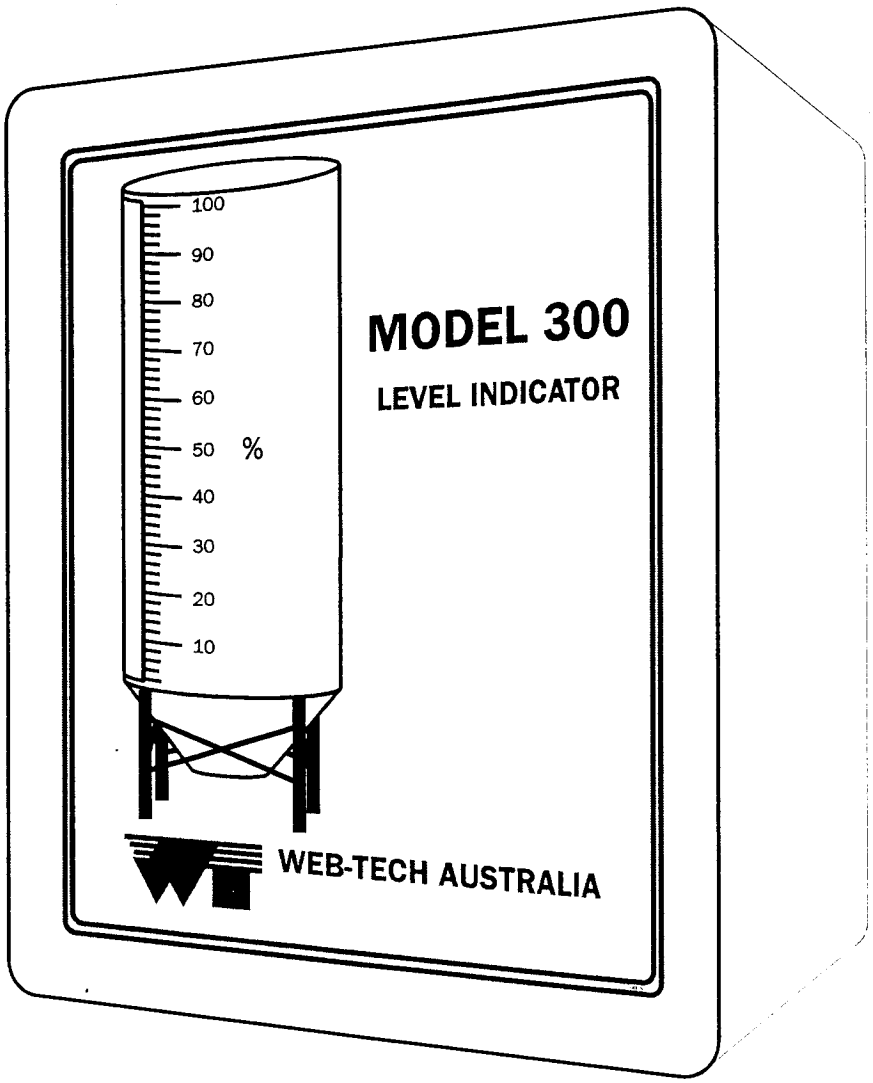
Model 300
Level Indicator
Operation Manual



WEB-TECH AUSTRALIA

Table of Contents

List of Illustrations

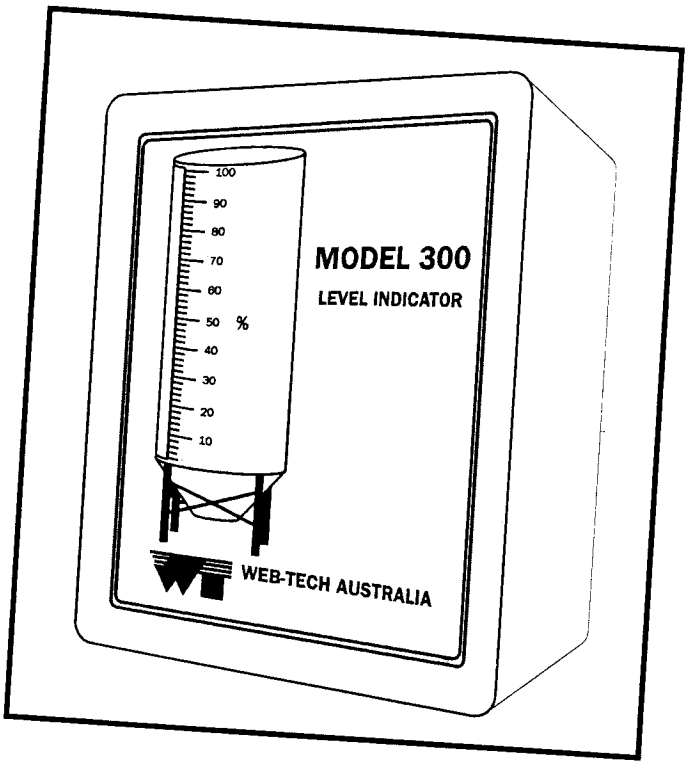


Figure 1-1
Model 300 *Level Indicator*

1.0 General Description

The Web-Tech Model 300 Level Indicator, is a microprocessor based instrument providing continuous measurement of material levels in silos and storage vessels for both new and existing applications. The instrument provides an indication of material level via a bar graph graduated in 2% increments. The Model 300 also provides a 4-20mA current signal which is directly representative of the quantity of material in the vessel. A standard feature of the instrument, is the provision of two fully programmable setpoints, enabling the activation of external devices such as motors, pumps, alarms, etc. at predetermined material levels. Figure 1-1 illustrates the Model 300 Level Indicator.

1.1 Standard Features

- # *embedded Motorola 8 bit microprocessor*
- # *20 bit A/D resolution*
- # *local LED bar graph display, graduated in 2% increments*
- # *isolated 4-20mA current loop (800 Ω max)*
- # *current loop fault indication*
- # *12 bit D/A resolution on analogue output*
- # *two (2) fully programmable setpoints*
- # *system status relay output*
- # *accepts both full and half bridge load cells*
- # *X1 and X10 selectable gain settings on analogue input*
- # *easy programming of zero, span & setpoint levels*
- # *zero, span and setpoint levels retained indefinitely in non-volatile memory*
- # *120/240Vac dual voltage operation*
- # *IP66 (NEMA 4X) rated enclosure, featuring a quick release lockable cover*

1.2 Using the Keypad and Menu Display

The Model 300 level indicator uses a basic four key pad and simple LED bar graph display to perform all of the setup and calibration functions required. This combination ensures that all of the these functions can be carried out simply and quickly. Figure 1-2 opposite shows the location and layout of the keypad and bar graph display.

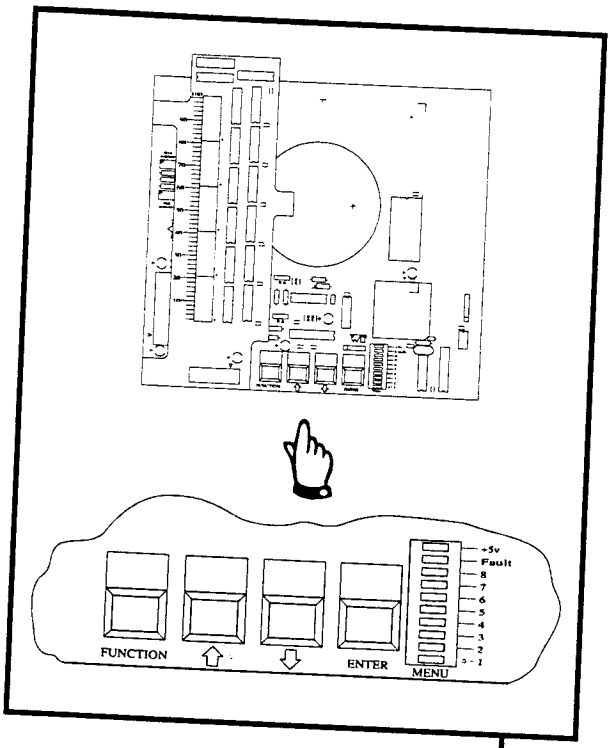


Figure 1-2
Keypad & Menu Display on CPU card

The keypad is used to scroll through and access the various functions and input calibration and setup information. The bar graph display is used, in conjunction with the keypad, to identify which function has been selected. The display also provides basic information on fault identification. The individual keypad functions and their relationship to the bar graph display, are detailed below. A graphical portrayal of this relationship is shown in Figure 1-3.

1.2.1 Menu Bar Graph Display

The **Menu** display is located just to the right of the keypad, and performs a number of tasks. Primarily, it serves to identify which programming function is currently selected. The bar graph consists of ten elements, eight of which are used to identify functions. These segments are numbered **1** to **8**. The two remaining segments help to identify basic system problems, namely +5v power failure and current loop faults.

The eight numbered segments mentioned earlier, are used either individually or in combination to identify a particular function. This function/segment relationship is explained in Table 1-1.

Segment	Function
1	ZERO
2	SPAN
3	SETPOINT #1
4	SETPOINT #2
5	4mA ADJUST
6	20mA ADJUST
7	AUTO-ZERO ON/OFF
8	AUTO-ZERO THRESHOLD
1 & 2	AUTO-ZERO FAULT RESET
2 & 3	AUTO-ZERO MAX. CORRECTION
5,6,7 & 8	AUTO-ZERO FAULT

Table 1-1 Display segment/function assignments

The two remaining segments are labelled **+5v** and **Fault**. The **+5v** segment indicates, when lit, the presence of the +5v electronics supply voltage, while the **Fault** segment illuminates when a problem exists with the current loop.

The **Menu** display also verifies correct operation of the microprocessor by scrolling continuously from top to bottom when not in the function programming mode. Failure of the display to scroll as just described, means that the microprocessor has ceased to operate. Should this situation ever occur, consult ***Web-Tech*** for technical support.

1.2.2 FUNCTION Key

The blue **FUNCTION** key, is used to scroll through the list of available functions as shown in Table 1-1.

Pressing this key once while in the normal monitoring mode, causes the **Menu** display to cease scrolling and illuminate the segment labelled **1**. At this stage, the Model 300 is still in the monitoring mode and continues to monitor material levels, provide 4-20mA output signals and activate setpoint relays as appropriate. With each press, the next function segment is illuminated while the previous segment is extinguished. Upon reaching the last function segment, an additional press will cause the **Menu** display to recommence scrolling and the transmitter is returned to its normal monitoring mode of operation. The above sequence can be repeated by merely pressing the **FUNCTION** key again.

1.2.3 ↑ and ↓ Keys

The red ↑ key and black ↓ key are used , once in the function programming mode, to enter setup and calibration data.

Each press of either key, causes the particular function selected to be altered by approximately 0.25%. Holding these keys depressed for one second or more results in the function selected being updated at a rate of about 8% per second. The key is released when the desired input setting is reached.

1.2.4 ENTER Key

The green **ENTER** key is used firstly, to confirm the selection of the desired function and secondly, to confirm the data input using the ↑ and ↓ keys.

Once the **ENTER** key has been pressed to store data, the Model 300 returns to the function selection mode enabling another function to be selected using the **FUNCTION** key as described earlier.

If the arrow keys have not been used, the **ENTER** key returns the Model 300 to its normal monitoring mode without changing data.

Pressing the **ENTER** key twice, causes the Model 300 to exit the function programming mode and return to its normal monitoring mode. The information just entered is used to recalibrate the transmitter at this point.

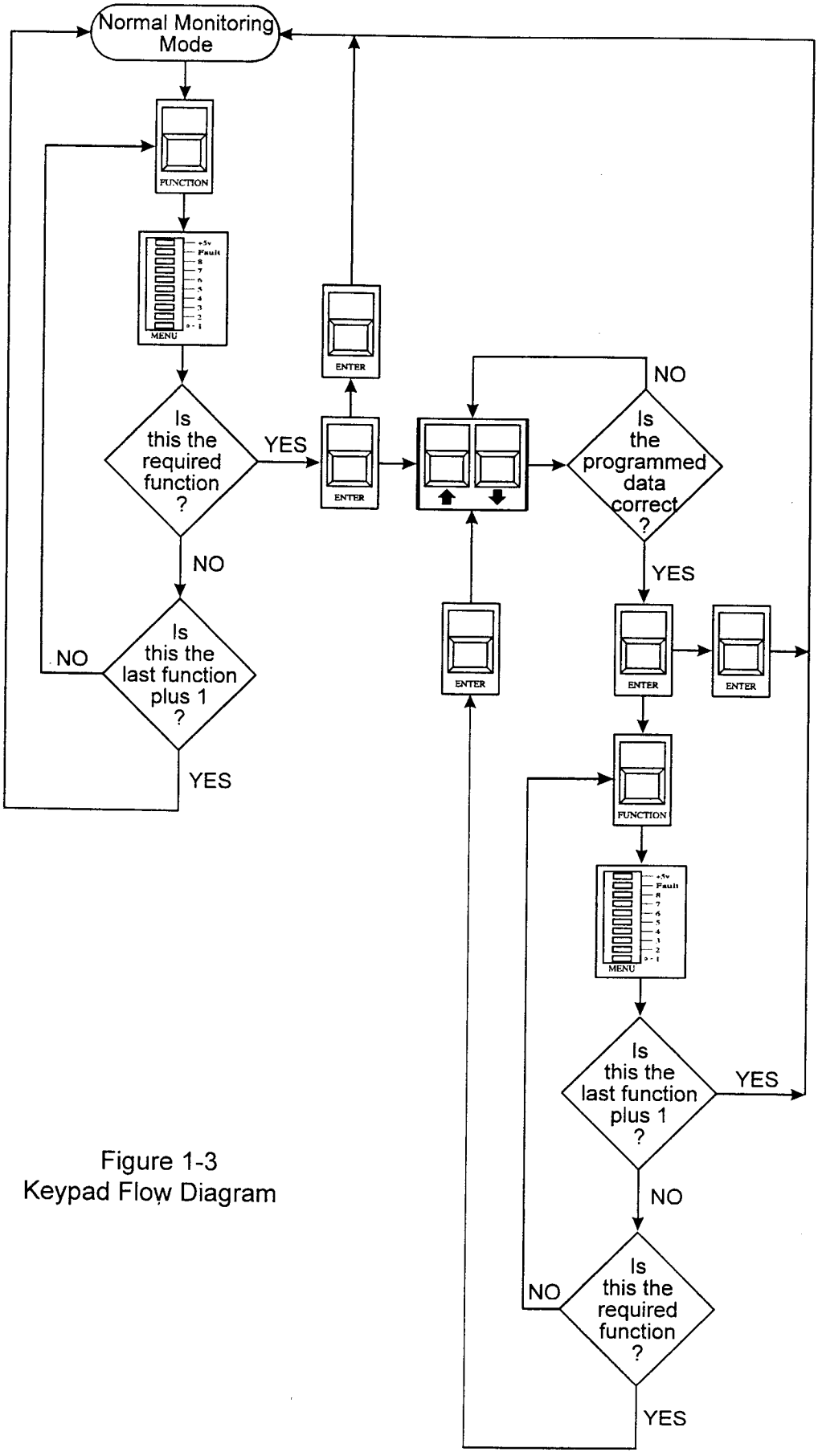


Figure 1-3
Keypad Flow Diagram

This page intentionally left blank.

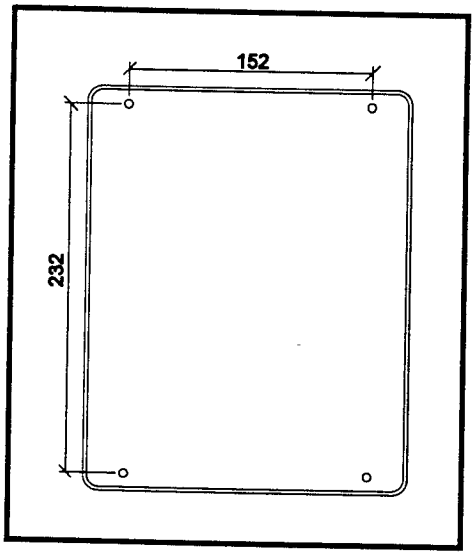


Figure 2-1
Standard Mounting Arrangement

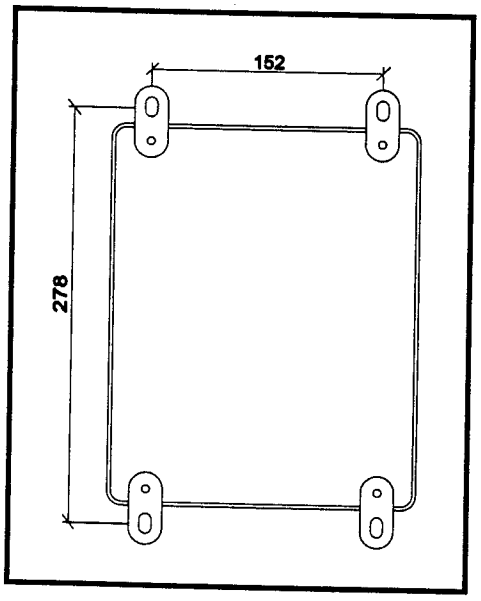


Figure 2-2
Mounting Arrangement Using Supplied Mounting Kit

2.0 Mounting Instructions

The Model 300 may be mounted by one of two methods. The mounting arrangement shown in Figure 2-1, is suitable for installations where the attaching screws can be inserted from behind the transmitter. Figure 2-2 shows the arrangement when using the supplied mounting kit. Either of these methods may be used without compromising the IP66 (NEMA 4X) rating of the enclosure.

The Model 300 has an operating temperature range of between -10°C and 50°C, when operated continuously. However, an installation location maintaining a temperature range of between 0°C and 50°C is preferred.

The transmitter should be wall mounted using the following procedure:

(a) Select a mounting location which will provide sufficient clearance for the opening of the enclosure door, and allow cabling access to the bottom of the enclosure.

(b) Decide upon which of the two mounting arrangements shown opposite, is the most suitable for your particular application. Drill holes in the wall using the dimensions shown in Figure 2-1 or Figure 2-2. The screws supplied in the enclosed mounting kit, (i.e. #10-32 pan head) can be used for the standard mounting arrangement detailed in Figure 2-1, providing the panel thickness does not exceed 3mm. If using the arrangement shown in Figure 2-2, you must supply the necessary hardware to attach the unit to the wall. The slots in the mounting feet supplied can accommodate screws up to 7mm in diameter.

(c) Place the unit on the wall and attach using selected hardware. Care should be taken when screwing into the enclosure, to ensure that the torque applied to the screws does not exceed **2.7 Nm**.

2.1 Wiring Procedure

All connections to the Model 300 are made via the two terminal blocks shown in Figure 2-3 opposite. Terminal block TB1 accepts the AC power connections, while TB2 accommodates all other terminations. Refer to Figure 2-9,Figure 2-10 and Figure 2-11.

In order to maintain the IP66 (NEMA 4X) rating of the enclosure, suitable cable glands and fittings need to be used.

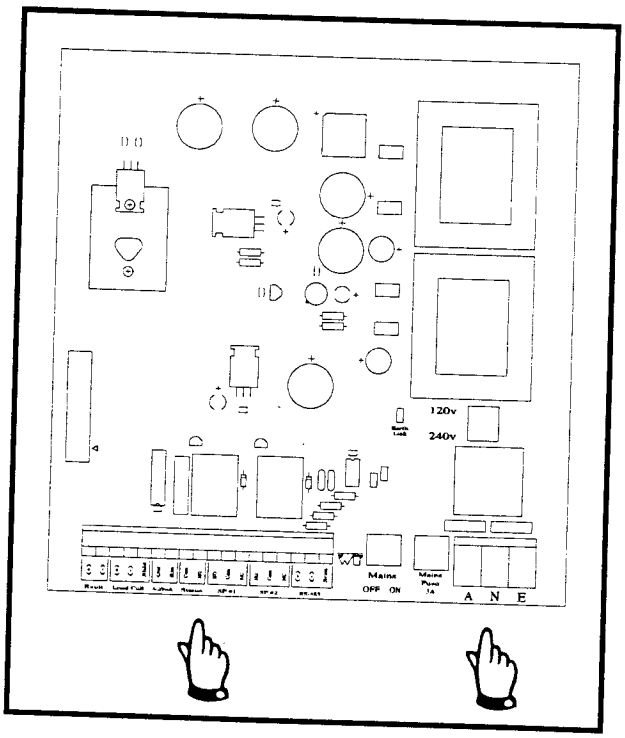


Figure 2-3
Terminal Blocks on Power Supply card

Care should be taken to ensure that all terminations are made in accordance with the following directions. Incorrect wiring may result in damage to the Model 300 and/or the attached equipment.

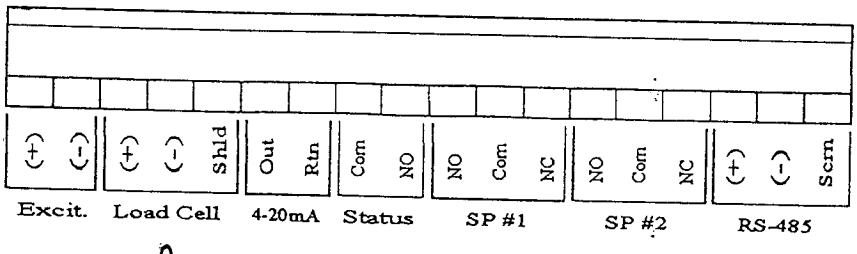
2.2 Connecting the Load Cell

The load cell is to be installed in accordance with the manufacturers' specifications and is therefore beyond the scope of this manual. Any queries regarding the load cell should be directed to the manufacturer.

Connect the load cell to the Model 300 as follows:

(a) Run interconnect cable between the load cell junction box and the Model 300. If using a half-bridge type load cell, use a suitable three core shielded cable such as **Belden 8791.** If using a full-bridge type load cell, use a suitable four core shielded cable such as **Belden 9773**.

(b) Connect the load cell wires to terminal block TB2 in accordance with the legends located below the terminal block as shown below.



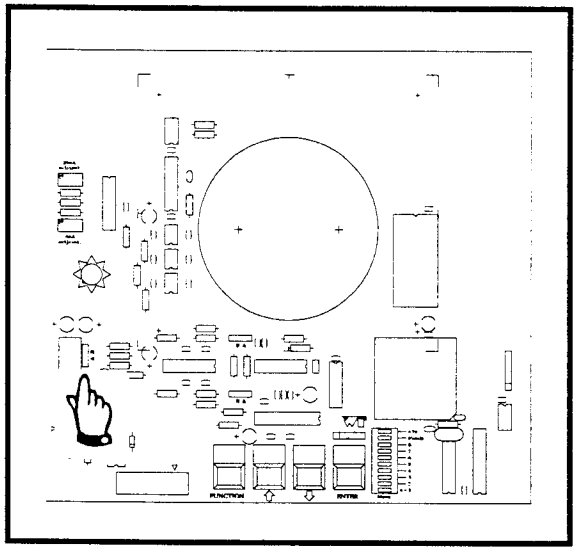


Figure 2-4
Full-Bridge/Half-Bridge Selection Link
(LK3 on CPU card)

NOTE: If using a half-bridge type load cell, connect the signal wire to the terminal marked **Load Cell (+)**. See Figure 2-11.

(c) If using a half-bridge type load cell, ensure that the selection link LK3 on the CPU card is in position **B**. This link should be in position **A** for full-bridge type load cells. The location of LK3 is shown by Figure 2-4.

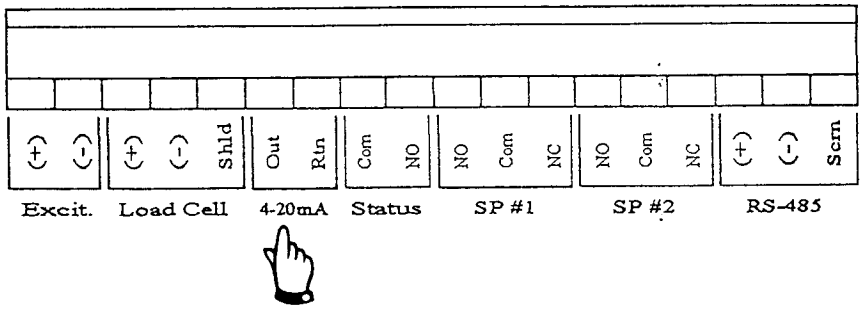
2.3 Connecting 4-20mA Current Loop

The 4-20mA current transmitter of the Model 300, provides a fully isolated industry standard current output capable of driving into a maximum loop load of 800 Ω.

Connect the current transmitter output to the external equipment as detailed below:

(a) Run the interconnect cable between the external equipment and the Model 300. Use a suitable two core shielded cable such as **Belden 8790**.

(b) Connect the interconnect cable to the terminal block, TB2, in accordance with the legends located immediately below.



2.4 Connecting the Setpoint Relays

A standard feature of the Model 300, is the provision of two fully programmable setpoint relays to enable control of auxiliary equipment such as alarms, pump motors, etc.

The setpoint relays have a contact rating of 30VDC @ 10A and 240Vac @ 5A (resistive). Please ensure that the power requirements of the equipment connected to these relays do not exceed this rating.

Before connecting the auxiliary equipment to the setpoint relays, some consideration should be given as to how this equipment is best controlled.

The setpoints operate such that the relays are de-energized when the bin level is at or below its respective setpoint. The relays become energised when the bin level is at or above a level equal to the setpoint plus hysteresis. The Model 300 has a hysteresis value of 1% pre-programmed at the factory.

For example, if a setpoint is programmed at 10% say, then the relevant relay will de-energise when the bin level drops to 10%. This relay will remain de-energized for all bin levels below 10%. If the bin is then filled, the relay will become energised when the level reaches 11%. The relay will then remain energised for all bin levels above 11%.

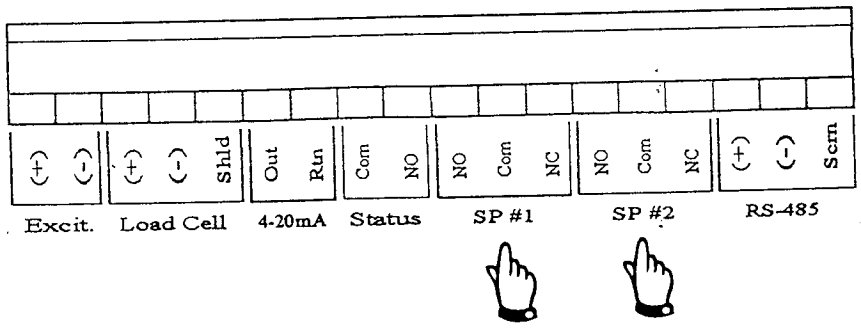
A detailed procedure for setting the setpoint levels, can be found in *Section 3.5 Programming of Setpoint Levels.*

Setpoint relay legends: NO - normally open contact
NC - normally closed contact
COM - common contact

Connect the auxiliary equipment to the setpoint relays as follows:

(a) Run interconnect cable between the external equipment and the Model 300. Select a cable of sufficient rating so as to accommodate the power requirements of the equipment being connected.

(b) Connect the interconnect cable to the terminal block, TB2, in accordance with the legends located immediately below.



2.5 Connecting the Status Relay

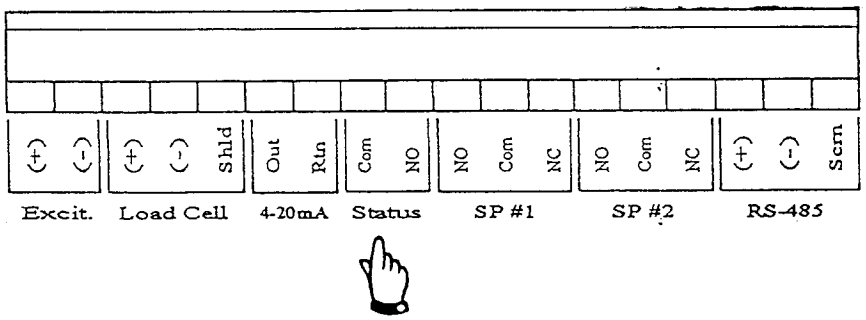
A small system status relay is incorporated into the Model 300. This relay would typically be connected to a PLC and be used to signal the PLC of any notifiable faults with the Model 300 or a power failure. This relay would normally be energised in a fully functional instrument. In the event of a fault or power failure occurring, the status relay would de-energise.

The status relay has a contact rating of 20VDC @ 0.5A. Under no circumstances should mains power or any other high power supply be connected to this relay.

Connect the status relay output to the external monitoring device (e.g. PLC) as detailed below.

(a) Run the interconnect cable between the external monitoring device and the Model 300. Use a cable suitable for use with the voltages and currents to be used.

(b) Connect the interconnect cable to the terminal block, TB2, in accordance with the legends located immediately below.



2.6 Connecting Mains Power

The Model 300 was designed as a dual voltage instrument and is therefore capable of operating from either 120Vac or 240Vac.

Do not turn on mains power until instructed to do so in the following procedure.

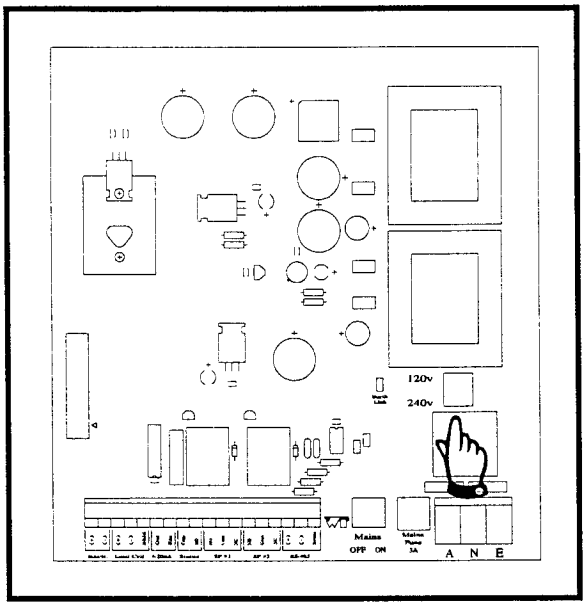


Figure 2-5
Mains Voltage Selection Switch on Power Supply card

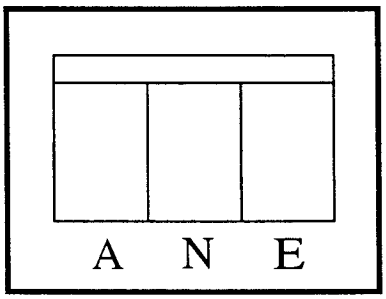


Figure 2-6
Mains Supply Terminal Block, TB1

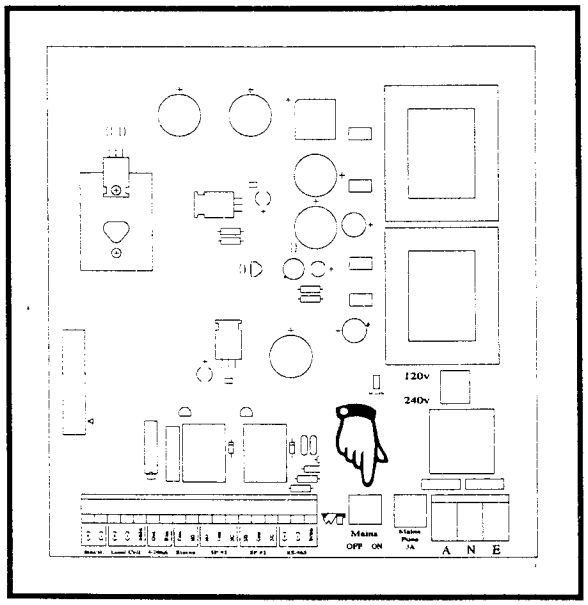


Figure 2-7
Mains ON/OFF Switch

To connect mains power to the instrument, proceed as follows.

(a) Verify local mains supply voltage (i.e. 120Vac or 240Vac) and set voltage selector switch to reflect this voltage. See Figure 2-5 opposite.

(b) Run power supply cable between the mains power source and the Model 300. Use cable of a suitable mains rating, for example, normal three core mains flex.

(c) Connect power supply cable to the terminal block, TB1, in accordance with the legends located immediately below. Terminal block TB1 is located directly below the mains voltage selector switch shown in Figure 2-5.

The active wire should be connected to the terminal labelled **A**, while the neutral wire is connected to the terminal marked **N**. The earth lead from the power cable is connected to the terminal labelled **E**. Figure 2-6 shows the mains supply terminal block, TB1.

(d) Check that the Mains ON/OFF switch is set to **OFF**. See Figure 2-7 opposite.

(e) Turn **ON** mains supply at the source.

(f) Turn **ON** the Mains ON/OFF switch. Check to see that the **+5v** indicator LED illuminates on the **Menu** Display located on the CPU card as shown in Figure 2-8.

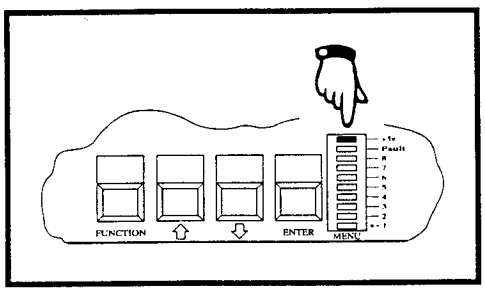


Figure 2-8
+5v Indicator LED on Menu Display

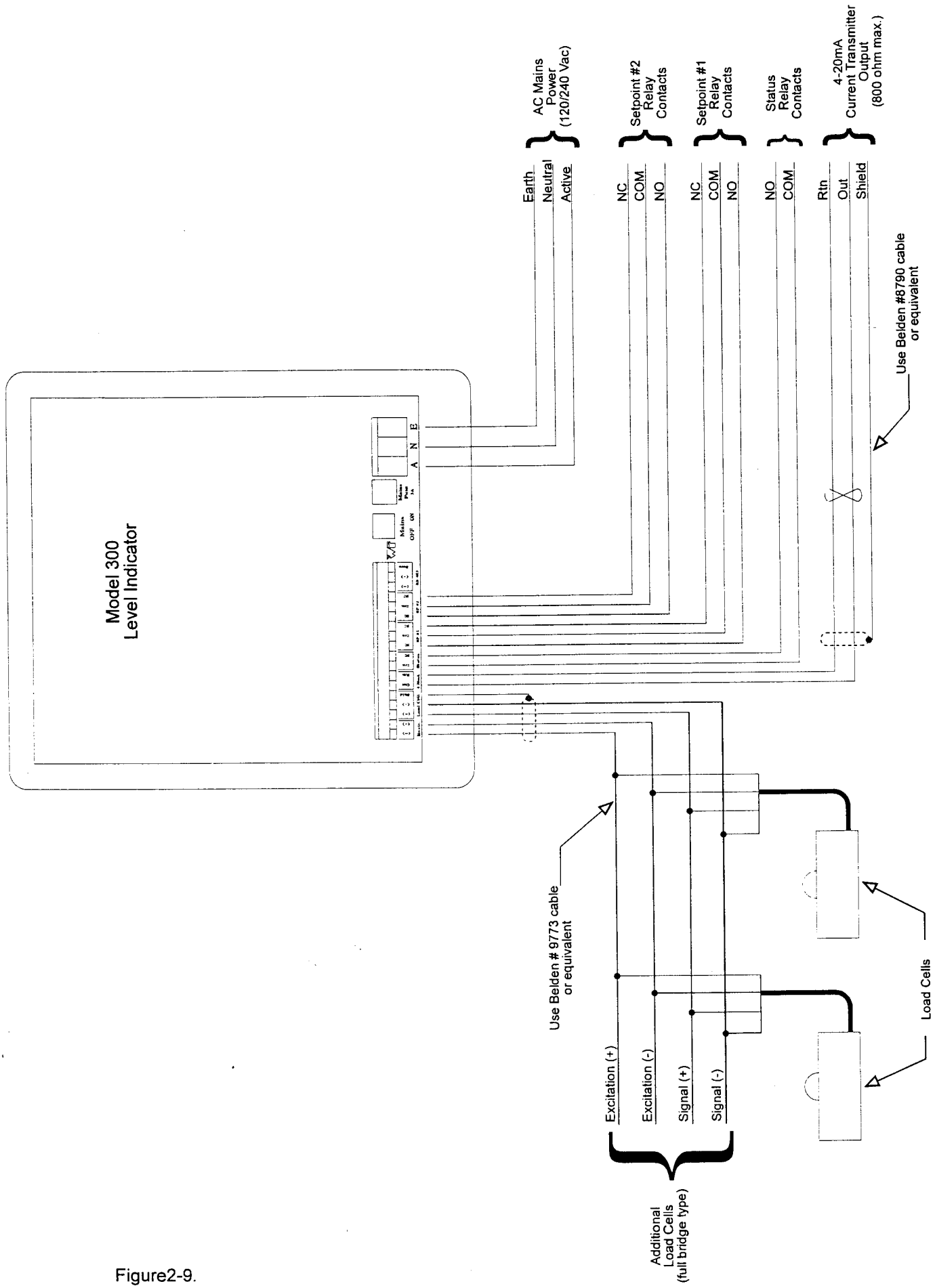


Figure2-9.

Model 300 Wiring Interconnect Diagram

(when using full bridge type load cells)

Figure 2-10

Model 300 Wiring Interconnect Diagram
(when using half bridge type load cells)

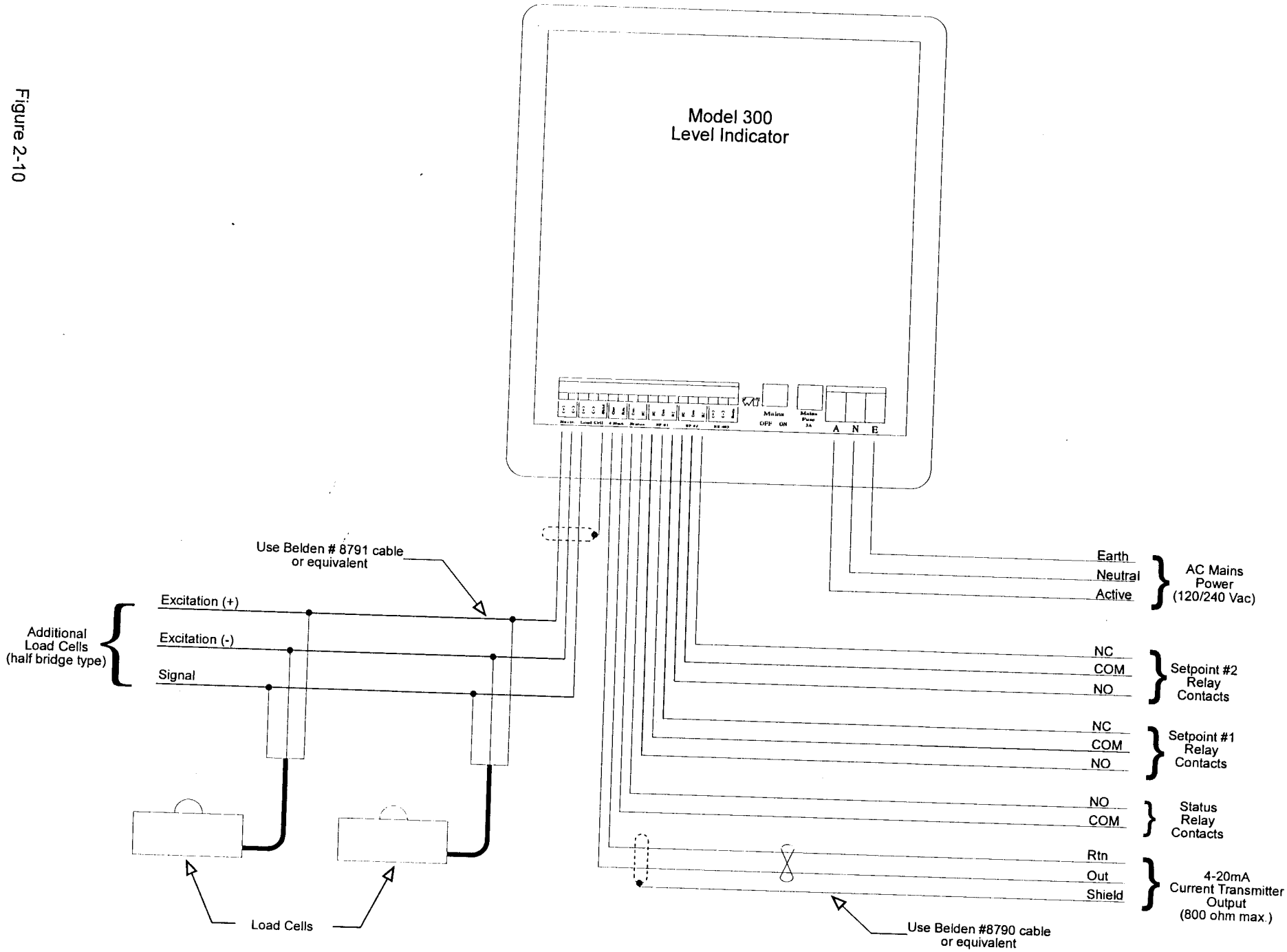
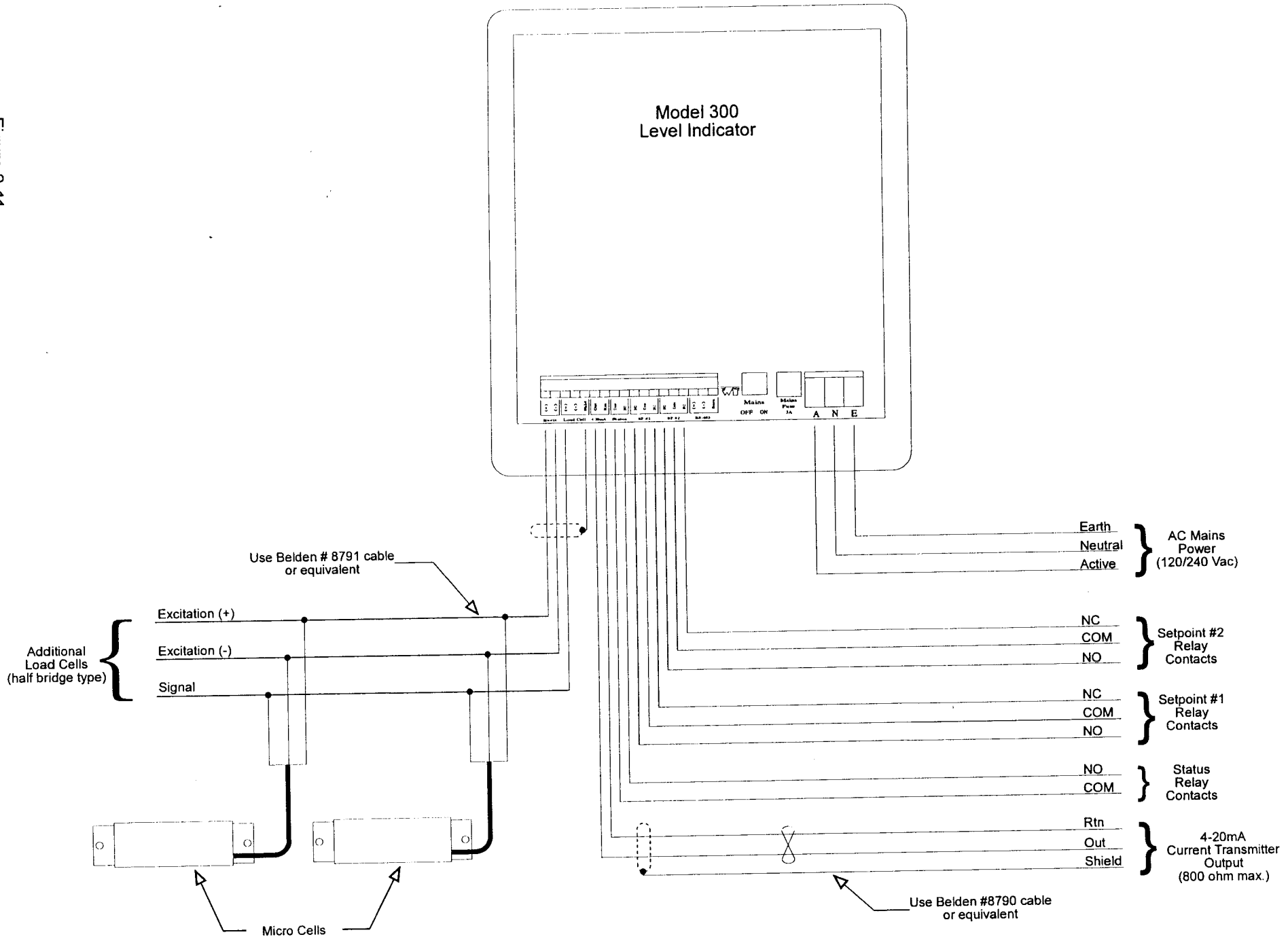


Figure 2-11

Model 300 Wiring Interconnect Diagram
(when using MicroCells)



3.0 Calibration Procedure

The Model 300 requires a simple calibration procedure be carried out to compensate for the variations which will invariably exist between different applications. An equally simple procedure allows the user to pre-programme the setpoint levels.

The calibration procedure which appears later in this chapter, would normally be carried out upon installation and commissioning of the level indicating system. Once performed, the calibration procedure need not be repeated unless one or more of the following events occur.

(a) The original load cells used in the commissioning are replaced. Even though the load cells may be replaced with an identical part, their electrical characteristics may vary sufficiently to degrade the accuracy of the system.

(b) The material in the storage vessel is replaced with another of a different bulk density. This change in bulk density, will result in the load cell output being offset by an amount directly proportional to the variation in the bulk densities.

(c) The Model 300 is removed from the original application site and re-installed on a different application. This shift invariably means different materials, different load cells and a different storage vessel, all of which can affect system accuracy.

The procedure for programming the setpoints, on the other hand, need only be repeated when the user wishes to alter the setpoint levels.

The calibration procedure consists of a number of short simple routines. The first of these calibrates the 4-20mA current transmitter output. The second set of routines known as ZERO and SPAN, calibrates the Model 300 to accommodate the characteristics of the particular application. While the final procedure allows the user to adjust the current transmitter output to *align* it with other equipment in the system. Each of these routines is explained in more detail in the following text.

3.1 4-20mA Current Transmitter Calibration

This procedure calibrates the 4-20mA current transmitter to ensure that the Model 300 outputs a current of 4mA when the storage vessel is empty, and a current of 20mA when the vessel is full. These parameters reflecting the requirements of the industry standard.

This procedure does not require the emptying or filling of the bin, as the signals representing these conditions are generated internally by the microprocessor.

To perform the current transmitter calibration, proceed as follows:

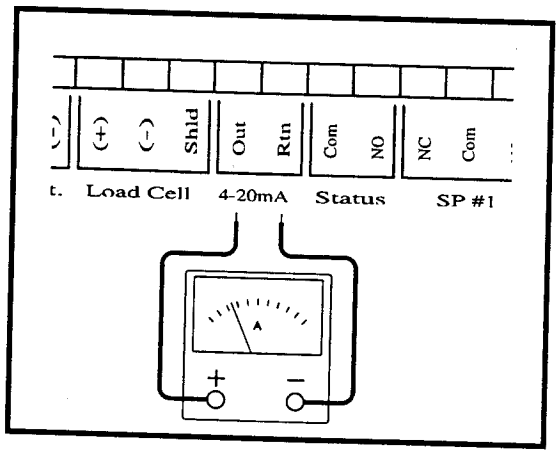


Figure 3-1
Connect Ammeter to 4-20mA Output.

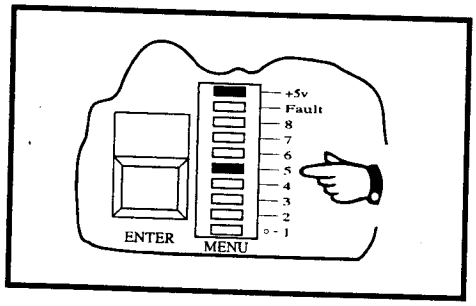


Figure 3-2
4mA Calibration Indicator on Menu Display

(a) Ensure that the Model 300 is turned **OFF**.

(b) Disconnect the 4-20mA output from any external equipment, if connected.

(c) Connect an ammeter to the 4-20mA output terminals of the Model 300 as shown in Figure 3-1.

(d) Turn **ON** the Model 300 mains switch. The **+5v** indicator LED on the **Menu** display should illuminate.

(e) Press the blue **FUNCTION** key on the CPU card of the Model 300. The **Menu** display on the CPU card should cease scrolling and the segment labelled **1** should illuminate.

(f) Press the blue **FUNCTION** key a number of times until the segment labelled **5** is illuminated. This segment identifies the 4mA calibration menu option. See Figure 3-2 .

(g) Press the green **ENTER** key **ONCE**. This selects the 4mA calibration function. The ammeter should indicate a reading of approximately 4mA.

(h) Adjust the **4mA adjust** potentiometer located on the CPU card, see Figure 3-3, until the ammeter reads as close to 4mA as possible.

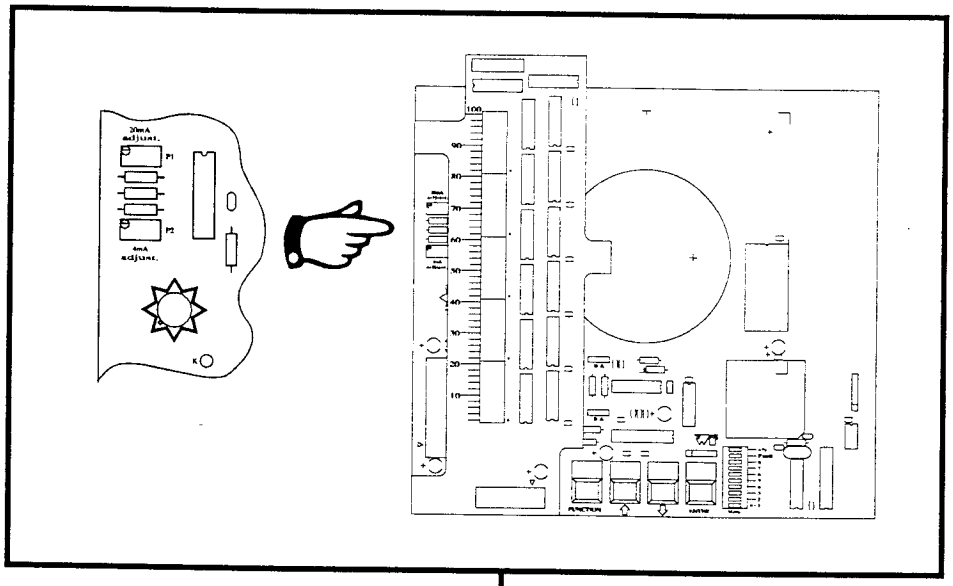


Figure 3-3
4mA and 20mA Adjustment Potentiometers on CPU card

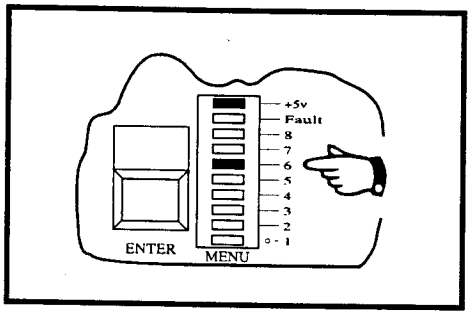


Figure 3-4
20mA Calibration Indicator on Menu Display

(i) Press the green **ENTER** key. The **Menu** display should commence scrolling.The Model 300 is now back in normal monitoring mode.

(j) Press the blue **FUNCTION** a number of times until the segment labelled **6** on the **Menu** display illuminates. This segment identifies the 20mA calibration menu option. See Figure 3-4.

(k) Press the green **ENTER** key **ONCE**. This selects the 20mA calibration function. The ammeter should indicate a reading of approximately 20mA.

(l) Adjust the **20mA adjust** potentiometer located on the CPU card, see Figure 3-3, until the ammeter reads as close to 20mA as possible.

(m) Press the green **ENTER** key. The **Menu** display should commence scrolling. The Model 300 is now back in normal monitoring mode.

This completes the current transmitter calibration procedure. The adjustments made on the two potentiometers are non-interactive, therefore there is no need to repeat the process.

3.2 Load Cell Amplifier Gain Adjustment

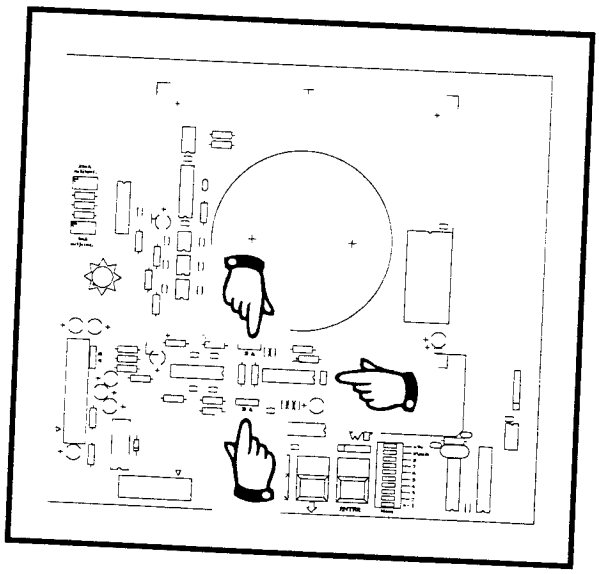


Figure 3-5
Location of Gain Links on CPU card

The Model 300 provides load cell amplifier gains of unity and ten. This enables the device to accept a wide range of load cell outputs.

In most cases the Model 300 would use the unity gain setting thereby allowing input signals of up to 1 volt DC. However, where the load cell output under full load is less than about 1mV, then the (x10) gain setting is recommended.

The unit comes from the factory configured for unity gain, but the gain can be easily altered by positioning the links LK1, LK2 and LK4 on the CPU card, as detailed in Table 3-1 below. The location of these links is shown in Figure 3-5.

Link	x1 Gain	x10 Gain
LK1	B A	B A
LK2	B A	B A
LK4		

Table 3-1
Amplifier Gain Link Settings

3.3 ZERO and SPAN Calibration *(optimum)*

This *optimum* procedure for setting the ZERO and SPAN parameters, provides the highest level of accuracy but can only be performed if you are prepared to completely empty and fill the storage vessel.

These two routines provide the Model 300 with two essential pieces of information. Firstly, the ZERO operation is performed when the storage vessel is empty. It tells the on board microprocessor that the current load cell output corresponds to an empty vessel. The second

operation called SPAN, is performed when the vessel is full. This routine informs the microprocessor that the current load cell output corresponds to a full vessel.

The microprocessor uses these two pieces of information to determine the equation of the line passing through these two points. The Model 300 then uses this line equation to convert between load cell output and current bin level.

It is essential that both the ZERO and SPAN procedures be carried out, although the sequence in which they are performed is largely irrelevant.

NOTE: Before proceeding with the ZERO and SPAN calibration, carry out the 4-20mA Current Transmitter Calibration as detailed in Section 3.1 of this manual.

3.3.1 ZERO Calibration

Perform the ZERO operation as follows:

(a) Turn **ON** the Model 300 mains switch. The **+5v** indicator LED on the **Menu** Display should illuminate.

(b) Ensure that the storage vessel is empty.

(c) Press the blue **FUNCTION** key. The **Menu** display should cease scrolling and the segment labelled **1** should illuminate. This segment identifies the ZERO menu function. See Figure 3-6.

(d) Press the green **ENTER** key **ONCE**. This selects the ZERO menu function.

(e) Press and hold the black ⬇ key on the CPU card. Keep the key depressed until the bar graph indicates 0%. Release the key. Either of the arrow keys must be depressed at least once to activate the zero function.

(f) Press the green **ENTER** key **ONCE**. The microprocessor now reads the output of the load cell and relates this reading to an empty

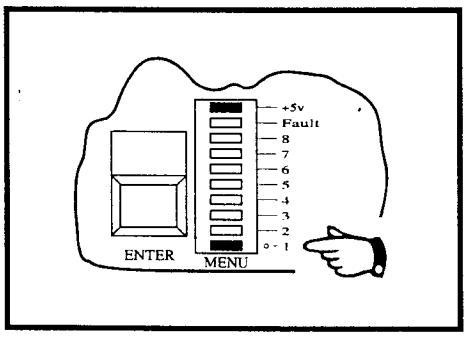


Figure 3-6
ZERO Function Indicator on Menu Display

vessel condition. This completes the ZERO setting procedure. If neither of the arrow keys have been depressed the Model 300 will exit the function at this point without changing the zero.

(g) Press the green **ENTER** key **ONCE** more. This causes the Model 300 to exit programming mode and return to its normal monitoring mode. The **Menu** display should resume scrolling at this point.

3.3.2 SPAN Calibration

The following operation relates to the SPAN setting procedure and needs to be carried out before the Model 300 can provide meaningful bin level information.

(a) Ensure that the bin is completely full.

(b) Press the **FUNCTION** key **TWICE**. The LED segment labelled **2** on the **Menu** display should illuminate. This identifies the SPAN menu function. See Figure 3-7.

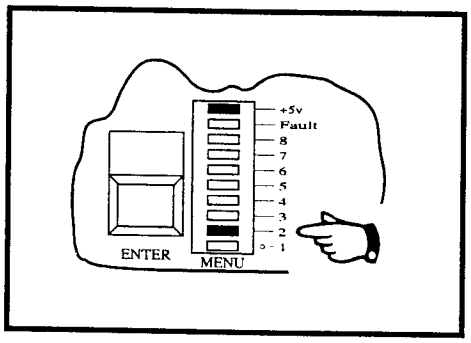


Figure 3-7
SPAN Function Indicator on Menu Display

(c) Press the green **ENTER** key **ONCE**. This selects the SPAN menu function.

(d) Press and hold the red ⬆ key on the CPU card. Keep the key depressed until the bar graph indicates 100%. Release the key. Either of the arrow keys must be depressed at least once to activate the span function.

(e) Press the green **ENTER** key **ONCE**. The microprocessor now reads the output of the load cell and relates this reading to a full vessel condition. This now completes the SPAN setting procedure. If neither of the arrow keys has been used the Model 300 will exit the function at this point without changing the span.

f) Press the green **ENTER** key **ONCE** more. This causes the Model 300 to exit programming mode and return to its normal monitoring mode. The **Menu** display should resume scrolling at this point.

This completes the ZERO and SPAN calibration routine.

The information obtained by the microprocessor during the ZERO and SPAN procedures, is now used to perform the internal calibration.

The Model 300 is now ready for use.

3.4 ZERO and SPAN Calibration

(by adding a known quantity of material)

Ideally the ZERO and SPAN should be performed with an empty and full bin respectively. This affords the greatest level of accuracy. However, should the emptying and filling of the storage vessel for calibration not prove convenient and your application does not require high accuracy, then the following calibration procedure may be adopted.

This method of calibration may be *fine tuned* at a later date when the vessel does become empty or full through normal operation. This *fine tuning* will provide the same degree of accuracy as if the optimum calibration procedure in *Section 3.3* had been followed.

Perform the ZERO and SPAN procedures as detailed below:

(a) Turn **ON** the Model 300 mains switch. The **+5v** indicator LED on the **Menu** Display should illuminate.

(b) Press the blue **FUNCTION** key **ONCE**. The **Menu** display should cease scrolling and the segment labelled **1** should illuminate. This segment identifies the ZERO menu function. See Figure 3-6.

(c) Press the green **ENTER** key **ONCE**. This selects the ZERO menu function.

(d) Estimate or measure the quantity of material currently contained in the storage vessel.

e) Use the ⬆ and ⬇ keys to adjust the output until the bar graph indicates the value determined in step (d) above. Either of these keys must be depressed at least once to activate the zero function.

(f) Press the green **ENTER** key **ONCE**. The microprocessor now reads the output of the load cell and relates this reading to the present level of material in the bin. This completes the ZERO setting procedure. If neither of the arrow keys has been used the Model 300 will exit the function at this point without changing the span.

The following operation relates to the SPAN setting procedure and needs to be carried out before the Model 300 can provide meaningful bin level information.

(g) Add a known quantity of material to the vessel. Determine the new level of material in the bin by adding the quantity just put in to the level obtained in step (d) above.

NOTE: The amount of material added should be at least equal to 25% of the vessel capacity. This is necessary to obtain a reasonable level of accuracy.

(h) Press the blue **FUNCTION** key **ONCE**. The segment labelled **2** on the **Menu** display should illuminate. This segment identifies the SPAN menu function. See Figure 3-7.

(i) Use the ⬆ and ⬇ keys to adjust the bar graph until it indicates the value determined in step (g) above. Either of these keys must be depressed at least once to activate the function.

(j) Press the green **ENTER** key **ONCE**. The microprocessor now reads the output of the load cell and relates this reading to the present level in the bin. This completes the SPAN setting procedure. If neither of the arrow keys has been used the Model 300 will exit the function at this point without changing the span.

(k) Press the green **ENTER** key **ONCE** more. This causes the Model 300 to exit programming mode and return to its normal monitoring mode. The **Menu** display should resume scrolling at this point.

This completes the ZERO and SPAN calibration routine.