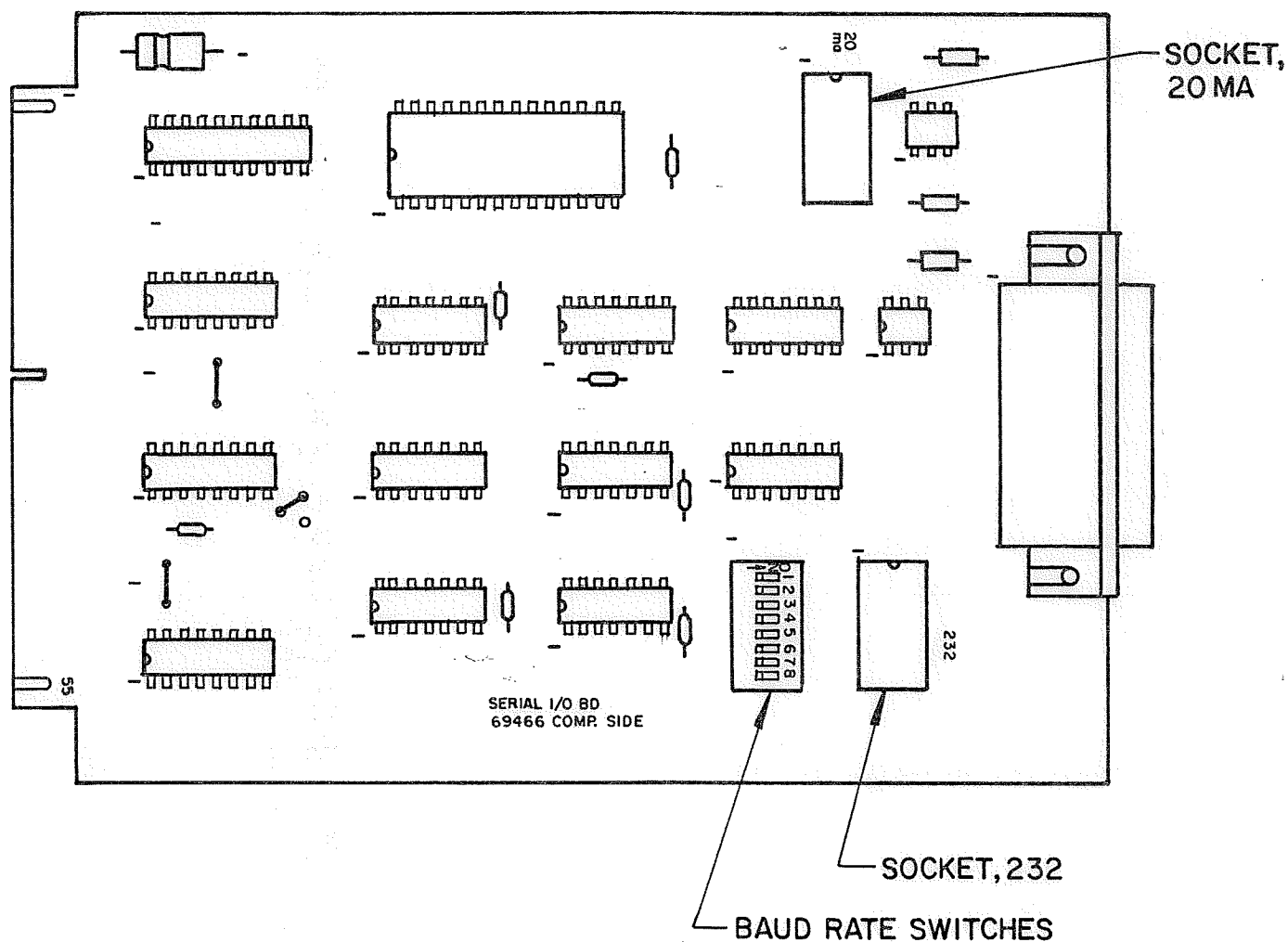


FIGURE 8-2

Serial I/O Board
Switch and Socket Locations

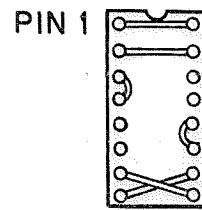


FIGURE 8-3

JP-A Jumper Plug
(Without Handshake)

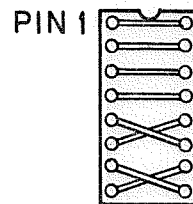


FIGURE 8-4

JP-B Jumper Plug
(With Handshake)

SECTION IX

Serial I/O Applications

Modems

A typical modem will work in full duplex mode at 300 baud. Set jumpers on the serial I/O card according to pinout 1 (DTE) as described in the Serial I/O Specifics. Set switch 2 to "ON" position to select 300 baud if the modem is, in fact, set up for 300 baud.

Computers

Computers are generally set up as DCE (Data Communications Equipment) in full duplex mode. Set the jumper plug on the serial I/O card according to pinout 2 (DCE) as described in the Serial I/O Specifics. The baud rate that the computer is set up for will have to be determined. The baud rate switches on the serial I/O card will have to be set to the same rate.

SECTION X

Rear Panel Removal

Disconnect AC power cord.

Loosen retaining screws holding side panels in place and remove the side panels. (See Figure 10-1)

Remove the 6 screws holding the rear panel in place. The rear panel can then be pulled back and down for access to the circuit cards.

To remove a card the retaining rod must first be slid out of its guide holes.

Connectors plugged into the cards may also have to be removed.

Notes:

The top panel may be removed after the side panels are taken off for better visibility.

There is more clearance if the rear panel is dropped over the edge of a table when it is pulled back.

Card order in rack counted left to right:

1. Keypad/display card
2. Serial I/O card
3. Microprocessor card
4. Memory card
5. Lamp driver card
6. Spare
7. Spare
8. A/D converter card

When replacing cards be sure that pin 1 is up or the component side of the card is facing toward the left.

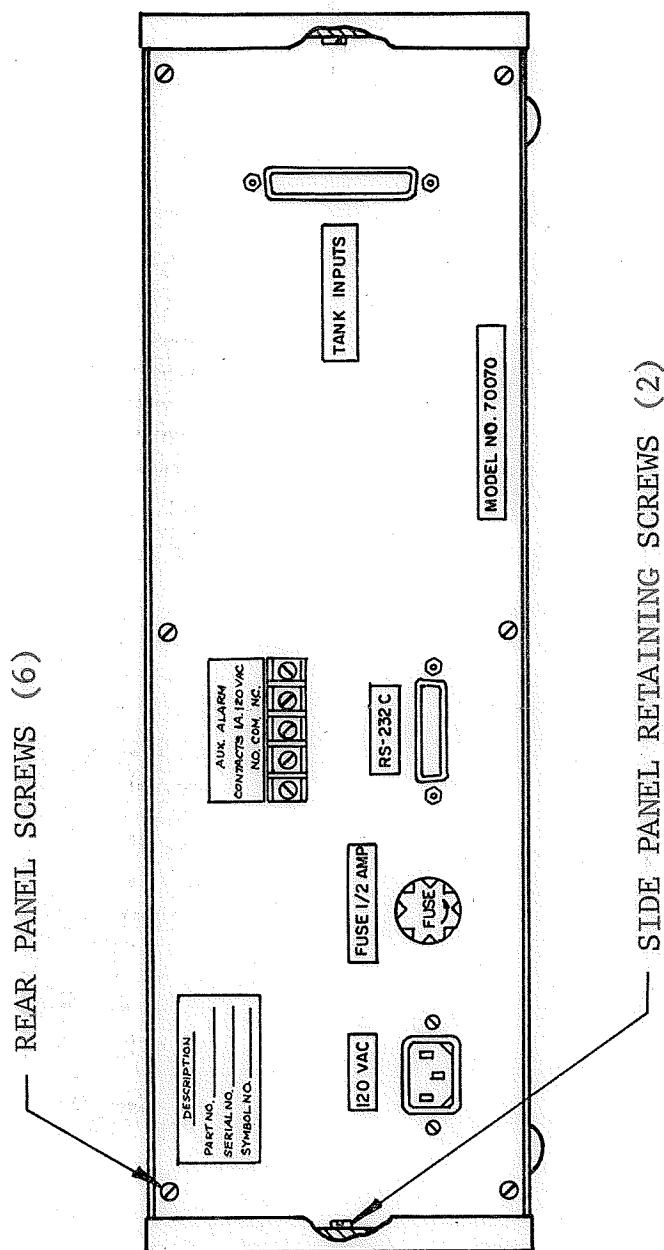


FIGURE 10-1
REAR PANEL REMOVAL

SECTION XI

Troubleshooting Guide

The problems listed below are followed by possible causes and remedies. Possible causes are labeled A, B, C, etc.; the respective remedies are also labeled A, B, C, etc.

Most of the problems listed may have a cause related to the electronics. If this guide does not help cure the problem, then consult the factory for remedies and/or repair.

CONTENTS

- I. Display related problems.
 - 1. All digits blanked.
 - 2. PO -- displayed.
 - 3. P HELP displayed.
 - 4. Empty tank displayed.
 - 5. Incorrect level displayed.
- II. Keypad related problems.
 - 1. Keypad not working properly.
- III. Alarm lamp related problems.
 - 1. Lamp stays on.
 - 2. Lamp stays off.
 - 3. Lamp will not flash.
- IV. Miscellaneous problems.
 - 1. Lost key.
 - 2. Unneeded alarms.

I. Display related problems

1. All digits of the display blanked.

Possible causes:

- A. AC cord disconnected.
- B. Blown fuse.

Remedies:

- A. Plug AC cord into both the rear panel socket and a live AC outlet.
 - B. Replace 1/2 amp. fuse located on rear panel.
2. "PO -- XXXX" shown on the display. (X = undetermined digit)

Possible causes:

- A. Low AC voltage supplied to unit (brown out).
- B. AC power surge activating "Power Out Circuit".

Remedies:

- A. Restore AC voltage to its proper level.
- B. Reset the electronics by turning unit off for 3 seconds, then turning it on again.

Note: AC voltage regulators can cure problems of repeated power surges and/or brown outs.

3. "P HELP" shown on the display.

Explanation -- When power is first turned on, the electronics checks the memory to be sure it has not been disturbed while the unit was off. If the memory has been disturbed, the slosh delay and alarms are set to the factory set default value. "P HELP" is displayed to make the operator aware of this condition.

Troubleshooting Guide (Cont'd)

I. 3. Possible causes:

- A. Power surge upsetting memory.
- B. Unit off longer than six months resulting in the battery becoming completely discharged.

Remedies:

- A. Set slosh delay and alarms to the desired settings. Also see note under problem 2.
 - B. Set the slosh delay and alarms to the desired settings and leave the unit on for 48 hours to recharge the battery.
4. Value shown on the display indicates that the tank is empty when the tank is known to have contents.

Possible causes:

- A. Wiring from the level transmitter not properly connected.
- B. Fuse blown in a Zener Barrier Safe-Pak (if used).

Remedies:

- A. Be sure tank input connector on the rear panel is secured properly. Also check all other connections leading to the tank.
 - B. Consult Zener Barrier Safe-Pak literature.
5. Incorrect value shown for tank contents.

Possible cause:

- A. Unit needs to be recalibrated.

Remedy:

- A. See section on calibration.

II. Keypad related problems

1. Keypad not working properly.

Possible cause:

- A. Keypad lock set in locked position.

Remedy:

- A. Turn key to unlocked position.

Troubleshooting Guide (Cont'd)

III. Alarm lamp related problems

1. Alarm lamp stays on for an apparent non-alarm condition or --
2. Alarm lamp stays off for an apparent alarm condition.

Note: Use self-test button to see if the lamp will go on and off.
If not, then the problem is in the lamp driver circuit.

Possible cause:

- A. Improper alarm setting.

Remedy:

- A. Check the appropriate high or low alarm and set properly.
3. Alarm lamp does not flash when going into a new alarm condition.

Possible cause:

- A. A too long of a slosh delay setting where the acknowledged alarm does not have time to reset.

Remedy:

- A. Set the slosh delay setting to a shorter time.

IV. Miscellaneous problems

1. Lost key for the keypad lock.

Remedies:

- A. Get spare key from under the power supply inside the cabinet. See section for removing the rear panel. Clip the strap holding the key and remove.
- B. Order new key. (Keying for each unit is standardized.)
2. Alarms that are not needed and horn comes on when cycling tanks.

Remedy:

- A. Set the high and low alarms to 9999 and 0000 respectively. If the tank's highest level is less than a value of 9999, then no alarms will ever be triggered.

If the tanks reach a level value of 9999, then set the high alarm to 0000. In this case an alarm condition will always exist, and the horn will always be acknowledged.

Troubleshooting Guide (Cont'd)

III. Alarm lamp related problems

1. Alarm lamp stays on for an apparent non-alarm condition or --
2. Alarm lamp stays off for an apparent alarm condition.

Note: Use self-test button to see if the lamp will go on and off.
If not, then the problem is in the lamp driver circuit.

Possible cause:

- A. Improper alarm setting.

Remedy:

- A. Check the appropriate high or low alarm and set properly.

3. Alarm lamp does not flash when going into a new alarm condition.

Possible cause:

- A. A too long of a slosh delay setting where the acknowledged alarm does not have time to reset.

Remedy:

- A. Set the slosh delay setting to a shorter time.

IV. Miscellaneous problems

1. Lost key for the keypad lock.

Remedies:

- A. Get spare key from under the power supply inside the cabinet.
See section for removing the rear panel. Clip the strap holding the key and remove.
- B. Order new key. (Keying for each unit is standardized.)

2. Alarms that are not needed and horn comes on when cycling tanks.

Remedy:

- A. Set the high and low alarms to 9999 and 0000 respectively.
If the tank's highest level is less than a value of 9999, then no alarms will ever be triggered.

If the tanks reach a level value of 9999, then set the high alarm to 0000. In this case an alarm condition will always exist, and the horn will always be acknowledged.