METERING ELECTRONICS

Design path forward

Frank Montalvo
Liquid Controls

LIQUID CONTROLS®

HISTORY

After retiring from racing in 1954, **Fred Wacker** founded Liquid Controls with **George Richards** upon developing and patenting the first tri-rotor high-flow meter for the US Air Force.

LC has since been the leader in precision fuel measurement technology thanks to our founder and the talented people before us.

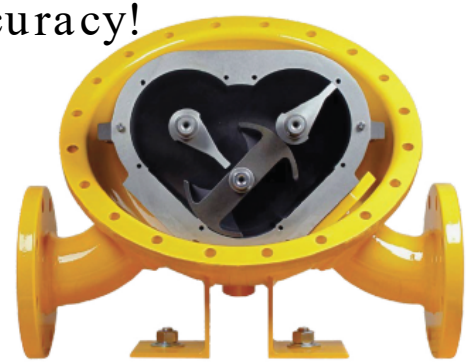
Fred Wacker reviewing the first LC meter with the US Air Force in 1954.

Fred Wacker and his #8 car.

THE ORIGINAL TRI-ROTOR METER

The **Liquid Controls tri-rotor** meter design consists of a die-cast housing in which three rotors, in synchronized relationship, measure fuel with every turn.

No metal-to-metal contact between the rotors means no wear, no wear means ultimately providing a lifetime of measurement accuracy!

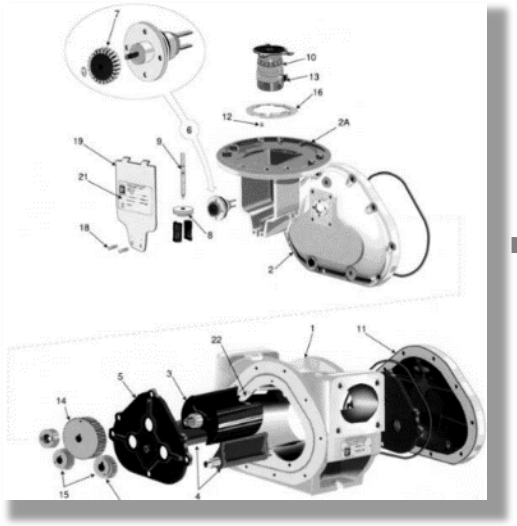


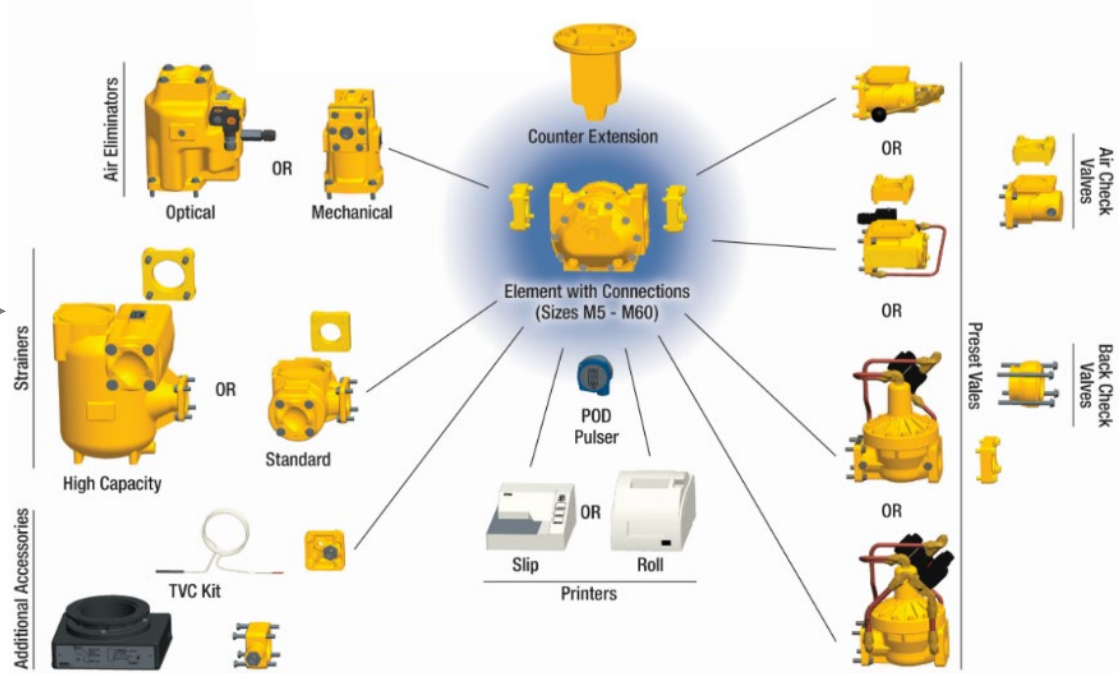
LIQUID CONTROLS®

Core Metering Products

REGISTER
- Valve, connectors, software

Meter





SIZE – *Flow Rate*
- Housing, Brg Plates, Rotors

CLASS – *Fluid Type*
- Seals
- Component Mat.

PACKAGE
Meter, Register, Air Eliminator, Strainer, Valve, Printer

LIQUID CONTROLS®

PRIMARY MARKETS

LIQUID CONTROLS®

REFINED FUELS TRUCK MARKET

M-5®,M-7®, M-10®

REFINED FUELS TRUCK METERS

LPG TRUCK MARKET

MA-7®

LPG BOBTAIL METER SYSTEMS

AVIATION FUELS MARKET

M-25®, M-30®, M-45®, M-60®, M-80®

MILITARY AND COMMERCIAL AVIATION

LIQUID CONTROLS®

REGISTRATION EVOLUTION

LIQUID CONTROLS®

Mechanical	*LCR-II*	*LCR 600*	*LCR.iQ / MASTERLOADx.iQ*
			
1950's – present: › Mechanical Registers	**1990's – present:** › Electronic Registration › Start/Stop timestamp › Open protocols › Printed tickets	**2000's – present:** › Data Management › Process Automation › Open protocols › Electronic Ticketing	**2019 – 2030's** › Configurable by market › Sensor Agnostic (Plug/Play) › 1st and 3rd Party Data › Wireless integration › Remote app controls › Cloud Server Networking

LIQUID CONTROLS®

RESPONSIBILITY to DELIVER DATA & TECHNOLOGY

- Centralized Data Aggregation
- Mission Configurability
- Operator Mobility
- Safe and Easy User Experience

LIQUID CONTROLS®

CENTRALIZED DATA AGGREGATION

CENTRILOGiQ®

A centralized platform of mission-centric technologies that process and connect and deliver fueling system data to wherever it's needed.

LIQUID CONTROLS®

CENTRALIZED DATA AGGREGATION

BLUETOOTH
- Wireless printing with compatible Bluetooth enabled printers
- Wireless control and data transfer via FUELiQ app or SDK

Wi-Fi
- Wireless control and data transfer via FUELiQ app or SDK
- Wireless diagnostics and data log transfer

ETHERNET
- Fueling control and data transfer via LCP protocol
- Transaction details accessible using FTP

SERIAL CONNECTION
- Fueling control and data transfer via LCP protocol
- Ticket printing

CELLULAR (EXTERNAL)
IN-CAB (EXTERNAL)
HANDHELD (EXTERNAL)

LIQUID CONTROLS®

CENTRALIZED DATA AGGREGATION

YEARS OF ONBOARD FUELING DATA

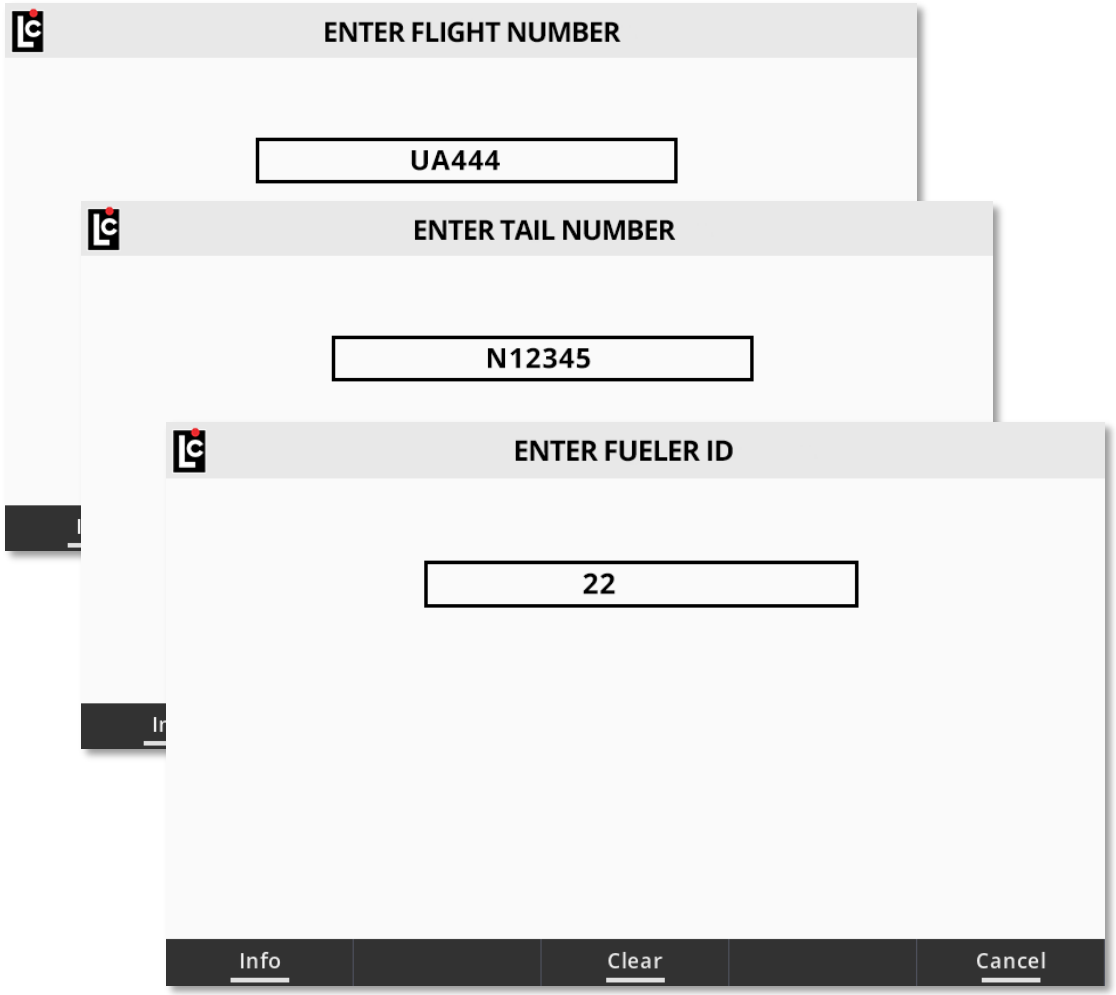
- Accessible wirelessly via Wi/Fi
- Accessible to print from operator screen

REAL-TIME TRANSACTIONAL DATA VIA LCP

- Read/Write access and control of over 300 real-time data fields

LIQUID CONTROLS®

MISSION CONFIGURABILITY:



Definable Fueler Prompts

- Up to **6** forced fueler entry prompts **pre-transaction**.
- Up to **4** forced fueler entry prompts **post-transaction**

All user prompt entries are:

- ***Printed on the ticket***
- ***Stored in the data log***
- ***Available via LCP data***

LIQUID CONTROLS®

MISSION CONFIGURABILITY:

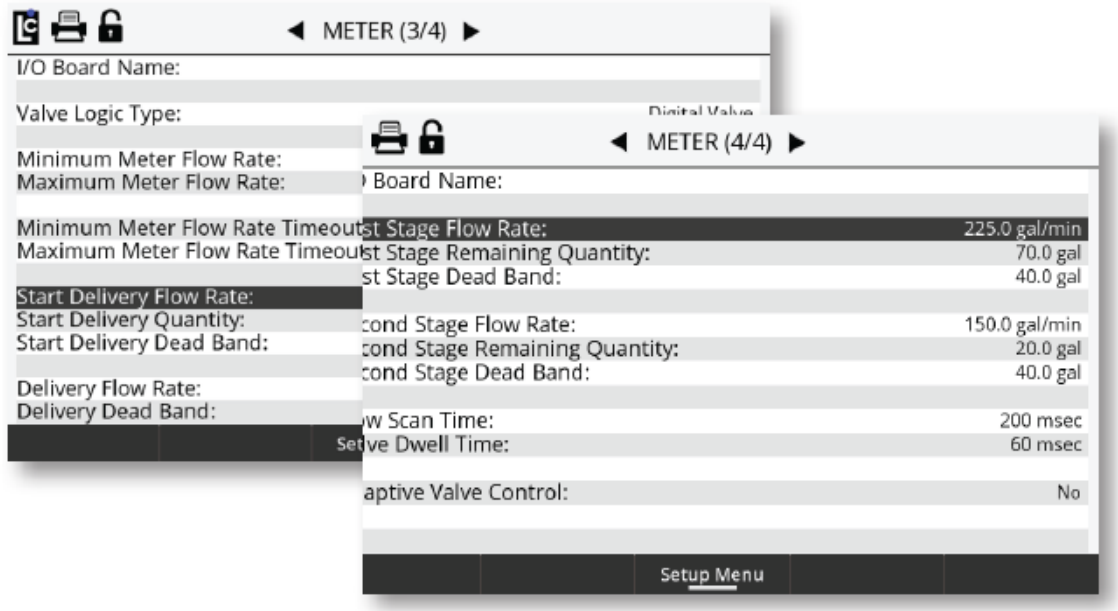
DIGITAL VALVE CONTROL

The LCR.iQ provides configurable digital valve control to gain higher levels of control over delivery flow rates than conventional registers that are limited to utilizing simple 2-stage block valves for flow control.

Gain Full Flow Control Over Your Deliveries

Gain full control over your fueling application with multi-stage variable control and ramp up and ramp down of flow rates during deliveries.

- Ideal for applications where precise flow-rate control is critical for both safety and fueling accuracy.
- Utilize the same fueling equipment in both high and low flow rate applications.

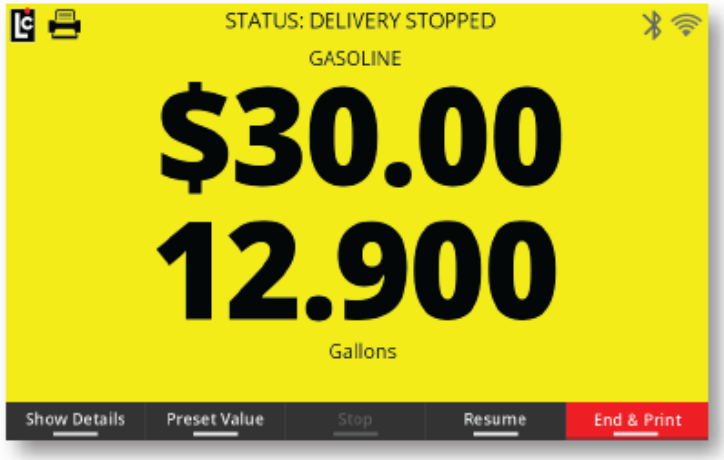


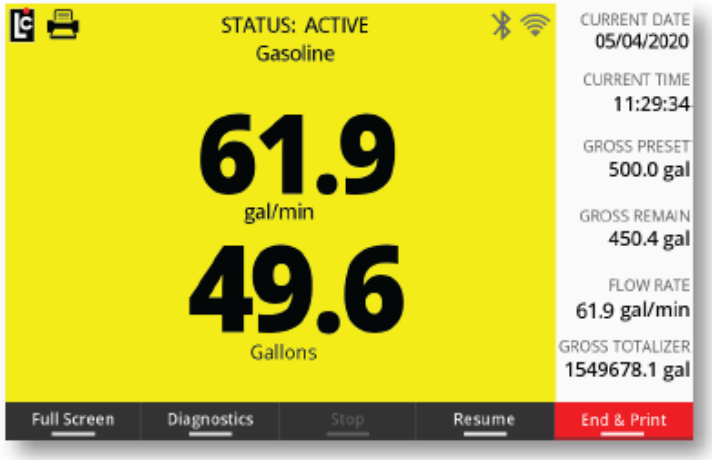
LIQUID CONTROLS®

MISSION CONFIGURABILITY:

CONFIGURABLE LARGE DIGIT DISPLAY

The LCR.iQ now allows users to configure the large digit data displayed to include total retail sale and volume measured to the 1/1000th decimal place or flow rate and volume when real-time of rate of fuel delivery monitoring is required.





Configure Large Digit Details

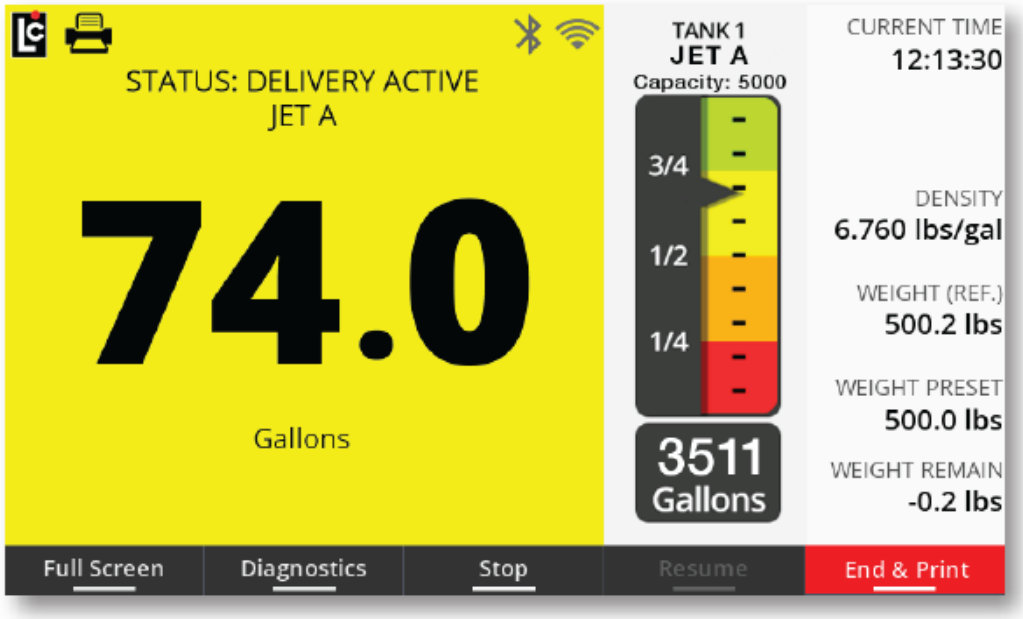
Certain retail fueling applications require total sale and volume to the 1/1000th place or real-time flow rates on the primary fueling screen.

LIQUID CONTROLS®

MISSION CONFIGURABILITY:

AUTOMATICALLY MEASURED OR MANUAL TANK INVENTORY

The LCR.iQ provides highly accurate tank level measurement and inventory management for up to 12 tanks and products. Each tank can be configured according to product type, tank size, or measurement method to be used (either automatic or manual level control).



TANKiQ™ *(patent pending)*

Auto-Calibrating Tank Measurement

The LCR.iQ offers the first ever continuously calibrated tank profile that does not require entering tank strapping charts.

- *When combined with an approved tank level gauge with 4-20 mA output, it auto-generates a precise tank strapping profile.*
- *Delivers highly accurate measured tank inventory and controls without the need of middleware or third party control devices.*

LIQUID CONTROLS®

MISSION CONFIGURABILITY

EXPANDABLE INPUTS & OUTPUTS

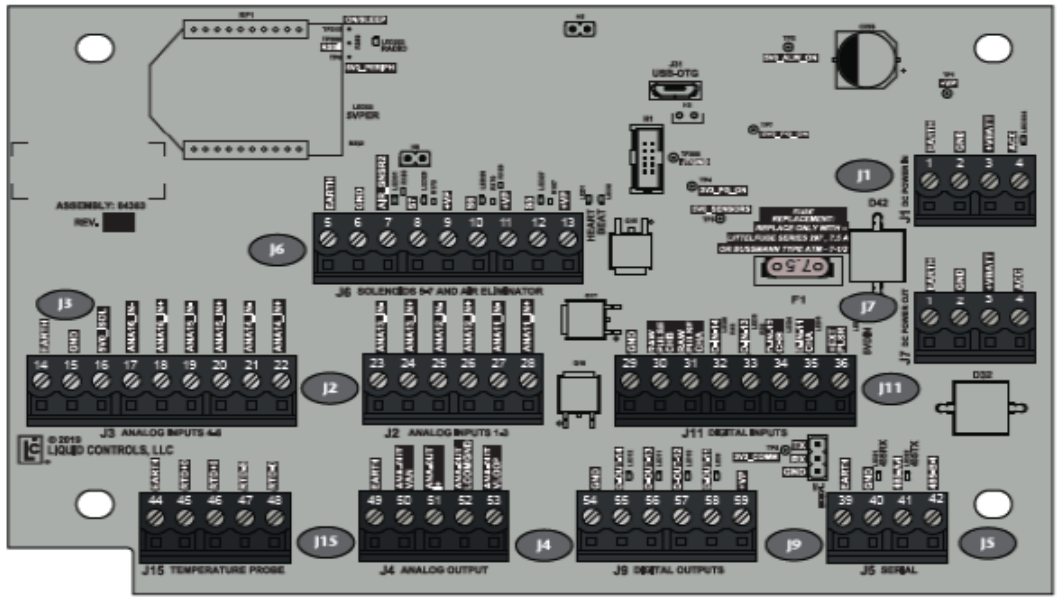
The SENSEiQ expansion board is available for applications with more demanding sensing and control options such as multiple measured tank levels, water detection, remote controls, external display devices, etc.

SENSEiQ™

Sensor Expansion Board

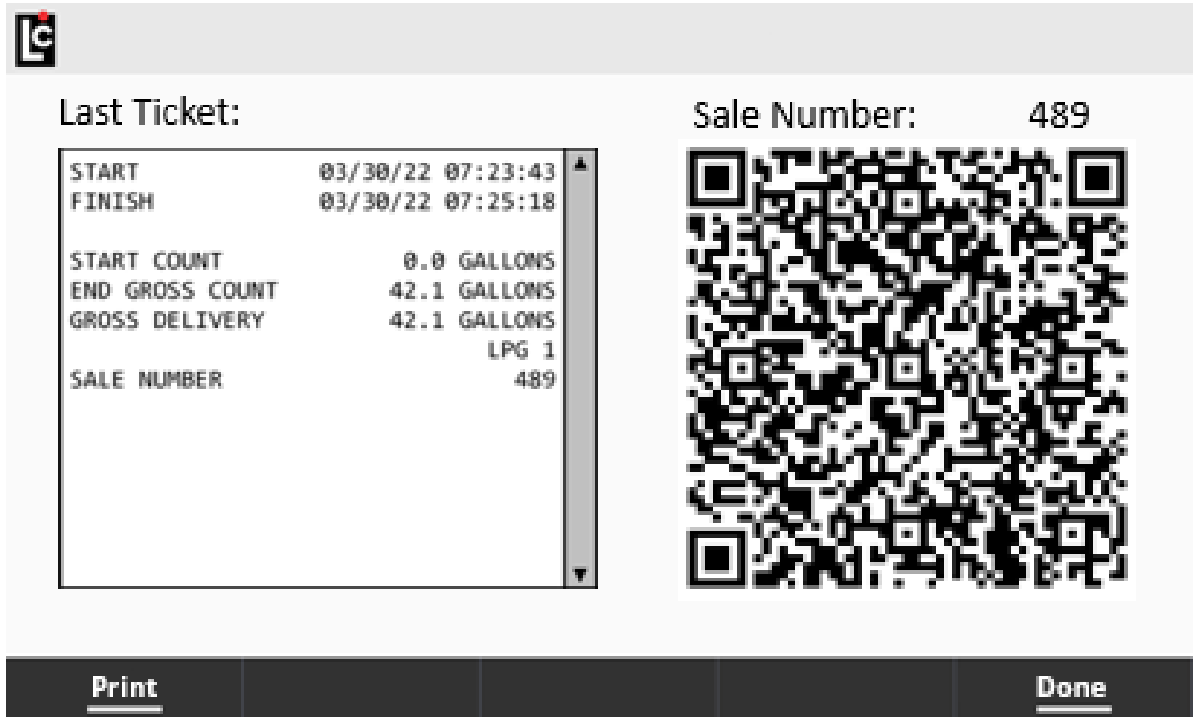
Provides end users the capability to connect and control a multitude of external devices in applications where additional I/O is required.

- 6 Analog inputs: Multiple Tank level sensors, H2O sensor
- 4 Digital inputs: remote start / stop / print. Pulse inputs
- 4 Digital outputs: Large digit external displays, calibrated pulse output, alarms, deadman control alarms.



LIQUID CONTROLS®

OPERATOR MOBILITY:



QR code retrievable tickets

- *Scan with mobile device*
- *Instantly view electronic ticket on device*
- *Store or forward electronic to back office*

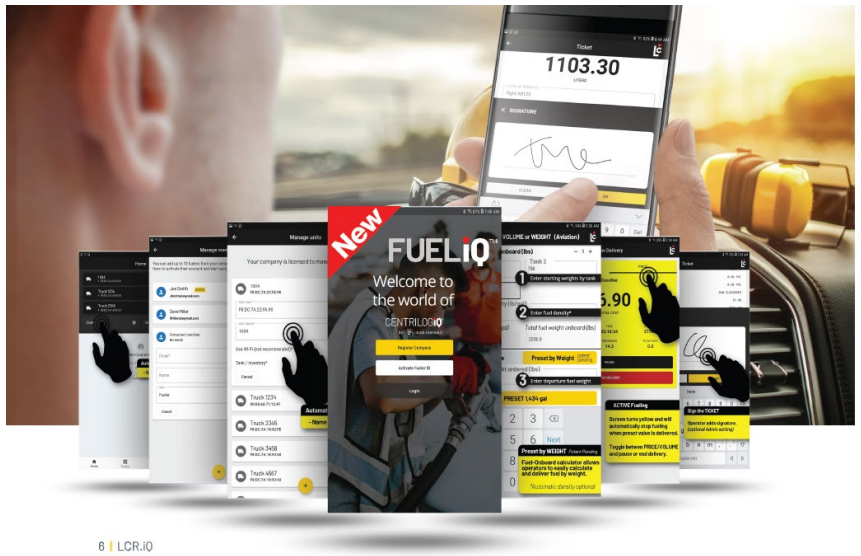
LIQUID CONTROLS®

OPERATOR MOBILITY

FUELiQ™ Android App

Liquid Controls' new FUELiQ Android application provides a wireless pathway for fuelers and third-party data providers to gain read-write access to pre-settable data fields on the LCR.iQ for operational mobility, efficiency, and transactional data.

[currently in limited beta testing]



- New "Fuel Onboard" feature
- Weight/Mass conversion for easy volume presets
- Delivers ticket to back office
- Zone 1 devices available

LIQUID CONTROLS®

OPERATOR MOBILITY

WIRELESS PRINTING

- High mobility delivery experience
- W&M compliant
- No more wires to the cab

LIQUID CONTROLS®

USER EXPERIENCE

OPERATOR FRIENDLY SCREENS WITH DAY / NIGHT MODES AND BRIGHTNESS CONTROL

LCR.iQ® screens adapt to the operator. Full, active fueling screen with yellow background when "Start" is pressed with day/ night mode and brightness control options.

Day mode idle screen *Night mode idle screen* *Active fueling mode full screen* *Active night mode detail screen*

LIQUID CONTROLS®

CENTRILOGiQ™ the center of fueling logic

The LCR.iQ™ is designed to be a user configurable central platform of fueling logics connecting critical sensing devices in fueling systems to the outside world.

In the coming years, we see…

- A sharp increase in new sensing and communication technologies to prepare for.
- New regulatory issues and operational challenges that we haven't faced before
- New uses of fueling information to drive safer and more efficient operations.