

Servo Gauge 139M**INTRODUCTION**

The 139M Servo Gauge is an intelligent, microprocessor based instrument for accurate measurement of product level, interface level, density and temperature (external sensor required for temperature). With the addition of one or more precision pressure transmitters (HART® protocol) to the system, real time accurate measurement of product density is also possible. It also provides reliable and precise alarms on level, temperature and real time density. Local and remote calibration and check of its performance is possible. Remote indication of the measured data is available using Communication Interface Unit (CIU) or Single Tank Indicator (STI), which also interface with a standard PC and / or a standard dot matrix printer. Transmission is on two wire RS 485 bus which allows looping of 16 Servo Gauges.

OPERATION**LEVEL MEASUREMENT**

The heart of the Servo Gauge is a weight sensor which continuously measures the tension in a wire which suspends a compact displacer. The wire is stored on a precision grooved drum. The tension, when the displacer is immersed in the liquid to a predetermined position, is the equilibrium tension.

A small change in the liquid level causes a corresponding change in the weight of the displacer and consequently the tension in the wire. If the tension change exceeds the set value, a variable speed positioner is energised which drives the wire drum (through magnetic coupling) to reposition the displacer so as to maintain the equilibrium tension.

While positioning the displacer, the positioner takes one step for each 0.0425 mm of displacer movement. Each step updates the level buffer by one increment. Positioner performance is continuously checked by an additional encoder mounted on the drive shaft.

INTERFACE LEVEL MEASUREMENT

Interface level measurement is executed on command. It programs another equilibrium tension which lowers the displacer to immerse in the lower liquid to a predetermined position.

DENSITY MEASUREMENT

The displacer is lowered to a predetermined level inside the liquid. The loss of weight of displacer in the liquid is sensed and divided by the programmed volume of the displacer to compute the product density (on demand).

**FEATURES**

- Level, Interface Level and Density measurement in one instrument
- Average temperature measurement with external temperature sensor
- Two density measurement options viz., on demand spot / average density and real time average density (using pressure transmitter)
- Two wire transmission bus allows looping, reduces cabling
- Automatic calibration of product level and compensation for density variation
- Automatic compensation for wire weight and tank deformation
- Wave integration in level measurement
- Accepts external current input and contacts to transmit data to control room
- Local and remote repeatability check
- Field calibration and checking through a portable programming unit possible without opening the instrument

REAL TIME DENSITY MEASUREMENT

For real time density measurement a precision pressure transmitter is employed to measure the head of the product column above this transmitter. Knowing this head and the precise product level, Servo Gauge computes the product density (real time).

LPG LIQUID, VAPOUR & TOTAL MASS MEASUREMENT

A pressure transmitter is employed to measure vapour pressure in case of pressurised liquid storage. Using the measurements, strap table and ASTM tables, LPG Servo Gauge calculates mass of liquid as well as vapour component and total mass. The same is displayed and transmitted.

SPECIFICATIONS

LEVEL AND INTERFACE LEVEL MEASUREMENT

Measuring range	: 0-27000 mm (standard) 0-37000 mm (on request)
Level accuracy	: ± 1 mm*
Sensitivity	: ± 0.1 mm*
Repeatability	: ± 0.1 mm*
Interface accuracy	: ± 2 mm*
Resolution	: 1 mm or 0.1 mm (selectable)
Displacer speed	: 2400 mm / minute (maximum)
Displacer diameter	: 90 mm (standard), 45 mm & 65 mm (optional)

* For Servo Gauge with 90 mm displacer gauging a product with a density of 0.8 gm/cc. Interface level measurement for density of 0.8 and 1 gm/cc.

DENSITY MEASUREMENT ACCURACY

On demand	: ± 0.005 gm/cc
Real time	: ± 0.08 % *

* With a pressure transmitter of accuracy $\pm 0.04\%$ of URL. Accuracy of real time density measurement is a function of the accuracy of pressure transmitter.

TEMPERATURE MEASUREMENT

(using external temperature sensor)

Measuring range	: -200°C to $+200^{\circ}\text{C}$
Accuracy	: $\pm 0.2^{\circ}\text{C}$
Resolution	: 0.1°C
Sensor type	: RTD spot / Averaging (Multi-point / Multi-element) Maximum 14 nos.

LPG MASS MEASUREMENT

Accuracy	: $\pm 1.3\%$ of reading with SG density $\pm 0.3\%$ of reading with manually entered density
Resolution	: 0.01 Metric Tonnes

DATA TRANSMISSION AND DISPLAY

Transmission

To Communication Interface Unit	: 2 way, 2 wire RS 485 ASCII coded / MODBUS
Data protection	: Longitudinal and vertical parity check
To Tank Side Indicator Controller	: 2 way, 2 wire RS 485 ASCII coded
Baud rate	: 1200 (standard) 2400 (optional)
To Portable Programming Unit	: Via infrared optical link
Display	: 2 line, 16 character backlit alphanumeric LCD display
Motor limit	: 2 programmable ML-HI and ML-LO with displacer stuck and wire break sensing
Programmable alarms	: 4 for level (HH, H, L, LL) 1 for temperature and 2 for density alarms (real time density)

EXTERNAL INPUTS (OPTIONAL)

- 4-20 mA DC - 1 no.
- NO/NC contacts (potential free) - 2 nos.

SECONDARY OUTPUTS (OPTIONAL)

- 4-20 mA DC, isolated, maximum load 750 proportional to level*
- Two / Four programmable relay contacts (potential free), NC/NO contact rated 6A @ 230VAC/28VDC (Resistive).
- For alarms or control of external field equipment through remote command

* Not available if real time density / LPG Servo Gauge option is chosen

POWER SUPPLY

- 110/230 VAC, $\pm 10\%$, 50Hz, 1, mains isolated, 25 VA
- Note : Additional 20 VA for heaters for operation at -50°C

CABLING

- Power : 2 core, 2.5 mm² Copper
- Signal : 1 twisted pair, 1 mm²
Rmax 200, Cmax 1 F
- For Tank Side Indicator Controller : 2 pair, 1 mm² Copper

CERTIFICATIONS

- Servo Gauge & terminal compartment enclosure : Flameproof as per IS 2148-1981 suitable for Group IIA & IIB area
Cert no.- CMRI/TC/H201 dated - 22/02/96 issued by CMRI, Dhanbad.
Cert. no.- R1(1) 136/ S.B.Electro-mechanicals/36 dated - 29/01/93 issued by CCE, Nagpur.
Cert. no.- 65/15/94 - TECH dated - 26/03/95 issued by DGFASLI, Mumbai.
Weatherproof to IP:65 as per IS:2147-1962
Test report No.- PCI/1/947/93-94 dated - 08/09/93 issued by IDEMI, Mumbai.
- Terminals for temperature sensor and pressure : Intrinsically safe as per IS:5780-1980 for Ex ia IIA & IIB T6
Cert. no.CMRS/TC/338 dated - 07/07/97 issued by CMRI, Dhanbad.

Design conforms to CENELEC EN 50.018 & EN 50.020

ENVIRONMENT

- Ambient operating temperature : -10°C to $+60^{\circ}\text{C}$ (standard)
 -50°C to $+85^{\circ}\text{C}$
- Storage temperature : -50°C to $+85^{\circ}\text{C}$

MATERIALS OF CONSTRUCTION

Displacer	: SS 316
Measuring wire	: SS 316
Main housing & drum compartment cover	: See table below
Servo compartment cover	: Cast aluminium LM6
Measuring drum shaft & magnetic coupling cap	: SS 316
Magnetic coupling	: Strontium ferrite magnets
Drum bearings	: Carbon filled PTFE
`O` rings	: Viton - Standard PTFE (for high pressure drum side only) - Optional

Max. operating pressure (kg cm ²)	Material of main housing and drum compartment cover	Mounting flange	Weight of Servo Gauge
6	Cast Aluminium LM6	2" ANSI 150 lbs FF / RF	25 Kg.
30	SS316 SS304	2" ANSI 300 lbs RF	42 Kg.

OPTIONAL ACCESSORIES

Following is the list of accessories available. The respective product leaflet numbers are indicated within brackets.

Calibration Chamber (LF-139-0805)

Fabricated Calibration Chamber (LF-139-0810)

This is a recommended accessory to enable automatic calibration of reference.

Portable Programming Unit (LF-139-0806)

It is a hand held portable unit for programming / calibration of Servo Gauge from tank top.

Tank Side Indicator Controller (LF-139-0808)

It is a local indicator controller mounted at tank side which displays all parameters and also sends various commands to Servo Gauge.

Communication Interface Unit (LF-133-0807)

It is control room indicator for multiple tanks providing relay and current output. One CIU can be used for Maximum of 64 tanks.

Single Tank Indicator (LF-139-0809)

It is control room indicator for single tank providing relay and current output.

Averaging Temperature Sensor (LF-133-0808)

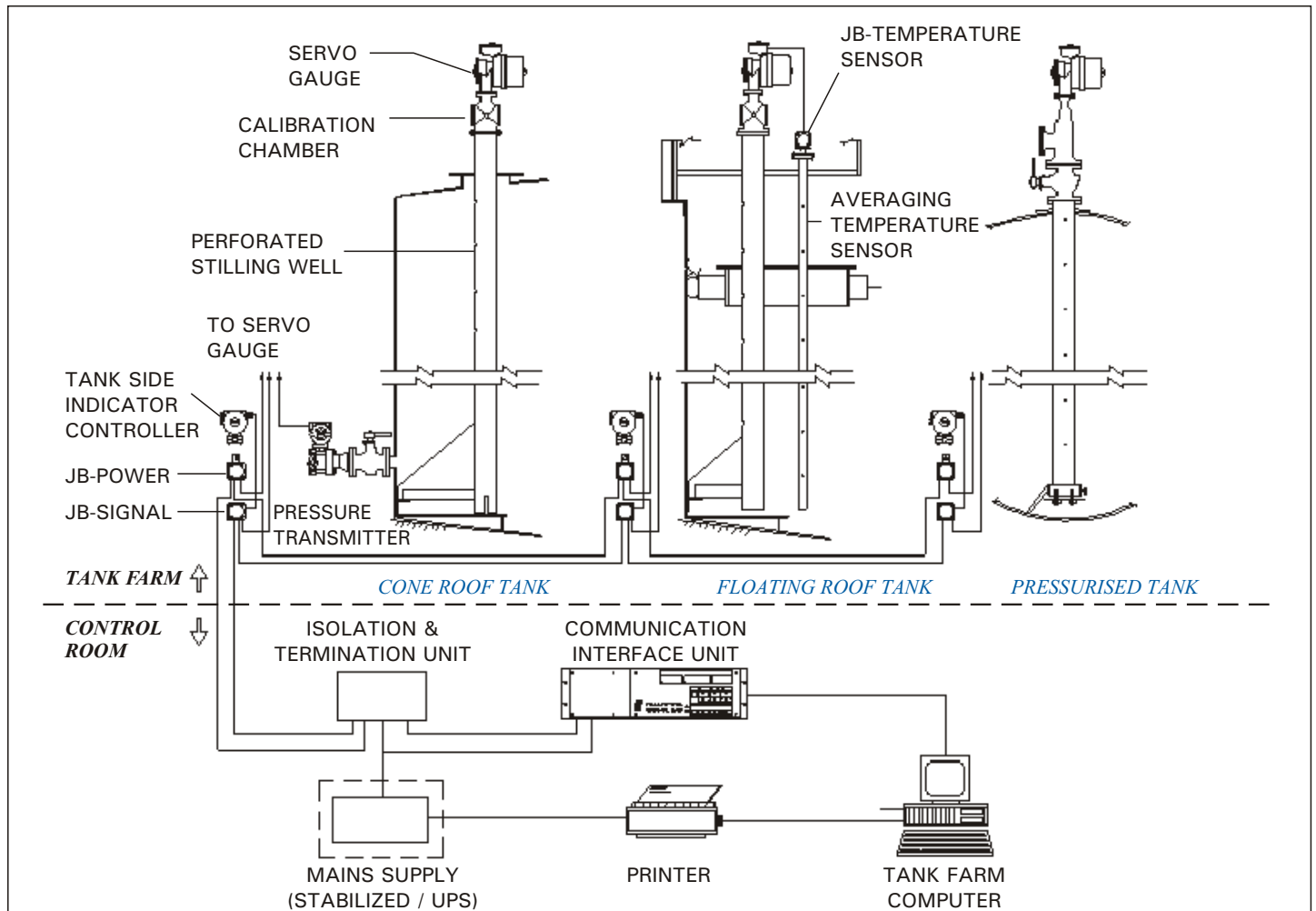
(Multi-point / Multi-element) (LF-133-0809)

This is an accessory used for measurement of average temperature of product stored in bulk storage tanks.

LPG Servo Gauge (LF-139-0817)

A variant for inventory calculations & measurements of liquids stored in pressurised vessels.

TYPICAL SERVO GAUGE BASED TANK INVENTORY MANAGEMENT SYSTEM



ORDERING INFORMATION

MODEL
139 M

SERVO GAUGE

CODE	PRESSURE	MATERIAL OF MAIN HOUSING AND DRUM COVER
2	0-6 Kg/cm ²	Cast Aluminium LM6
7	0-30 Kg/cm ²	SS 316
8	0-30 Kg/cm ²	SS 304

CODE	DENSITY
1	Density (On demand)
2	Density (Real time) *

CODE	TEMPERATURE MEASUREMENT AND SENSOR TYPE
0	No temperature sensor
1	Pt - 100 single point
2	Averaging temperature sensor

CODE	SECONDARY OUTPUTS
0	No secondary output
1	4-20 mA DC (proportional to level) *
2	Two relay contacts
3	4-20 mA DC + NO / NC contacts *
5	Four relay contacts

CODE	EXTERNAL INPUTS
0	No external input
1	4-20 mA DC
2	NO / NC contacts (2 nos.)
3	4-20 mA + NO / NC contacts (2 nos.)

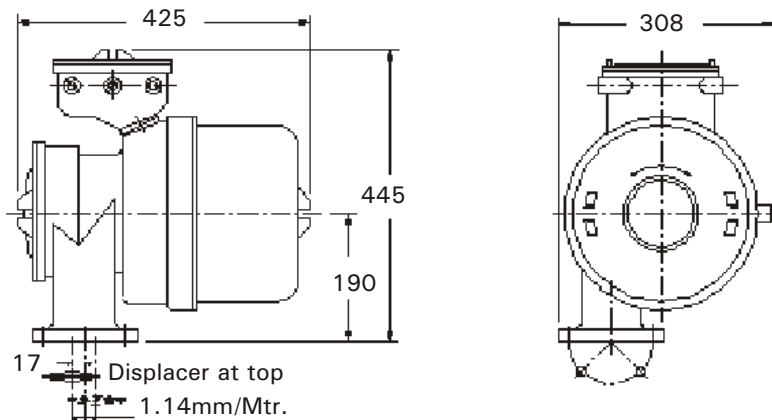
CODE	POWER
1	110 VAC, 50 Hz, 1 (standard)
2	230 VAC, 50 Hz, 1

CODE	CABLE ENTRIES
1	1/2 " NPT (F)
2	3/4 " UNF (F)

139M 7 2 2 0 3 1 1 TYPICAL MODEL NO.

Note : * For real time density measurement / LPG Servo Gauge, a pressure transmitter is employed. In such case, secondary current output of 4-20 mA DC (option 1 & 3) is not selectable.

MECHANICAL DIMENSIONS



*** Continuous developments may necessitate changes without notice.

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