Liquid Controls

REFINED FUEL METERING SYSTEMS

SERVICE TRAINING

History of Liquid Controls

- Company started in 1954
  - Manufacturer of unique design three-rotor PD meters, and associated valves, strainers, and air eliminators;
  - First meter sold to U.S. Air Force
- Plant expansion and relocation to new facility in Lake Bluff, IL in 1992
- 1994 Achieved ISO 9001 certification
- Addition of new industrial metering technologies, and subsidiary companies beginning in the mid 1990's
- Company purchased by IDEX in January, 2001

Operations - Facilities

- **Liquid Controls - Lake Bluff facility**

- **60,000 sq. ft.**
- **Factory: 45,000**
- **Office: 15,000**

AGENDA

Mechanical components of the system

1. Principle of meter operation
2. Basic considerations in meter selection
3. Meter calibration
4. Temperature compensation
5. Additional testing
6. Meter installation
7. Operation requirements
8. Disassembling and reassembling meter
9. Air eliminators
10. Strainers
11. Valves

AGENDA

Electronic components of the system

1. Introduction to electronic registers
2. Advantages of electronic registers
3. Accessories
3. Installation of LCRII
4. Setup

AGENDA

Operation of metering system

1. How to start delivery?

2. Operation of LCRII inputs and outputs and how they control flow of the product

a. System with mechanical air eliminator, air check valve and security valve

b. System with optical air eliminator and security valve

3. How does the meter count?

4. How to make preset delivery?

5. Calibration with and without lap pad

6. Additional features of LCR600(flow toggle)

AGENDA

Troubleshooting

1. Meter won't pump
2. Printing calibration ticket
3. Accessing diagnostics with lap pad
4. Diagnostic messages
5. Troubleshooting exercises
6. Clear All
7. EZCommand
8. Flashing software.

AGENDA

Additional features of LCR600

Metering Principle
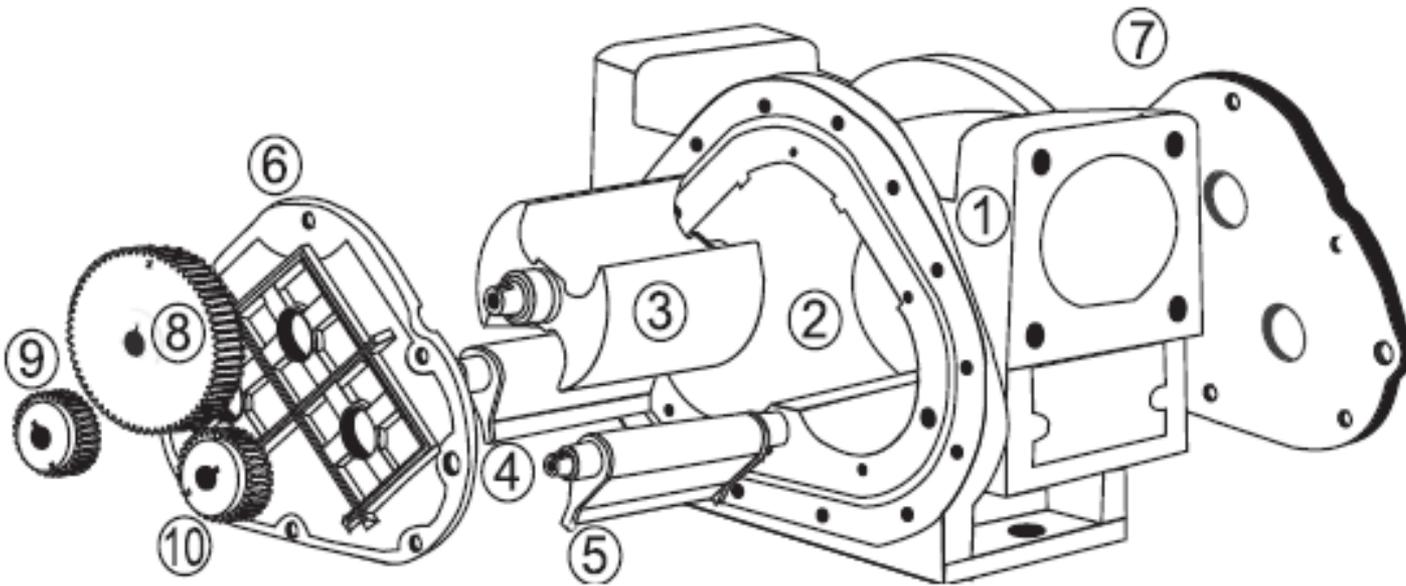
Meter Element Exploded Line Drawing

The <u>meter housing</u> (1) is designed with <u>three cylindrical bores</u> (2). Three rotors, the <u>blocking rotor</u> (3) and two <u>displacement rotors</u> (4,5) rotors turn in synchronized relationship within the bores. The three rotors are supported by <u>bearing plates</u> (6,7). The ends of the rotors protrude through the plates. The <u>blocking rotor gear</u> (8) is placed on the end of the blocking rotor. The <u>displacement rotor gears</u> (9,10) are placed on the ends of the displacement rotors. These gears create the timed Relationship between the three rotors.

M7_3D-Animation.mpg

Blocking rotor

Displacement rotors
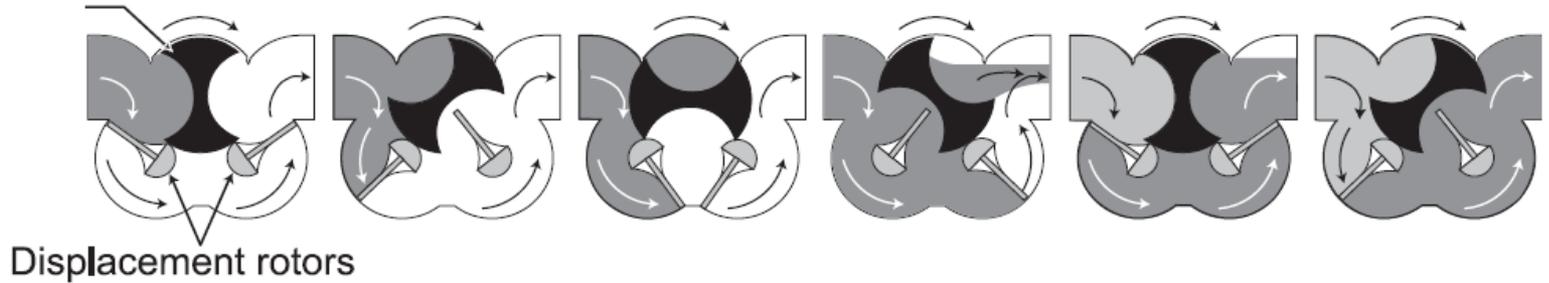
As fluid moves through the meter housing, the rotor assembly turns. Fluid is broken into uniform sections by the turning rotors. Fluid displacement happens simultaneously. As fluid enters, another portion of the fluid is partitioned and measured. At the same time, the fluid ahead is being displaced out of the meter. Since the volume of the bores is a known value, the same amount of fluid passes through the meter during each revolution of the blocking rotor. The exact amount of fluid that has passed through the meter can be accurately be determined.

At any position in the cycle, the meter body, the blocking rotor and at least one of the displacement rotors form a continuous capillary seal between the un-metered upstream product and the meter down stream product.

➢ Capillary seal means no metal to metal contact within the metering element. **This means no wear.**

➢ No wear means no increase in slippage

➢ No increase in slippage means no deterioration in accuracy
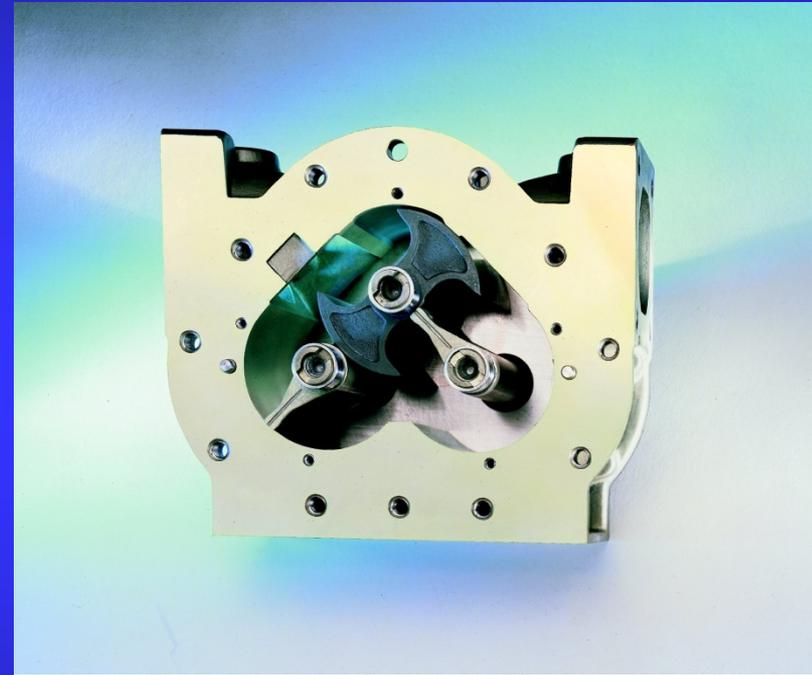
LiquidControls_Velocity.wmv

Packing Gland Components

1. Driver
2. Shaft
3. Stainless steel thrust washer
4. Rulon thrust washer
5. Buna/Viton/Teflon "U" Cup
6. Aluminum/stainless housing
7. Washer - Nylon
8. Output gear 2:1
9. Retaining ring
10. Bushing
11. Retaining plate
12. Buna/Viton/Teflon O-ring
13. Two retaining plate screws
14. Output gear 1:1
15. Carbon Guide Bearing
16. Washer - Stainless Steel
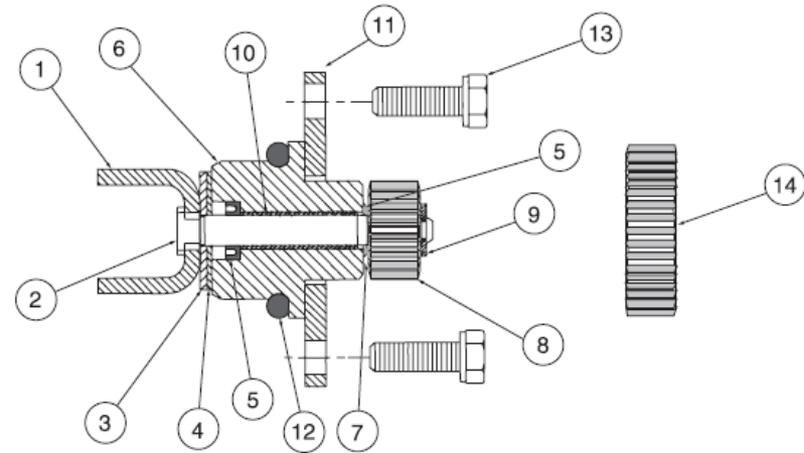
Standard Packing Gland
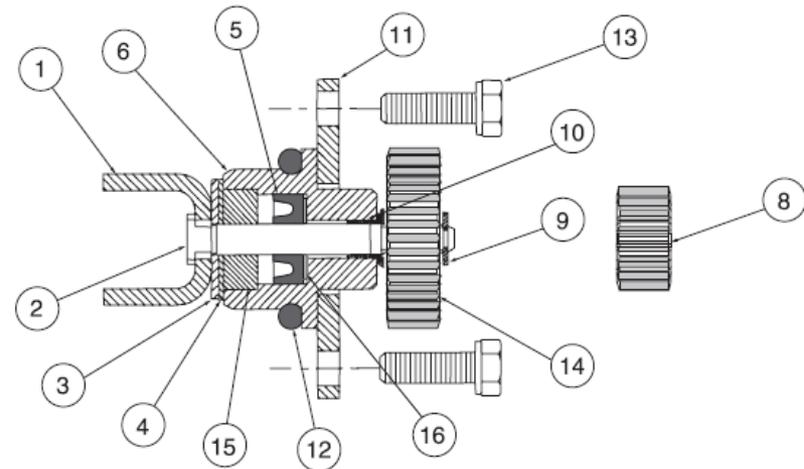
LPG Packing Gland

The rotary motion of the measuring element is transmitted through packing gland, to the face gear which drives the drive shaft and thus turns the electronic register or adjuster and register stack.
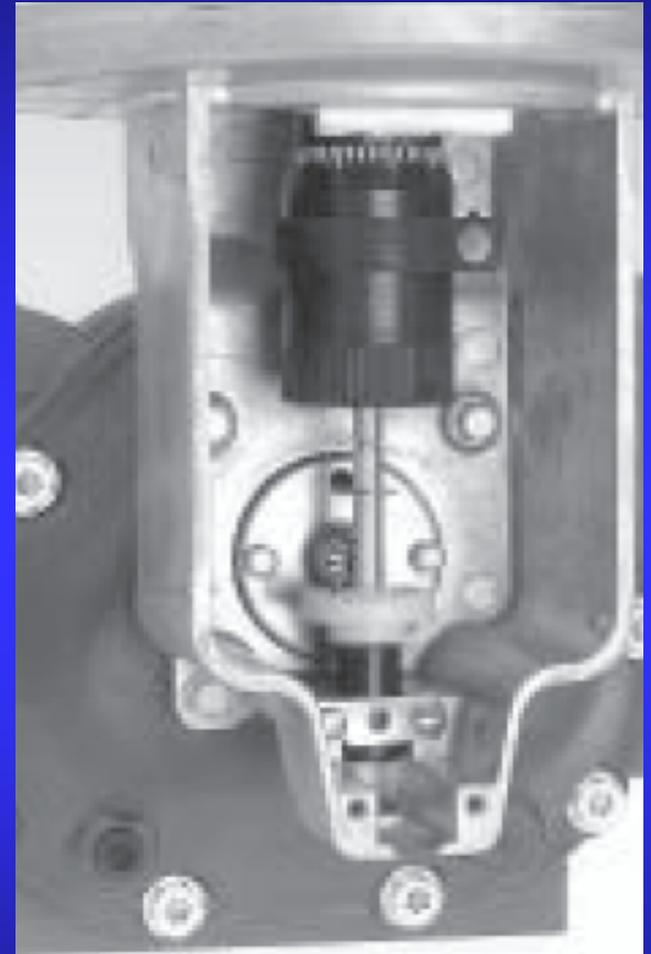
5 Basic considerations in meter selection

- ➤ Product
- ➤ Flow rate
- ➤ Pressure
- ➤ Temperature
- ➤ Viscosity

Product

➤ The liquid to be measured is important in selecting the metallurgy of the meter, as described below.

- Aluminum
  - Fuels, LPG, etc.
- Cast iron (OBSOLETE)
  - Chlorinated Solvents
- 316 Stainless Steel
  - Caustics, DEF

Meter Classes

➢ CLASS 1 METER - For use with refined petroleum products such as leaded and unleaded gasoline, fuel oils, diesel fuel, kerosene, ethylene glycol (antifreeze) and propylene glycol at rated capacity. Also used on motor oils and rotogravure ink at reduced rates of flow.

➢ CLASS 2 METER - For use with aviation gasolines and jet fuels when meter is installed downstream of the filter/separator. Non-ferrous construction... meters may be operated at rated capacity.

➢ CLASS 3 METER - For use with a wide variety of products such as: liquid sugars, corn syrup, corn sweeteners, dextrose, fructose, sucrose, maltose, lactose, corn oil, soy bean oil, cotton seed oil, coconut oil, and shortening's etc. Rate of flow is based on viscosity to pressure loss relationship.

- CLASS 4 METER - For use with treated waters (deionized, demineralized, and potable) and certain solvents where no red metals are allowed. Meters may be operated at rated capacity, except for continuous duty service. NOTE: Substitute for former class 6 and 17 applications. Anodized aluminum and stainless steel construction.

- CLASS 7 METER - For use with chlorinated solvents such as: perchloroethylene, trichloroethylene, trichloroethane, and methlyene chloride. Also used for general solvent service. Meters may be operated at rated capacity, except for continuous duty service. All ferrous construction.

- CLASS 8 METER - For use with acid pH liquids such as: nitric, phosphoric and glacial acetic acids, amines citric (fruit juices) and vinegars. All 316 stainless steel construction. Operation at up to 80% of maximum rated capacity is recommended.

- CLASS 10 METER - For use with liquefied petroleum gas (LPG) including butane, isobutane, pentane, ethane, freons and propane. NOTE: materials of construction (including seals) are UL approved for propane, modifications to materials of construction may be required for other liquids listed.

- CLASS 12 METER-NH3

- CLASS 14 METER - For use with crude oil (LACT and NOD). Also for heated and/or viscous liquids including animal fats, resins, #6 oil and non-abrasive asphalt emulsions. Rate of flow based on viscosity to pressure loss relationship. NOTE: Substitute for former class 5 applications.

- CLASS 15 METER - For use with oil or water based latex products, polyester resins, and adhesives (neutral pH). Also available for metering herbicides and nitrogen fertilizer solutions (requires Viton and Teflon seals).Operation at 80% of rated capacity or less is recommend. Shear sensitive liquids must be operated at 1/3 of rated capacity or less.

- CLASS 16 METER - For use in general solvent metering service such as: methanol, toluene, xylene, naphtha, acetone, MEK, MIBK, and alcohols including ethanol. 200 proof alcohol. Class 7 meters should be used if the application involve the use of chlorinated solvents. Meters may be operated at rated capacity except for continuous duty service.

- CLASS 18 METER - DEF

- CLASS 27 METER - For use with alkaline pH latex products and adhesives, and some clear liquid fertilizers (10-34-0). Operation at lower than rated capacity is recommended. Shear sensitive liquids must be operated at 1/3 of rated capacity or less. All ferrous construction.

- CLASS 30 METER - For use with herbicides such as Aatrex, Atrazine, Bicep, Bladex, Dual, Lasso, Lasso ME, Treflan, Sutan, Sutazine, and Eradicane (required Teflon seals). Operation at up to 80% of maximum rated capacity is recommended. Available in M-5 meter only. Use class 15 in all other meter sizes.

- CLASS 37 METER - For use with sodium hydroxide (caustic) solutions, high sulfur crude oil (LACT and NOD) and other alkaline pH liquids including non-abrasive asphalt emulsions and liquid feed (molasses) supplement and some resins. Construction suitable for heated and/or viscous liquids. Rate of flow based on viscosity to pressure loss relationship. All ferrous construction.

- CLASS 47 METER - For use with mildly abrasive liquids, all ferrous construction. Consult Customer Service at the factory for all applications.

Flow rate

➤ Generally, the flow rate required by the application dictates the meter size.

➤ Maximum published flow rates for meters are based on well lubricating products having the viscosity of water. Exceptions to the published flow rates include: Meter Classes 8, 15, 20, 27, and 30 flow rates are reduced to 80% of the maximum published flow rate due to the characteristics of the liquids.

➤ Maximum flow rates are also affected by other factors

- Product viscosity and pressure loss

- Continuous duty or intermittent duty

Liquid Controls PD Meters

METER MODELS	Listed in order of Maximum Nominal Flow Rates. Consult LC PD Product Overview # 100-10 for product application and material class recommendations. Maximum Non-Shock Working Pressure (PSI) ratings are based on products at temperatures below 160°F (71°C). See page 7 for working pressure vs. temperature data.

| Maximum Nominal Flow Rate | | Standard | Primary | Material Classes | 150 PSI 10.3 BAR | 275 PSI 19 BAR | 300 PSI 21 BAR | 350 PSI 24 BAR | 740 PSI 51 BAR | 1,480 PSI 102 BAR |
GPM	L/min	Flange Size*	Material	Available	1034 kPa	1896 kPa	2068 kPa	2413 kPa	5102 kPa	10204 kPa
30	113	1 1/2"	Aluminum	10				MA-4+		
60	227	1 1/2"	Aluminum	1, 2, 3, 4, 10, 14, 16, & 30	M-5	M-5**		MA-5+		
		2" Optional	Stainless Steel	8	M-5					
100	380	2"	Aluminum	1, 2, 3, 4, 10, 14, 15, & 16	M-7	M-7**		MA-7+		
		1 1/2" Optional	Stainless Steel	8	M-7					
			Cast Iron	7, 27, & 37	M-7	M-7**				
		2"	Brass	20	M-7	M-7**				
		2"	Steel	1, 2, 7, 10, 14, 16 & 37	MS-7	MSAA-7	MSA-7		MSB-7	MSC-7
150	550	2"	Aluminum	1 & 2	M-10	M-10**				
200	757	3"	Aluminum	1, 2, 3, 4, 10, 14, 15, & 16	M-15	M-15**		MA-15+		
		3"	Steel	1, 2, 10, 14 & 16	MS-15	MSAA-15***	MSA-15		MSB-15	MSC-15
		3"	Stainless Steel	8		MSAA-15***				
300	1,136	3"	Aluminum	1, 2	M-25	M-25**				
350	1,325	4"								
		3" Optional	Aluminum	1, 2, 3, 4, 14, 15 & 16	M-30					
		3"	Cast Iron	7, 27, 37 & 47	M-30					
		3"	Steel	1, 2, 10, 14 & 16	MS-30	MSAA-30***	MSA-30		MSB-30	MSC-30
		3"	Stainless Steel	8		MSAA-30***				
450	1,700	4"	Aluminum	1 & 2	M-40					
		3"	Steel	1 & 2	MS-40					
600	2,271	4"								
		6" Optional	Aluminum	1, 2, 3, 14 & 15	M-60	M-60**				
700	2,650	4"	Steel	1, 2, 10 & 14	MS-75	MSAA-75***	MSA-75		MSB-75	MSC-75
800	3,000	6"								
		4" Optional	Aluminum	2	M-80^	M-80**				
1,000	3,785	6"	Steel	1, 2, 10 & 14	MS-120	MSAA-120***	MSA-120		MSB-120	MSC-120
		6"	Stainless Steel	8		MSAA-120***				

Pressure

➢ Pressure: Recommended Meter

Pressure	Recommended Meter
• 150 psi (1034 kPa)	ALL M series meters
• 350 psi (2413 kPa)	MA series
	MA4, MA5, MA7 & MA15-Aluminum
• 150 psi (1034 kPa)	MS series /150# flanged
• 275 psi (1896 kPa)	MSAA series /150# flanged
	M5, M7, M10, M15, M25, M60, & M80 (Meter only)
• 300 psi (2068 kPa)	MSA series /300# flanged
• 720 psi (4963 kPa)	MSB series /300# flanged
• 1440 psi (9927 kPa)	MSC series /600# flanged

Note: All pressure ratings are based on non-shock working pressure.

Temperature

Temperature is related to seal material selection

- ➢ Seal materials:
    - ⇨ Buna   -65° F to 250° F (-54° C to 121° C)
    - ⇨ Viton   -20° F to 400° F (-28.9^o C to 204° C)
    - ⇨ Teflon   -450° F to 500° F (-268° C to 260° C)
    - ⇨ Kalrez   +5° F to 550° F (-15.0^o C to 288° C)
- ➢ Above 200° F (93°C) add:
    - ⇨ High Temperature Trim
    - ⇨ Heat Extension
    - ⇨ Hot Oil Jacketing or Insulation

What about Viscosity?

- **Viscosity -** Is the property of a fluid that is a measure of its resistance to flow.

- We need to know a product's viscosity, relate it to flow rate and find the product's pressure loss.

- Common viscosity measurement units
  - SSU = Saybolt Seconds Universal
  - CPS = Centipoises
  - CST = Centistokes
  - PaS = Pascal Seconds
  - mPaS = milli Pascal Seconds

Meter Calibration, Temperature compensation and other testing

What do customers expect

from our meters?

Repeatability
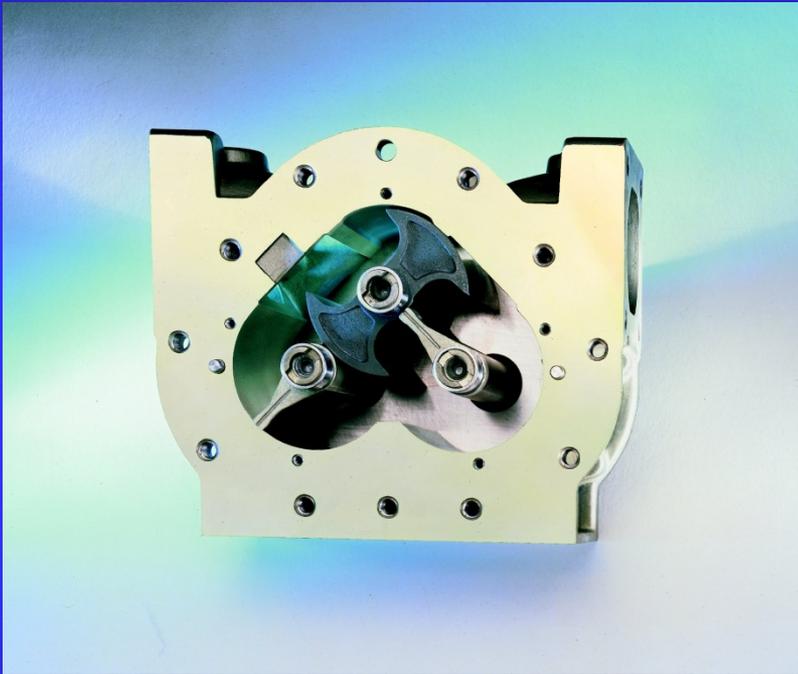
Capable of 0.02% or better at any flow rate over entire range

Superior Accuracy
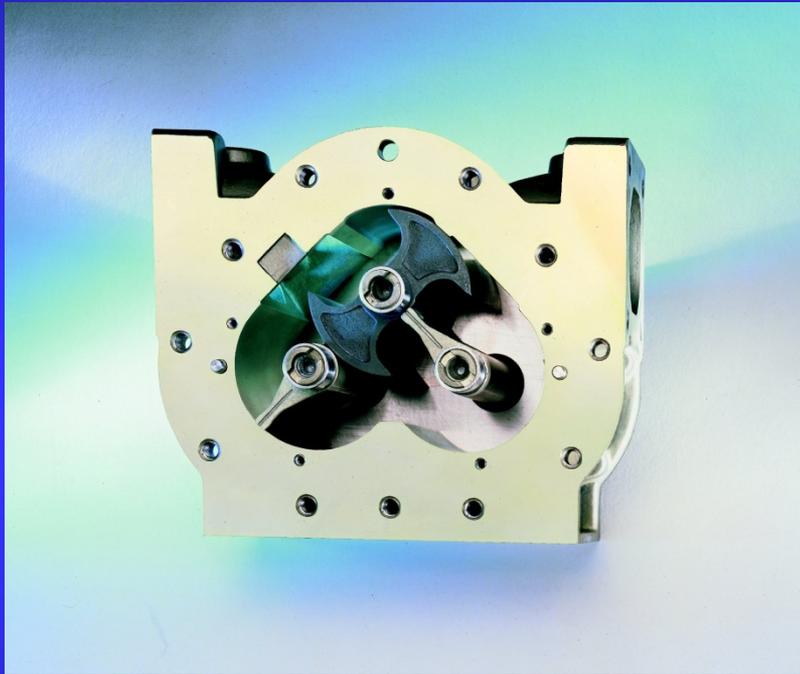
- *With all other conditions being constant*, the LC meter does not vary more than 0.05% in repeatability over entire range of flow rates.
  - Repeatability of 0.03% possible with electronic registration

Superior Linearity
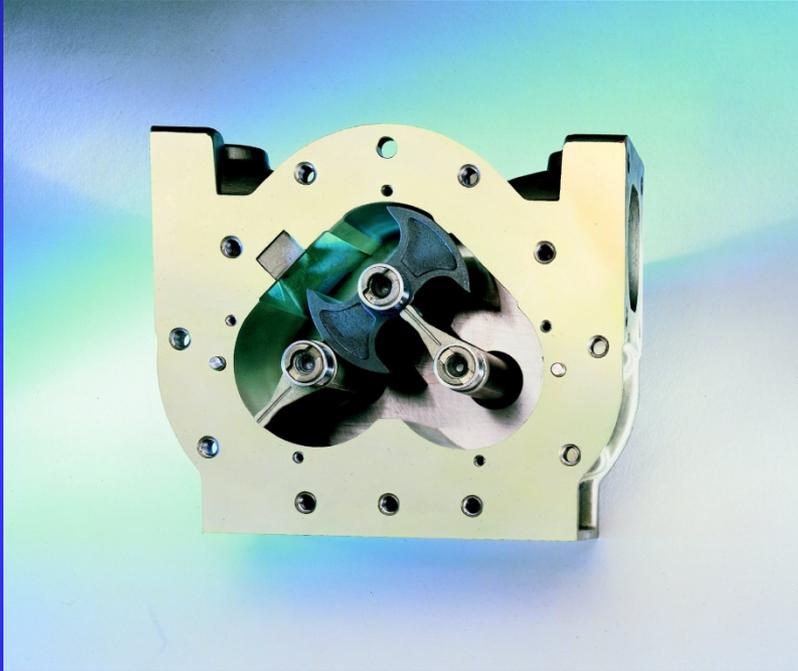
- Capable of ±0.125% or better over a 5:1 range from maximum nominal flowrate.

- Capable of ±0.22% or better over a 10:1 range from maximum nominal flowrate.

- Capable of ±0.5% or better over a 40:1 range from maximum nominal flowrate.

Note: Accuracy obtainable when all variables remain constant. Reading/measurements must be equal to a minimum of one minute of flow at selected rate(s). All accuracy statements based on metering Stoddard Solvent, approximate viscosity 1 CPS. On higher viscosity products, the average deviation in accuracy will be even less.

Table T.2.
Accuracy Classes and Tolerances for Liquid Measuring Devices Covered in
NIST Handbook 44, Section 3.30.

Accuracy Class	Application	Acceptance Tolerance	Maintenance Tolerance	Special Test Tolerance[1]
0.3	- Petroleum products delivered from large capacity (flow rates greater than 115 L/min or 30 gpm)** devices, including motor-fuel devices - Heated products (other than asphalt) at temperatures greater than 50 °C (122 °F) - Asphalt at temperatures equal to or below 50 °C (122 °F) - All other liquids not shown in the table where the typical delivery is over 200 L (50 gal)	0.2 %	0.3 %	0.5 %
0.3A	- Asphalt at temperatures greater than 50 °C (122 °F)	0.3 %	0.3 %	0.5 %
0.5*	- Petroleum products delivered from small capacity (at 4 L/min (1 gpm) through 115 L/min or 30 gpm)** motor-fuel devices - Agri-chemical liquids - All other applications not shown in the table where the typical delivery is ≤ 200 L (50 gal)	0.3 %	0.5 %	0.5 %
1.1	- Petroleum products and other normal liquids from devices with flow rates** less than 1 gpm. - Devices designed to deliver less than 1 gal	0.75 %	1.0 %	1.25 %

* For test drafts ≤ 40 L or 10 gal, the tolerances specified for Accuracy Class 0.5 in the table above do not apply. For these test drafts, the following applies:

  (a) Maintenance tolerances on normal and special tests shall be 20 mL plus 4 mL per indicated liter or 1 in³ plus 1 in³ per indicated gallon.

  (b) Acceptance tolerances on normal and special tests shall be one-half the maintenance tolerance values.

[1] Special test tolerances are not applicable to retail motor fuel dispensers.
** Flow rate refers to designed or marked maximum flow rate.

(Added 2002) (Amended 2006 and 2013)

N.4.2.   Special Tests (Except Milk-Measuring Systems). – "Special" tests shall be made to develop the operating characteristics of a measuring system and any special elements and accessories attached to or associated with the device. Any test except as set forth in N.4.1. Normal Tests and N.4.5. Product Depletion Test shall be considered a special test. Special tests of a measuring system shall be made at a minimum discharge rate of 20 % of the marked maximum discharge rate or at the minimum discharge rate marked on the device, whichever is less.

(Amended 1978 and 2005)

N.4.2.   Special Tests. – "Special" tests shall be made to develop the operating characteristics of a device and any special elements and accessories attached to or associated with the device. Any test except as set forth in N.4.1. Normal Tests shall be considered a special test.

   N.4.2.1.   Slow-Flow Meters. – A "special" test shall be made at a flow rate:

   (a)   not larger than twice the actual minimum flow rate; and

   (b)   not smaller than the actual minimum flow rate of the installation.

N.4.5.   Product Depletion Test. – Except for vehicle-mounted metering systems used solely for the delivery of aviation fuel, the effectiveness of the vapor eliminator or vapor elimination means shall be tested by dispensing product at the normal flow rate until the product supply is depleted and continuing until the lack of fluid causes the meter indication to stop completely for at least 10 seconds. If the meter indication fails to stop completely for at least 10 seconds, continue to operate the system for 3 minutes. Finish the test by switching to another compartment with sufficient product to complete the test on a multi-compartment vehicle or by adding sufficient product to complete the test to a single compartment vehicle. When adding product to a single compartment vehicle, allow appropriate time for any entrapped vapor to disperse before continuing the test. Test drafts shall be of the same size and run at approximately the same flow rate.

(Added 2005)

VOLUMETRIC PROVING

From
Meter

20
15
10
5
0
-5
-10
-15
-20
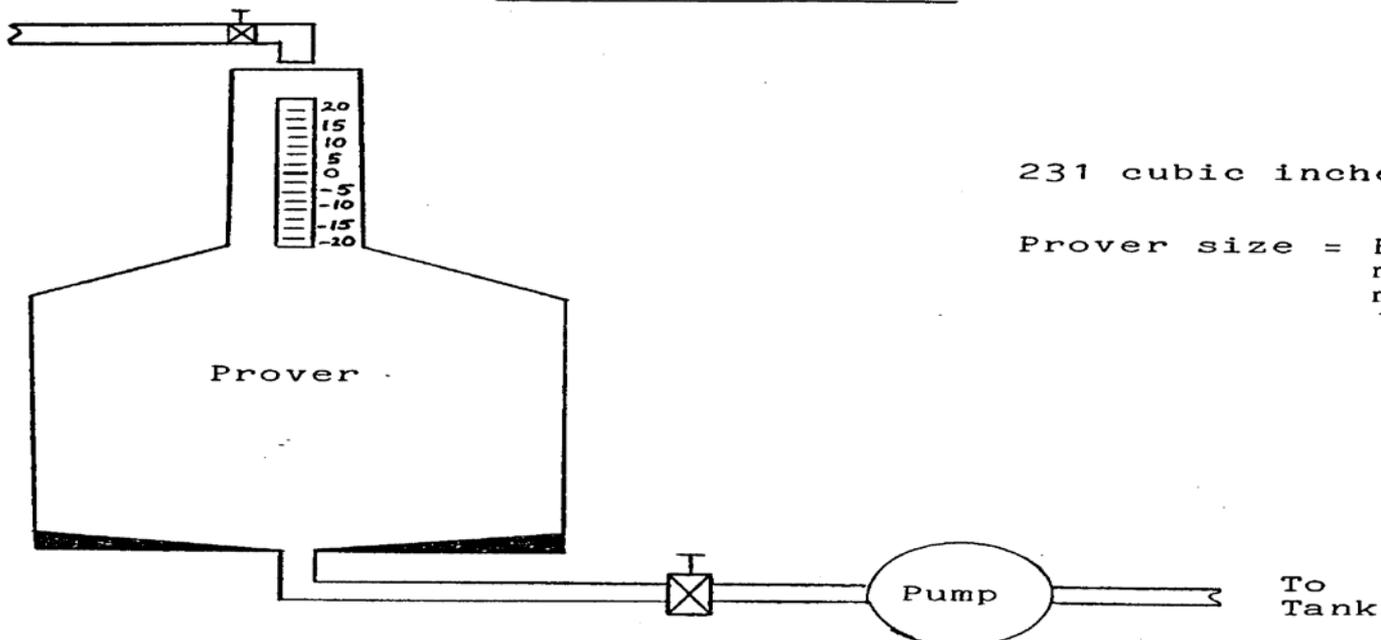
Prover

231 cubic inches = 1 gallon

Prover size = Flow rate of
meter for
minimum of
1 minute

Pump

To
Tank

1. Make sure there are no leaks downstream of meter

2. Wet prover

3. Always repeat same drain down time between tests. (Allow more time with viscous products.)

4. Close prover valve

5. Turn pump on before resetting register

6. Shut off flow of liquid with valve at inlet of prover

7. Read liquid line in sight glass the same way

8. Drain prover and repeat test for repeatability

9. Compute error in accuracy

10. Make calibration change

11. Repeat test twice to confirm accuracy and repeatability

N.3. Test Drafts. – Test drafts should be equal to at least the amount delivered by the device in 1 minute at its maximum discharge rate, and shall in no case be less than 180 L (50 gal) or 225 kg (500 lb).

(Amended 1989)

Proving by Weight

1. Record weight of container

2. Container should be large enough to hold volume the meter would measure for a period of at least 1 minute

3. Fill container to known volume

4. Record weight of container plus product

5. Subtract weight of container

6. Know weight per gallon of product at given temperature

7. Divide weight per gallon into net weight of product in the container - this will give volume in container

The above value is compared to the register reading on the meter. Any variance between the register and product in container is corrected through changing the adjuster setting of the meter.

Please note: Make sure the container is wetted before proceeding to fill container to determine net weight of product. Always repeat the procedure at least twice after setting the adjuster to confirm repeatability of test. Always allow same drain time between batches.

If a mini-bulk tank is used and the following procedure used, it is not necessary to wet the container:
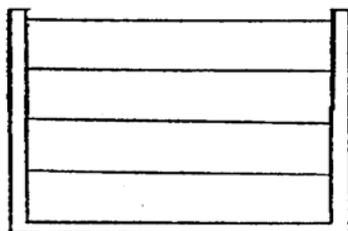
4th run - 50 gallons

3rd run - 50 gallons   calibrate
                              meter between
2nd run - 50 gallons   batches

1st run - 50 gallons

Master Meter Proving
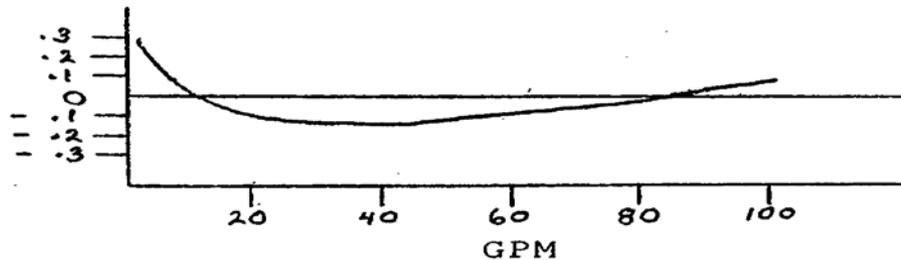
TEST METER

MASTER METER
OR
REFERENCE METER

Check master meter with volumetric prover to establish curve

GPM

1. Establish desired rate of flow

2. Stop meters by shutting off valve

3. Reset registers

4. Start pump and open valve

5. Stop flow with valve when master meter reaches desired reading (example: 100 gallons)

6. Note test meter reading

7. Repeat test to determine repeatability

8. Determine deviation between test meter and master meter and change adjuster setting accordingly

Master Meter Proving
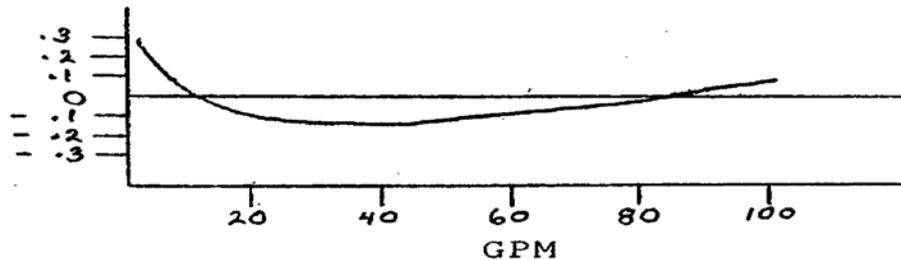
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8. Determine deviation between test meter and master meter and
    change adjuster setting accordingly

Product	Coefficient of Expansion per Degree Fahrenheit	Product	Coefficient of Expansion per Degree Fahrenheit
Acetone	.0008	LPG	.0017
Alcohol	.0006	Lube Oils	.0004
Antifreeze	.00036		
Aviation Fuel	.0005	Methanol	.00066
		Methyl Acetate	.0007
Benzene	.0006	Methyl Alcohol	.00066
Bunker C	.00045	Methyl Ethyl Ketone (MEK)	.00073
Butane	.00109	Mineral Spirits	.00056
		Motor Oil	.0004
Carbontetrachloride	.0006		
Caustic Soda (50% Solution)	.00015	Naptha	.00072
Corn Syrup	.00017	Nitric Acid	.00116
Crude Oil	.00045	Nitrogen Solution 28%	.00035
		NH3	.0013
Diesel Fuel	.0005		
Diethyl Ketone	.0006	Oil & Fatty Acids	.0004
Ethanol	.0006	Pentane	.00084
Ethyl Mercaptan	.0006	Propylene Glycol	.0004
Ethylene Glycol	.00036		
		Resin	.0007
Freon 11	.00085		
Freon 12	.0014	Sodium Chloride	.00015
Freon 21	.0018	Styrene	.0005
Fuel Oil #2, #6	.0005		
		Toluene	.00061
Gasoline	.0006		
		Unleaded Gasoline	.0006
Heptane	.0006		
Hexane	.0007	Vegetable Oil	.0004
		Vinegar	.00056
Iso-Butyl Alcohol	.00058		
Isopropanol	.00053	Water	.0002
JP-4 (Jet Fuel)	.0005	Xylene	.0006
Kerosene	.0005		

Calculating Volume Change

To compute the change in volume for a temperature change for a given liquid, use the formula:

(Δt)(Coefficient of Expansion)(100) = % change in volume

For example:
NH3 = .0013/°F Coefficient of Expansion
Temperature change (Δt) = 10°F

(10°F)(.0013/°F)(100) = 1.3% change in volume

Conversion to Celsius

To convert from Coefficient of Expansion per Degree Fahrenheit to Coefficient of Expansion per Degree Celsius, multiply the value per Degree Fahrenheit by 1.8.

For example:

Kerosene = .0005 Coefficient of Expansion per Degree Fahrenheit. Multiply .0005 by 1.8 to get:
Kerosene = .0009 Coefficient of Expansion per Degree Celsius.

Mechanical TVC

ETVC KIT
Electronic Temperature Volume Compensation

Meter installation and operation requirements.

Mounting Arrangements

Mounting arrangements

LC meters may be mounted in a variety of configurations, as shown below. Do not position the meter on its side, i.e., with cover plate face down or up.
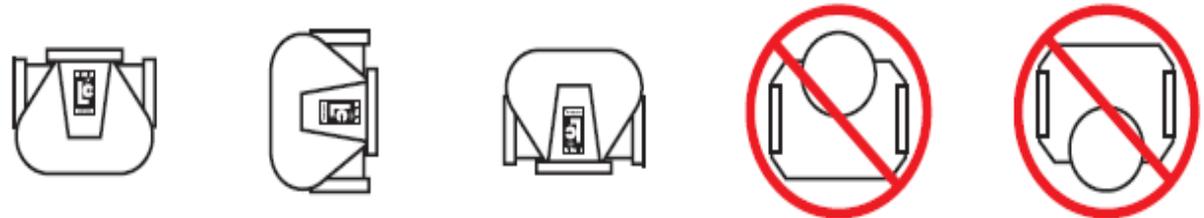
Note: regardless of meter mounting configurations, accessories such as the air/vapor eliminator must always be mounted in a vertical orientation to permit proper operation of the float-actuated apparatus.

Installation

➤ Make sure any necessary safety precautions have been taken.

➤ Install the meter and components in conformance with state and federal construction, electrical and safety codes.

➤ Prior to installing the meter, ensure that the entire meter is flushed of all debris with a liquid that is compatible with the material of construction within the meter.

➤ Keep external surfaces of the meter clean.

➤ The meter must always be securely bolted to a platform or support. **NEVER HANG A METER ON THE CONNECTING PIPING!**

➤ Prevent pipe strain or stress when making meter connections. **THE WEIGHT OF THE PIPES MUST ALWAYS BE SUPPORTED INDEPENDENT OF THE METER!**

➤ Install the meter on the downstream (discharge) side of the system pump. **PRODUCT SHOULD NEVER BE PULLED (SUCTIONED) THROUGH THE METER.**

Installation (cont)

- ➢ **ALWAYS** position the meter with service in mind.

- ➢ Install a strainer on the inlet side of the meter to avoid foreign debris such as weld slag from entering the measuring system.

- ➢ Ensure that the metallurgy of the meter is correct for the given type of liquid.

- ➢ A meter should not be used with a different liquid from the original liquid specified unless the physical characteristics and pH rating are similar and the application has been verified by Liquid Controls or through a full service distributor.

- ➢ Read the manual as well as the supporting literature provided in the meter packet, shipped with each meter.

- ➢ If you have any questions, consult Liquid Controls or a Liquid Controls full service distributor.

Operation Requirements

➢ Meter must remain full of product at all times.

➢ Upstream lines must be maintained full to prevent air from entering the meter

➢ Every meter should be calibrated in the field, under actual service and installation conditions.

➢ Provide a means of conveniently diverting liquid for calibration purposes.

➢ Give careful attention to system plumbing and piping, keeping the system free of entrained air or vapor.

➢ Follow the installation guide lines provided by the pump manufacture to minimize air and vapor elimination issues.

➢ On vehicle tank installations, piping layout and tank design are important in preventing problems with split compartment test conformance.

➢ Avoid Hydraulic shock and Thermal Expansion. Both are extremely harmful to the critical measuring components within the measuring chamber. Pressure relief valves should be used in any portion or branch of the system that might be closed off by closure of operating valves or block valves.

➢ For liquids that tend to flash or vaporize easily at higher ambient temperatures, it is desirable to use flooded suctions and piping sized larger than the normal pump size.
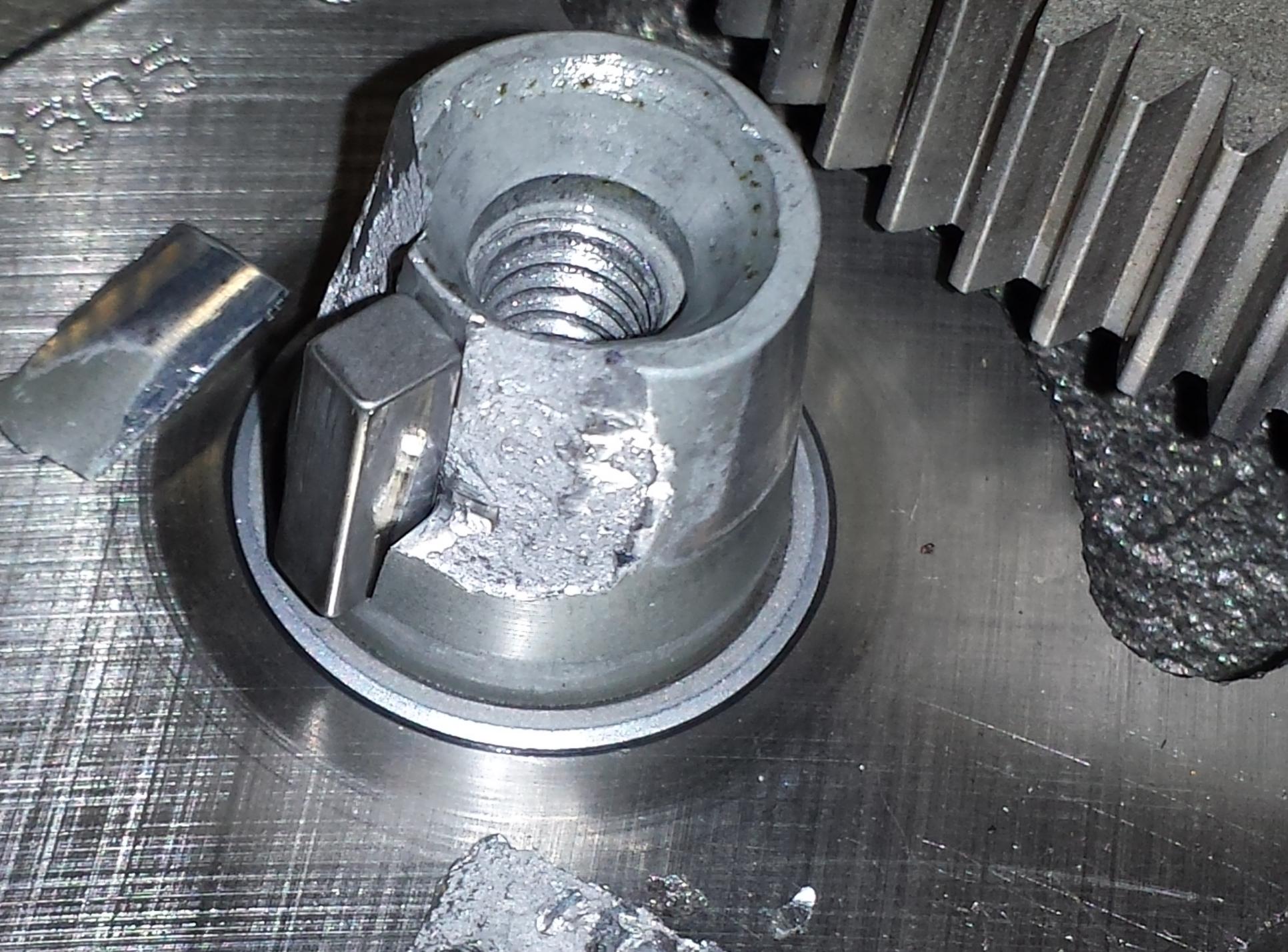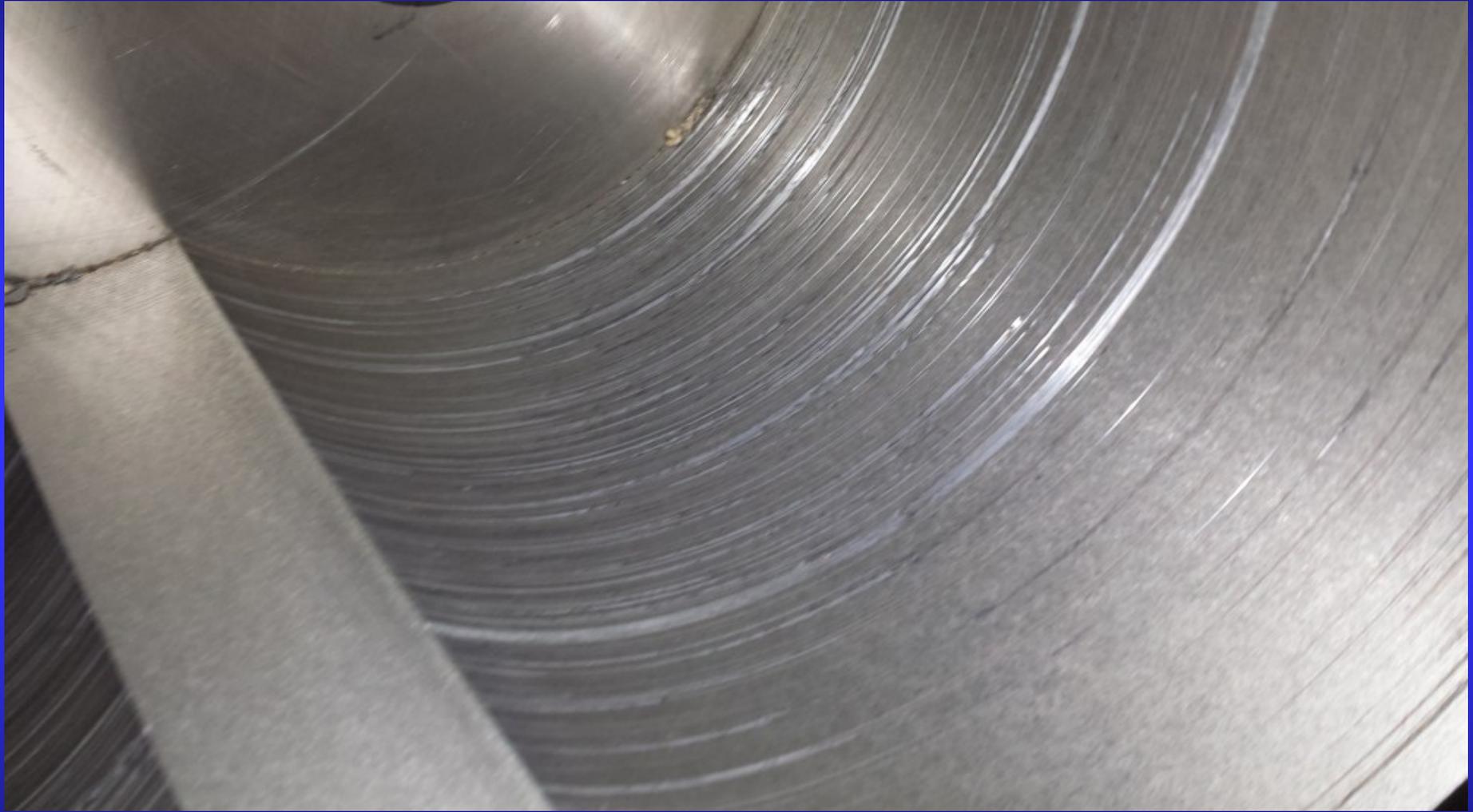
Torque all fasteners such as screws and bolts in accordance with specifications listed on the torque chart in the M/MA manual.

Examine all fasteners to make sure they are not bent rusted or pulled. If bolt (s) are found bent, examine the housing and check the covers for flatness. Use a straight edge to determine flatness.

Use anti-seize – When removing or replacing bolts, always coat the bolts with anti-seize.

TORQUE PATTERN M-7 COVERS
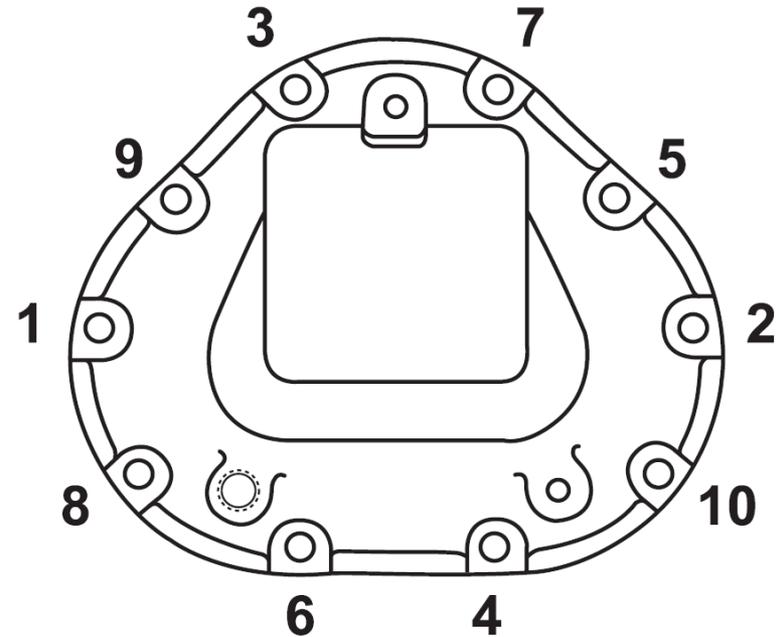
Torque Chart

Grade 5 Fasteners		
Bolt Size	**Foot-Pounds**	**Newton-Meter**
	NOMINAL*	NOMINAL*
#8 (.164) - 32 UNC-2A	42	4.8
#10 (.190) - 24 UNC-2A	63	7.1
1/4" (.250) - 20 UNC-2A	7.3	9.9
5/16" (.3125) - 18 UNC-2A	15.3	20.7
3/8" (.375) - 16 UNC-2A	27	37
7/16" (.4375) - 14 UNC-2A	43	58
1/2" (.500) - 13 UNC-2A	66	90
5/8" (.625) - 11 UNC-2A	132	179
3/4" (.750) - 10 UNC-2A	233	316

Torque Tolerance is ± 10%

Wrench and Socket Size Chart

Meter Element	MA-4 M-5 MA-5	M-7 MA-7 M-10	M-15 M-25	MA-15	M-30 M-40	M-60 M-80
Dust Cover Screws	5/16 hex wrench	5/16 hex wrench	slotted screwdriver	slotted screwdriver	slotted screwdriver	slotted screwdriver
Drain Plug	1/4" Allen wrench	1/4" Allen wrench	3/8" Allen wrench	3/8" Allen wrench	3/8" Allen wrench	3/8" Allen wrench
Meter Cover Screws	1/2" hex wrench/socket	1/2" hex wrench/socket	1/4" Allen or 1/2" hex wrench/socket	1/4" Allen or 1/2" hex wrench/socket	9/16" hex wrench/socket	3/4" hex wrench/socket
Counter Bracket Screws	3/8" hex wrench/socket	3/8" hex wrench/socket	N/A	3/8" hex wrench/socket	N/A	3/8" hex wrench/socket
Bearing Plate Screws	5/16" hex wrench/socket	5/16" hex wrench/socket	5/16" hex wrench/socket	5/16" hex wrench/socket	7/16" hex wrench/socket	1/2" hex wrench/socket
Rotor Gear Screws	5/16" hex wrench/socket	3/8" hex wrench/socket	3/16" Allen wrench	3/16" Allen wrench	3/16" Allen wrench	3/16" Allen wrench

Accessories
Strainers, air eliminators and valves

Strainers

F & FA Series Aluminum Body Strainers

F Series Cast Iron, Stainless steal and Brass body strainers

FS, FSA and FSAA Steel Body Strainers

2" & 3" High Capacity Strainers Class 1, Petroleum

➢ **Help protect the meter from serious damage caused by burrs dislodged from piping, pipe scale or foreign material.**
➢ **Are a good insurance against the cost of down time and replacement parts incurred from a damaged meter.**
➢ **Should be mounted on the inlet side of the meter and are necessary even when a course strainer is located on the upstream side of the pump is installed.**
➢ **Are not meant to be used as a system filter but as limited protection for the metering element.**
➢**High Capacity Strainer assists in passing split compartment testing.**

How it works:

Liquid product enters the strainer housing from the supply line and is then routed through the strainer basket. Any debris that is larger then the mesh in the basket will be trapped in the basket.
The Strainer basket has a 2 ply screen. The inner screen mesh is made of either 20, 40, 80, 100, 150 or 200 squares per inch. The outer screen works as a backing and to reinforce and support the inner mesh screen. Basket mesh selection is based on maximum fluid viscosity at minimum ambient operating temperature.
THE STRAINER IS NOT A FILTER

Air eliminator
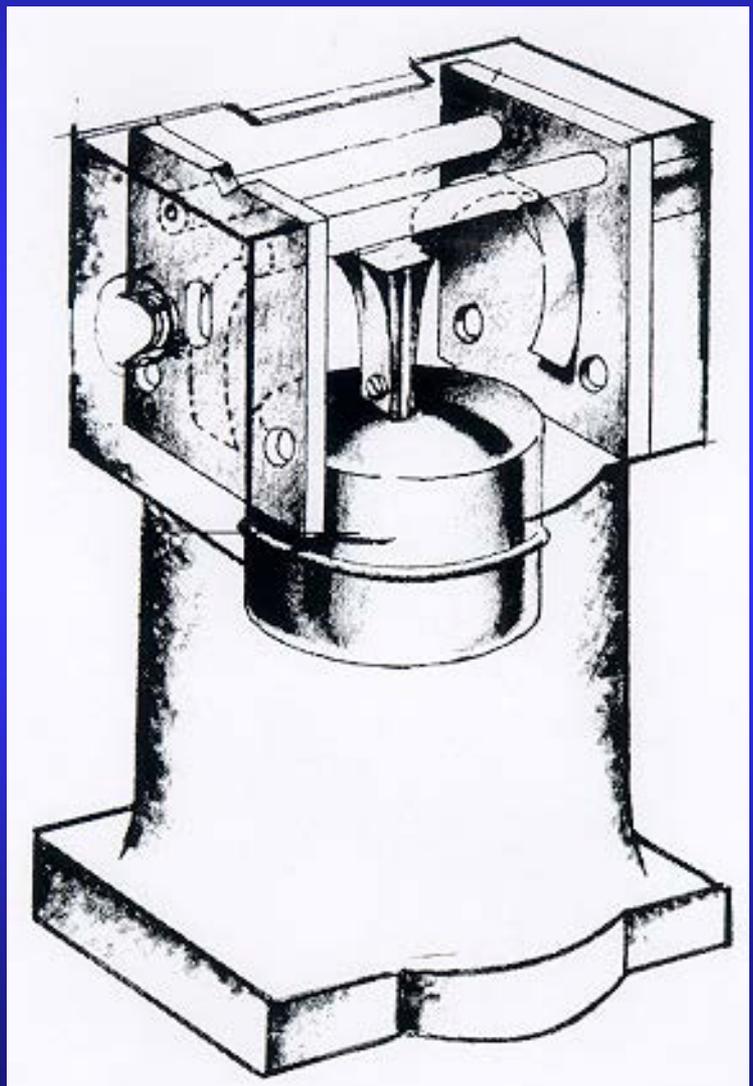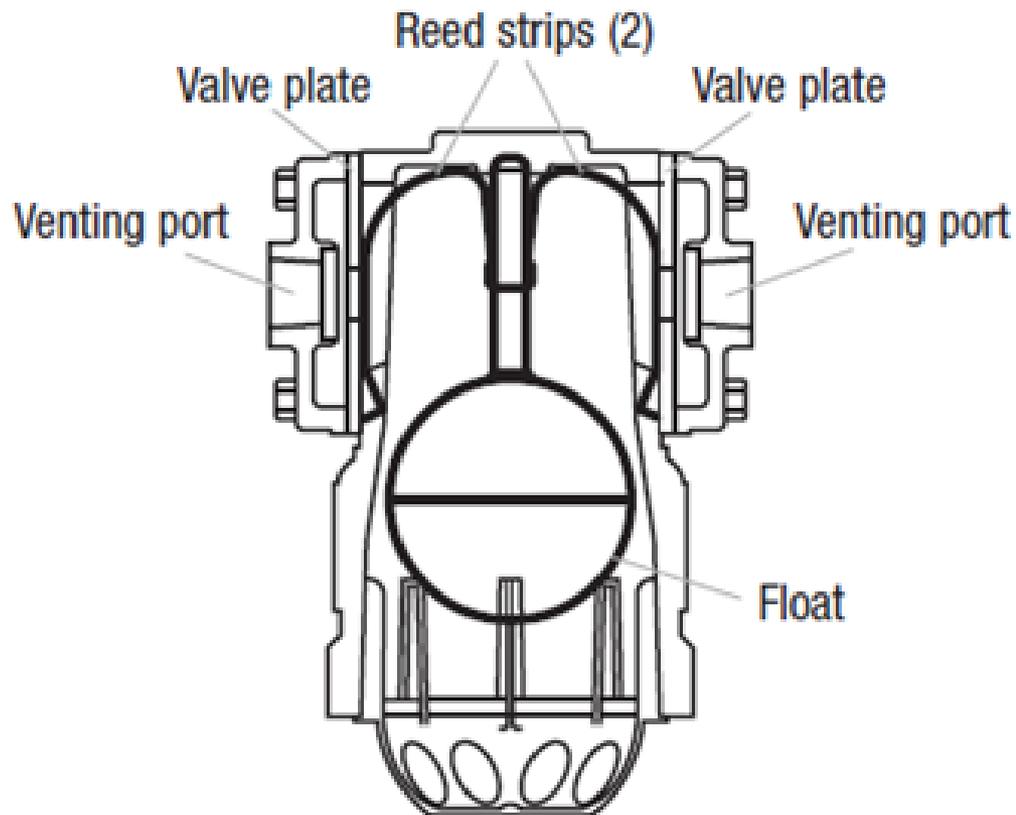
Mechanical air eliminator
(float activated)

12

S.2.1. Vapor Elimination.

(a) A liquid-measuring device shall be equipped with a vapor or air eliminator or other automatic means to prevent the passage of vapor and air through the meter.

(b) Vent lines from the air or vapor eliminator shall be made of metal tubing or other rigid material.

(Amended 1975)

AIR ELIMINATOR

Needed:

For Weights and Measures testing.

If the source tank empties.

Possibility of pumping air.

Type of pump.

Stripping tanks / compartments.

61
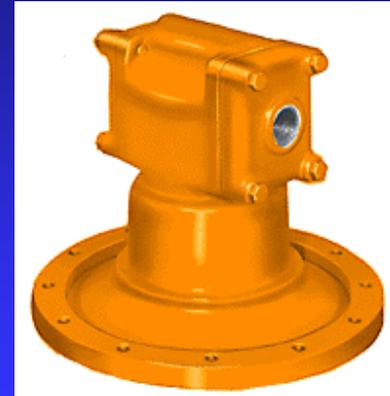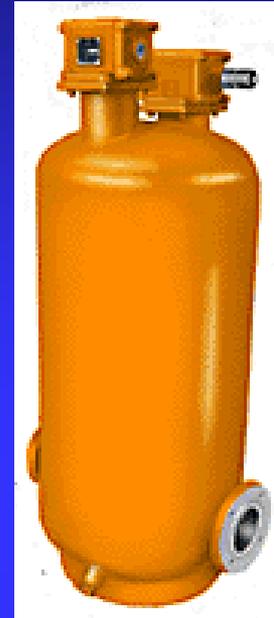
AIR ELIMINATOR

Optical Air Eliminator

*Petroleum
*LPG
*Bulk Plant

Only for use with LC electronic registers

AIR ELIMINATOR

Mounting position
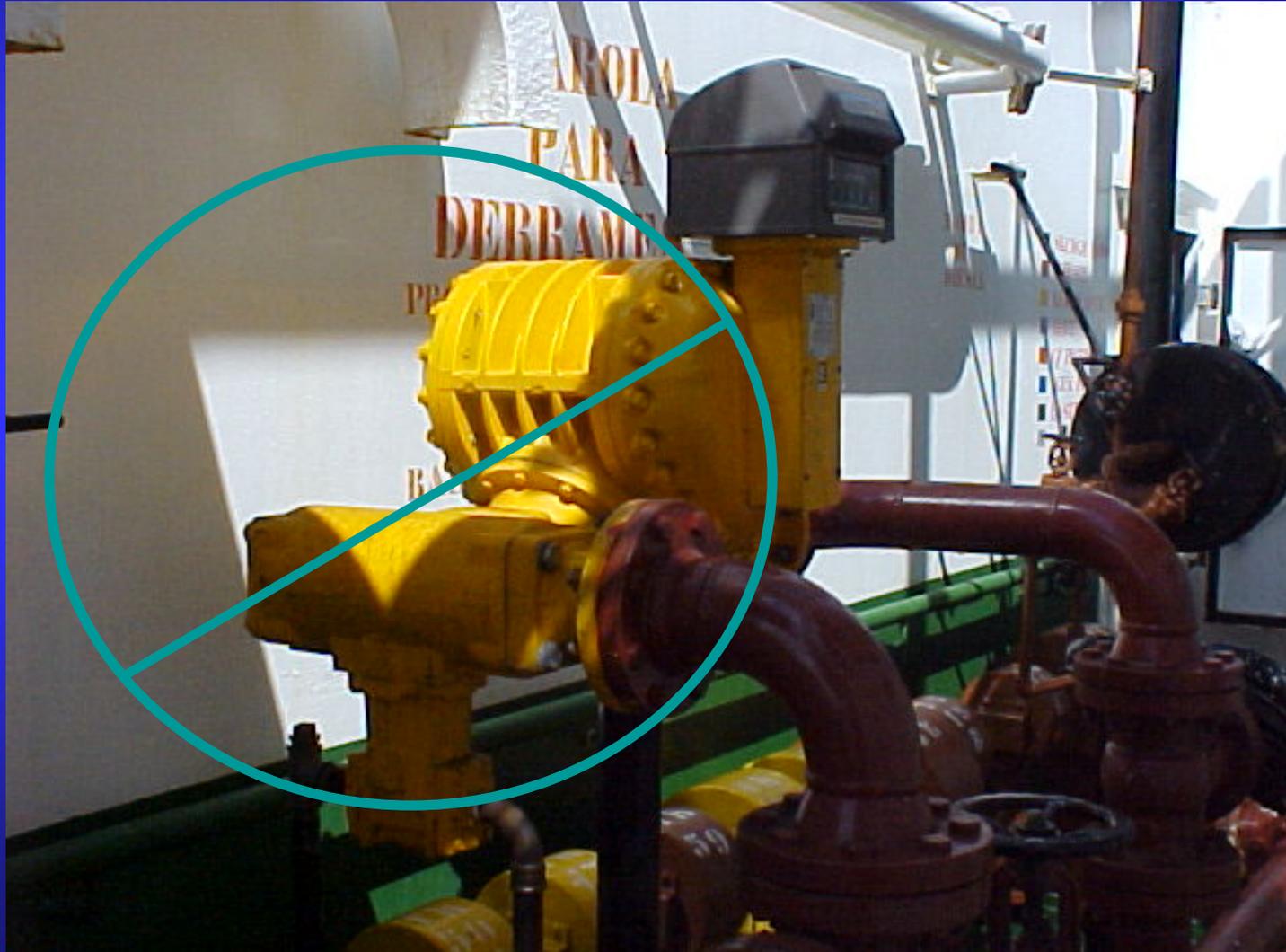
Back check valves

S.2.3.   **Directional Flow Valves.** – Valves intended to prevent reversal of flow shall be automatic in operation.

*Provides some back pressure in the system allowing the air eliminator to work more effectively.

*Prevents product from flowing back through the meter.
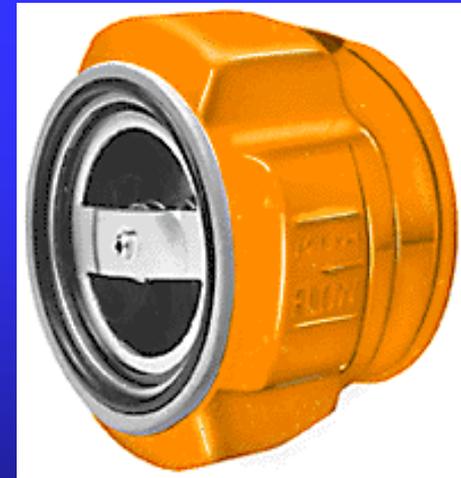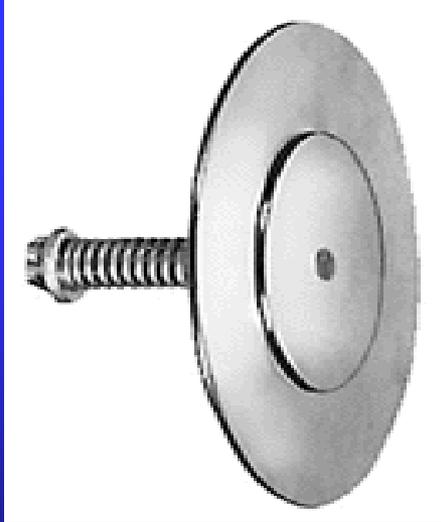
Air check valves

Air actuated/Differential Check Valves:

➢ Designed to prevent flow whenever air or vapor is present.

➢ Check valves are normally closed, spring loaded valves that are installed on the meter outlet.

➢ Fluid pressure over comes the internal spring tension of the valve from the inlet side so the pressure is greater then the back pressure combined with the force of the spring.

➢ When the back pressure plus the spring strength is greater than the fluid pressure, the valve will remain closed.

➢ These valves are designed to work in conjunction with the air/vapor eliminator and is important when split compartment testing.
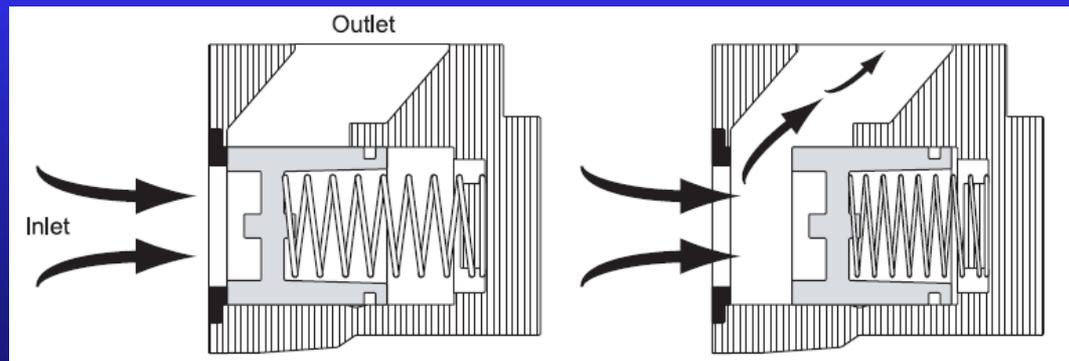
Electronic valves

Block valve
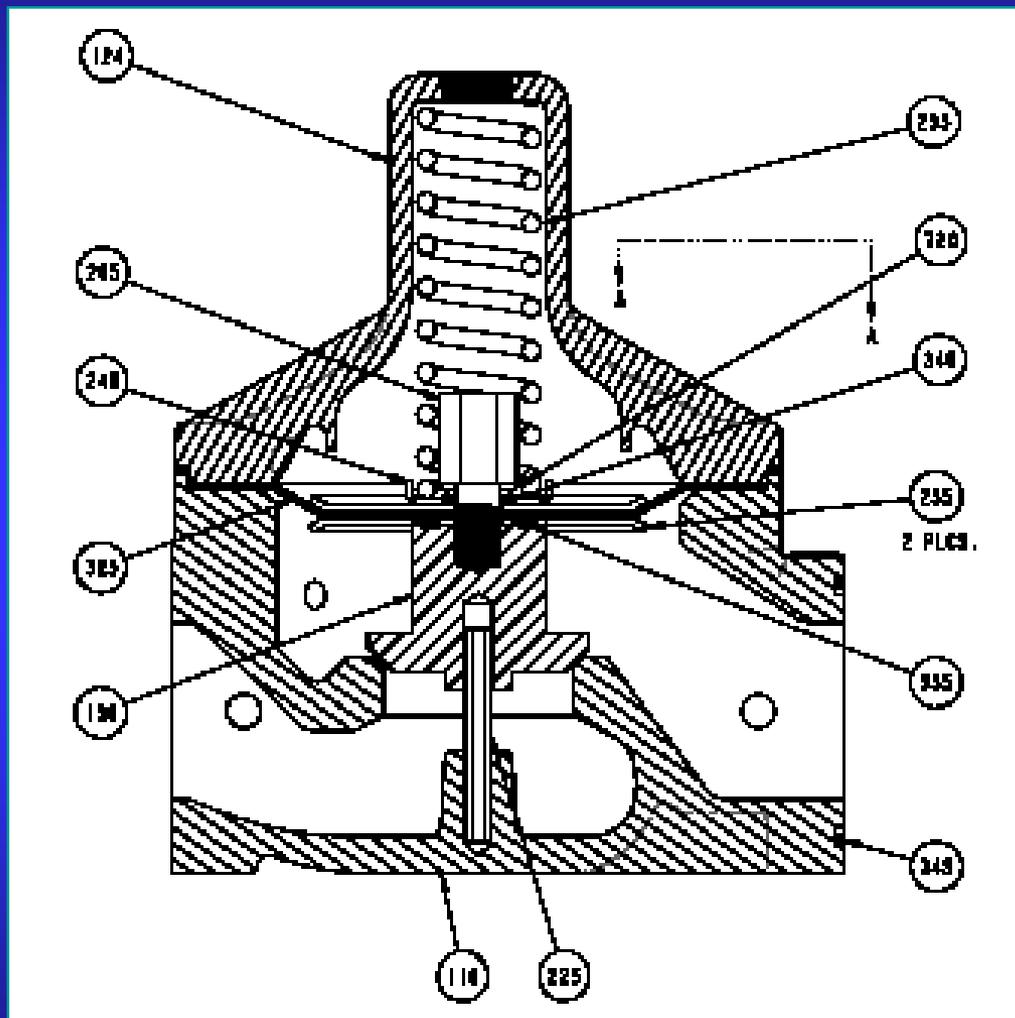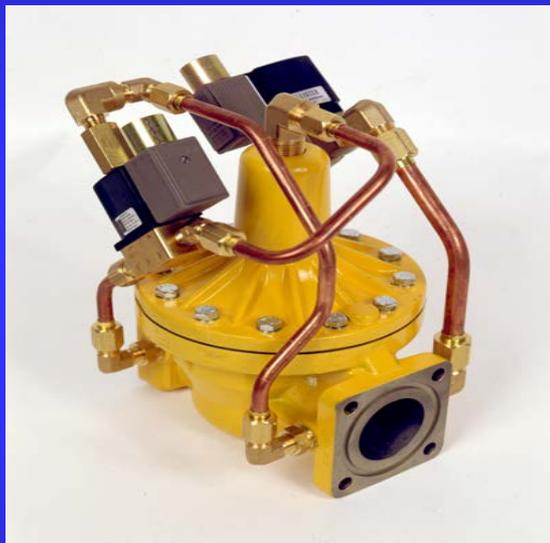
LCR-II

ELECTRONIC REGISTRATION

LCR-II "Inside" = Liquid Controls Register

Class 1 Div. 1

Class 1 Div. 2

Electronic Registration Solutions:

Replace any and all functions of mechanical registration!

- ➢ Mechanical Counters
- ➢ Mechanical Printers
- ➢ Mechanical Presets
- ➢ Mechanical Adjusters
- ➢ Mechanical TVC's
- ➢ Micro-switches
- ➢ Counter Driven Pulse devices
- ➢ Manual Control Valves/Linkage
- ➢ Register Gear Plates
- ➢ Rate of Flow Indicator

The LCRII Advantages

➢ Extremely Accurate Electronic Registration

➢ Electronic Calibration Adjustment

➢ Electronic Temperature Compensation

➢ Electronic Shift and Accumulative Totalizers

➢ Inventory Totalizer

➢ Computer Generated Tickets with multiple ticket formats including POS Price and Tax

➢ Electronic Calibrated Pulse Output

➢ Electronic Output for Secondary Remote Readout

➢ Electronically actuated Valve Outputs for Security and accurate electronic preset control

➢ Electronic Auxiliary Outputs used for Alarms, Pump Control, Injection Systems

➢ Multi-Point Calibration

➢ Flow Monitor Output

The LCRII Advantages (Cont)

- Calibration for up to Four Products

- Driver Friendly – Easy PUMP & PRINT Operation

- Compatible with Most Flow Meters on the Market

- Mounts Directly to both Liquid Controls and Competitive Flow Meters (Standard V-R Register Bolt Pattern)

- RS 232 and 485 communication

- Easy Interface To Other Host PC Devices

- Back Lit for High Visibility in Low Light Situations

- Available In Class 1, Div1 or Class 1, Div 2

- Will Operate From -40 to +160 Deg F OR -40 to +70 Deg C

- USA and Canadian Weights and Measures Certified

- Controls all Weights and Measures Metrological Data

Installation

- **Basic Component**
- **Optional Components**
- **Electrical Checks**
- **Wiring Connections**
- **LCR Vs. LCR-II**

Setup and Operation

- **How to use the Lap pad**
- **7 main modes of the LCR/LCR-II**
- **Calibration and Multi-Point Calibration using Lap pad**
- **Calibration of LCR-II Without Lap pad**
- **Delivery Using the Lap pad**
- **Pump and Print Deliveries**
- **Printing Delivery Tickets and Shift Reports**

Troubleshooting

- **Printing Calibration Tickets**
- **Diagnostics Mode**
- **System Issues**
- **Power Issues**
- **Lap pad Issues**
- **Printer Issues**
- **Valve Issues**
- **Pulser Issues**
- **Display Issues**
- **Error Messages**

Additional Functions

- **Flashing**
- **VT100 Terminal**
- **Dual Meter Multiplexer**
- **LCR Host / EZCommand Lite**

Installation

➢ **Basic Component**

➢ **Optional Components**

➢ **Electrical Checks**

➢ **Wiring Connections**

LCRII Primary System Components

Electronic Slip Printer

LCRII Register

Power & Data Cable Kits

Optional System Components

Remote Display

POD Pulser

OEA

E25352 Dual Meter Multiplexer

ETVC Kit

Block Valve

E-7 Valve

Lappad
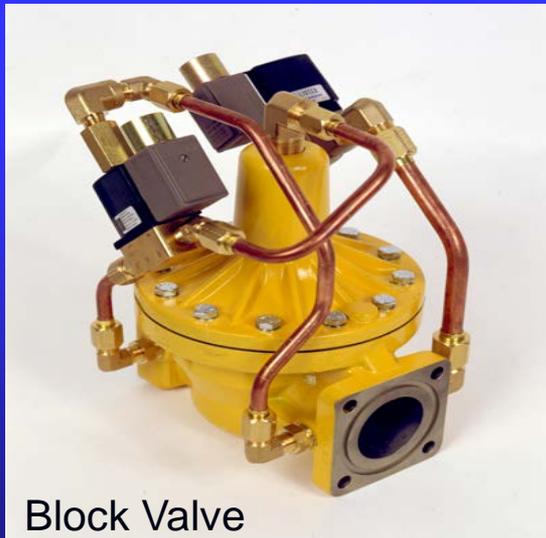
Power Requirements: LCR/LCRII operate from 9 to 28VDC

Electrical System Check:

➢Battery terminals and cables must be in good condition with clean, tight, corrosion free connections

➢The battery must be charged in accordance with the manufacturer's specifications

➢The alternator must be large enough to meet the total demands of the truck, including the LCR/LCR-II. The LCR/LCR-II requires a Minimum of 5A for proper operation.

➢Run the truck at low idle with ALL accessories ON (including hose reel), and verify that the voltage does not drop below 9VDC

➢If truck has a history of electrical problems, make sure to resolve these problems prior to installing the LCR/LCR-II

➢Inspect all truck electrical/electronic equipment for proper installation

➢Determine if the truck is positive or negative ground. (consult factory for installation assistance on positive ground trucks)

➢Make sure that the radio antennas are installed in accordance with manufacturers specification to prevent RF interference

➢Always install the provided 7.5Amp in-line fuse for protection of the system

Typical truck Installation (LPG)

➢**Cable is typically run from the front to the rear**

➢**Avoid installing cable around sharp edges, rotating truck components, hot surfaces**

➢**Liquid Controls recommends that all system cables be installed in automotive split loom or Liquid-tight conduit**
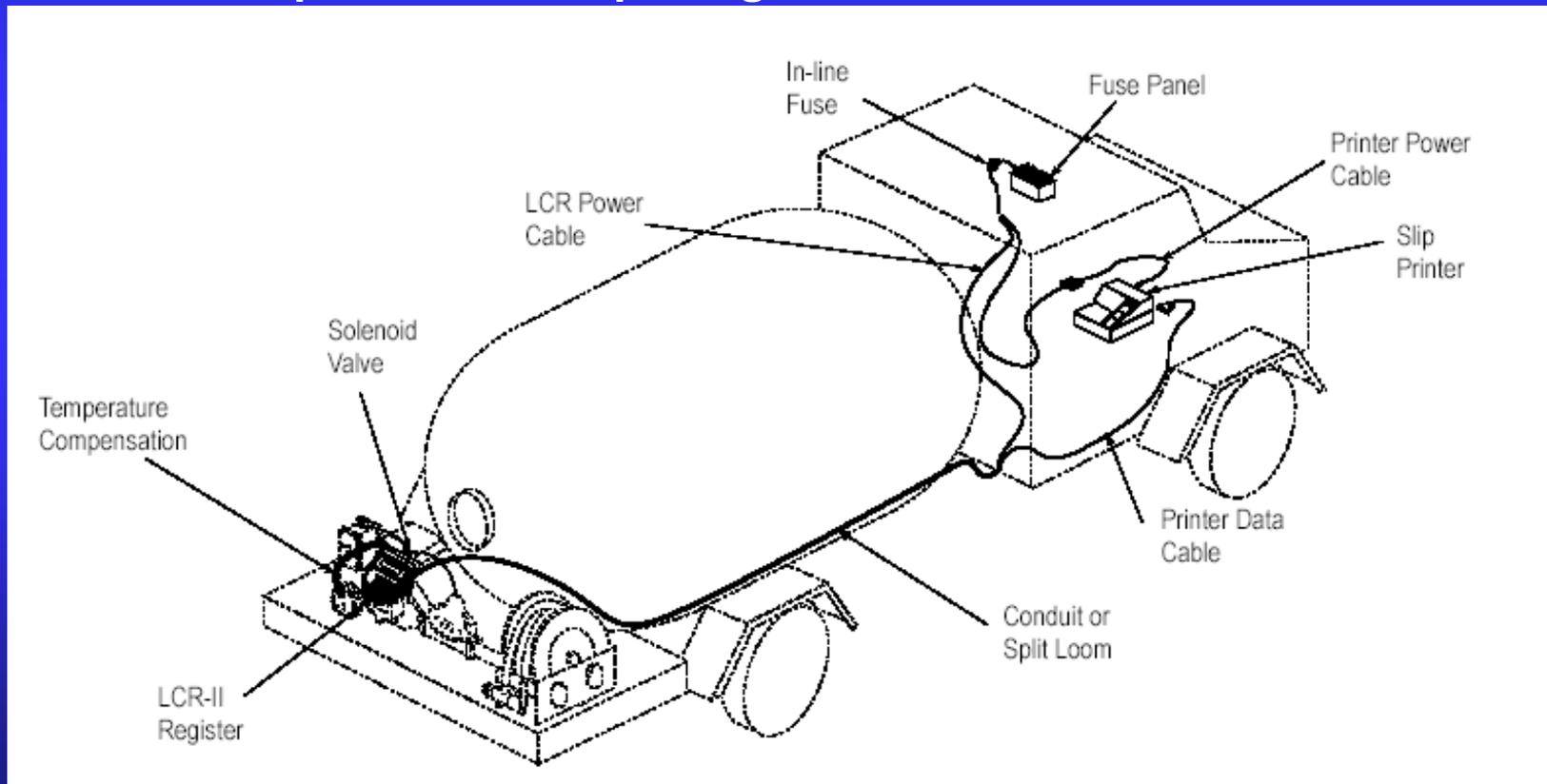
LCRII REC Head Mounting Kits:

- A direct replacement for a 400 or 800 series Neptune register. Supplied complete with mounting bolts and drive coupling for use with LCR and RSCB with integral pulser.
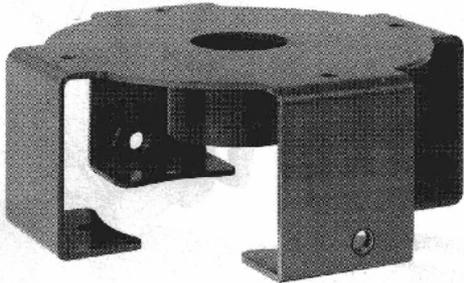
Neptune (w/o previous existing mechanical TVC)

- A direct replacement for mechanical ATC on Neptune 1 $\frac{1}{4}$", 1 $\frac{1}{2}$", or 2" LPG meters. Requires the user to remove the mechanical ATC and replace it with LCR or RSCB with integral pulser. Supplied complete with mounting bolts and drive coupling.
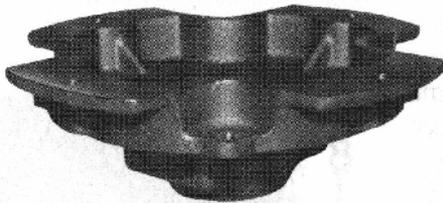
Neptune (w/previous existing mechanical TVC)

To Liquid Controls

To Smith Meter

To Daniel/Tolkheim Meter

To Brooks Meter

To Neptune Meter

Drive Shaft Couplings

LCRII Register
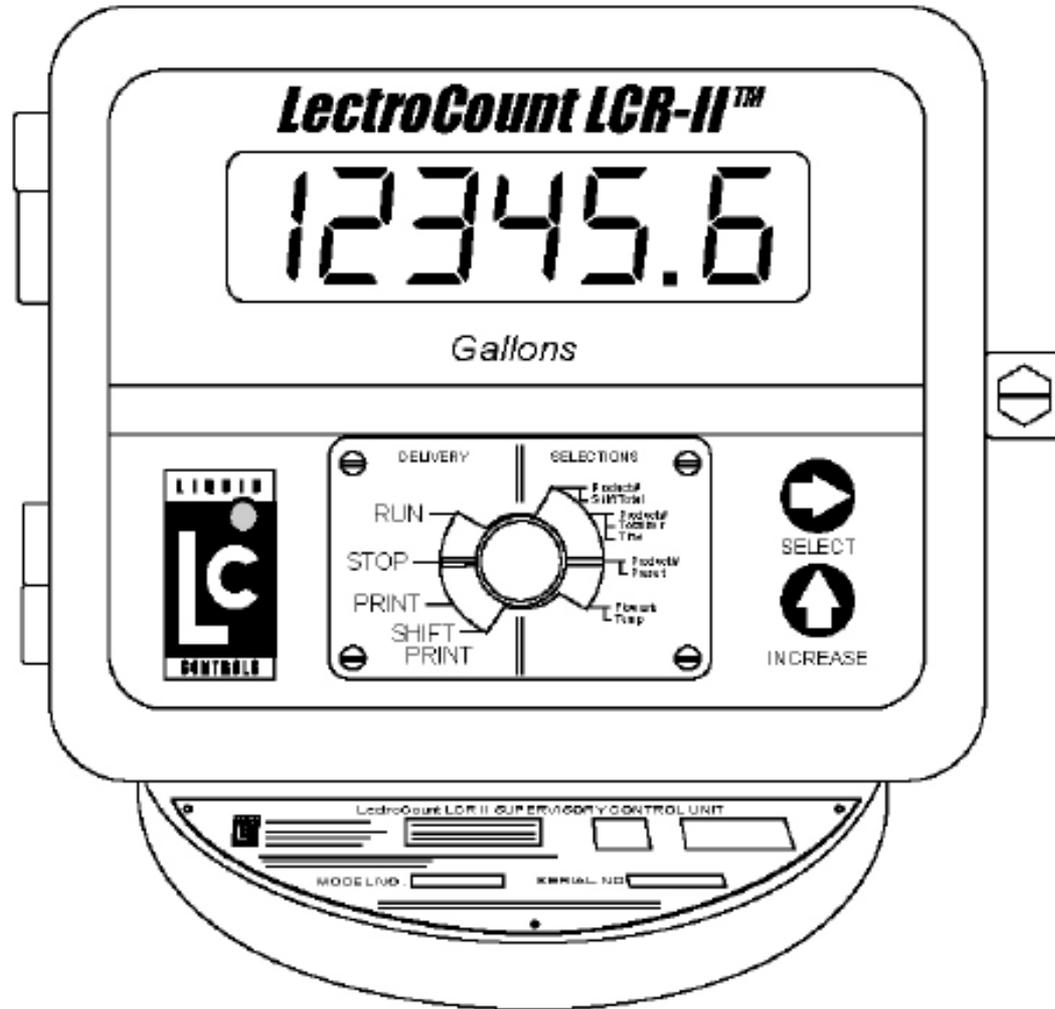
Board Layout – Assy 81390-2

Original LCR Board Class 1 Div. 1 Housing Only

Will only run LCR software (not LCR-II)
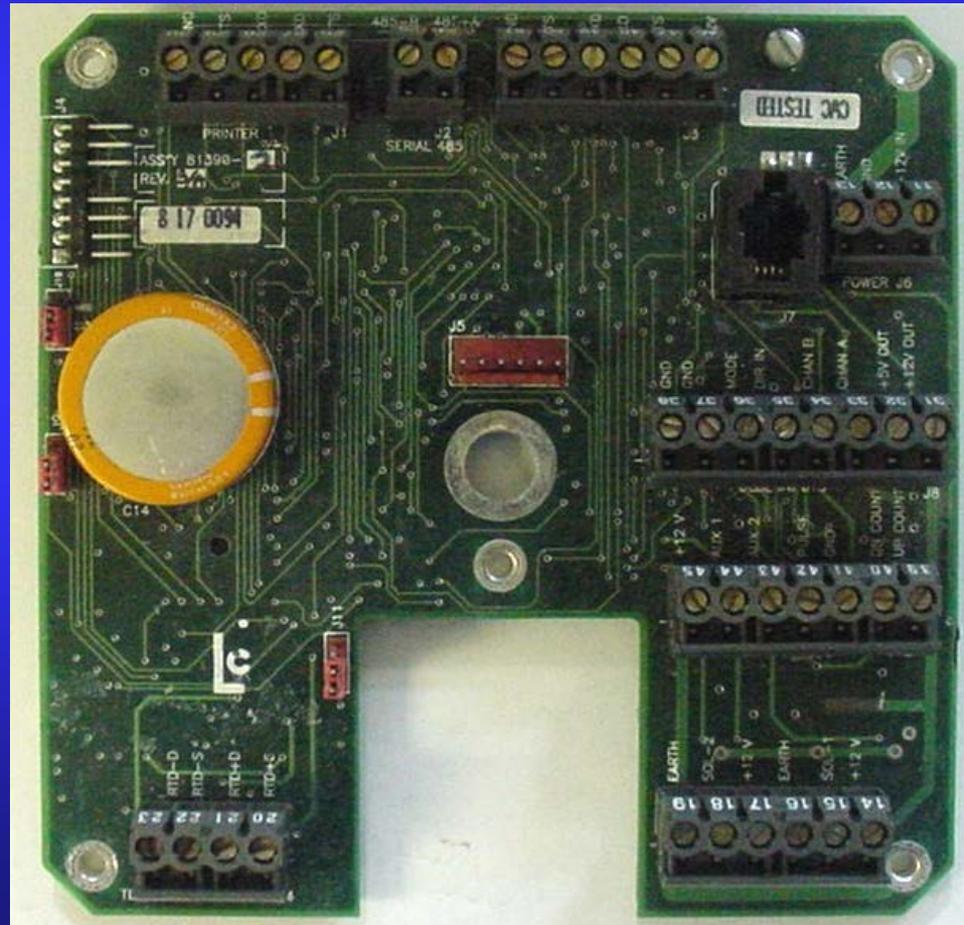
Board Layout – Assy 81547 and 81547-1/2

81547 – will only run LCR software

81547-1/2 – will run either LCR or LCR-II software
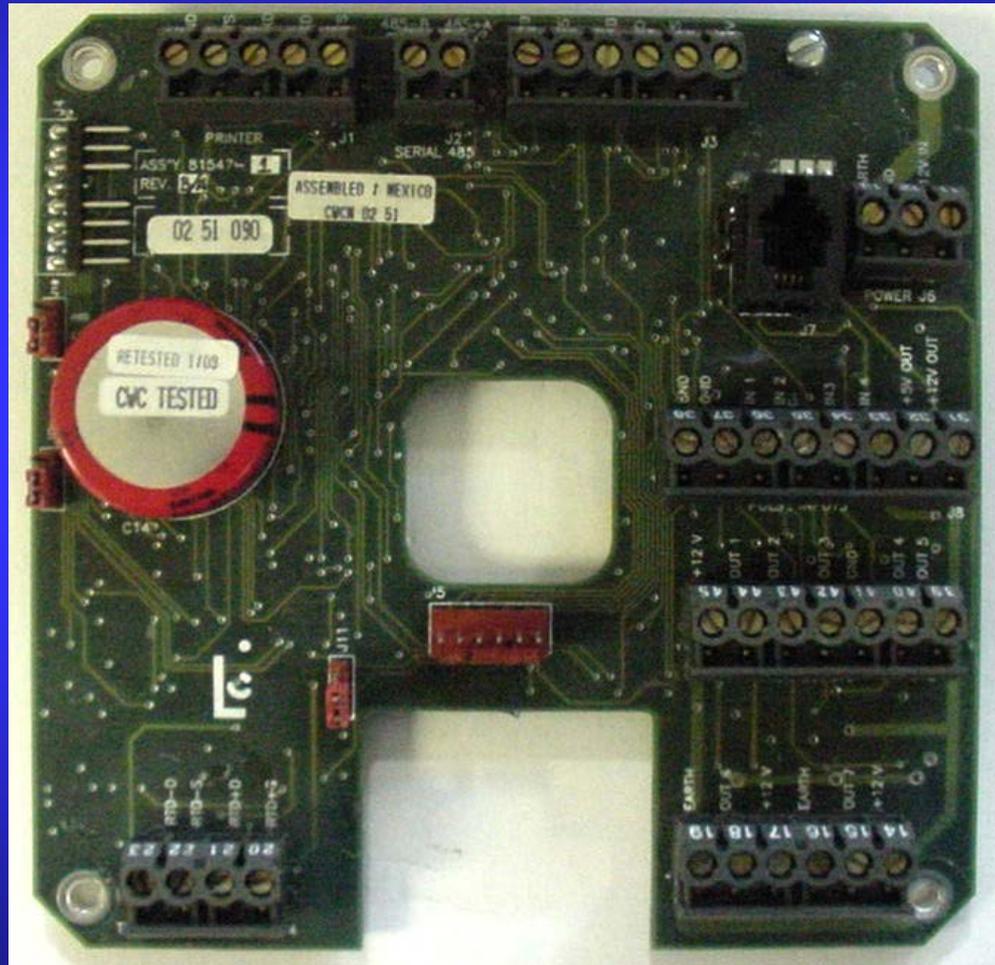
Board Layout – Assy 81920

81920 – will run either LCR or LCR-II software

81920
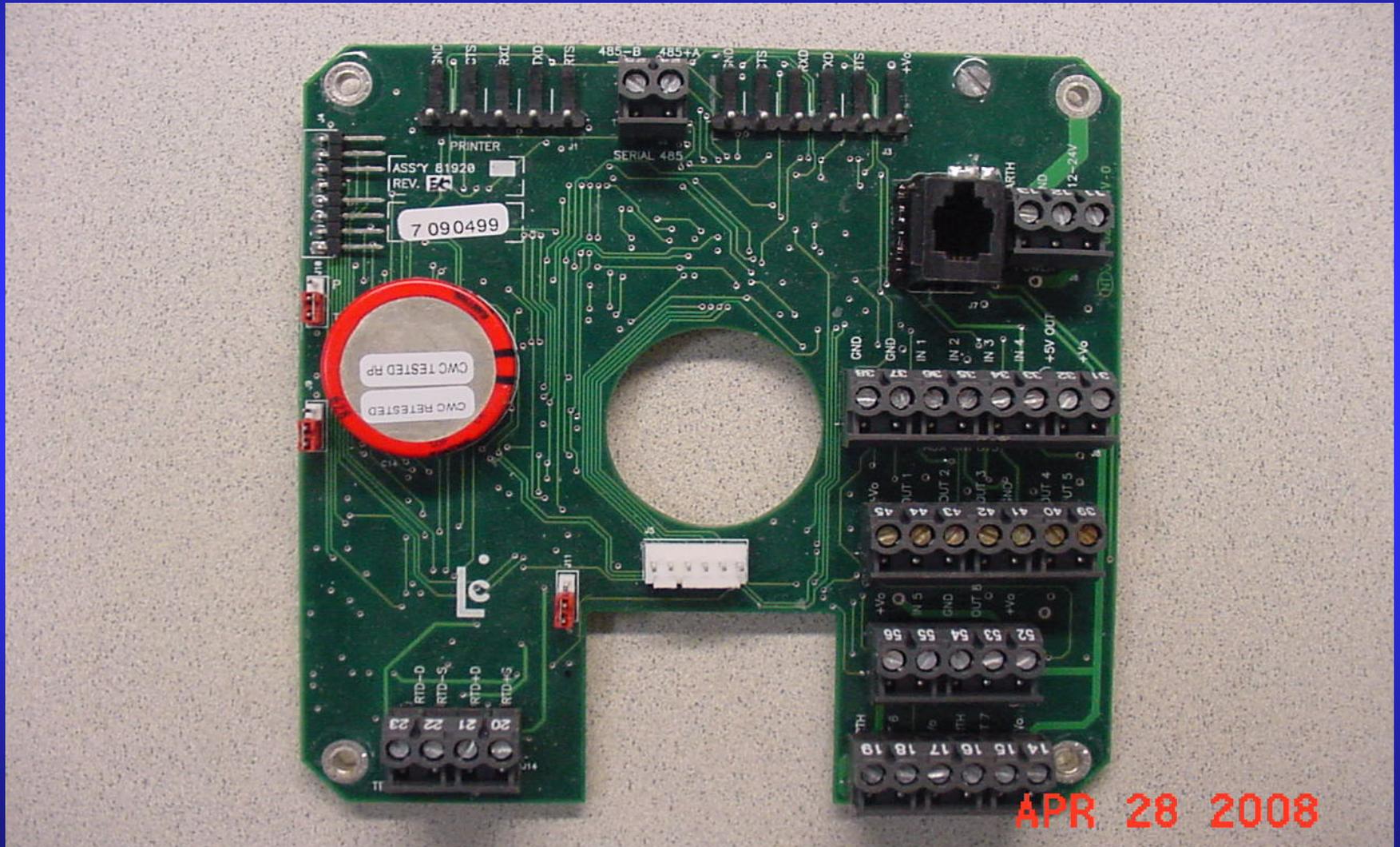
Board Layout – Assy. 840404/5

840404/5– will run LCR-II++ or LCR600 software
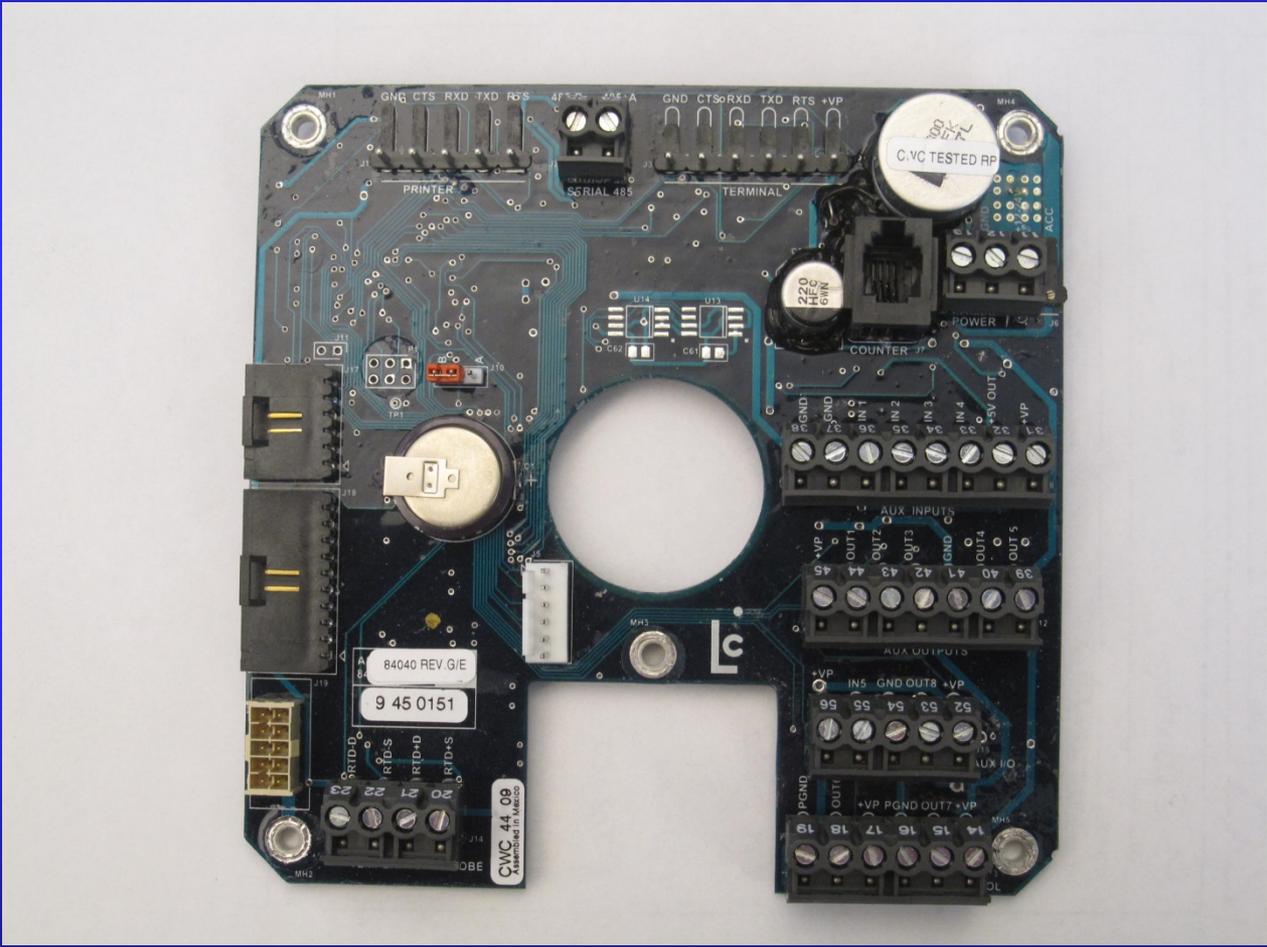
LECTROCOUNT® LCR-II™ CPU 840405 WIRING SCHEMATIC — E3657/E3658

Pub. No. 500405

Setup of the LCR/LCR-II

➢ **How to use the Lappad**

➢ **7 main modes/chapters of the LCR/LCR-II**

➢ **Calibration and Multi-Point Calibration using Lappad**

➢ **Calibration of LCR-II Without Lappad**

➢ **Delivery Using the Lappad**

➢ **Pump and Print Deliveries**

➢ **Printing Delivery Tickets and Shift Reports**

Using the Lappad To Program the LCR/LCR-II:

Use the arrow keys to scroll through the 7 modes/chapters of the Main Menu:

➢ *General Setup* – General information to be programmed during the initial setup of the LCR/LCR-II system. (Date, Time, Preset Functions…)

➢ *System Calibration* – System wide calibration parameters to be programmed during the initial setup of the LCR/LCR-II system. (Units, Rate Base, Decimal Places, Printer Type….)

➢ *Product Calibration* – Product specific calibration parameters to be programmed when calibrating each individual product to be used with the LCR/LCR-II system

➢ *Diagnostic* – Real time system diagnostic information

➢ *Security* – Additional security for systems with Lappad installed full time

➢ *Delivery and Preset* – Setup deliveries, presets and POS pricing/taxing

➢ *Product and Shift Information* – Displays shift and accumulative totalizer Information by product

OPERATOR	Operator can change or enter data.
PASSWORD	System must be unlocked.
WEIGHTS & MEASURES	Switch must be in CALIBRATION position to enter or change data.
FACTORY	*Read only (cannot be changed by operator)*
NOT EDITABLE	Read only (cannot be changed by operator)

The cursor indicates if data can be entered or changed in the field below it. If the cursor is flashing, pressing **ENTER** will move the cursor to the second line in the field and data may be entered or changed. In some cases, data is entered using the keypad. In other cases, data is entered by selecting entries using the ↓↑ keys. A "**^**" Character in the top line of the field indicates that a scroll list is used for the field. In fields that have a "**?**", a "**YES**" or "**NO**" response is selected. Information that is entered through the Lap Pad or selected from a menu of choices is stored in the LCR-II by pressing **ENTER**. The cursor also moves back to the top line of that menu screen.

General Setup - Screen 1

DATE FORMAT^	DATE	TIME HH:MM:SS
MM/DD/YY	10/06/02	09:05:24

General Setup - Screen 2

SALE #	TICKET #	UNIT ID	NO-FLOW TIMER
25	1	123456	180

Lap Pad Security Levels and Functions

Using the Alpha Keys:

➢**To type the Letter "A", press the ALPHA key with the box in the upper left corner (Upper alpha key), then release. Then press the "1" or "A/B" key and the letter "A" should appear**

➢**To type the letter "B", press the ALPHA key with the box in the lower right corner (Lower alpha key), then release. Then press the "1" or A/B Key and the letter "B" should appear**

➢**An ALPHA key most be typed before each letter**

➢**Do not hold down ALPHA key while attempting to type the desired letter.**

```
TICKET NUMBER                    1006

         MID-TOWN PROPANE
         233 SOUTH STREET
         EARFIELD, PA 34225
         (412) 382-6653

     QUALITY SERVICE - DISCOUNT PRICES
        YOUR DRIVER: HARRY HOLMES
    3% DISCOUNT IF PAID IN 7 DAYS !!!

SALE # 45010 DATE 09/02/98 14:27:46
COUNT: START 0.0    END            15.1
GROSS DELIVERY          15.2 GALLONS
NET DELIVERY            15.1 GALLONS
1075   PROPANE              LPG       1
GALLONS CORRECTED TO          60.0ºF
```

```
TICKET NUMBER                    1005
TICKET HEADER LINE 1
TICKET HEADER LINE 2
TICKET HEADER LINE 3
TICKET HEADER LINE 4
TICKET HEADER LINE 5
TICKET HEADER LINE 6
TICKET HEADER LINE 7
TICKET HEADER LINE 8
TICKET HEADER LINE 9
TICKET HEADER LINE 10
TICKET HEADER LINE 11
TICKET HEADER LINE 12
TRUCK/CAMION             35791
METER NUMBER             137566
SALE /VENTE                  45009
                09/02/98 13:36:08
START/DEBUT             0.0 LITRE
GROSS DELIVERY          15.2 LITRE
END  /FIN               15.1 LITRE
PRICE/PRIX          $      1.1200
AMOUNT/MONTANT      $       16.91
TAX/TAXE            $        0.38
TOTAL              $        17.29
AUX QUANTITY           35.9 BARRELS
1993   FUEL OIL           DISTILLAT1
TABLE 6B API GRAVITY=            55
VOL. CORRECTION TO/A          15.0º C
```

```
          Liquid Controls Aviation

Customer:_____

Tail #:_____Flight #:_____

Origin_____Destination_____

Transaction:_____Fueler:_____

METER NUMBER M-60 JET A AVIATION   1
SALE NUMBER                      475
TIME START         09/02/98 13:26:40
TIME END           09/02/98 13:35:58
START COUNT                0 GALLONS
END GROSS COUNT           46 GALLONS
GROSS DELIVERY            46 GALLONS
START TOTALIZER          100 GALLONS
END TOTALIZER            146 GALLONS
```

Alpha Key Usage

General Setup Page 1 Options

General Setup - Screen 1		
DATE FORMAT^	DATE	TIME HH:MM:SS
MM/DD/YY	10/06/02	09:05:24

DATE FORMAT^
This field is used to determine in which format the date will be displayed and printed: month first or day first. Press **ENTER** and the cursor will drop to the second line. Now you can use the arrow keys to select the format, either month first (**MM/DD/YY**) or day first (**DD/MM/YY**). When the choice is displayed, press **ENTER** and the cursor will move back to the top line. Press down arrow and the cursor will move to:

DATE MM/DD/YY (or **DD/MM/YY** depending on the previous field).
This field is used to set the LCR-II internal calendar. The LCR-II updates its calendar and will print the correct date on delivery tickets. Press **ENTER** and the cursor will drop to the bottom line. Enter the current date on the keypad using only numbers. Press **ENTER** and the cursor will move back to the top line. Press down arrow and the cursor will move to:

TIME HH:MM:SS
This field is used to set the LCR-II internal clock. The time, like the date, is updated by the LCR-II and printed on the delivery tickets. Press **ENTER** and the cursor will drop to the bottom line. Enter the current hour, minutes, and seconds. Use **military time** (e.g. press 13:01:15 for 1:01:15 PM).
HINT: To synchronize the clock to the second, press **ENTER** when the appropriate second is reached. Press **ENTER** and the cursor will move to the top line. Press down arrow and the cursor will move to:

General Setup Page 2 Options

General Setup - Screen 2

SALE #	TICKET #	UNIT ID	NO-FLOW TIMER
25	1	123456	180

SALE #

This field is used to track the number of transactions that the LCR-II processes. The LCR-II will increment the field each time a delivery is made, wrapping around to **000000** after **999999**. Press **ENTER** and the cursor will drop to the bottom line. Key in the starting **SALE #**, up to 6 digits. Press **ENTER** and the cursor will move to the top line. Press down arrow and the cursor will move to:

TICKET #

This is similar to the sale number. It will increment every time that the LCR-II prints a ticket. If multiple or duplicate tickets are used for transactions, the ticket number will be incremented more than the sale number. **NOTE**: If a **TICKET # of 0** is entered, the **TICKET #** will not print on the delivery ticket and the **TICKET #** will not increment. Press **ENTER** and the cursor will drop to the bottom line. Key in the starting **TICKET #**, up to 6 digits. Press **ENTER** and the cursor will move to the top line. Press down arrow and the cursor will move to:

UNIT ID

This is a number that can be used to identify the driver, location, or truck that the LCR-II is associated with. Press **ENTER** and the cursor will drop to the bottom line. Key in your **UNIT ID**, up to 10 characters. Press **ENTER** and the cursor will move to the top line. Press down arrow and the cursor will move to:

NO-FLOW TIMER

The **NO-FLOW TIMER** is an internal timer in the LCR-II that starts running when the LCR-II senses that there is no longer any product moving through the meter. If the timer counts up to its set point, the LCR-II will assume that the delivery is over, and print a ticket. The timer can be set to count up to **3600** seconds before printing the ticket. This feature can be deactivated by entering **0** seconds, allowing multiple tanks to be filled at a location. The timer helps to ensure that deliveries are not split between authorized and unauthorized locations. **NO-FLOW TIMER** is not active in prover mode. If the value is set to **0** or any value greater than **180**, "**Multiple Deliveries at One Site**" will be printed on the delivery ticket. **NOTE**: Internal timer is activated once the flow delivery has started and a minimum amount of flow (1 gallon or 5 liters) is registered and then is stopped. Press **ENTER** and the cursor will drop to the bottom line. Enter the desired **NO-FLOW TIMER** number in seconds. Press **ENTER** and the cursor will move to the top line. Press down arrow and the cursor will move to:

General Setup Page 3 Options

General Setup - Screen 3

PRESET^	PRESET TYPE^	PULSE OUTPUT EDGE^
GROSS	CLEAR	RISING

PRESET^
Available preset options include **NET**, **BOTH**, **GROSS**, and **NONE**. Selecting **NONE** will disable presetting. Presetting **NET**, **GROSS**, or **BOTH** is allowed. Press **ENTER** and the cursor will drop to the bottom line. Use down arrow to scroll through the available preset options. When the desired option is displayed, press **ENTER** and the cursor will move to the top line. Press down arrow and the cursor will move to:

PRESET TYPE^
There are three preset types:

> **CLEAR**
> Resets the preset values to **0** after the current delivery is ended.
> **RETAIN**
> Maintains the preset values to be used again on the next delivery.
> **MULTIPLE**
> Allows more than one preset to be run before a delivery ticket is printed. Printing must be initiated by a **PRINT** command.
> **INVENTORY**
> Maintains the remaining preset amount between deliveries (i.e. indicates the remaining volume in the vehicle tank)

Press **ENTER** and the cursor will drop to the bottom line. Use down arrow to scroll through the four options. When the desired choice is displayed, press **ENTER** and the cursor will move to the top line. Press down arrow and the cursor will move to:

PULSE OUTPUT EDGE^
This feature allows you to synchronize the calibrated pulse output waveform with the requirements of an external system that uses that LCR-II signal. There are two choices: **RISING** or **FALLING**. (Some counters increment on rising, others on falling pulse edges. Refer to equipment technical manual to determine the specific requirements of your connected equipment). Press **ENTER** and the cursor will drop to the bottom line. Use □ to scroll between
the two choices. When the desired choice is displayed, press **ENTER** and the cursor will move to the top line. Press down arrow and the cursor will move to:

General Setup Page 4 Options

General Setup - Screen 4

HDR^	TICKET HEADER LINE
1	

HDR^
This field is used to select the line number of the ticket header that will be edited in the following field. Press **ENTER** and the cursor will drop to the bottom line. Use the up or down arrow keys to scroll through the numbers from **1** to **12**. When the desired choice is displayed, press the **ENTER** key and the cursor will move to the top line. Press down arrow and the cursor will move to:

TICKET HEADER LINE
This feature is useful when using blank (as opposed to pre-printed) tickets. The field allows the fuel dealer to enter the company name, address, telephone number, etc., which will be printed on each delivery ticket. This field (35-character max.) allows you to enter or edit ticket header labels. The Header Line will scroll in tandem with the **HDR #** selected in the previous field. Any lines that are left blank will not be printed on the ticket.

NOTE: Header Lines 11 and 12 can only be edited in the **CALIBRATION** mode. **TICKET HEADER LINE 11** only prints when **AUX OUT 1** is **ON** or **ON DURING DELIVERY** as shown on the Lap Pad Screen. **TICKET HEADER LINE 12** only prints when **AUX OUT 2** is **ON** or **ON DURING DELIVERY**. After data has been entered, press **ENTER.** Press down arrow and the cursor will move to:

General Setup Page 5 Options

```
General Setup - Screen 5
┌─────────────────────────────┬─────────────────────────────┐
│ PRINT GROSS & PARAM?        │ VOL CORRECTED MSG?          │
├─────────────────────────────┼─────────────────────────────┤
│ YES                         │ YES                         │
└─────────────────────────────┴─────────────────────────────┘
```

PRINT GROSS & PARAM?
This allows one to choose whether to have the gross volume and compensation parameter printed on the ticket if the product is temperature compensated. Press **ENTER** and the cursor will drop to the bottom line. Use down arrow to scroll between the two choices, **YES** or **NO**. When the desired choice is displayed, press the **ENTER** key and the cursor will move to the top line. Press down arrow and the cursor will move to:

VOL CORRECTED MSG?
This field allows you to print a message on the delivery ticket indicating that delivery volume has been corrected to a base temperature (defined later in **SYSTEM CALIBRATION**). The user has the option (**YES** or **NO**) to print the message. Press **ENTER** and the cursor will drop to the bottom line. Use down arrow to scroll between the two choices, **YES** or **NO**. When the desired choice is displayed, press the **ENTER** key and the cursor will move to the top line. Press **M1** to return to the top of the **GENERAL SETUP** menu.

General Setup

General Setup - Screen 1

DATE FORMAT^	DATE		TIME HH:MM:SS
MM/DD/YY	10/06/02		09:05:24

General Setup - Screen 2

SALE #	TICKET #	UNIT ID	NO-FLOW TIMER
25	1	123456	180

General Setup - Screen 3

PRESET^	PRESET TYPE^	PULSE OUTPUT EDGE^
GROSS	CLEAR	RISING

General Setup - Screen 4

HDR^	TICKET HEADER LINE
1	

General Setup - Screen 5

PRINT GROSS & PARAM?	VOL CORRECTED MSG?
YES	YES

General Setup Old

System Calibration Page 1 Options

```
System Calibration - Screen 1
```

METER ID	TICKET?	PRINTER
1234567890	YES	EPSON NewFontB

METER ID
This number allows you to uniquely identify an LCR-II/Meter combination. If the LCR-II is part of a multimeter system, it is important that this number be unique. It is recommended that the meter serial number be entered here. This number will print on the calibration/diagnostic ticket. Press **ENTER** and the cursor will drop to the bottom line. Key in 1 to 10 characters. Press **ENTER** and the cursor will move to the top line. Press down arrow and the cursor will move to:

TICKET?
This field allows you to choose whether or not a ticket will be required for each delivery. Most Weights & Measures governed truck applications will require a ticket. If **YES** is chosen, the LCR-II will not allow deliveries to be made unless a ticket is in the printer, the printer is operational and the previous delivery ticket has been printed in its entirety. Press **ENTER** and the cursor will drop to the bottom line. Use down arrow to scroll between the two choices, **YES** or **NO**. When the desired choice is displayed, press **ENTER**. The cursor will move to the top line. When **NO** is selected, tickets are not mandatory but will print if a printer is connected and available to print a ticket. Press down arrow and the cursor will move to:

PRINTER^
This field allows you to select a printer type. The six choices are **EPSON NewFontB** (select for use with EPSON 200 Roll and EPSON 220 Roll), **EPSON NewFontA** (select for use with EPSON TM-T88ii), **EPSON OldFontA** (select for use with EPSON 290 or 295 Slip), **EPSON OldFontB** (select for use with EPSON 300 Roll), **Okidata ML184T (select**or for use with Okidata ML184T), **Blaster** (select for use with Cognitive Solutions Thermal Printer). Press **ENTER** and the cursor will drop to the bottom line. Use down arrow to scroll between the choices. When the desired choice is displayed, press **ENTER** and the cursor will move to the top line. Press down arrow and the cursor will move to:

Available Printer Types

Epson TMU 295

Epson TMU 200

Axiohm Blaster

Epson TM T88III

Epson TMU 220

Okidata

Printer Types

System Calibration Page 2 Options

System Calibration - Screen 2

UNITS^	RATE BASE^	DECIMAL^	RESIDUAL^
GALLONS	PER MINUTE	TENTHS	ROUND

UNITS^
This field is used to choose the units of flow measurement. The choices are **GALLONS**, **LITRES**, **CUBIC M**, **LBS** (pounds), **KGS** (kilograms), **BARRELS**, and **OTHER**. Press **ENTER** and the cursor will drop to the bottom line. Use the up or down arrow keys to scroll through the choices. When the desired choice is displayed, press **ENTER** and the cursor will move to the top line. Press down arrow and the cursor will move to:

RATE BASE^
Use this field to select the time unit for measurement on the flow rate display. The choices are rate **PER HOUR**, **PER MINUTE** and **PER SECOND**. Press **ENTER** and the cursor will drop to the bottom line. Use down arrow to scroll between the three choices. When the desired choice is displayed, press **ENTER** and the cursor will move to the top line. Press down arrow and the cursor will move to:

DECIMAL^
This field allows you to choose between whole units, tenths and hundredths of a unit. Press **ENTER** and the cursor will drop to the bottom line. Use down arrow to scroll between **WHOLE**, **TENTHS**, and **HUNDR**. When the desired choice is displayed press **ENTER** and the cursor will move to the top line. Press down arrow and the cursor will move to:

RESIDUAL^
Volumes less than the least significant digit can be rounded into that digit or truncated (thrown away) depending on the selection mode. Press **ENTER** and the cursor will drop to the bottom line. Press down arrow to scroll between **ROUND** and **TRUNCATE**. When the desired choice is displayed press **ENTER** and the cursor will move to the top line. Press down arrow and the cursor will move to:

System Calibration Page 3 Options

System Calibration - Screen 3				
TEMP	**OFFSET**	**T UNIT^**	**RTD SLP**	**RTD OFS**
25.53	0.00	DEG. F	0.024724	2.817

TEMP
This field displays the current temperature reading from the RTD temperature probe and allows one to enter a corrected value from a Weights & Measures thermometer. If the LCR-II is not equipped with the optional Electronic Temperature Volume Compensation (ETVC) Kit, this field will read **"------".**

> **To make a correction:** Run enough product through the meter to allow the temperature to stabilize. Compare the **TEMP** reading with the current Weights & Measures thermometer reading. If the readings are different, the Weights & Measures reading should be entered. Press **ENTER** and the cursor will drop to the bottom line. Enter the new value. The new value will overwrite the previous one and the **OFFSET** field will be recalculated by the LCR-II. Offset adjustments are limited to ±0.3°C (±0.54°F). Adjustments greater than this limit require replacement of the RTD probe. Press **ENTER** and the cursor will move to the top line. Press down arrow and the cursor will move to:

OFFSET
The offset represents the difference between the official Weights & Measures reading and the LCR-II RTD reading. The offset is automatically calculated if an entry is made in the previous field. If a Weights & Measures thermometer reading was not entered in the previous field, subtract the value listed in the **TEMP** field from the Weights & Measures measurement. Key in the difference in the offset field. If the number is negative, use "*" on the Lap Pad to change the sign. Adjustment is limited to ±0.3°C (±0.54°F). Any adjustment larger than ±0.3°C (±0.54°F) generates a "**RANGE ERROR**" message and requires replacement of the RTD probe. Press down arrow and the cursor will move to:

T UNIT^
This field allows you to choose the temperature units - Degrees Fahrenheit or Degrees Celsius. Press **ENTER** and the cursor will drop to the bottom line. Use down arrow to scroll between the two choices, **DEG. F** and **DEG. C**. When the desired choice is displayed, press **ENTER** and the cursor will move to the top line. Press down arrow and the cursor will move to:

RTD SLP
Factory calibration setting only. Press down arrow and the cursor will move to:

RTD OFS
Factory calibration setting only. Press down arrow and the cursor will move to:

System Calibration Page 4 Options

System Calibration - Screen 4

FLOW DIR^	LAST CALIBRATED	LCR #
→	07/11/02 11:44:00	250

FLOW DIR^
This field allows you to match the LCR-II flow direction to the meter's pulse output. If the counter runs backwards, this arrow should be changed. The choices are left to right arrow or right to left arrow. Press **ENTER** and the cursor will drop to the bottom line. Use down arrow to scroll between the two choices, When the desired choice is displayed, press **ENTER**. Press down arrow and the cursor will move to:

LAST CALIBRATED
This field contains the date and time of the last calibration. It cannot be edited. Press down arrow and the cursor will move to:

LCR #
This field contains the node address for RS485 communication. Enter a number between 1 and 250. The default value is 250. Press down arrow and the cursor will move to:

System Calibration Page 5 Options

System Calibration - Screen 5

CALIB #	CALIB EVENT	CONFIG EVENT
34	19	1

CALIB #
For metrology use only. This is the number of times the calibration switch position has been entered. **DISPLAY ONLY.** Press the down arrow and the curser will move to:

CALIB EVENT
For metrology use only. This is the number of times the calibration has been changed. **DISPLAY ONLY**. Press the down arrow and the curser will move to:

CONFIG EVENT
For metrology use only. This is the number of times the configuration has been changed. **DISPLAY ONLY.**
Press the **M1** key to return to the top of the **SYSTEM CALIBRATION** menu. Press down arrow to move to:
PRODUCT CALIBRATION

System Calibration

System Calibration - Screen 1

METER ID	TICKET?	PRINTER^
1234567890	YES	EPSON 295 SLIP

System Calibration - Screen 2

UNITS^	RATE BASE^	DECIMAL^	RESIDUAL^
GALLONS	PER MINUTE	TENTHS	ROUND

System Calibration - Screen 3

TEMP	OFFSET	T UNIT^	RTD SLP	RTD OFS
25.53	0.00	DEG. F	0.024724	2.817

System Calibration - Screen 4

FLOW DIR^	LAST CALIBRATED	LCR #
→	07/11/02 11:44:00	250

System Calibration - Screen 5

CALIB #	CALIB EVENT	CONFIG EVENT
34	19	1

Product Calibration Page 1 Options

Product Calibration - Screen 1

#^	CODE	PRODUCT NAME	PROD TYPE^
1	12345	Product Name	**DISTILLATE**

#^(Product Number)
This number will correspond to one of the four product types/calibrations that can be set up in the LCR-II. At least one calibration must be set up to allow deliveries. Press ENTER and the cursor will drop to the bottom line. Use down arrow to scroll between the four choices, 1 to 4. Press the ENTER key when the desired choice is displayed. Press down arrow and the cursor will move to:

CODE
A five character alphanumeric code can be entered here. The code will correspond to one of the products within this product type. This code can also be entered in the DELIVERY & PRESET menu. Press ENTER and the cursor will drop to the bottom line. Enter a code that will aid the operator in identifying the product or one that has been specified for use by a host computer system. Press ENTER and the cursor will move to the top line. Press down arrow and the cursor will move to:

PRODUCT NAME
The PRODUCT NAME contains a product description (up to 18 alphanumeric characters) that will print on the delivery ticket. NOTE: Make sure that the PRODUCT NAME matches up with the PROD TYPE^, #^, and CODE that are also entered on this screen. This name can also be entered in the DELIVERY & PRESET menu. Press ENTER and the cursor will drop to the bottom line. Enter the appropriate PRODUCT NAME. Press ENTER and the cursor will move to the top line. Press down arrow and the cursor will move to:

PROD TYPE^
This field will scroll along with the #^(Product Number) that is shown in the first field. The product type AMMONIA, AVIATION, DISTILLATE, GASOLINE, METHANOL, LPG, LUBE OIL and "blank" can also be set up in the PRODUCT & SHIFT INFORMATION menu. Press down arrow and the cursor will move to:

Product Calibration Page 2 Options

Product Calibration – Screen 2

COMPENSATION TYPE	COMP PARAM	BASE TEMP
TABLE 54B	653	15.0

COMPENSATION TYPE^
Select the type of Temperature Volume Compensation to be used for this specific product number. No deliveries are permitted if the LCR-II is configured for temperature compensation and the temperature circuit has failed or the measured temperature is out of the specified range (see Table in Appendix A). Scroll through the choices: **Linear F, Linear C, API Table 24, API Table 54, API Table 6B, API Table 54B, API Table 54C, API Table 54D, NH3** or **NONE**. If "**NONE**" is selected, deliveries will be in gross quantities only. Net Quantities will read "**0**" on the screen. Refer to the **Compensation Types and Parameters** table (Appendix A) when choosing the type of compensation to be used. Press the down arrow and the curser will move to:

COMP PARAM
This field contains the coefficient of expansion, the standard density, API gravity, or the specific gravity that will be used with the **COMPENSATION TYPE** selected in the previous field. Enter a number based on the **COMPENSATION TYPE** and the product that is being metered. Refer to the **Compensation Types and Parameters** table found in Appendix A. Press the down arrow and the curser will move to:

BASE TEMP
This field is used to set the base temperature for temperature compensated deliveries when using either the **Linear C** or **Linear F** Compensation type. It defaults to either 60°F or 15°C when using either the API tables or NH3. Enter a number. Press **ENTER** to return to the top line. Press down arrow and the cursor will move to:

Compensation Types and Parameters

Product	VCF Type	Parameter Coefficient	Range	Scale ºC or ºF	T_{base}	T_{min}	T_{hold}	T_{max}
General	Linear	Linear	0 to 0.005	ºC	15	-90	N/A	+100
General	Linear	Linear	0 to 0.0025	ºF	60	-130	N/A	+212
LPG *USA*	API Table 24	Specific Gravity	0.500 to 0.550	ºF	60	-50	-50	+140
LPG *Europe & Canada*	API Table 54	Density kg/L	0.500 to 0.600	ºC	15	-46	-46	+60
Refined Petroleum Products *Europe & Canada*	API Table 54B	Density kg/m^3	653.0 to 1075.0	ºC	15	-50	-40	+95
Refined Petroleum Products *USA*	API Table 6B	API Gravity	0 to 85	ºF	60	-50	-40	+200
General	API Table 54C	Coefficient	0.000486 to 0.001674	ºC	15	-50	-40	+95
Lube Oil *Europe & Canada*	API Table 54B	Density kg/m^3	800 to 1164	ºC	15	-50	-40	+95
Ammonia *Canada*	NH_3	N/A	N/A	ºC	15	-30	-30	+40

Compensation Types and Parameters

Product Calibration Page 3 Options

Product Calibration - Screen 3			
#^	PULSE/UNIT	PROVER QTY	UNITS^
1	1111.000000	0.000	GALLONS

#^ (**Product Number**)
This number will correspond to one of the four product types/calibrations that can be set up in the LCR-II. At least one calibration must be set up to allow deliveries. Press down arrow and the curser will move to:

PULSES/UNIT
This field is the number of pulse edges that the LCR-II counts per unit of measure. (Only Gross Volume applies). This number is used to scale the **PROVER QTY** (Gross). Press down arrow and the curser will move to:

PROVER QTY
This field displays the metered volume. When this value is overwritten with the actual **PROVER QTY**, a new **PULSES/UNIT** (k-Factor) will be recalculated automatically. (Only for Calibration use.) If this is the initial calibration for this meter, first enter the rest of the **PRODUCT CALIBRATION** data before entering this field. Once the other **PRODUCT CALIBRATION** parameters are entered, press **START** and fill up a reliable prover. As the prover is filled, this field will increment, displaying a volume based on the existing **PULSES/UNIT** parameter. After the prover has been filled, press **PRINT** and enter the exact prover reading in place of the reading displayed. When the new reading is entered, the **PULSES/UNIT** parameter will be recalculated by the LCR-II, "zeroing" out the error. Refill the prover. Check to ensure that the prover and LCR-II gross volumes are within tolerance limits. If not, enter the new prover volume, and retest. Press down arrow and the cursor will move to:

UNITS^
This field is used to choose the units of flow measurement. The choices are **GALLONS**, **LITRES**, **CUBIC M**, **LBS** (pounds), **KGS** (kilograms), **BARRELS**, and **OTHER**. Press **ENTER** and the cursor will drop to the bottom line. Use the up or down arrow keys to scroll through the choices. This is a global unit of measure that is product specific and when changed in one field will change accordingly in all related fields in other menus. Press down arrow and the cursor will move to:

Nominal Pulses - Product Calibration

LC Meter Size	Max Flow Rate	Revs/Gallon	Pulse Edges/ Gallon	Pulse Edges/ Litre
P	60	12.237	4894.8	1293.11
M/MA5	60	4.079	1631.6	431.04
M/MA7/10	150	5.555	2222.0	587.01
M/MA15/25	300	2.058	823.2	217.47
M30/40	450	0.742	296.8	78.41
M60/80	800	0.398	159.2	42.06
MS-75	700	0.255	102.0	26.95
MS-120	1200	0.158	63.2	16.70

APPENDIX D: NOMINAL RAW PULSER RESOLUTION (100 ppr encoder)

Product Calibration Page 4 Options

Product Calibration – Screen 4			
GROSS COUNT	PRESET	REMAINING	UNITS^
0.0	0.0	============	GALLONS

GROSS QTY
This field displays the gross delivery total for the product being delivered. DISPLAY ONLY. Press down arrow and the curser will move to:

PRESET
The Gross Preset amount is entered here. When this amount is reached the valve outputs are turned off. This feature is not enabled in the Calibration Mode. Press down arrow and the curser will move to:

REMAINING
The number of units remaining to be delivered on the current **GROSS DELIVERY** preset is displayed. This feature is not enabled in the Calibration Mode. Press down arrow and the curser will move to:

UNITS^
This field is used to choose the units of flow measurement. The choices are **GALLONS**, **LITRES**, **CUBIC M**, **LBS** (pounds), **KGS** (kilograms), **BARRELS**, and **OTHER**. Press **ENTER** and the cursor will drop to the bottom line. Use the up or down arrow keys to scroll through the choices. This is a global unit of measure that is product specific and when changed in one field will change accordingly in all related fields in other menus. Press down arrow and the cursor will move to:

Product Calibration Page 5 Options

Product Calibration – Screen 5			
GROSS QTY	NET QTY	UNITS^	TEMP
0.0	0.0	GALLONS	23.4

GROSS QTY
This field displays the gross delivery total for the product being delivered. DISPLAY ONLY. Press down arrow and the curser will move to:

NET QTY
This field will show the **NET QTY** of the delivery in progress, or the last delivery if the meter isn't running. DISPLAY ONLY. The net quantity is calculated by multiplying the gross quantity by the calculated Volume Correction Factor (VCF). If no compensation is active, it is set to zero. The VCF calculation is based in part on the temperature reading from the RTD and the offset that was calculated/entered in the **SYSTEM CALIBRATION** menu. Press down arrow and the curser will move to:

UNITS^
This field is used to choose the units of flow measurement. The choices are **GALLONS**, **LITRES**, **CUBIC M**, **LBS** (pounds), **KGS** (kilograms), **BARRELS**, and **OTHER**. Press **ENTER** and the cursor will drop to the bottom line. Use the up or down arrow keys to scroll through the choices. This is a global unit of measure that is product specific and when changed in one field will change accordingly in all related fields in other menus. Press down arrow and the cursor will move to:

TEMP
This displays the actual product temperature if the optional ETVC Kit is installed. DISPLAY ONLY. Press down arrow and the curser will move to:

Product Calibration Page 6 Options

Product Calibration – Screen 6

S1 CLOSE	AUX MULT	AUX QTY	AUX UNIT^
0.0	0.000	0.0	LITRES

S1 CLOSE
This number is used to set the dwell period if the LCR-II is controlling a two-stage valve or presetting with a one-stage valve. This represents the number of measurement units (e.g. **GALLONS**, **LITRES**) that are remaining on a preset delivery before the valve is placed in a bypass, trickle, or dwell mode. An **S1 CLOSE** value is needed for each of the four product numbers. Enter a number between 0 and 500. The number entered here will match up with the **#^(Product Number)** that was selected in the first field of this menu. Press down arrow and the curser will move to:

AUX MULT
This field is used to convert the quantity delivered, (e.g. **GALLONS**, **LITRES**) to an alternate volume or mass unit such as **CUBIC METERS**, **LBS**, etc. The user must furnish an applicable conversion factor. If **AUX MULT** is set to **0**, it will not print on the delivery ticket. Example: To convert **GALLONS** to **LBS**, **AUX MULT** is calculated as follows:

$$\text{AUX MULT} = (SpGr) \times (8.345 \text{ lbs/gal})$$
(Where SpGr is the specific gravity.)

Press down arrow and the curser will move to:

AUX QTY
This field is used to display the volume delivered in terms of the alternate volume or mass unit. Press down arrow and the curser will move to:

AUX UNIT^
This field is used to define the auxiliary unit of measure that will be printed on the delivery ticket, i.e., **GALLONS**, **LITRES**, **CUBIC M**, **LBS**, **KGS**, **BARRELS**, or **OTHER**. Press down arrow and the curser will move to:

Product Calibration Page 7 Options

Product Calibration - Screen 7

PT^	RATE	UNITS^	RATE BASE^	%ERROR
1	0.00	GALLONS	PER MINUTE	0.000

PT^
This field is used to calibrate the meter/register at up to 10 different flow rates for each product type/calibration. Press down arrow and the curser will move to:

RATE
This field displays actual flow rate during delivery. Enter the actual flow rate for multi-point calibration. Press down arrow and the curser will move to:

UNITS^
This field is used to choose the units of flow measurement. The choices are **GALLONS**, **LITRES**, **CUBIC M**, **LBS** (pounds), **KGS** (kilograms), **BARRELS**, and **OTHER**. Press **ENTER** and the cursor will drop to the bottom line. Use the up or down arrow keys to scroll through the choices. This is a global unit of measure that is product specific and when changed in one field will change accordingly in all related fields in other menus. Press down arrow and the cursor will move to:

RATE BASE^
Choose the time unit for measurement on the flow rate display. The choices are units **PER HOUR**, **PER MINUTE** and **PER SECOND**. Use the up arrow or down arrow keys to scroll through the choices. Press **ENTER** to make a selection. Press down arrow and the curser will move to:

%ERROR
This field contains the **%ERROR** difference against the base number.

$$\%ERROR = \frac{(PROVER\ QTY - METER\ QTY)}{PROVER\ QTY} \times 100$$

Press down arrow and the curser will move to:

Product Calibration Page 8 Options

Product Calibration – Screen 8

PT^	PROVER QTY	UNITS^	%ERROR	LINEAR^
1	0.000	GALLONS	0.000	SETUP

PT^
This field is used to calibrate the meter/register at up to 10 different flow rates for each product type/calibration. Press down arrow and the curser will move to:

PROVER QTY
This field needs to contain the exact volume in the prover tank tested at actual flow rate. When an entry is made, the actual **%ERROR** (delivery) against the base number will be recalculated automatically. Press down arrow and the curser will move to:

UNITS^
This field is used to choose the units of flow measurement. The choices are **GALLONS**, **LITRES**, **CUBIC M**, **LBS** (pounds), **KGS** (kilograms), **BARRELS**, and **OTHER**. Press **ENTER** and the cursor will drop to the bottom line. Use the up or down arrow keys to scroll through the choices. This is a global unit of measure that is product specific and when changed in one field will change accordingly in all related fields in other menus. Press down arrow and the cursor will move to:
.
%ERROR
This field contains the **%ERROR** difference against the base number.

$$\%ERROR = \frac{(PROVER\ QTY - METER\ QTY)}{PROVER\ QTY} \times 100$$

Press down arrow and the curser will move to:

LINEAR^
Select **SETUP** for single-point calibration or when setting up multi-point calibration. Select **APPLIED** to activate multi-point calibration.

Press down arrow and the curser moves to the first field in Product Calibration Screen 1.

Product Calibration

Product Calibration - Screen 1

#^	CODE	PRODUCT NAME	PROD TYPE^
1	12345	Product Name	DISTILLATE

Product Calibration – Screen 2

COMPENSATION TYPE	COMP PARAM	BASE TEMP
TABLE 54B	653	15.0

Product Calibration - Screen 3

#^	PULSE/UNIT	PROVER QTY	UNITS^
1	1111.000000	0.000	GALLONS

Product Calibration – Screen 4

GROSS QTY	PRESET	RAMAINING	UNITS^
0.0	0.0	--------------	GALLONS

Product Calibration – Screen 5

GROSS QTY	NET QTY	UNITS^	TEMP
0.0	0.0	GALLONS	23.4

Product Calibration – Screen 6

S1 CLOSE	AUX MULT	AUX QTY	AUX UNIT^
0.0	0.000	0.0	LITRES

Product Calibration - Screen 7

PT^	RATE	UNITS^	RATE BASE^	%ERROR
1	0.00	GALLONS	PER MINUTE	0.000

Product Calibration – Screen 8

PT^	PROVER QTY	UNITS^	%ERROR	LINEAR^
1	0.000	GALLONS	0.000	SETUP

Product Calibration Old

Diagnostics Page 1 Options

Diagnostics – Screen 1

DIAGNOSTIC MESSAGES^	SUPPLY VOLTAGE
TVC ACTIVE	13.5

DIAGNOSTIC MESSAGES^
This field allows an operator to check pending diagnostic messages. Press **ENTER** and the cursor will drop to the second line of the screen. Press down arrow to scroll through the list of messages. The last message is "**END OF LIST**". Press down arrow and the curser will move to:

SUPPLY VOLTAGE
The field shows the current supply voltage. The correct operating voltage is +9 to +28 VDC.
DISPLAY ONLY. **NOTE: Voltage above +17 VDC will not indicate correctly.** Press down arrow and the curser will move to:

Diagnostics Page 2 Options

Diagnostics – Screen 2		
SOFTWARE	LANGUAGE	TICKET
SR210v1.00	SL200v1.04	ST200v1.05

SOFTWARE
The software number is shown here. This number is critical for any troubleshooting discussions with the Liquid Controls factory service personnel. Press down arrow and the curser will move to:

LANGUAGE
The software number designating language selection (English, Spanish, etc.) is displayed here. DISPLAY ONLY. Press down arrow and the curser will move to:

TICKET
The software number designating the ticket format is displayed here. DISPLAY ONLY. Press down arrow and the curser will move to:

Software Part Numbering System

Base Software
SR210 - USA, Canada
SR212 - Europe
SR214 - Aviation
SR215 - Aviation P&P Active
SR219 - Railroad

Language
SL200 - English
SL201 - Spanish
SL202 - French Canadian
SL203 - Portuguese
SL204 - Swiss/German
SL205 - Dutch
SL206 - Portuguese
SL207 - Swedish
SL208 - Polish
SL210 - Italian
SL211 - French/France
SL212 - Turkish

Ticket
ST200 - Standard Form
ST201 - Canadian (English/French)
ST202 - Compressed Format
ST203 - Hand Held Computer Format
ST204 - Spanish
ST206 - Compressed w/ Subtotal Pricing
ST208 - No Multiple Delivery Message (US Only)
ST210 - Aviation Format
ST212 - Double Spaced English/French
ST213 - Portuguese for Brazil
ST214 - Swiss/German
ST215 - Compressed Format w/ Price & Taxes
ST216 - Fixed Length, Short Form
ST217 - Dutch
ST220 - German
ST222 - Portuguese for Portugal
ST223 - French, Soft Form Unpriced
ST224 - Spanish, Standard Priced
ST227 - Swedish
ST228 - Compressed w/ Price, w/o Multiple Message & Time
ST229 - Polish
ST230 - Italian
ST232 - French for France
ST234 - Turkish
ST236 - Short Form Unpriced w/ Totalizers
ST241 - Aviation with Ticket Header Available
ST242 - Aviation Unpriced, Spanish
ST245 - Standard Polish w/o Price
ST246 - Double Spaced w/o Labels
ST247 - Standard Priced English w/ Temperature
ST250 - Aviation with Differential Pressure

Diagnostics Page 3 Options

Diagnostics – Screen 3			
GROSS COUNT	RATE	UNITS^	RATE BASE^
0	0.0	GALLONS	PER MINUTE

GROSS COUNT
This field displays a running total of the gross number of units for the current delivery. DISPLAY ONLY. Press down arrow and the curser will move to:

RATE
This field displays the actual flow rate. DISPLAY ONLY. Press down arrow and the curser will move to:

UNITS^
This field is used to choose the units of flow measurement. The choices are **GALLONS**, **LITRES**, **CUBIC M**, **LBS** (pounds), **KGS** (kilograms), **BARRELS**, and **OTHER**. Press **ENTER** and the cursor will drop to the bottom line. Use the up or down arrow keys to scroll through the choices. This is a global unit of measure that is product specific and when changed in one field will change accordingly in all related fields in other menus. Press down arrow and the cursor will move to:

.
RATE BASE^
Choose the time unit for measurement on the flow rate display. The choices are units **PER HOUR**, **PER MINUTE** and **PER SECOND**. Use the up arrow or down arrow keys to scroll through the choices. Press **ENTER** to make a selection. This a global setting that is initially set in System Calibration. Press down arrow and the curser will move to:

Diagnostics Page 4 Options

Diagnostics – Screen 4

PULSR FAULTS
(0)

PULSR FAULTS
This field displays the number of Quadrature pulser faults detected during the last delivery. DISPLAY ONLY.

Press down arrow and the curser moves to the first field in Diagnostics Screen 1.

Diagnostics

Diagnostics – Screen 1

DIAGNOSTIC MESSAGES^	SUPPLY VOLTAGE
TVC ACTIVE	13.5

Diagnostics – Screen 2

SOFTWARE	LANGUAGE	TICKET
SR210v1.00	SL200v1.04	ST200v1.05

Diagnostics – Screen 3

GROSS COUNT	RATE	UNITS^	RATE BASE^
0	0.0	GALLONS	PER MINUTE

Diagnostics – Screen 4

PULSR FAULTS
0

Security Page 1 Options

Security Screen 1		
USER KEY	SECURITY^	
00001	UNLOCKED	

USER KEY (Password)
Use this field to enter the owner/office password. To enter a password, press **ENTER** to drop into the data entry field. Enter a password using up to 10 alphanumeric characters. Press **ENTER**. This password will be required in the future to unlock the system in order to gain access to secured menu and data entry fields. This password will also be needed to change the time using the LCR-II control buttons. If it is desired to have access to time adjustment, the **USER KEY** must be numeric only and contain 5 digits. Press down arrow and the cursor will move to:

SECURITY^
This field is used to lock the system. Press **ENTER** to drop to the bottom field. Use down arrow to scroll between **LOCKED** and **UNLOCKED**. Press **ENTER** to select the desired option. While the system is **LOCKED**, the operator is unable to change system data other than **GROSS** and **NET PRESETS**, **PRODUCT CODE**, **PRODUCT NAME**, and **NO FLOW TIMER**. **NOTE**: The LCR-II is shipped **LOCKED** from the factory.

Press down arrow and the curser will return to the first option on Security Screen 1.

Security

Security Screen 1

USER KEY	SECURITY^	
00001	UNLOCKED	

Factory Calibration

Factory – Screen 1

R100.0	R128.6	RAW ADC	RTD SLP	RTD OFS
-105.2	2884.7	796	0.024750	2.605

Factory – Screen 2

SERIAL ID	USER KEY	LCR RESET^
7200015		NO

Delivery & Preset - Page 1 Options

Delivery & Preset – Screen 1

#^	CODE	PRODUCT NAME	PRODUCT TYPE^
1	12345	PRODUCT NAME	**DISTILLATE**

#^ (PRODUCT)
This field is used to select the product type that will be delivered. Scroll through numbers **1- 4** and select the product. Press down arrow and the curser will move to:

CODE
The code associated with the product name and type is displayed here and can be changed (refer to procedure in Product Calibration Menu). Press down arrow and the curser will move to:

PRODUCT NAME
The product name associated with the product code and type is displayed here and can be changed (refer to procedure in Product Calibration Menu). Press down arrow and the curser will move to:

PRODUCT TYPE^
This field displays the product type previously selected in **CALIBRATION**. Press down arrow and the curser will move to:

Delivery & Preset - Page 2 Options

Delivery & Preset – Screen 2

GROSS COUNT	NET COUNT	UNITS^
0.0	0.0	**GALLONS**

GROSS COUNT
This field displays a running total of the gross number of units for the current delivery. **DISPLAY ONLY.** Press down arrow and the curser will move to:

NET COUNT
This field displays a running total of the net number of units for the current delivery. DISPLAY ONLY. Press down arrow and the curser will move to:

UNITS^
This field is used to choose the units of flow measurement. The choices are **GALLONS**, **LITRES**, **CUBIC M**, **LBS** (pounds), **KGS** (kilograms), **BARRELS**, and **OTHER**. Press **ENTER** and the cursor will drop to the bottom line. Use the up arrow or down arrow keys to scroll through the choices. This is a global unit of measure that is product specific and when changed in one field will change accordingly in all related fields in other menus. Press down arrow and the cursor will move to:

Delivery & Preset - Page 3 Options

Delivery & Preset – Screen 3 (NOTE: This screen displays only if "Preset" is set to **NET** or General Setup – Screen 3 and the current product is temperature compensated).

NET COUNT	PRESET	REMAINING	UNITS^
0.0	0.0	‒ ‒ ‒ ‒ ‒ ‒ ‒ ‒ ‒ ‒ ‒	**GALLONS**

NET COUNT
This field displays a running total of the net number of units for the current delivery. DISPLAY ONLY. Press down arrow and the curser will move to:

PRESET
The **NET PRESET** amount can be entered here. A preset option of **NET** or **BOTH** must have been selected in **GENERAL SETUP**. Press the **ENTER** key and the curser will drop to the lower line. Enter a number value for the required Preset. Press **ENTER** and the cursor will move to the top line. Press down arrow and the curser will move to:

REMAINING
This field displays the number of units remaining for the current preset delivery. DISPLAY ONLY. Press down arrow and the curser will move to:

UNITS^
This field is used to choose the units of flow measurement. The choices are **GALLONS**, **LITRES**, **CUBIC M**, **LBS** (pounds), **KGS** (kilograms), **BARRELS**, and **OTHER**. Press **ENTER** and the cursor will drop to the bottom line. Use the up arrow or down arrow keys to scroll through the choices. This is a global unit of measure that is product specific and when changed in one field will change accordingly in all related fields in other menus. Press down arrow and the cursor will move to:

Delivery & Preset - Page 4 Options

Delivery & Preset – Screen 4 (NOTE: This screen displays only if "Preset" is set to **GROSS** or **BOTH** in General Setup – Screen 3).

GROSS COUNT	PRESET	REMAINING	UNITS^
0.0	0.0	- - - - - - - - - - - -	GALLONS

GROSS COUNT
This field displays a running total of the gross number of units for the current delivery. DISPLAY ONLY. Press down arrow and the curser will move to:

PRESET
The **GROSS PRESET** amount can be entered here. A preset option of **GROSS** or **BOTH** must have been selected in **GENERAL SETUP**. Press the **ENTER** key and the curser will drop to the lower line. Enter a number value for the required Preset. Press **ENTER** and the cursor will move to the top line. Press down arrow and the curser will move to:

REMAINING
This field displays the number of units remaining for the current preset delivery. DISPLAY ONLY. Press down arrow and the curser will move to:

UNITS^
This field is used to choose the units of flow measurement. The choices are **GALLONS**, **LITRES**, **CUBIC M**, **LBS** (pounds), **KGS** (kilograms), **BARRELS**, and **OTHER**. Press **ENTER** and the cursor will drop to the bottom line. Use the up arrow or down arrow keys to scroll through the choices. This is a global unit of measure that is product specific and when changed in one field will change accordingly in all related fields in other menus. Press down arrow and the cursor will move to:

Delivery & Preset - Page 5 Options

Delivery & Preset – Screen 5

PRICE/UNIT	TAX/UNIT	%TAX
0.0000	0.0000	0.0000

PRICE/UNIT
Press the **ENTER** key and the curser will drop to the lower line. Enter a number value for the required Price/Unit if applicable.
Press **ENTER** and the cursor will move to the top line. Press down arrow and the curser will move to:

TAX/UNIT
Press the **ENTER** key and the curser will drop to the lower line. Enter a number value for the required Tax/Unit if applicable.
Press **ENTER** and the cursor will move to the top line. Press down arrow and the curser will move to:

%TAX
Press the **ENTER** key and the curser will drop to the lower line. Enter a number value for the required % Tax if applicable.
Press **ENTER** and the cursor will move to the top line. Press down arrow and the curser will move to:

Delivery & Preset - Page 6 Options

Delivery & Preset – Screen 6

SUBTOTAL	TAX	TOTAL
0.0000	0.0000	0.0000

SUBTOTAL
Price per unit times quantity. DISPLAY ONLY. Press down arrow and the curser will move to:

TAX
Total of all taxes for delivery. DISPLAY ONLY. Press down arrow and the curser will move to:

TOTAL
Sum of **SUBTOTAL** plus **TAX**. DISPLAY ONLY. Press down arrow and the curser will move to:

Delivery & Preset - Page 7 Options

Delivery & Preset – Screen 7

AUX OUT 1^	AUX OUT 2^
ON DURING DELIVERY	FLOW DIRECTION

AUX OUT 1^
This field activates optional outputs, e. g. pump control, additive injection, alarms, etc. Choices are **OFF**, **ON** or **ON DURING DELIVERY.** Press the **ENTER** key and the curser will drop to the lower line. Press the up arrow or down arrow and scroll through the options until the required output is found. Press **ENTER** and the cursor will move to the top line. Press down arrow and the curser will move to:

AUX OUT 2^
This field can be programmed to indicate flow direction or it can be optionally programmed similar to **AUX OUT 1^**. Press the **ENTER** key and the curser will drop to the lower line. Press the up arrow or down arrow and scroll through the options until the required output is found. Press **ENTER** and the cursor will move to the top line.

Press down arrow and the curser moves to the first field in Delivery & Preset Screen 1.

Delivery and Preset

Delivery & Preset – Screen 1

#^	CODE	PRODUCT NAME	PRODUCT TYPE^
1	12345	PRODUCT NAME	DISTILLATE

Delivery & Preset – Screen 2

GROSS COUNT	NET COUNT	UNITS^
0.0	0.0	GALLONS

Delivery & Preset – Screen 3

NET COUNT	PRESET	REMAINING	UNITS^
0.0	0.0	-------------	GALLONS

Delivery & Preset – Screen 4

GROSS COUNT	PRESET	REMAINING	UNITS^
0.0	0.0	-------------	GALLONS

Delivery & Preset – Screen 5

PRICE/UNIT	TAX/UNIT	%TAX
0.0000	0.0000	0.0000

Delivery & Preset – Screen 6

SUBTOTAL	TAX	TOTAL
0.0000	0.0000	0.0000

Delivery & Preset – Screen 7

AUX OUT 1^	AUX OUT 2^
ON DURING DELIVERY	FLOW DIRECTION

Product & Shift - Page 1 Options

Product & Shift Screen 1

#^	PROD TYPE^	SHIFT START	DLVRY
1	DISTILLATE	07/11/02 1:44:00	22

#^ (**Product Number**)
This field is used to select one of four possible product types/calibrations. Press **ENTER** and the cursor will drop to the bottom line. Use down arrow to scroll through the numbers **1-4.** When the product number is selected for which corresponding **PROD TYPE^** information will be entered, press **ENTER** and the cursor will move to the top line. Press down arrow and the cursor will move to:

PROD TYPE^
This field will scroll along with the **#^(Product Number)** that is shown in the first field. The product type **AMMONIA, AVIATION, DISTILLATE, GASOLINE, METHANOL, LPG, LUBE OIL** or **"blank"** can be selected. Press **ENTER** and the cursor will drop to the bottom line. Press down arrow to scroll through the available options. When the desired choice is displayed, press **ENTER** and the cursor will move to the top line. Press down arrow and the cursor will move to:

SHIFT START
The starting time and date for the current shift are shown here. DISPLAY ONLY. Press down arrow and the curser will move to:

DLVRY
This field shows the number of deliveries that have been made since the last time **CLR SHIFT** was set to **YES** or a shift ticket was printed. DISPLAY ONLY. Press down arrow and the cursor will move to:

Product & Shift - Page 2 Options

Product & Shift – Screen 2

#^	SHIFT GROSS	SHIFT NET	UNITS^
1	1647.6	0.0	GALLONS

#^ (Product Number)
This field is used to select one of four possible product types/calibrations that can be set up in the LCR-II. At least one calibration must be set up to allow deliveries. Press down arrow and the curser will move to:

SHIFT GROSS
This field displays the gross number of units that have been delivered through the meter since the last time the **CLR SHIFT** field was set to **YES** or a shift ticket was printed. **SHIFT GROSS** is the sum total of the delivery ticket gross quantities during the current shift. **DISPLAY ONLY**. Press down arrow and the cursor will move to:

SHIFT NET
This field displays the net (temperature compensated) number of units that have been delivered through the meter since the last time **CLR SHIFT** field was set to **YES** or a shift ticket was printed. **SHIFT NET** is the sum total of the delivery ticket net quantities during the current shift. **DISPLAY ONLY**. Press down arrow and the curser will move to:

UNITS^
This field is used to choose the units of flow measurement. The choices are **GALLONS**, **LITRES**, **CUBIC M**, **LBS (**pounds), **KGS** (kilograms), **BARRELS**, and **OTHER**. Press **ENTER** and the cursor will drop to the bottom line. Use the up or down arrow keys to scroll through the choices. This is a global unit of measure that is product specific and when changed in one field will change accordingly in all related fields in other menus. Press down arrow and the cursor will move to:

Product & Shift - Page 3 Options

Product & Shift – Screen 3

#^	GROSS TOTAL	NET TOTAL	UNITS^
1	6193.8	0.0	GALLONS

#^ (Product Number)
This field is used to select one of four possible product types/calibrations. At least one calibration must be set up in the LCR-II to allow deliveries. Press down arrow and the curser will move to:

GROSS TOTAL
This field shows the total gross volume that has gone through the register since the field was last initialized. This value can be initialized to any positive number if the Selector Switch is in the **CALIBRATION** position. This is a "live" totalizer and will count regardless of a delivery being active. Press down arrow and the cursor will move to:

NET TOTAL
This field shows the total net volume that has gone through the register since the field was last initialized. This value can be initialized to any positive value if the Selector Switch is in the **CALIBRATION** position. This is a "live" totalizer and will count regardless of a delivery being active. Press down arrow and the cursor will move to:

UNITS^
This field is used to choose the units of flow measurement. The choices are **GALLONS**, **LITRES**, **CUBIC M**, **LBS (**pounds), **KGS** (kilograms), **BARRELS**, and **OTHER**. Press **ENTER** and the cursor will drop to the bottom line. Use the up or down arrow keys to scroll through the choices. This is a global unit of measure that is product specific and when changed in one field will change accordingly in all related fields in other menus. Press down arrow and the cursor will move to:

Product & Shift - Page 4 Options

Clear & Shift – Screen 4

CLR SHIFT?
NO

CLR SHIFT?
This field is used to print a **SHIFT TICKET** and clear the **SHIFT GROSS**, **SHIFT NET**, and **DLVRY** fields. If **YES** is selected, the shift fields will be reset to **0** after the shift ticket is printed. After the ticket is printed, this field will revert to **NO**. If **TICKET?** is set to **NO**, shift totals can be cleared without printing a shift ticket. Press **ENTER** and the cursor will drop to the bottom line. Press the down arrow key key to scroll between **YES** and **NO**. When the desired entry is displayed, press **ENTER** and the cursor will return to the top line.

Press down arrow and the curser moves to the first field in Product & Shift Screen 1.

Product and Shift Information`

Product & Shift Screen 1

#^	PROD TYPE^	SHIFT START	DLVRY
1	DISTILLATE	07/11/02 1:44:00	22

Product & Shift – Screen 2

#^	SHIFT GROSS	SHIFT NET	UNITS^
1	1647.6	0.0	GALLONS

Product & Shift – Screen 3

#^	GROSS TOTAL	NET TOTAL	UNITS^
1	6193.8	0.0	GALLONS

Clear & Shift – Screen 4

CLR SHIFT?
NO

Operation of metering systems

How do you start delivery?

1. Press the RELEASE button on the Epson printer.
2. Insert a blank delivery ticket.
3. Press the FORWARD button on the printer to engage the print head to the ticket.
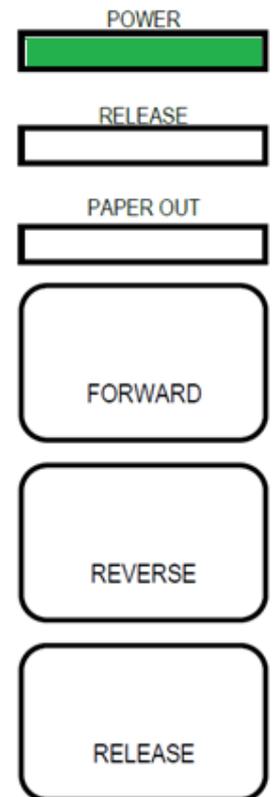
How do you start delivery?

4. Turn the Selector Switch on the LCR-II to the RUN position.
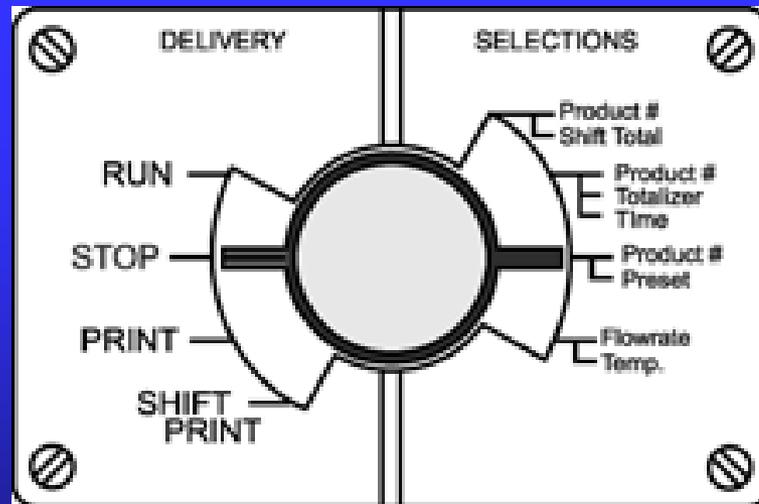
Before register resets…….

It goes through multiple checks:

1. Is this meter calibrated?

2. Is there correct temperature input(if temperature compensated)?

3. What is the input from Optical Air Eliminator (if present)?

4. Is printer ready?

5. Is there controlling device present (lap pad, computer)? If yes, command from device needed.

6. LCRII is a self diagnostic unit. It also checks itself.

reset.mpg

Block valve
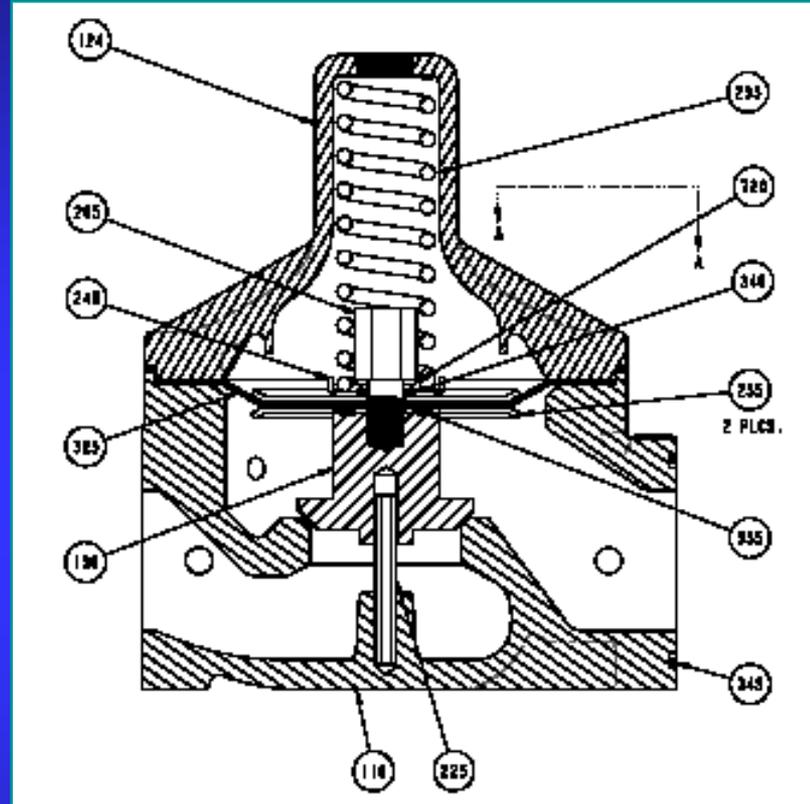
CONN#	PIN#	STOP (Delivery inactive)	Run (FULL FLOW)	
	14	12VDC	12VDC	
J13	15	12VDC	0VDC	
	17	12VDC	12VDC	
	18	12VDC	12VDC	
Note:				
		Connect your negative lead to ground PIN #12 .		

How to finish delivery?

5.   Pull the delivery hose and fill the customer's tank.
6.   When the delivery is completed, turn the Selector Switch from the RUN position to the PRINT position. This will instruct the LCR-II to print a delivery ticket. (NOTE: Once a delivery is started and the meter has registered more than one gallon, if the meter is stopped for a period of time exceeding the NO-FLOW time out (60 min. max.), the LCR-II will terminate the delivery and automatically print a delivery ticket.)
7.   Press the RELEASE button to remove the delivery ticket from the printer.

How to reprint delivery ticket?

1. Press the RELEASE button on the Epson printer.
2. Insert a blank delivery ticket.
3. Press the FORWARD button on the printer to engage the print head to the ticket.
4. Turn the Selector Switch on the LCR-II to the PRINT position and then to the STOP position. This will instruct the LCR-II to reprint the delivery ticket.
5. Press the RELEASE button to remove the delivery ticket from the printer.

How to print shift ticket?

1. Press the RELEASE button on the Epson printer.
2. Insert a blank delivery ticket.
3. Press the FORWARD key on the printer to engage the print head to the ticket.
4. Turn the Selector Switch on the LCR-II to the SHIFT PRINT position for more than 2 seconds.
5. Turn the Selector Switch back to the STOP position. The ticket will automatically print.
6. Press the RELEASE button to remove the shift ticket from the Epson printer.

Additional operation with and without lap pad
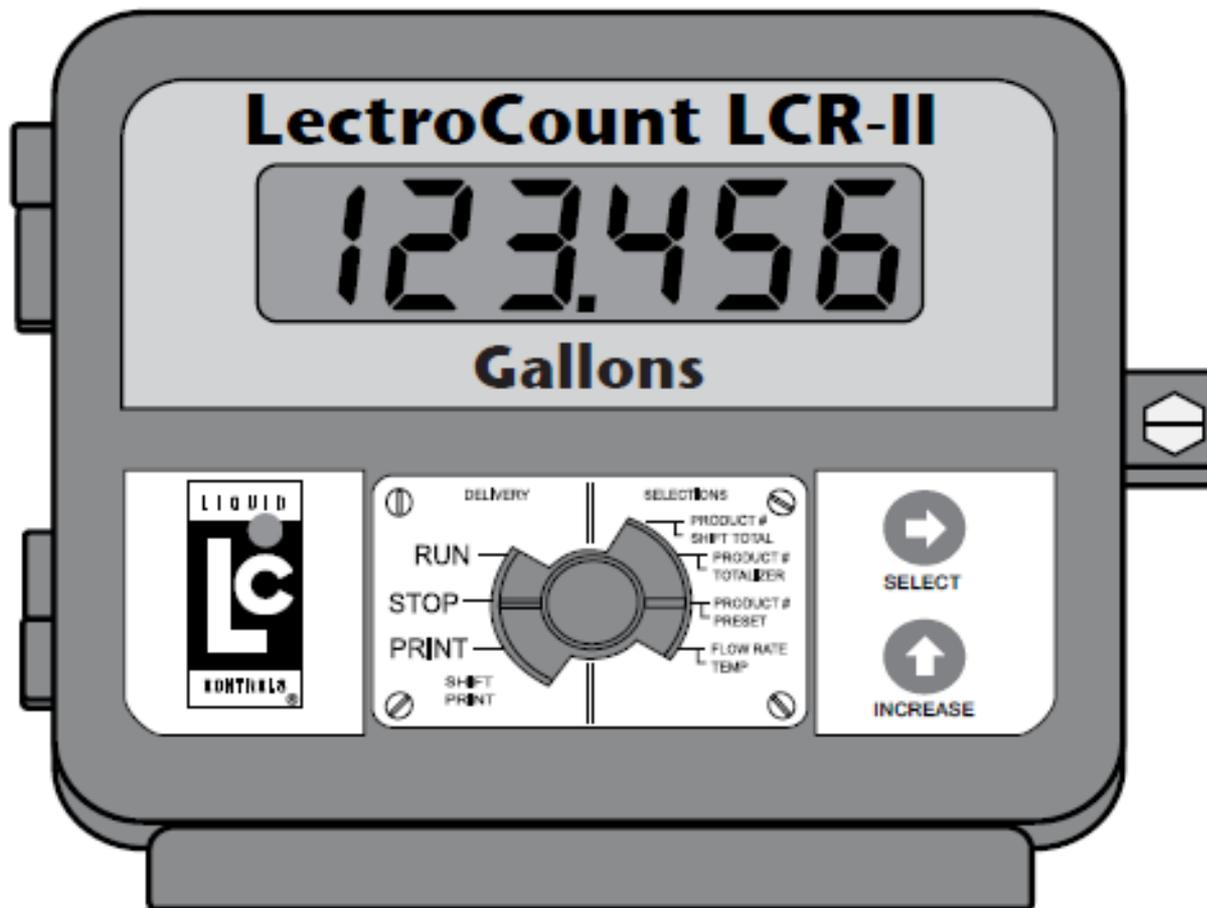
Preset delivery

CONN#	PIN#	STOP (Delivery inactive)	Run (FULL FLOW)		Run (LOW FLOW)
	14	12VDC	12VDC		12VDC
J13	15	12VDC	0VDC		12VDC
	17	12VDC	12VDC		12VDC
	18	12VDC	12VDC		0VDC
Note:					
Connect your negative lead to ground PIN #12 .					

Calibration

Without lap pad
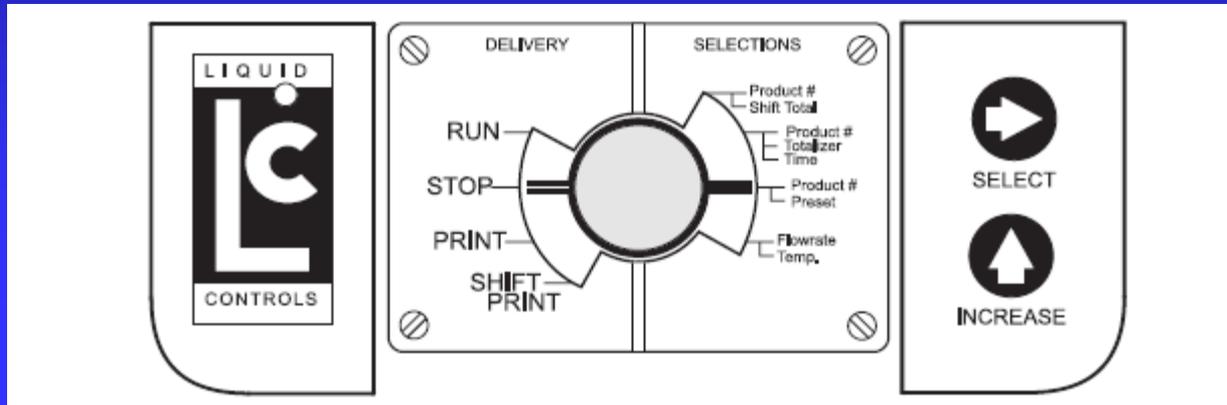
With lap pad

Multi-point calibration

1.To widen flow range of the meter

2. To make good meter even better meter

Multi-point calibration

LIQUID CONTROLS CALIBRATION TEST
Typical Single-point LPG Meter Accuracy Curve
Meter: MA7
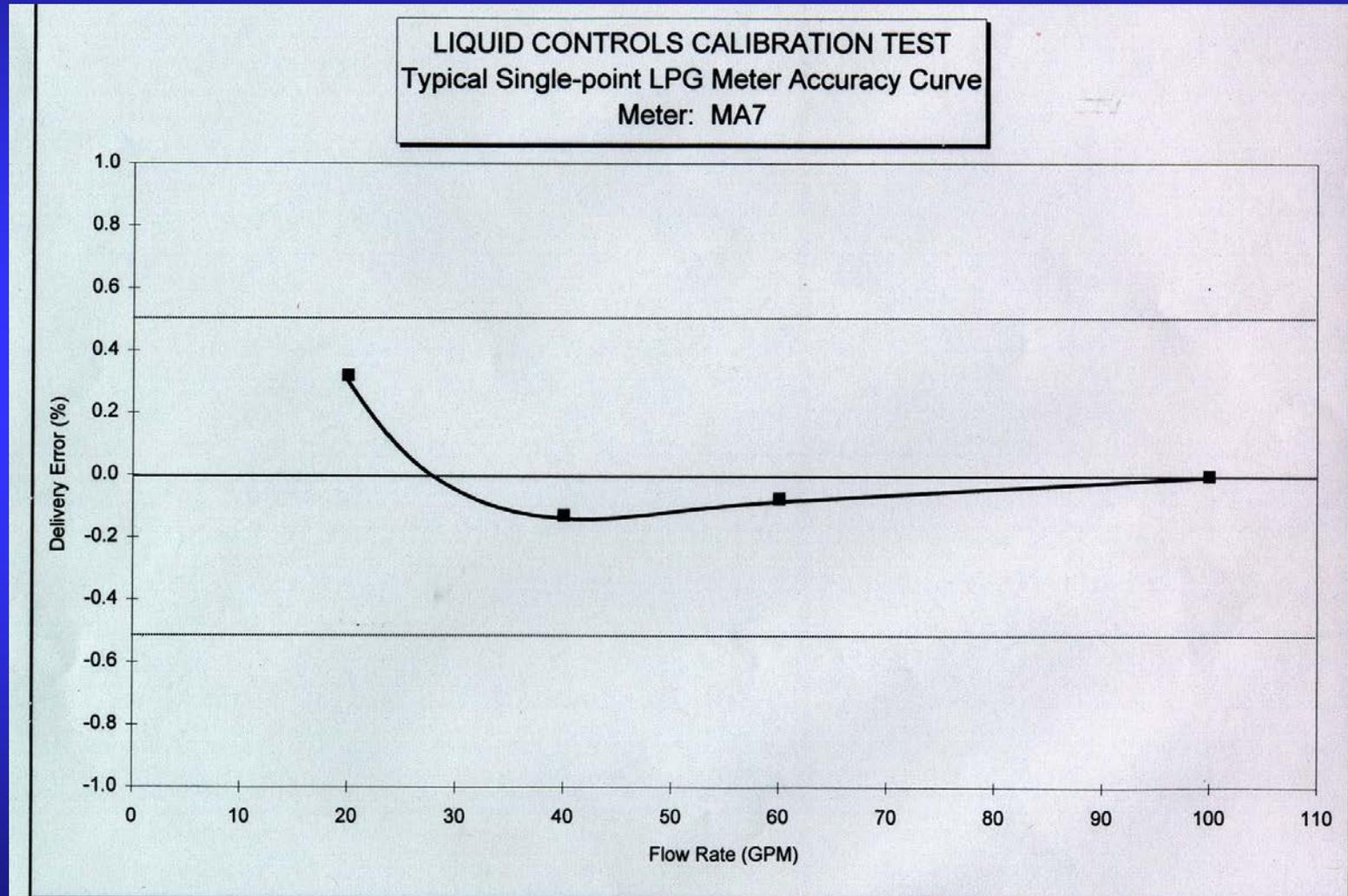
Multi-point calibration

Product Calibration - Screen 7

PT^	RATE	UNITS^	RATE BASE^	%ERROR
1	0.00	GALLONS	PER MINUTE	0.000

Product Calibration - Screen 8

PT^	PROVER QTY	UNITS^	%ERROR	LINEAR^
1	0.000	GALLONS	0.000	SETUP

Multi-point calibration

LIQUID CONTROLS CALIBRATION TEST - 05/15/97
Multi-point LPG Meter Accuracy Curve
Meter: MA7
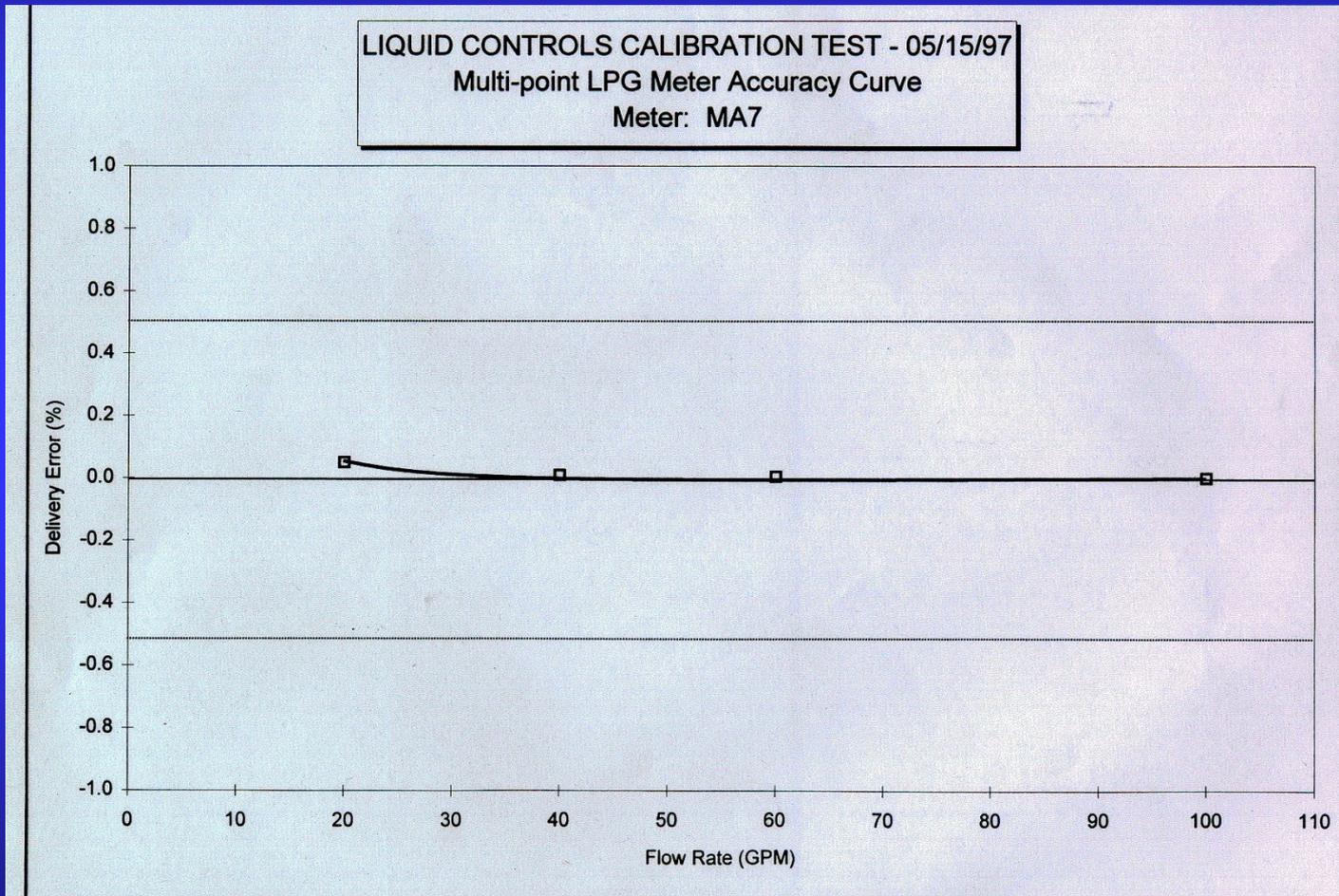
Sealing meter
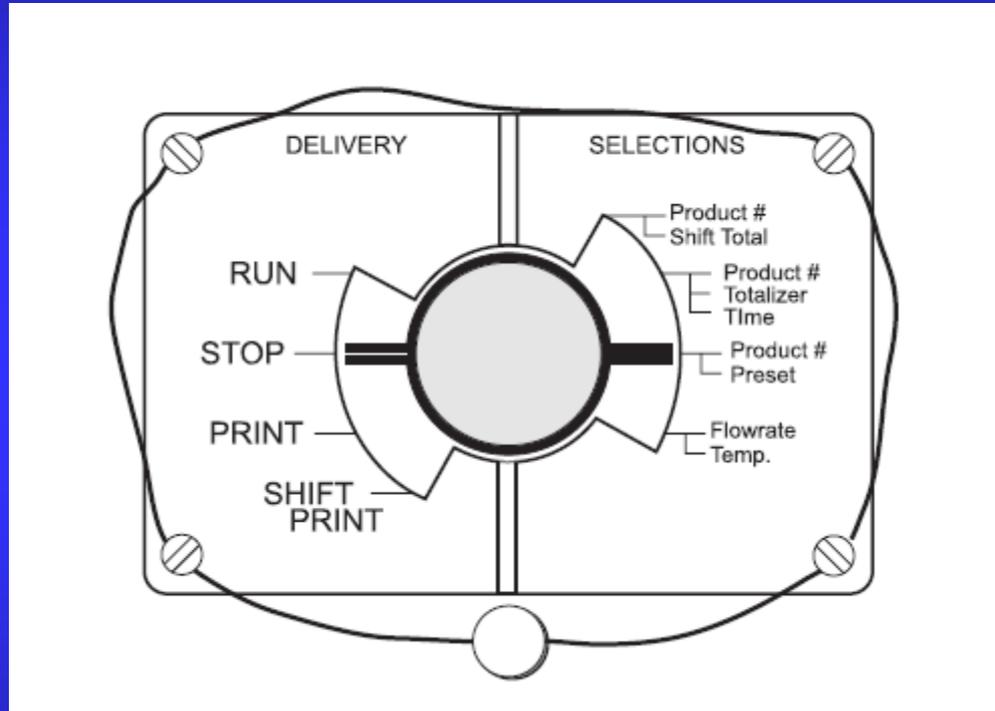
System with optical air eliminator and security valve

Delivery not active

Delivery active
(Air in the system)

S1
S2
Sensor
S3
LectroCount LCR-II
123456

Delivery active
(Liquid in the system)

S1

S2

S3

Sensor

LectroCount LCR-II

123456

Gallons

ON

Flow

High-Flow

OFF

Valve at Full Flow
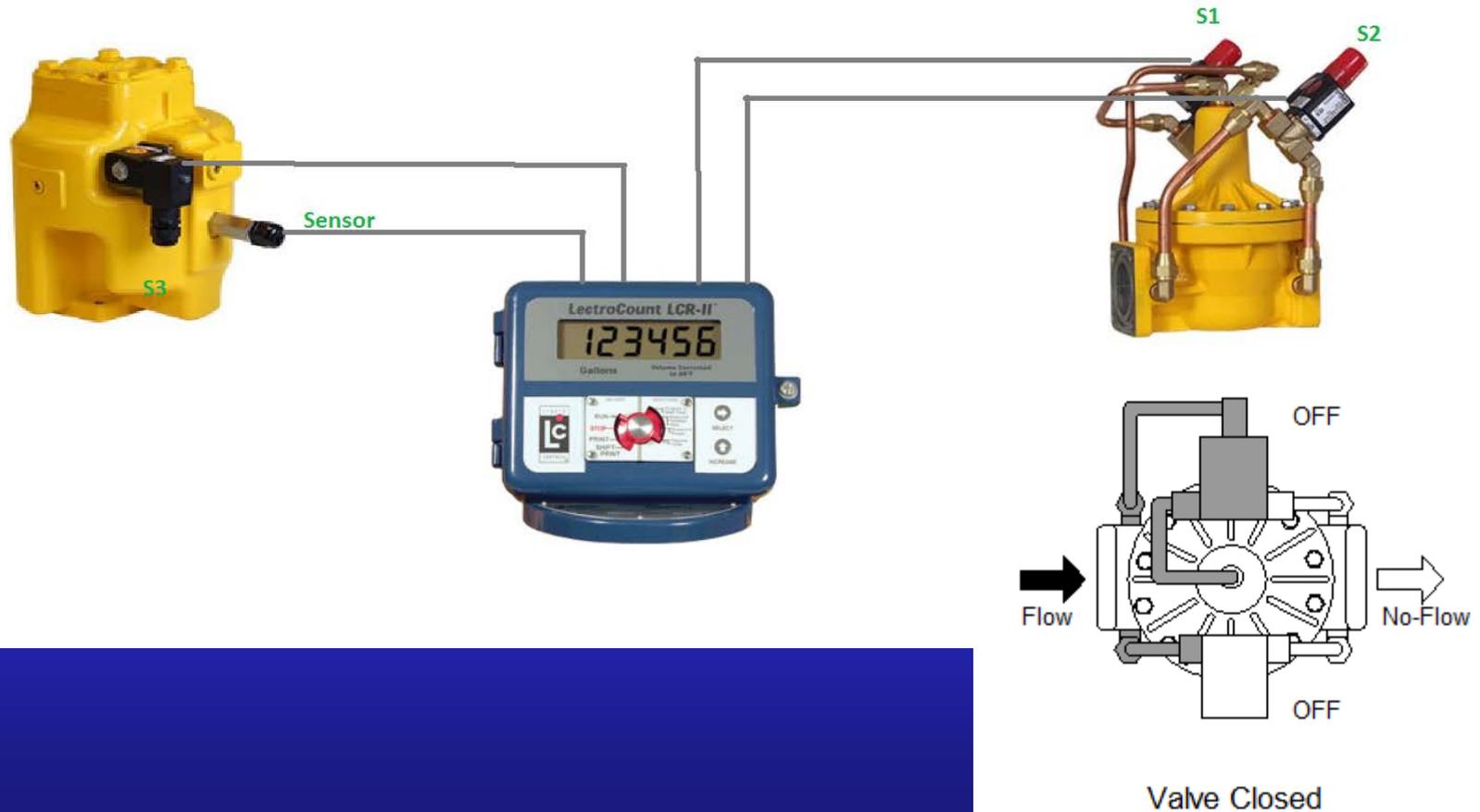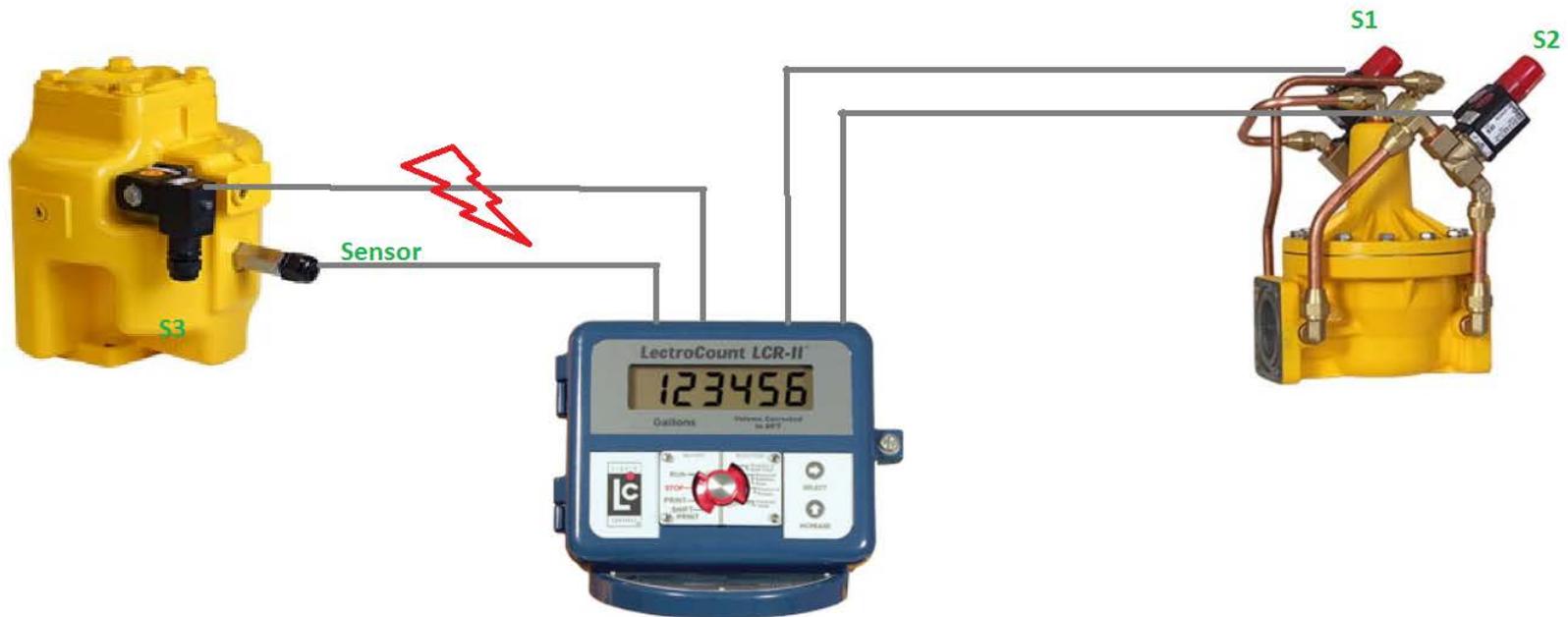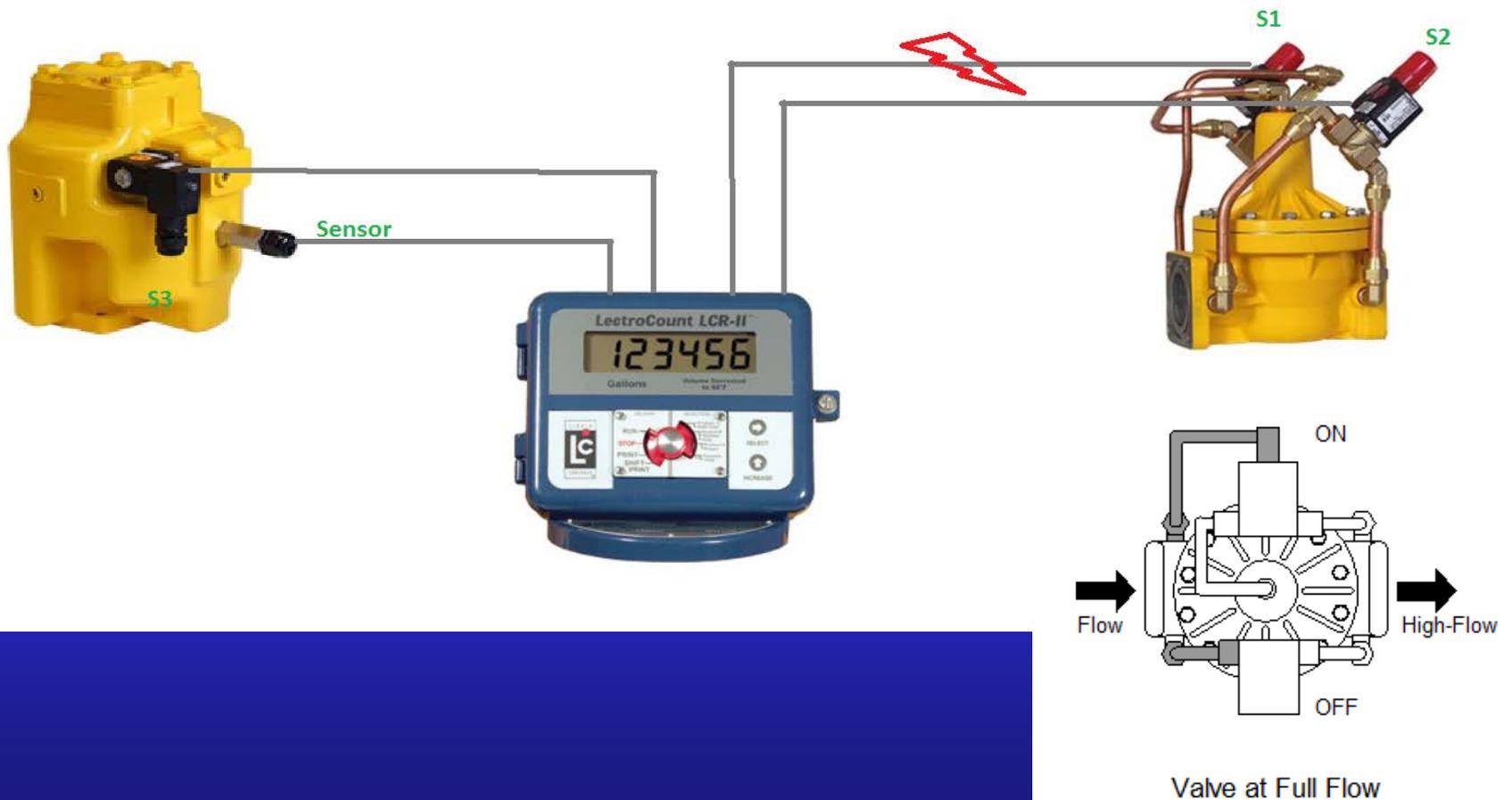
Wiring of optical sensor and security valve
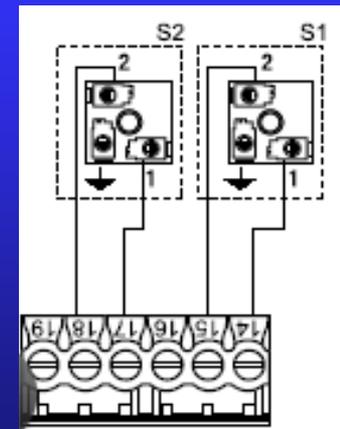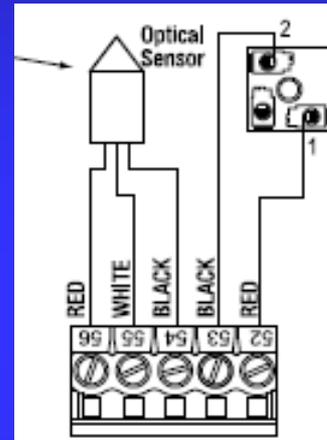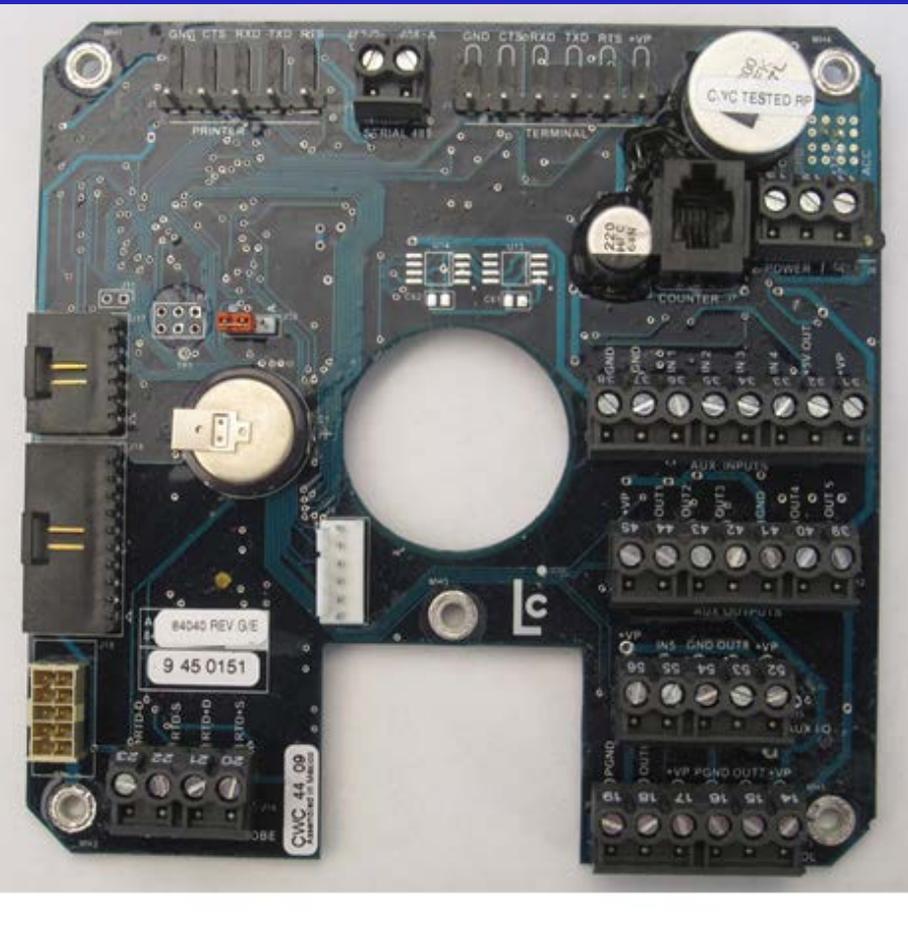
Voltage references for Optical Air Eliminator and Security valve

LCR Board Voltage Ref for J15 and J13

CONN#	PIN#	STOP (Delivery inactive)	RUN (Liquid in system)	Run (Air in system)
	52	12VDC	12VDC	12VDC
	53	12VDC	12VDC	0VDC
J15	54	0VDC	0VDC	0VDC
	55	0VDC	0VDC	12VDC
	56	12VDC	12VDC	12VDC
	14	12VDC	12VDC	12VDC
J13	15	12VDC	0VDC	12VDC
	17	12VDC	12VDC	12VDC
	18	12VDC	12VDC	12VDC

Note:

Connect your negative lead to ground PIN #12 .

System with mechanical air eliminator, air check valve and security valve

Delivery active
(Liquid in the system)

Liquid

LectroCount LCR-II
123456

S1

S2

Delivery active
(Air in the system)

Air

S1

S2

Outlet

Inlet

123456
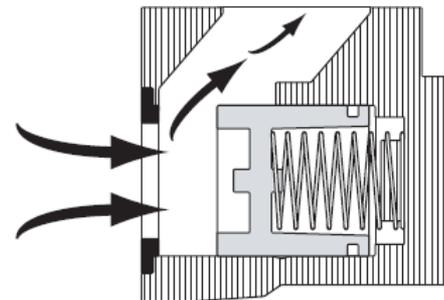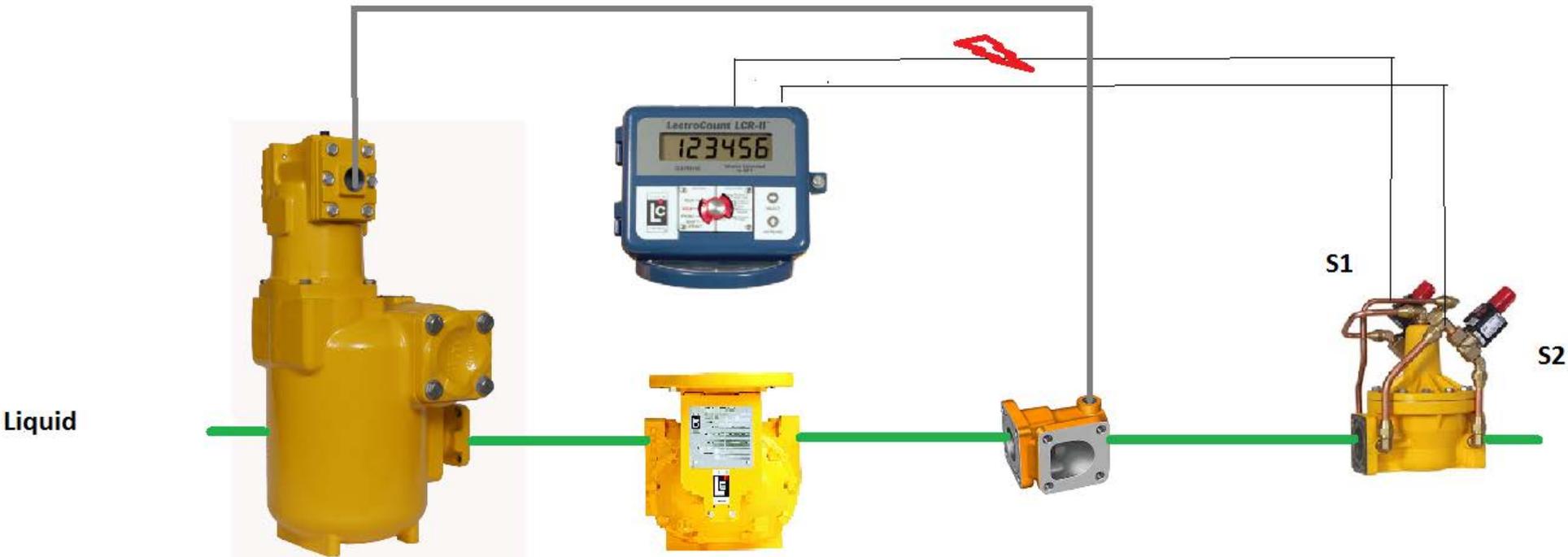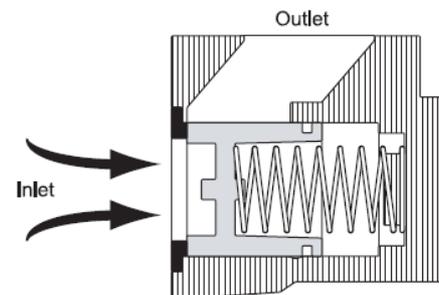
Troubleshooting

Troubleshooting

Meter won't pump !!!!

Troubleshooting

Does register reset?

Troubleshooting

If yes,……..

Ask yourself qustion

What can stop flow of the product?

Troubleshooting

If no,……..

General Troubleshooting Tools

➢Ask questions – Get the customer to explain the situation to you. If he is remote he is your eyes and ears to the problem.

➢Whenever possible, speak directly with the operator to avoid 2nd hand miss information.

➢Use a reliable digital volt meter as voltage levels are critical to the system operation. A trouble light is not helpful.

➢NEVER remove jumpers or terminal blocks while voltage is applied to the LCR/LCR-II circuit board

➢In case of a major problem such as a burned or moisture damaged circuit board, investigate the possible causes before replacing the part and powering up the system.

➢Print Diagnostics ticket, if able to.

Printing A Diagnostic Ticket

1. Insert a ticket in the printer

2. Turn the Red Selector Switch from STOP down to SHIFT PRINT and back to STOP **in less then 2 seconds.**

3. Do not print Diagnostic ticket unless the register states "Diagnostic Messages Available" or some other error message on the bottom of the delivery ticket
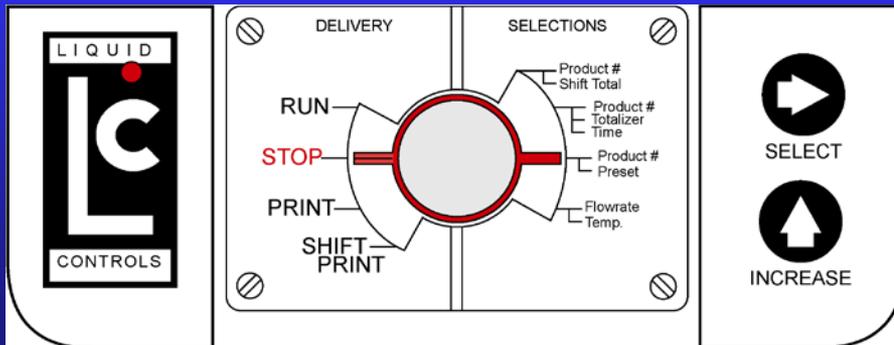

```
CALIBRATION TICKET #              1
CALIBRATION EVENT #               1
CONFIGURATION EVENT #             1
CALIBRATION DATE 01/03/99  08:45:17
METER IDENTIFIER          137566
SERIAL NUMBER             8050027
PRODUCT NUMBER 1          GASOLINE
  COMP TYPE               TABLE 6B
  API GRAVITY=                  55
  PULSES       2222.000000/GALLONS
PRODUCT NUMBER 2          GASOLINE
  COMP TYPE               TABLE 6B
  API GRAVITY=                  55
  PULSES       2222.000000/GALLONS
PRODUCT NUMBER 3          GASOLINE
  COMP TYPE               TABLE 6B
  API GRAVITY=                  55
  PULSES       2222.000000/GALLONS
PRODUCT NUMBER 4          GASOLINE
  COMP TYPE               TABLE 6B
  API GRAVITY=                  55
  PULSES       2222.000000/GALLONS
FIRMWARE                  SR200v2.00
                          SL200v1.03
                          ST200v1.03
TEMPERATURE           75.41 DEG. F
ADC OFFSET             2.586 DEG. C
ADC SLOPE           0.024775  /BIT
TEMP ZERO              0.00 DEG. F
PULSER FAULTS                     0
LAST GROSS            55.0 GALLONS
LAST NET             54.6 GALLONS
```

Diagnostics Messaging

Diagnostics – Screen 1	
DIAGNOSTIC MESSAGES^	SUPPLY VOLTAGE
TVC ACTIVE	13.5

Diagnostic Messages are Real Time Messages

Messages are NOT Stored in Memory

There May be More Than One Diagnostic Message in Memory

Press ENTER key to Drop the Curser to The Lower Line and Scroll Through the Diagnostic Messages at the time of the Failure!

Most Common Diagnostic Messages:

(Consult the LCRII Setup and Operation Manual Appendix C for a complete list of error messages and complete descriptions of each message below)

Flash CRC Failure – Perform a clear all, if problem persists, replace main board

Flash Not Initialized – Turn red switch to calibration mode and try process again

Range Error – Entered parameter is out of range. Use Setup and Operation manual to verify the range of the field.

Start Enabled / Switch To Run To Begin Delivery – Switch is not in run position. Turn switch to run.

Temperature Error – Disable Temperature Compensation if it is not required. If Required, verify that probe is connected properly. Check board for moisture damage.

VCF Domain Error – Check board for moisture damage. Perform clear all. If problem persists, replace main board.

Pulser Failure – See Pulser Failure issues

Meter Calibration Error – Check to see that the product to be delivered has a K-Factor

Power Fail Error – LCR lost power for more than 15 second while in an active delivery. Verify that the LCR was supplied with voltage during delivery.

Preset Error – Message appears when there is a Flash Memory Error detected during delivery when accessing any of the fields used by Presets.

Terminal Not Connected – Message appears when a terminal or Lap Pad is disconnected during a delivery.

Data Access Error – Message appears when a Flash Memory Error occurs.

Check Printer and Cable – Verify that a ticket was in the printer at the time the delivery was initiated. Check cables and connections. Replace printer & Verify that replacement printer operates.

DELIVERY TICKET PENDING - This message appears when a delivery has been terminated but a delivery ticket has not been completely printed. When this occurs, it is assumed that the delivery is still active. No fields can be changed until the delivery ticket has been entirely printed.

Init Warning – Message appears when NO-FLOW-TIMER or a ticket required field returns an error.

Clear All Instructions

LCR CLEAR-ALL

There are instances where the LCR may display an error message such as "Watchdog Error", "Preset Error", "Flash CRC Failure", "VCF Domain Error" or it just may not be operating properly and it is necessary to reset the board to get rid of the problem. It is also recommended to execute this procedure after flashing new software on a CPU board.

The clear-all procedure resets the processor on the board and sets all the settings back to defaults. Before you perform this procedure, make sure you write down all the settings currently on the board since the memory will be cleared.

The settings we recommend you write down are the following:

General Setup
Date_____   Time_____   Sale #_____   Ticket#_____
Unit ID_____   No-Flow Timer_____   Preset_____
Preset Type_____   Print Gross & Param_____

System Calibration
Meter ID_____   Printer_____   Units_____   Decimal_____
T Unit_____   Flow Dir_____

Product Calibration
#^_____   Code_____   Product Name_____
Prod Type_____   Compensation Type_____   Comp Param_____
Pulses/Unit_____   S1 Close_____

Product and Shift Information
Gross Total_____   Net Total_____

Clear-All Procedure

1. Make sure the last delivery ticket has been printed and is not pending.

2. Connect a Lap Pad adapter and a Lap Pad keyboard to the register data cable connected to the printer.

3. Remove the switch plate located on the front of the register and rotate the red switch to the calibration position (6 o'clock).

4. In the "General Setup" menu, change the date to 01/01/00.

5. In the "System Calibration" menu, scroll down to the 6th screen and write down the CALIB #.

6. Add the CALIB # and the number 65792; the number resulting of this addition will be your access code. Example, if the CALIB# is 13, your access code will be 65805 (65792 + 13).

7. In the "Security" menu, move the cursor to the most right field and press the "ENTER" key. The cursor will drop to the bottom line.

8. Type in the access code from STEP 6 and press the "ENTER" key. The factory mode menu will appear.

9. Using the ⬆ key, move the cursor to LCR RESET and press the "ENTER" key. The cursor will drop to the bottom line.

10. With the ⬇ key, select CLEAR ALL and press the "ENTER" key. After 5 seconds, the board will reset.

11. Press the M1 key to exit the factory menu.

12. Re-enter all the settings you wrote down.

Clear All Instructions

Practical Application (1)

Setup LCR-II for the following situation and make a preset delivery of 100 gallons:

General Setup
Date and Time - Current
Unit ID - 9999 TRK
Preset - NET   **Preset Type** - Clear
Ticket Header – (See Below)
Line 1 - Liquid Controls
Line 2 - 105 Albrecht Drive
Line 3 - Lake Bluff   IL   60046
Print Gross & Param – NO   **Vol Corrected MSG** - YES

System Calibration
Meter ID - 12345689
Printer - Epson 295 Slip Printer (Page 14 LCRII Setup and Operational Manual)
Units (of measure) - Gallon
Decimal – Tenths
Temperature = Deg F

Product Calibration
Product Code - 1075   **Product Name** - PROPANE   **Product Type** - LPG
Compensation Type - Appendix A   **Comp Parameter** = API Specific Gravity .505
#1 Pulses / Unit - 500
S1 Close = 3.0

Print one each; Calibration; Delivery; Shift tickets
Must display current date, time and underline net volume only!
Volume Corrected message must be printed

Practical Application (2)

Setup LCR-II for the following deliveries: make three (3) preset deliveries, one each 50, 75 and 100 gallons: MAKE ALL THREE DELIVERIES **WITHOUT** the lappad.

General Setup
Date and Time - Current
Unit ID – 1926 MRLN
Preset – GROSS   **Preset Type** - Clear
Ticket Header (See Below)
Line 1 = IDEX CORPORATION
Line 2 = 630 DUNDEE ROAD   SUITE 400
Line 3 = NORTHBROOK IL   60062
Line 4= GO CUBS
Print Gross & Param – NO   **Vol Corrected MSG** - NO

System Calibration
Meter ID - 307949
Printer - Epson 295 Slip Printer (Page 14 LCRII Setup and Operational Manual)
Units (of measure) - Gallon
Decimal - WHOLE

Product Calibration
Product Code - 1234   **Product Name** - DYED DIESEL   **Product Type** - DISTILATE
#1 Pulses / Unit - 75
S1 Close – 3.0

Print one each; Calibration; Delivery; Shift tickets
Must display current date, time and gross volume only!
Print all three deliveries on the same ticket (to save paper.) Print a Shift Ticket reflecting the correct total and number of deliveries.

Practical Application (3)

Setup LCR-II for the following situation and make five (5) identical preset deliveries, each 215 liters:

General Setup
Date and Time - Current
Unit ID – (Your Phone # with no separation i.e. 8472951050)
Preset – NET   **Preset Type –** Multiple
Ticket Header (See Below)
Line 1 = Your Name
Line 2 = Your Street Address
Line 3 = Your City, State, Zip Code
Print Gross & Param – YES   **Vol Corrected MSG** - YES

System Calibration
Meter ID - 1082RRL
Printer - Epson 295 Slip Printer (Page 14 LCRII Setup and Operational Manual)
Units (of measure) - LITER
Decimal - TENTHS
Temperature - DEG F

Product Calibration
Product Code = 5437   **Product Name** = HIGH TEST   **Product Type** = GASOLINE
Compensation Type = Appendix A   **Comp Parameter** = API Gravity 74
#1 Pulses Per Unit = 400
S1 Close = 5.0

Print one each; Calibration; Delivery; Shift tickets
Must display current date, time with BOTH gross and net volumes!
Volume Corrected Message must be printed on the ticket.
The delivery ticket should reflect ONE DELIVERY TOTAL ONLY.

Practical troubleshooting

EZCommand operation

1. Programming LCRII
2. Saving/loading configurations
3. Flashing software

Additional features of LCR600

1.Large display with multiple lines of information.

2. Alphanumeric keypad allowing navigation between menus and full programming without external device.

3. Access to all menus including calibration

4. On screen diagnostics

5. Multiple delivery screen specific for application

6. 16 product calibrations

7. 100 product names

8. Multiple tax structures

9. Cash and volume discounts

10. Price preset

11. Miscellaneous transactions

12. Toggle flow rate output

Toggle flow rate

Toggle Flow Rate

Toggle flow rate is a programmable flow rate set point that energizes the Auxiliary 1 and/or Auxiliary 2 output signals. The output signals remains activated above the set flow rate value and deactivates when the flow rate falls below the value.

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Toggle flow rate

<u>Auxiliary 1 (1 amp max output)</u>

A common output is an air operated valve (AOV) for the pump's bypass. When the flow rate value is attained, the Aux 1 output is energized. This will activate an air solenoid directing air to the AOV of the pump closing the bypass valve. This changes the pump from low pressure mode to full flow high bypass pressure. When the flow rate falls below the set value, Aux 1 de-energizes which deactivates the air solenoid. With the air removed from the AOV the pump returns to low flow

Toggle flow rate

<u>Auxiliary 2 (150 milliamps max. output)</u>

 A possible use for the Aux 2 output is changing the engine throttle position. Increasing the engine speed increases the pump input shaft RPM. This will add to the pump's flow output. The flow rate value in this field should be below the flow rate with a fully open nozzle or the output will never turn on.

Tank Truck

Check Valve

Air Supply

Manual Switch or Shut Off Valve

Filter / Dryer

Toggle Flow Rate
Aux #1 Output

Electrical / Air Switch

Low & Normal Flow Hose Reel

Diverter Valve – Normal Hose Reel

3-Way Diverter Valve

M-10-CLI-1 & LCR 600
- Optical Air Eliminator
- Hi-Capacity Strainer
- 2 Stage Diaphram Preset Valve

PZ10 Pump w/AOV

Multi Flow Pump Control
Aux #2 Output

ECM or Engine Cruise Control

High Flow Hose Reel
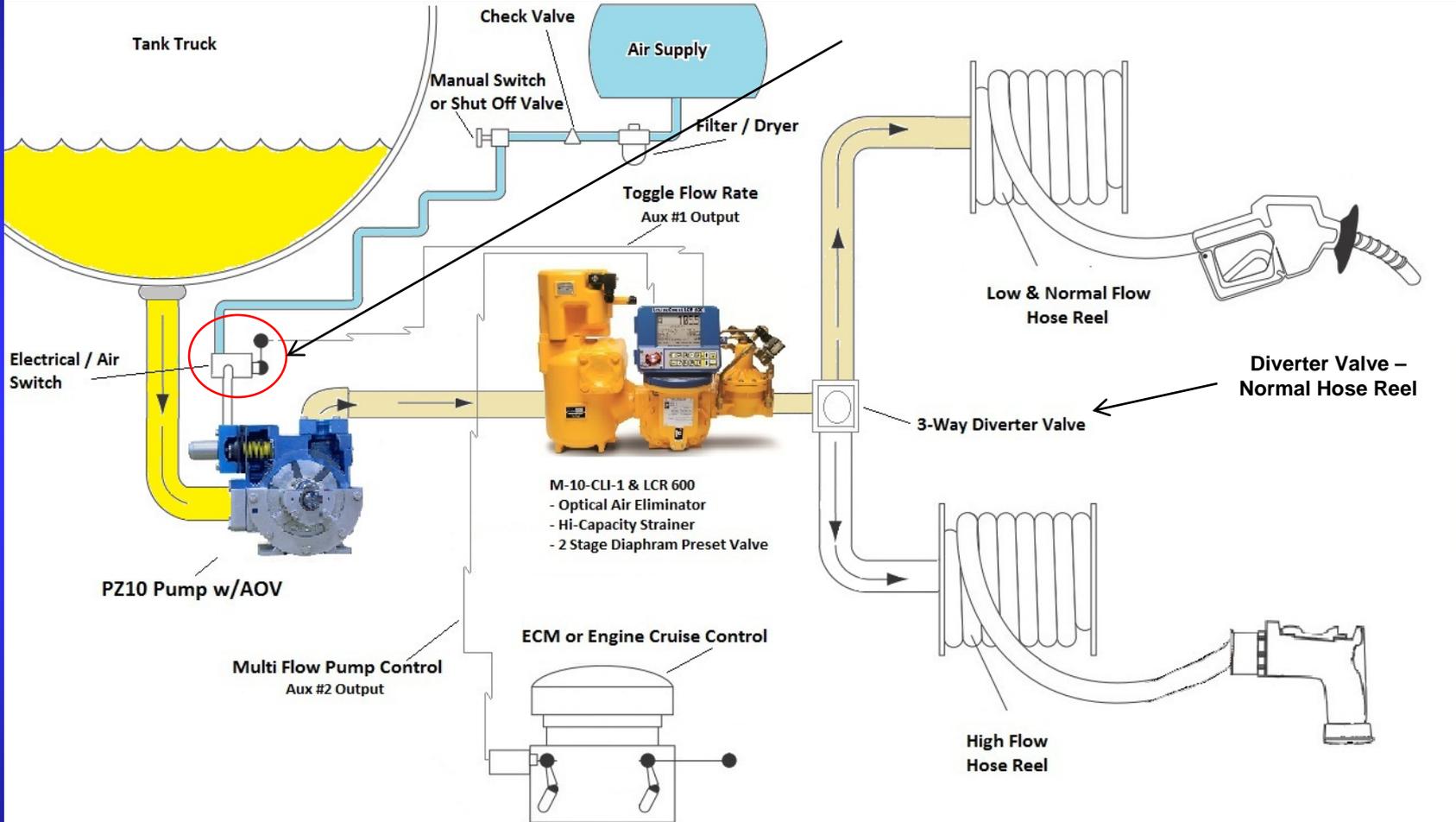
Air is not allowed to AOV.   Bypass is open allowing product to circulate.

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Air is allowed to AOV, thus closing the bypass.   Flow rate increases.

Tank Truck

Check Valve

Air Supply

Manual Switch or Shut Off Valve

Filter / Dryer

Toggle Flow Rate
Aux #1 Output

Electrical / Air Switch

Low & Normal Flow Hose Reel

Diverter Valve – Normal Hose Reel

3-Way Diverter Valve

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PZ10 Pump w/AOV

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High Flow Hose Reel
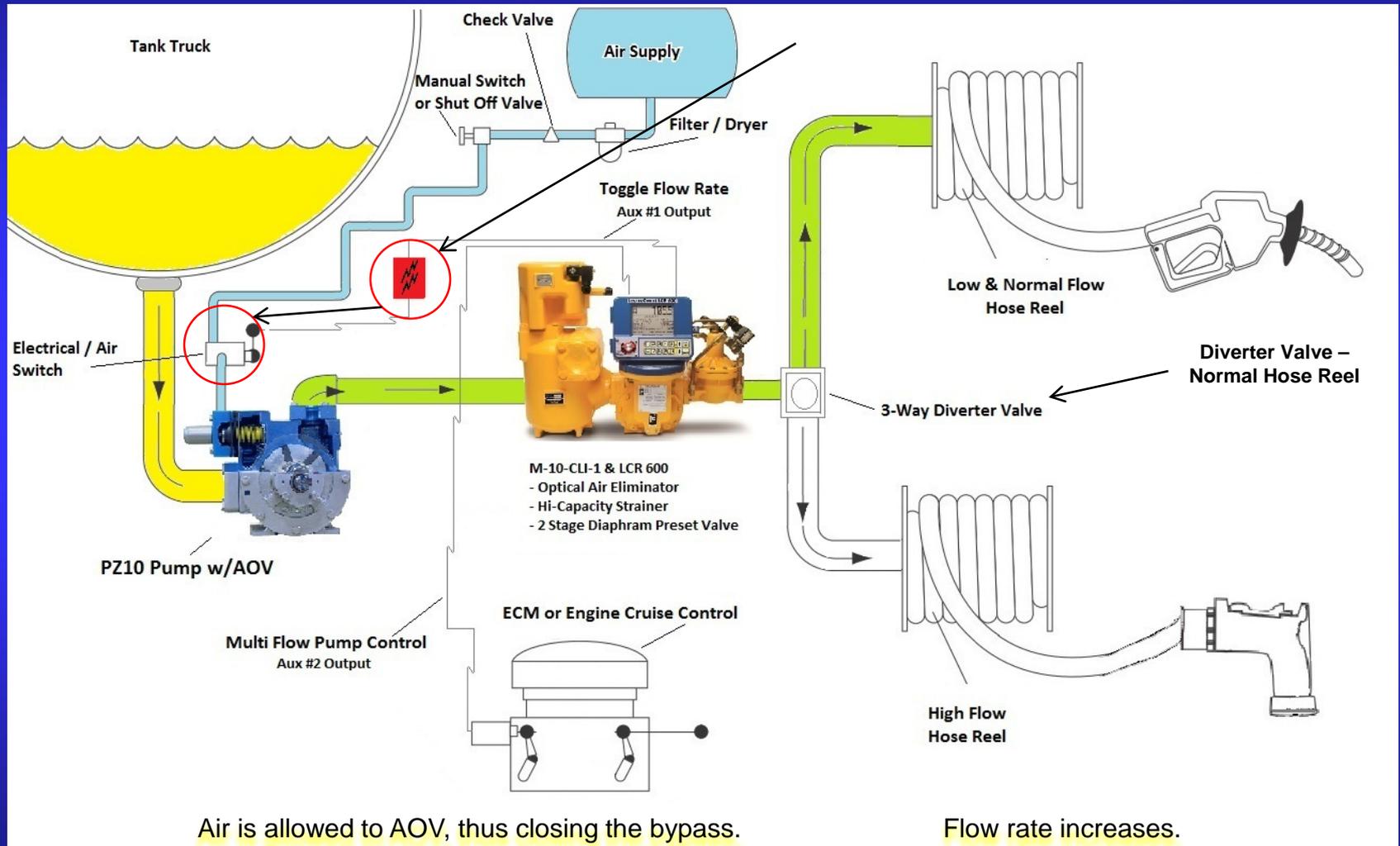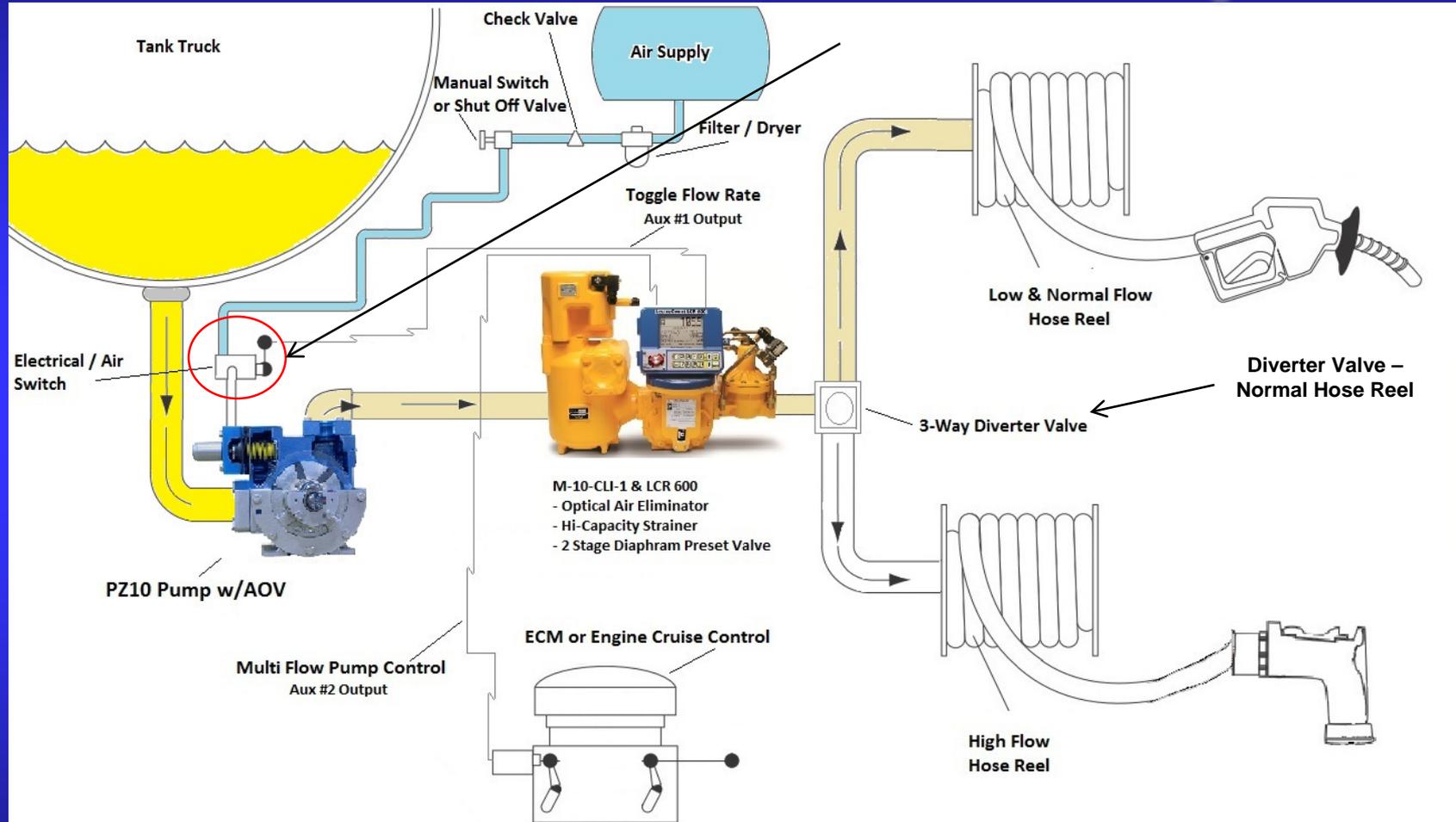
Air is not allowed to AOV.   Bypass opens allowing product to circulate.

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Tank Truck

Check Valve

Air Supply

Manual Switch or Shut Off Valve

Filter / Dryer

Toggle Flow Rate
Aux #1 Output

Low & Normal Flow Hose Reel

Electrical / Air Switch

3-Way Diverter Valve

M-10-CLI-1 & LCR 600
- Optical Air Eliminator
- Hi-Capacity Strainer
- 2 Stage Diaphram Preset Valve

PZ10 Pump w/AOV

ECM or Engine Cruise Control

Multi Flow Pump Control
Aux #2 Output

High Flow Hose Reel

Flow rate increases because increase in Engine RPM.