RETRON 80

RETRON 80

ELECTRONIC COMPUTING HEAD FOR

GASOLINE DISPENSERS

THIS DOCUMENT GIVES A TECHNICAL DESCRIPTION OF 'RETRON 80', INTENDED TO FAMILIARISE CLIENTS WITH BASIC CONSTRUCTION AND PERFORMANCE FEATURES. SHOULD ANY FURTHER INFORMATION BE REQUIRED, PLEASE CONTACT;

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RETRON 80 - TECHNICAL DESCRIPTION

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1.0 INTRODUCTION

RETRON 80 IS A MICROPROCESSOR BASED COMPUTER HEAD DESIGNED TO REPLACE TRADITIONAL MECHANICAL REGISTERS IN BOTH EXISTING AND NEW STANDARD MECHANICAL DISPENSERS. EXTERNAL DIMENSIONS OF THE RETRON ARE WITHIN THOSE OF CURRENT MECHANICAL REGISTERS AND SINCE THE UNIT INCORPORATES AN EXPLOSION-PROOF CONTAINER AND INSTRINSICALLY SAFE DISPLAYS, CONVENIENT FIELD RETROFITTING IS POSSIBLE.

WITH THE RAPID ESCALATION IN FUEL PRICES, LIMITATIONS IN MECHANICAL COMPUTERS ARE EXPOSED. THESE EXTEND BEYOND PRICE POSTING AND RESULT IN INCREASED MAINTENANCE EXPENDITURE DUE TO HIGHER TORQUE LOADINGS AND ADDED WEAR ON MECHANICAL PARTS. RETRON 80 HAS THE ADVANTAGE OF HAVING ONLY ONE ROTATING PART. THIS IS A LOW, CONSTANT TORQUE, ENCODER WHOSE SPEED DOES NOT VARY WITH GAS PRICE INCREASES. FURTHERMORE BOTH THE INCREASED TORQUE AND TORQUE VARIATIONS AFTER EACH PRICE CHANGE AFFECT THE ACCURACY OF THE FLUID METER AND THUS THE NEED FOR FREQUENT RECALIBRATION IF LOSSES OF UNMETERED PRODUCT ARE TO BE MINIMISED.
RETRON 80 CAN BE FIELD RETROFITTED INTO EXISTING MECHANICAL DISPENSERS THEREBY PROTECTING THE CURRENT INVESTMENT WHICH, IN SOME INSTANCES, INCLUDES PROPRIETARY DESIGNS. THE NEW COMPUTER CAN ALSO BE INTERFACED WITH SELF-SERVE CONSOLES SUCH AS FISHER & PAYKEL'S MICRO-M*. THE COMPLETE SYSTEM THEREBY OFFERS AS MUCH CONTROL AND PRODUCES AS MUCH INFORMATION AS THE FUNCTIONS OF THE CONSOLE PERMIT. THE RESULT IS THUS A FULLY ELECTRONIC SITE AT LOWER FIXED COST PER HOSE THAN IS POSSIBLE WITH NEW ELECTRONIC DISPENSERS. THE EFFECTS ON PROFITABILITY IN TIMES OF UNCERTAIN SUPPLY OF GASOLINE ARE OBVIOUS.

* Separate information on the Micro-M self-service fueling system is available.

2.0 CONSTRUCTION OF PROCESSOR MODULE

2.1 General

Refer to Diagram 1 - RETRON 80.

There are three main modules - the processor module and two display modules. The processor module is in an aluminium die-cast container with removable top and side covers. It is a flame proof enclosure and all electrical connections in or out are designed for use in hazardous environments.

The two display modules are identical and are mounted on opposite sides of the top cover. Each display face has three readouts;

TOP READOUT	- Total Sale in dollars etc	- 5 digits
CENTER READOUT	- Total Volume in gallons/litres	- 5 digits
LOWER READOUT	- Unit Price	- 4 digits

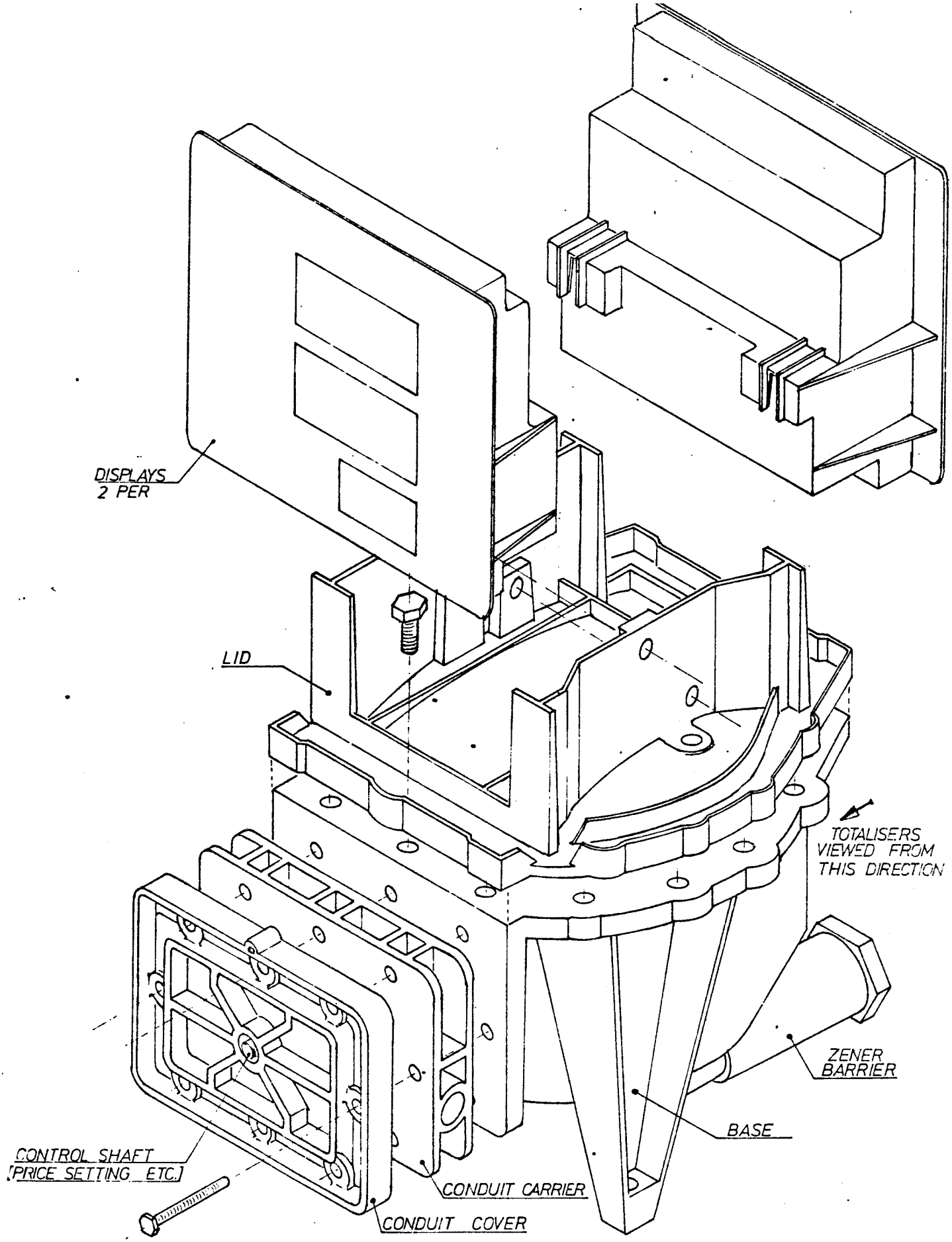
2.2 External Features - Processor Module

The flame proof aluminium container is made up of five separate castings:-

a) Base - An aluminium die casting with two flanges. One side incorporates a flame proof window through which the totalisers are viewed. The bottom of the container has integral diecast feet which are mounted at identical location points to current mechanical registers.

b) Main Lid - This seals the top of the container and provides mounting points for the two display faces. Carried on this lid is the main control actuator which is operated by the shaft and link mechanism connected to the starting handle of the dispenser.

c) Conduit Cover - Carries a control shaft for price setting and verification functions such as fault diagnosis. The spring loaded shaft activates a main processor board sensing switch to put into effect the functions required. (Similar operation to a digital watch).



RETRON 80

DIAG 1.

d) Conduit Carrier - Sandwiched between the conduit cover and base. This carrier is used as a termination point for mains power and external service connections. It is permanently fixed to the dispenser with conduit piping. This construction offers the advantage of complete computer module replacement without the necessity to remove conduit piping. Three conduit entries are provided.

e) Zener Barrier - A protective device designed to prevent excessive power from appearing outside of the processor module.

f) L.C.D. Display Panels - The two LCD display panels are intrinsically safe. Each of the two live conductors to each display is limited to safe power levels by zener diode safety barriers. The common conductor is solidly earthed to the main casting with a mechanical connector. The three core cables to each display are connected to the backs of the display housings via water-tight plugs. The display panels are housed in flame-proof plastic enclosures which are a push fit onto the main lid casting. These cases are rain-tight but not immersion proof.

Maximum values displayable on the panels are:-

TOTAL VOLUME 999.99 (litres) 99.999 (gallons)

TOTAL SALE 399.99 (dollars) etc

UNIT PRICE 999.9 (cents/litre) etc

g) Other Features - The flowmeter input shaft passes through the center of the base and couples directly to the dispenser output shaft. The lid, conduit cover and carrier are attached to the base with thread forming screws.

2.3 Internal Components - Processor Module

The flame proof container houses the following principal functional components:-

- Flowmeter shaft encoder (digitiser).
- Start switch.
- All control and computing circuity (microprocessors).
- Mains power terminals and terminals for self-service consoles, preset units and other auxiliary devices.

- Non resettable totalisers for money and volume. When the unit is installed a Weights and Measures Seal can be applied which prevents the container from being opened without breaking this seal.

- Two LED's, both visible through the flame proof window in the main container. One indicates power on, the other is used for diagnostic purposes (see sections 4.3, 4.4)

- Control shaft sensing switch.

- Dispenser pump control relay.

- An automatically rechargeable battery for display and data retention following mains termination.

2.4 Internal Assemblies

There are six main assemblies;

- Processor Board
- Main Terminal Board
- Chassis
- Encoder Unit
- Totalisers
- Standby Battery Board

The principal components, being microprocessors, are mounted on the Processor Board which receives signals from the encoder, and the main actuator shaft and controls the motor relay, displays and totalisers. Optional self-serve and preset keyboard are connected to and controlled by this board.

The Main Terminal Board connects to the Processor Board and contains the mains power termination, mains fuse, low voltage rectifier and control shaft microswitch.

The Chassis on which the Main Terminal Board mounts, supports the transformer, the electromagnetic interference filter and the motor control relay, all of which connect to the Main Terminal Board. The Chassis acts as the main frame and logic ground point.

The Encoder Unit mounts in the bottom of the processor module and is a moulded plastic assembly with a stainless steel shaft protruding. This shaft passes through a flameproof bushed hole in the centre of the base and connects to the dispenser fluid meter. Fluid meters with other than two or four revolutions/gallon will require a ratio changing module as supplied by the fluid meter manufacturers.

A patterned disk inside the encoder interrupts infra-red beams as it turns and the detected signals are sent to the processor board.

Accurate counting is achieved using two sensors phased 90^{0} apart which also provide direction information to correct vibration and detect excessive reverse flow. A third sensor is used to check the correct operation of the two primary sensors.

Two, independent, seven digit electromechanical totalisers are attached to a sheetmetal bracket under the lid, so as to be visible through the viewing window. The one on the left is volume total (whole litres etc) and on the right is money (whole dollars etc). When viewing from the window, the left and right hand totaliser connect into the left and right hand connectors on the processor board. The maximum rate at which pulses can be supplied to the totalisers is 300 per minute;

i.e. (litre or gallons)/minute + dollars/minute = 300 (max)

For example, a pump rate of 12 gallons/minute would result in a maximum price setting of $24 per gallon (greater than the maximum unit price) if gallons are displayed, and $5.61 per litre ($21 per gal) if litres are displayed. Increasing the pump rate to 30 gallons/minute reduces these maximums to $9.00 per gallon or $1.64 per litre (equivalent to $6.21 per gallon). If the maximum rate is exceeded the volume totaliser remains accurate at the expense of the money totaliser accuracy.

The Standby Battery Board is mounted on the same bracket as the totalisers. This automatically rechargeable battery powers the Auxiliary Memory Unit on the processor board for a minimum period of 30 days without mains power. The Auxiliary Memory Unit contains basic operating data (e.g. unit price setting). In addition the display is powered from the battery for 30 minutes after the mains supply is disconnected.

3.0 OPERATION (STAND-ALONE)

3.1 Startup

When mains power is applied to the RETRON the main Displays will:

(a) If they were previously blank;

After a short delay, display zero in Volume and Total Price displays, and the currently set Unit Price in the Unit Price display.

(b) If they were not previously blank;

Always retain their current display unchanged until either;

(i) the starting lever is moved from the OFF position to the ON position

or

(ii) the Control Shaft is depressed

or

(iii) a PRESET* amount is entered, either locally or remotely.

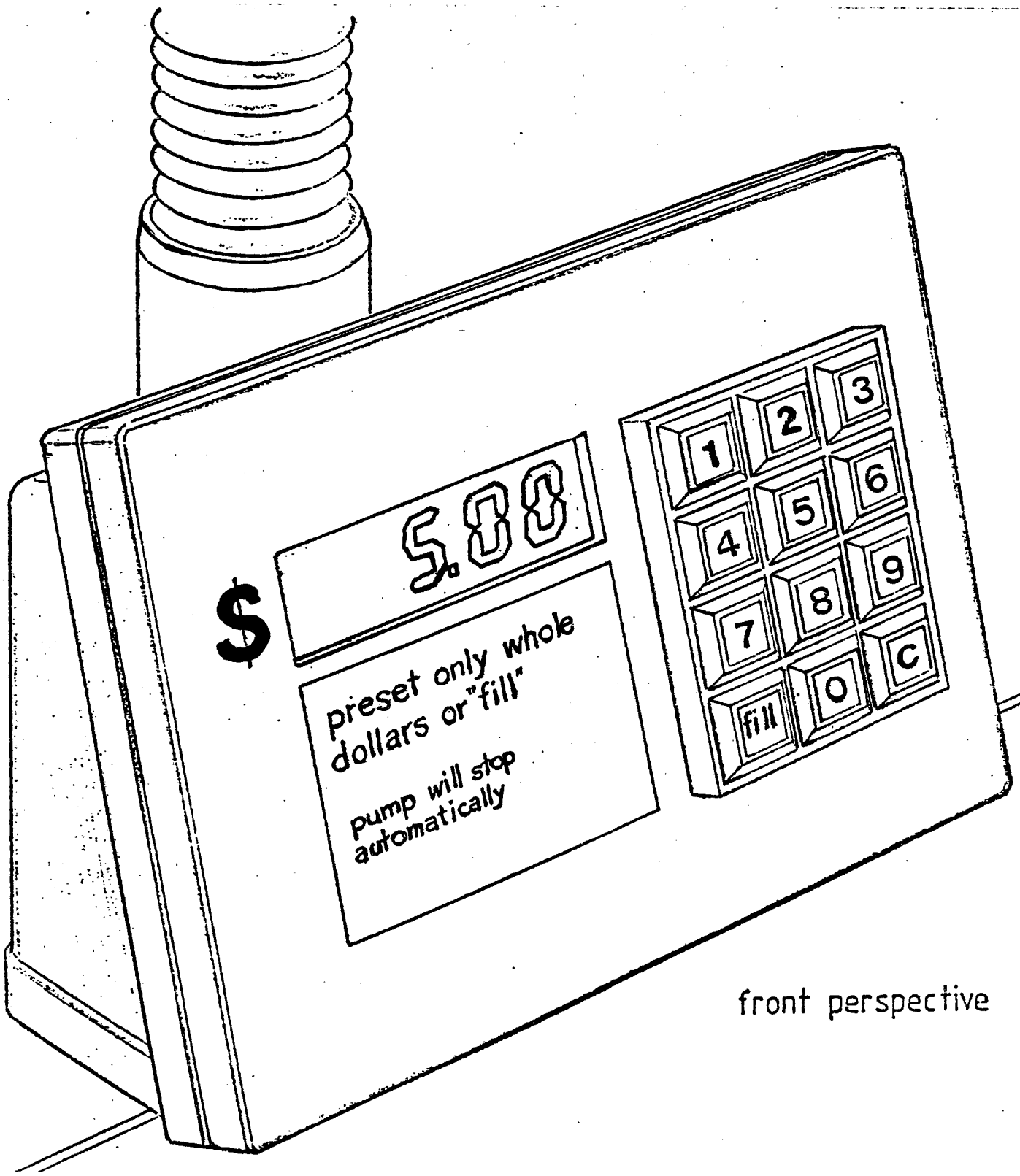
* Fisher & Paykel offer a Preset Keyboard (see Diag 2) which allows the station attendant or self-serve customer to select a desired whole dollar amount of gasoline for delivery at the dispenser. The method of operation of this option is fully discussed in Section 3.4. The use of such a Preset Keyboard facilitates speedier and more accurate delivery of gasoline, as against the manual method of trying to halt the delivery on an exact amount of total sale. The benefits are obvious in terms of shorter waiting lines and less gas given away 'free'.

3.2 Unit Price Setting

The technique for altering the Unit Price setting is similar to that currently used for setting digital clocks and watches. It has been found particularly easy to use, after a brief familiarisation session.

DIAGRAM 2

PRESET KEYBOARD



To set or change the Unit Price:

a) Ensure the starting lever has been set to OFF for at least 15 seconds, and any associated transaction on any attached self-serve system has been completed.

b) Remove dispenser dial plate on the side OPPOSITE the totalisers.

This reveals a small steel push-shaft in the middle of the RETRON conduit cover, directly below the Main Displays. This is termed the CONTROL SHAFT (CS).

c) Depress the CS. This causes a dash ("-") to appear in the least significant digit position of the Unit Price Display, and the 100's of cents digits to show "0" if it was previously blank.

d) Holding the CS depressed for more than 2 seconds causes the dash to be replaced by the incremented current Unit Price digit, then successive digits in cyclic order. Carry transfer to the next decade does not occur. One decade may be cycled indefinitely by holding the shaft depressed.

e) Releasing the CS at any time causes the currently displayed digit to be set in as part of the Unit Price.

f) To access the next significant and succeeding decades, repeatedly press the CS until a dash appears in the position it is desired to change, then hold the shaft depressed until the desired digit appears, and immediately release it.

g) The complete cycle of four decades may be stepped through up to three times in one continuous sequence. If any setting errors are still present after three attempts then the CS should be released for at least 5 seconds before attempting further re-setting.

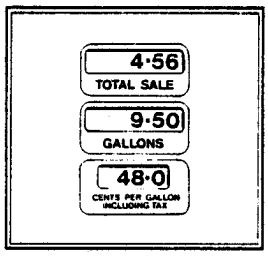
h) When the desired Unit Price has been obtained on the Unit Price Display, release the CS.

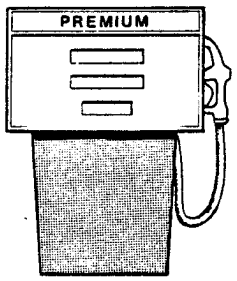
Within 10 seconds the Unit Price Display and the Total Money Display go blank. Five seconds later, the new Unit Price is re-displayed and normal operation is resumed.

i) Unit Price settings of less than 10.0 (cents/ litre or gal) are considered invalid.

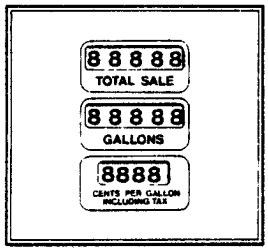
3.3 Operation - Non Preset

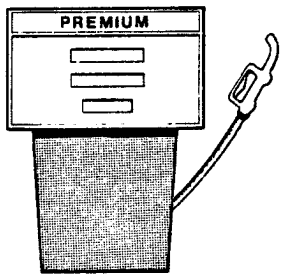
Starting Lever turned off for at least 1 second after 'power on' or 'previous delivery'.



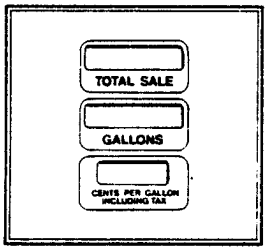


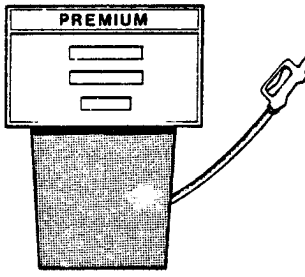
Remove hose from dispenser and move starting lever to 'on'. All displays show '8' (this is 'segment on test' to show that each segment is operational).



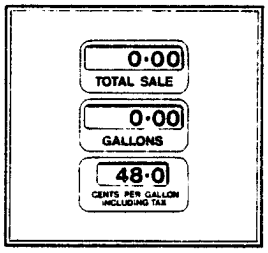


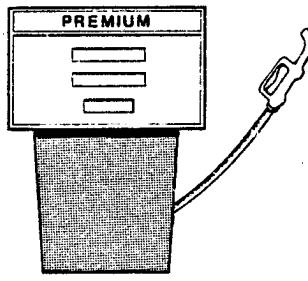
Wait 1 second then all '8's will disappear and displays go blank. This is 'segment off test'.



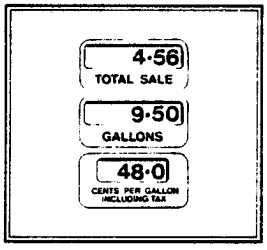


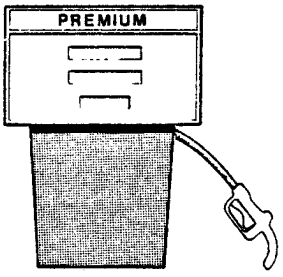
Wait ½ second and 'unit price display' will show unit price and 'volume/ money displays' show 0.00



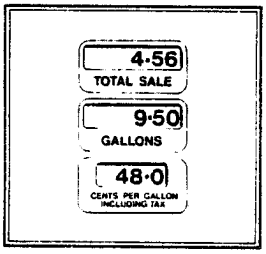


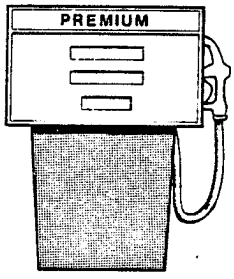
After ½ second delay, pump motor starts and dispensing may commence. After 0.04 gallons have been dispensed main displays will begin to show quantity delivered and total money.





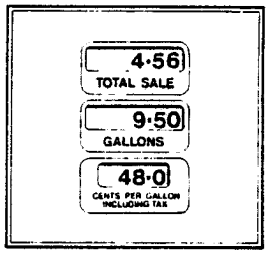
Move starting lever to 'off' and replace nozzle - motor stops. After 2 seconds main displays are frozen and delivery is terminated.

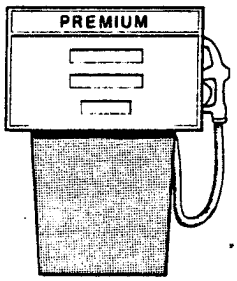




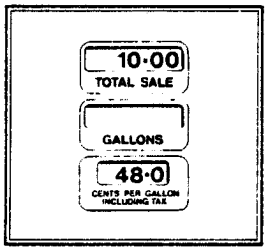
3.4 Operation - Preset

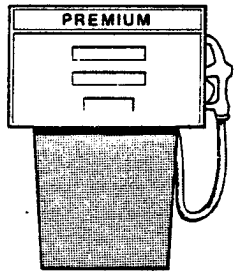
Starting lever turned off for at least 1 second after 'power on' or 'previous delivery'.



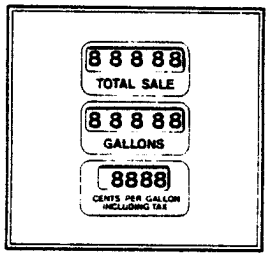


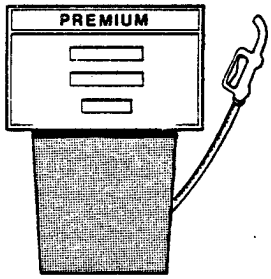
Preset one or two digits of required amount (whole dollars only) 'C' button may be used to clear mistakes.



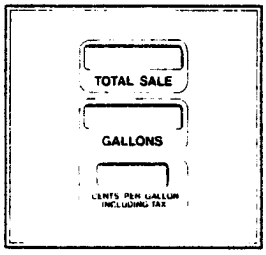


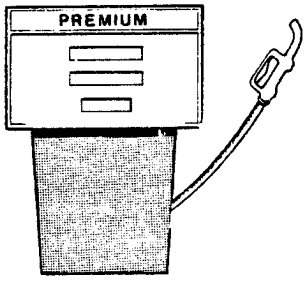
Remove hose from dispenser and move starting lever to 'on'. All displays show '8' (this is 'segment on test' to show that each segment is operational).



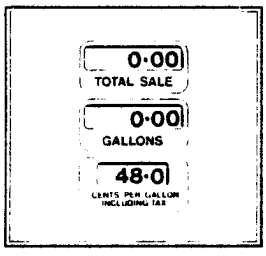


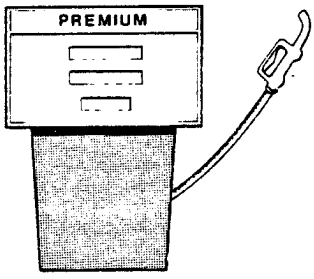
Wait 1 second then all the '8's will disappear and displays go blank. This is 'segment off test'.



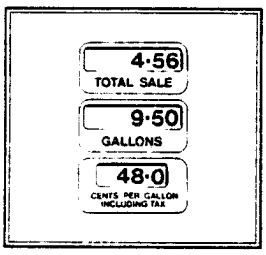


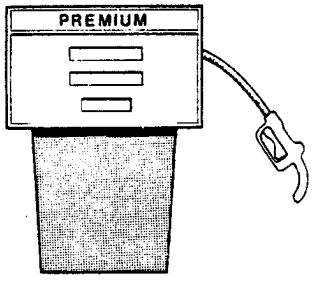
Wait ½ second and 'unit price display will show unit price and 'volume/ money displays' show 0.00.



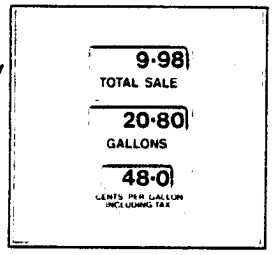


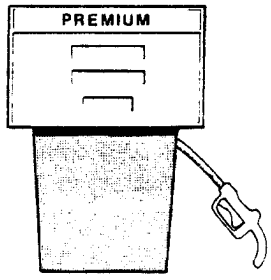
After ½ second delay pump motor starts. Preset keyboard still operable up to this stage, once delivery commenced and 0.04 gallons dispensed preset keyboard no longer operable and displays show quantity delivered and total money.



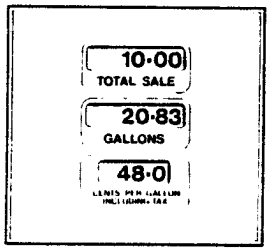


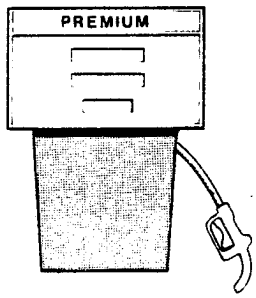
Deliver until amount delivered is approximately 0.3 gallons less than amount preset. Main valve shuts down (slow flow).



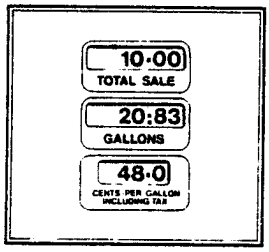


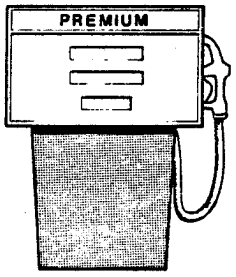
Continue delivery until amount delivered equals amount preset. Motor stops - final valve shuts.



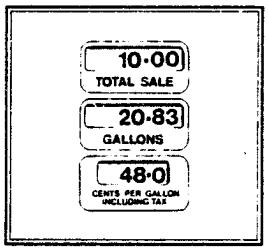


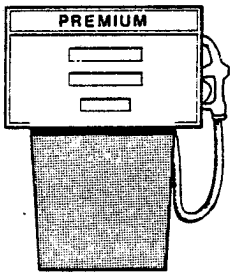
Motor starting lever to 'off' and replace nozzel - after 2 seconds displays frozen - delivery logically terminated.





After 3 seconds delay, valves electrically de-energised, providing expansion path from hose back to supply tank.





4.0 SPECIAL FEATURES

4.1 Automatic Arithmetic Self Test Function

During any product delivery, Total Price information is accumulated by continual repetitive addition of suitable sub-multiples of the displayed Unit Price.

At the completion of each separate delivery the correctness of the accumulated Price Total is verified by the performance of a separate decimal multiplication of the actual displayed Volume by the actual displayed Unit Price, and the result, after rounding, compared with the actual displayed Total Price.

Any discrepancy in the two values causes the following occurrences;

a) The Total Price display goes blank.

b) Normal operation is terminated and cannot be re-started.

c) The Special Purpose Indicator Lamp (see Section 4.4) indicates a self-diagnostic Fatal Error, Diagnostic Code #4, (see Section 4.5).

4.2 Verification of Self Test Function

Provision has been made for manual alteration of the displayed Total Price during product delivery, so that operation of the Arithmetic Self Test Function can be demonstrated and verified.

To deliberately introduce an error:-

1. Commence a delivery (note that a delivery is not considered as started until the Volume display shows non-zero).

2. At any time before terminating the delivery depress the Control Shaft (CS). Every time the shaft is depressed and released, the least significant Total Price digit increments once, in a cyclic fashion. Carry transfer to the next decade does not occur. In this way, any desired under or over error offset can be entered.

Some examples:

a) To enter an error of +5 cents -

Stop product flow when a '2' is showing in the units cents position of the Total Price; by depressing the CS 5 times, change the '2' to a '7'.

b) To enter an error of -5 cents -

Stop product flow when a '7' is showing in the units Total Price digit; by depressing the CS 5 times, change the '7' to a '2'.

c) To enter an error of +15 cents -

Stop product flow when a '2' is showing in the units Total Price digit; by depressing the CS 7 times, change the '2' to a '9'; deliver further product until the units Total Price digit shows '1'; then by depressing the CS 8 more times, changing the '1' to a '9'.

d) To enter an error of - 15 cents -

Stop product flow when an '8' is showing in the units Total Price digit; by depressing the CS 3 times, change the '8' to a '1'; deliver further product until the units Total Price digit shows '9'; then by depressing the CS twice more, change the '9' to a '1'.

The CS may be depressed and errors entered while product is flowing, but the exact effect is indeterminate until product flow is stopped and the displayed values examined.

To initiate the self test function, terminate the delivery by moving the starting lever to OFF. The Total Price Display will go blank if it was incorrect and the RETRON will cease normal operation.

4.3 Power-On Indicator Lamp

Because of internal interlocks which may prevent a dispenser from starting (especially if a self-serve system is attached) it can be difficult to ascertain whether a non-running dispenser is, in fact, switched on.

A lamp to indicate 'Power-On' is located just below the totalisers - near the right hand side of the totaliser window. It indicates the presence of 5 volt power, on the main circuit board.

Note: To view this lamp through the totaliser window, look down at an angle, to beneath the totalisers,

4.4 Special Purpose Indicator Lamp

This lamp is located just below the totalisers - near the centre of the totaliser window and is viewed accordingly. It is used to indicate whether the processor system is running correctly, and for determining whether the starting lever switch is working correctly.

Indications are:-

1.	Fast flash, approximately 4 Hertz or more.	Normal operation, starting lever sense switch is OFF.
2.	Slow flash, approximately 1 Hertz (less when product is flowing).	Normal operation, starting lever sense switch is ON.
3.	Lamp off (with power-on indicator lamp still glowing).	Self diagnostic error condition. Error code number is displayed on Unit Price L.C.D.
4.	Lamp on steady. Note that the lamp may remain steady on or off when special facilities are invoked - refer to Sections 4.1 and 4.6. This is not a fault condition.	Fault condition. (Note lamp always glows steady for approximately 2½ seconds after power-on).

4.5 Diagnostic Error Codes

If, at any time, a self diagnostic Error condition is detected, the following events occur:

Error Codes for F+P RETRON 80

1. The flowmeter is switched off (if it is running) and prevented from re-starting.

2. All displays are frozen in their current state - except in the case of error code #4 (arithmetic error), in which case the Total Price display is blanked.

3. The Special Purpose Indicator Lamp is switched off, (refer Section 4.4 above).

At this point depressing the Control Shaft causes the Unit Price display to show 'Err.x' (error 'x') where 'x' is the Error Diagnostic Code Number.

Error Codes have the following meanings:-

Err. 1 - Reserved for Program Memory self diagnostic error (not implemented in present version).

Err. 2 - Auxiliary Memory Unit diagnostic error.

Err. 3 - Invalid Unit Price Setting (i.e. attempt to take a delivery at less than 10 cents/ litre/gal).

Err. 4 - Arithmetic Error.

Err. 5 - System incompatibility (i.e. where the price set on Retron exceeds the capability of the console).

Err. 6 - (Unallocated). Processor Stack overflow (BOARD FAULT)

Err. 7 - Flowmeter shaft encoder error. Possibly partial or complete sensor channel failure or excessive rotation speed.

Err. 8 - Flowmeter shaft encoder error. Possibly excessive reverse direction rotation, partial sensor channel failure, or excessive rotation speed.

This error can also be caused by excessive rotation of the encoder shaft when no logical delivery is in progress - e.g. turning by hand, with the Starting Lever set to OFF.

Err 9 - Same as Error 7

To clear an Error Code from the display after corrective servicing has been effected.

1. Switch main power to flowmeter OFF then ON.

2. Briefly depress the Control Shaft

or

Move main starting lever from OFF to ON.

(The second action is necessary because of the interlock which ensures retention of all current displays after a momentary power break).

4.6 Display Segment Test

At the beginning of each product delivery, a brief all 8's and blanks test is performed on both main display panels. This enables direct observation that;

a) No segments are permanently fixed ON.

b) No segments are permanently fixed OFF.

However, this quick test does not show whether one segment might be shorted to its immediate neighbour so that two segments of the displays be 'illuminating' single display segments independantly of their immediate neighbours.

To invoke the Display Segment Test:-

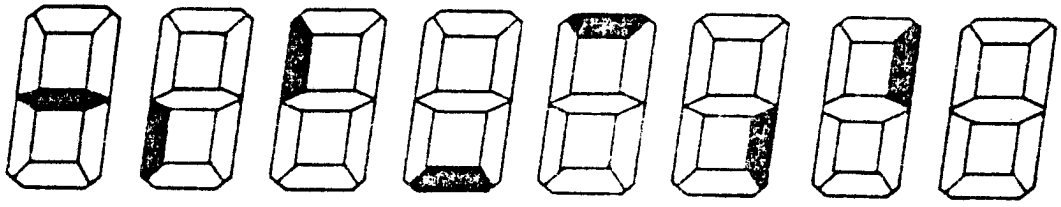
1. Ensure the starting lever has been set to OFF for at least 15 seconds, and any associated transaction on any attached self serve system has been completed.

2. Depress and release repeatedly, more than 15 times, the Control Shaft. (This causes a dash symbol to step through the Unit Price Display as when setting the Unit Price, but does not cause alteration to the Unit Price setting as long as the shaft is not held depressed for longer than 2 seconds at a time.)

3. When the correct number of shaft depressions has been reached, or exceeded, the digits in the main and preset displays each simultaneously switch on one segment at a time, in sequence.

DISPLAY TEST SEQUENCES

Main Segment Stepping Sequence



Special Segment Stepping Sequence For $100 Digit

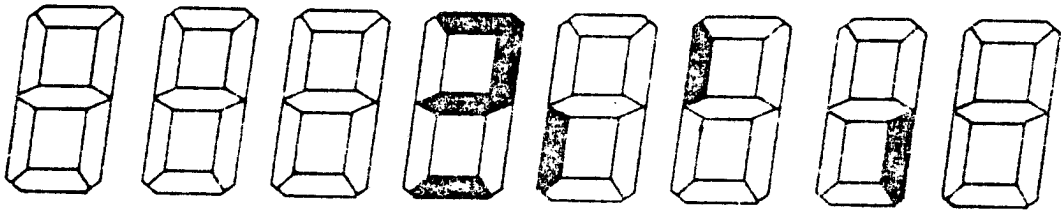


Fig 4.6A

5.0 PRODUCT SPECIFICATION

1. Dimensions: All physical dimensions equal to or less than existing Veeder-Root units. Main mounting points are identical.

2. Operating temperatures.

   Initial - $-10^{o}C$ to $+55^{o}C$
   ($+14^{o}F$ to $+131^{o}F$)

   Future $-35^{o}C$ to $+55^{o}C$
   ($-31^{o}F$ to $+131^{o}F$)

3. Input Drive : 2 options - 2 revs/unit volume
   4 revs/unit volume

4. Volume Display Range: 0 - 999.99 litres
   0 - 99.999 U.S. gallons

5. Money Display Range: 0 - 399.99 dollars

6. Unit Price Display Range: 999.9 cents/litre or gallon

7. Totaliser Display Range: 7 digits money and volume

8. Display Retention Period After Power Failure : 30 minutes (controlled by internal timer)

9. Data Retention Period After Power Failure : Minimum 30 days

10. Torque Required To Drive Encoder Shaft : Less than 1 in. lb.

11. Metering Resolution : 1 part in 1,000 of unit volume

12. Accuracy of Money Calculation : ± ½ cent rounded to nearest cent.

13. Maximum Flow Rate : 200 litres/min (or 50 gallons/min)

14. Motor Relay Rating : 10 amps.