Our Expertise, Your Values

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JOYO M&C

Our Expertise, Your Values

BJLM-80H Series
Tank Gauging Systems

JOYO M&C TECHNOLOGY CO., LTD
www.joyo-mc.com

Providing Higher Values for Your Products

by Our Expertise and Technologies in Liquid Measurement and Control

About JOYO M&C

Joyo M&C Technology Co., Ltd. is a company dedicated in developing and manufacturing products related to terminal automation systems, hi-precision measure & control instruments, and it also provides engineering solutions for terminal automation and bulk liquid storage and handling businesses. JOYO M&C was established in 2001 and is now located in the Zhongguancun Science and Technology Park, Tongzhou District, Beijing.

As a high-tech enterprise majoring in R&D and production of high-precision and top-leading products for more than 2 decades, JOYO M&C has come out with a lot of valued fine products by its own independent and persistent developments and has by far obtained many technical invention patents and utility model patents.JOYO M&C is one of the TOP suppliers for SINOPEC and PETROCHINA for over ten years. Its products are also supplied to oil companies in Russia, Mongolia, Kazakastan, South Aisa, Middle east and other countries in the world.

The products developed by Joyo M&C have been widely adopted by customers in different industries, and these products are making good economical and social benefits for them. After years of practice and development, the products and technologies provided by Joyo M&C have been widely recognized by the customers in the sector, of which, the intelligent Terminal Automation/Information System developed by JOYO M&C is being spread into applications as a benchmark throughout the oil distribution companies in China and has drawn wide attention from the customers as a successful model in the sector in recent years.

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System Overview

BJLM-80 series Servo Tank Gauging System are designed for the ambient and high pressure bulk liquid storage to facilitate monitoring inventory levels, temperature, density, volume and mass custody transfer and leak detection. BJLM-80 series Automatic Tank Gauging (ATG) Systems is custody transfer certified based on a web server technology, which allows access of ATG reports from PC software.

Applications

- BJLM-80H products are applicable to a wide range of liquid stocks, including the oil products, petrochemical stocks, liquid chemicals, edible oil and/or liquid foods being stored in ambient condition;
- Its high pressure version products are applicable to the high pressure liquids, such as LPG or other chemical stocks stored in high pressure;
- TM-80N series products are exclusively applicable to the bulk LNG stocks;
- These products are applicable to multiple types of tanks, including the fixed roof cylindrical tanks, floating roof cylindrical tanks, and spherical pressurized tanks, etc.

PART 1

BJLM-80H SMART TANK GAUGING SYSTEM

BJLM-80H series tank gauges with the MF/MPF/TF displacers are normally called as the BJLM-80H series SMART TANK GAUGING SYSTEM in which multiple functions has been integrated within one gauge simultaneously covering all the measurements of liquid in the tank aiming at quantifying the volume and mass of the products being stored in the tank.

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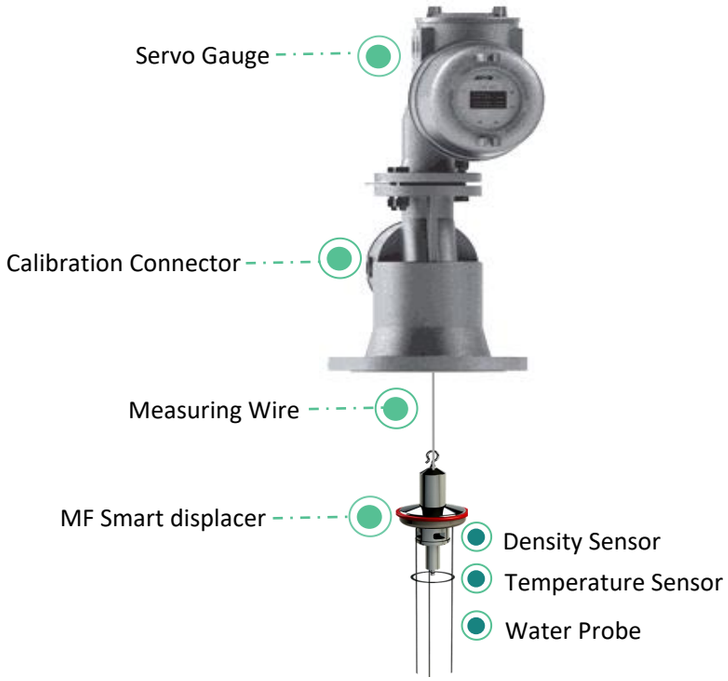
1.1 BJLM-80H with Smart MF Displacer

BJLM-80H servo tank gauges with MF smart displacers can be used to set up a Smart Tank Gauging System with multiple functions integrated in one gauge, aiming at measuring the bulk liquid stocks stored in ambient pressure. It features with MF displacer in which the density sensor, temperature sensor and water interface probe are integrated together. It performs multiple measurements upon commands, including the measurements for the liquid level, temperature, density, water interface level, and the tank bottom, and conducts the calculations of the volume, VCF and mass, providing data for custody transfers either in volume or in mass.

Structure



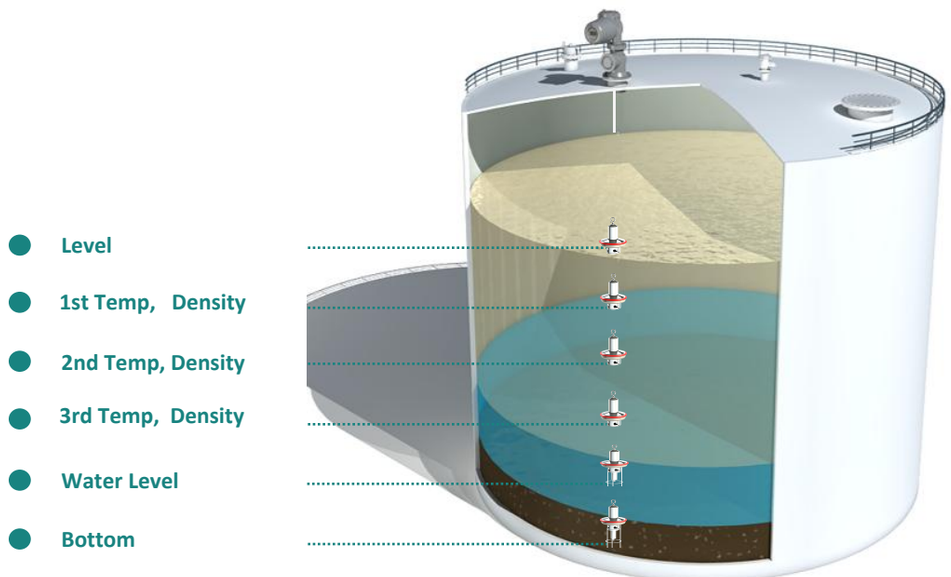
Functions Overview

Features

- Integration of LTD (level, temperature, density) measurements in one gauge, designed to measure the level, temperature, density, tank bottom and oil-water interface , and calculate the tankage either in volume or in mass;
- Hi-precision level measurement has been certified by the OIML R85;
- The monitoring interfaces for the temperature and density measurements are available;
- Electronic probing ensures the water interface measurement fast and sensitive;
- Can provide the data for custody transfer either in volume or in mass upon requirement;
- Less components for stronger functions, and easier installing, wiring and commissioning;
- Perfect applicability for challenging situations and demanding applications.

Measuring Process

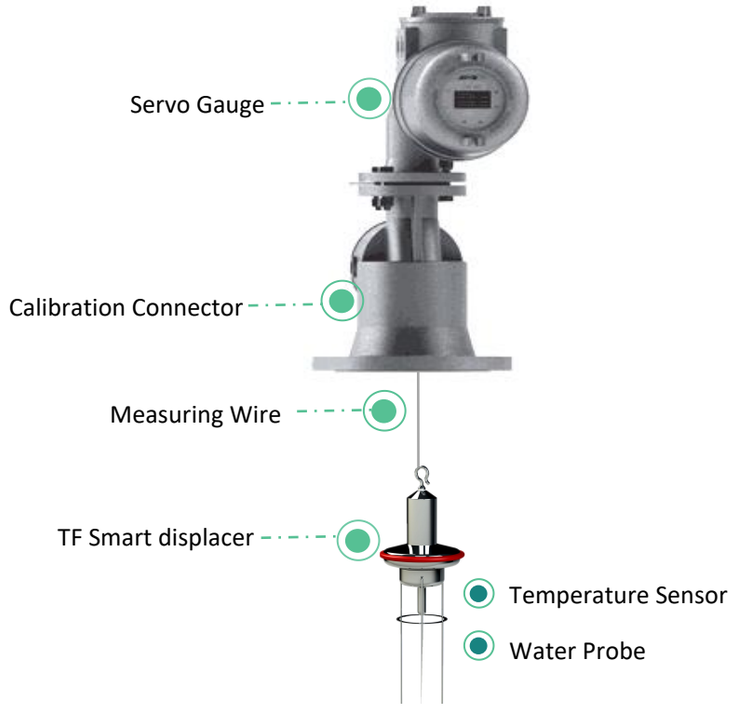
The displacer normally stays on the liquid surface and monitor the liquid level in real time. It dives down into the liquid for the designated measurements upon the commands being released from the TankStar monitoring software. It measures the oil-water interface level and the tank bottom level when it goes through the water interface and touches the bottom, and then it moves to the set points where the temperature and density measurements are required and stops there for around 2 minutes for each point (as per the configuration). Upon completing the whole process of the measurements, the displacer automatically returns to the liquid surface and resumes its level monitoring again.



1.2 BJLM-80H with TF Displacer

BJLM-80H tank gauges with the TF smart displacers are designed to set up a Tank Gauging System for bulk liquid stocks stored in ambient pressure. Temperature sensor is involved in the TF displacer, and multiple measurement functions are also integrated within one gauge, including the measurements for liquid level, temperature, oil-water interface and the bottom level. Such a TGS calculates the tankage/inventory in volume for the volume-based custody transfers.

Structure



Functions Overview

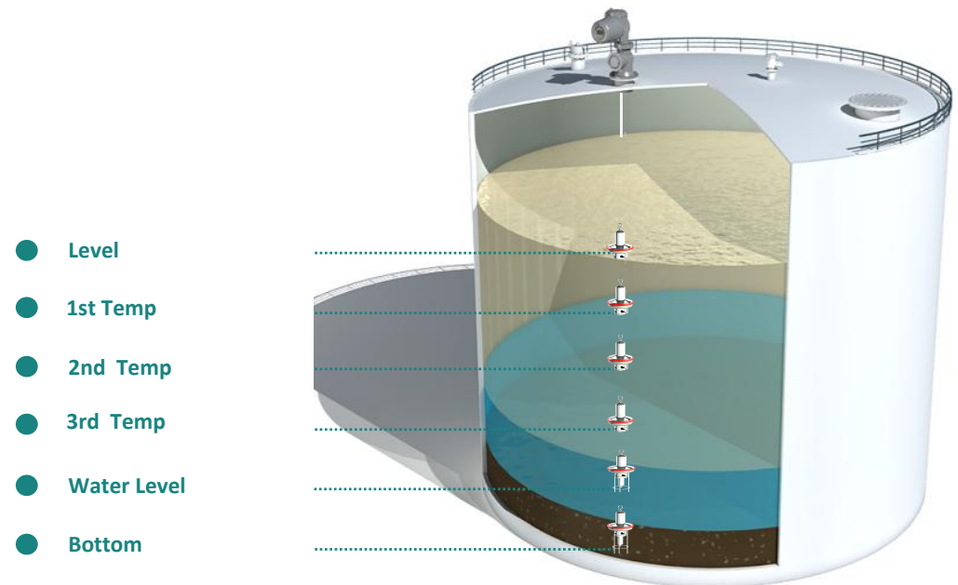
Level Temp Water Bottom Volume

Features

- Integration of LT (Level and Temperature) measurements in one gauge;
- Hi-precision liquid level measurement being certified by OIML R85;
- Monitoring interfaces are available for the measurements of liquid temperature, oil-water interface, and tank bottom level upon commands from the TankStar monitoring software;
- Less components for stronger functions, and easier installing, wiring and commissioning;
- Providing the data for the custody transfers either in volume or in mass upon requirement;
- Perfect applicability for challenging situations and demanding applications.

Measuring Process

The displacer normally stays on the liquid surface and monitors the liquid level in real time. It dives down into the liquid to perform the multi-point temperature measurements upon the commands from the TankStar software and also measures the oil-water interface according to the commands. Upon completing the whole process of the measurements, the displacer automatically returns to the liquid surface and resumes its level monitoring again.



1.3 BJLM-80H Smart TGS SystemFunctions

Measurement of:

Level (by displacer)

Water level (by MF displacer)

Temperature
- 3 points of temperature of liquid
- Average temperature of liquid
- Temperature interfaces

(by MF displacer)

Density
- 3 points of temperature of liquid
- Average temperature of liquid
- Temperature interfaces

(by MF displacer)

Volume
- Total Volume
- Water Volume
- Net standard volume
- Volume percentage

Mass (by MF dispalcer)

Data communication functions

Digital communication with other systems, DCS, SCADA, PLC,

Enterprise system etc (RS232, Ethernet,OPC etc)

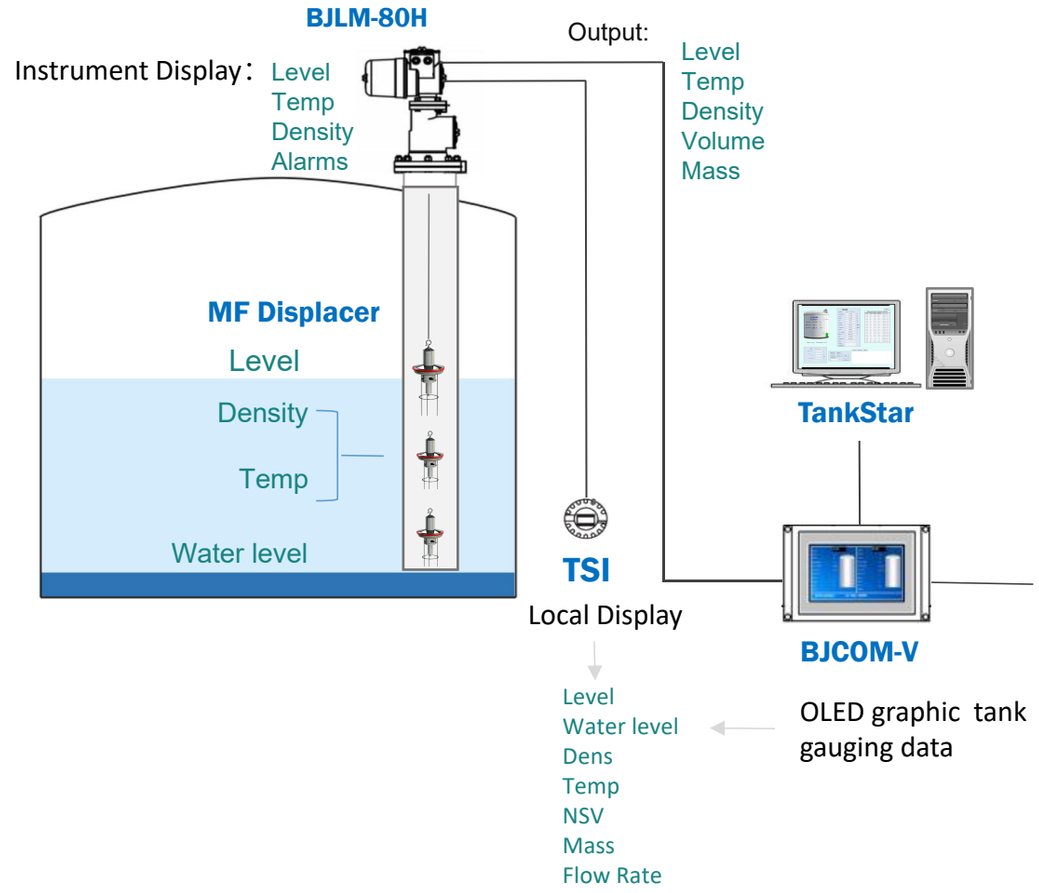
RS485 Modbus or BPM wired transmission of data

Wireless Modubs transmission of data

1.4 BJLM-80H Smart TGS SystemConfiguration

BJLM-80H with a MF smart displacer together with BJCOM-IV CIU and TankStar ATG management software forms a smart TGS. BJLM-80H servo gauge with MF/TF dispalcer perform mulfifuntions measurement in one sigle instrument which availible to install on a single tank nozzle and transimit all of the data to BJCOM-IV CIU.

TEMPERATURE , DENSITY, WATER LEVEL measured by MF dispalcer will be transmitted to servo gauge. Together with level measured by BJLM will be calculated into VCF, VOLUME MASS in Servo gauge mainborad, and will be output to TANKSTAR ATG software and/or to DCS/PLC/SCARDA throughout BJCOM CIU.



PART 2

BJLM-80H HYBRID TANK MEASUREMENT SYSTEM (HTMS)

BJLM-80H tank gauge based Hybrid Tank Measurement System (HTMS) consists of the BJLM-80H tank gauge with the SF regular displacer, the BJZT-V multi-point thermometer (MPT) and the hi-precision pressure transmitter, in which, the level is measured by the BJLM-80H servo tank gauge, the temperature by the BJZT-V multi-point thermometer and the density is calculated out of the pressure value output by the hi-precision pressure transmitter.

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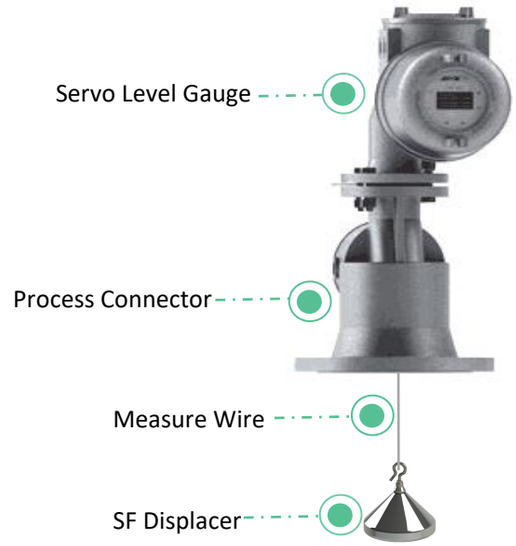
2.1 BJLM-80H with SF Displacer

BJLM-80H tank gauge with the SF regular displacer is a traditional servo level gauge. Its SF displacer is a mechanical displacer without any sensor being included inside. It provides the level measurement only as the traditional servo level gauge does. BJLM-80H tank gauge (with a SF displacer) working together with the Multi-Point Thermometer (for the temperature) and the hi-precision pressure transmitter (for the density) forms a HTMS.

Structure



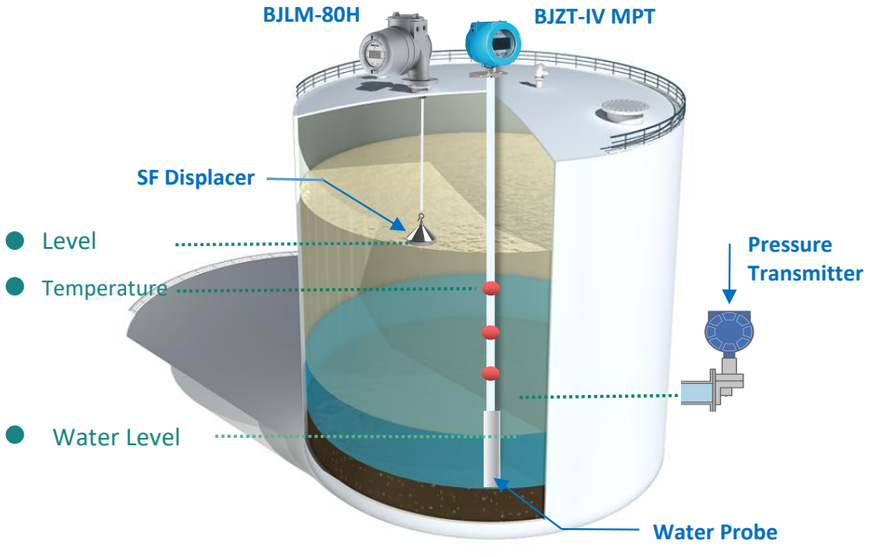
BJLM-80H tank gauge with the SF regular displacer consists of the Servo Level Gauge (head), the Process Connector, the Measuring Wire, and the SF Displacer, among which, the SF displacer is a mechanical displacer only, without any sensor being included inside.

2.2 BJLM-80H HTMS CONFIGURATION

BJLM-80H tank gauge based Hybrid Tank Measurement System (HTMS) consists of the BJLM-80H tank gauge with the SF regular displacer, the BJZT-V multi-point thermometer (MPT) and the hi-precision pressure transmitter, in which, the level is measured by the BJLM-80H servo tank gauge, the temperature by the BJZT-V multi-point thermometer, and the product's average density is calculated out of the output of the pressure transmitter.

Features of HTMS

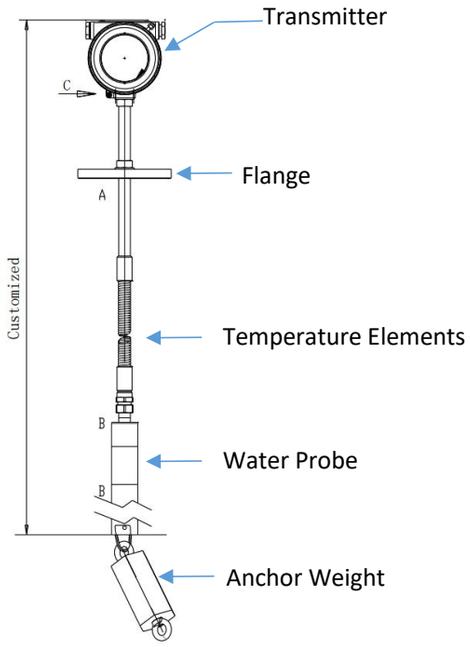
- Hi-precision level measurement has been certified by OIML R85;
- Online temperature measurement outputs are always available;
- Oil-water interface being measured by the water probe on the MPT;
- Liquid density is calculated out of the output by the pressure transmitter;
- Providing the data for the custody transfer either in volume or in mass, in which the mass data comes out of the output of the pressure transmitter being installed.



2.3 BJZT-V Multi-Point Thermometer

BJZT-V MPT is a multi-point thermometer designed to meet the demand of temperature measurements for both custody transfer and inventory control applications. It features with the integration of Multi-Point Temperature measurements and the Oil/Water interface measurements, providing both the temperature and water interface data via Hart or Modbus communication to another instrument or just for a local use onsite.

Structure



Technical Data

Temp. Element	Max. 16 pcs	**Water Measure Range**	Max 400mm
Accuracy of Temp.	± 0.1℃	**Accuracy of WL**	± 3 mm
Output	RS485 MODBUS / HART	**Length**	Max 30m
Sensor Type	PT100 RTD	**Ambient Temp.**	-40℃~+70℃
Voltage	DC 24V for HART, DC 6 ~ 28V for RS485	**Flange**	Customized, min 2" in dia.
Length	Max 30m	**Cable Inlet**	2 pcs of NPT 1/2"
Ex Rating	Ex ia Ⅱ C T6 Ga	**IP Protection**	IP68

2.4 BJLM-80H HTMS System Functions

Measurement of:

Level (by displacer)

Water level (by BJZT-V MPT)

Temperature
- Spot temperature of liquid
- Average temperature of liquid
- Temperature interfaces

(- BJZT MPT)

Density (- Pressor Sensor)

Volume
- Total Volume
- Water Volume
- Net standard volume
- Volume percentage

Mass (by BJLM- HTMS)

Data communication functions

Digital communication with other systems, DCS, SCADA, PLC,

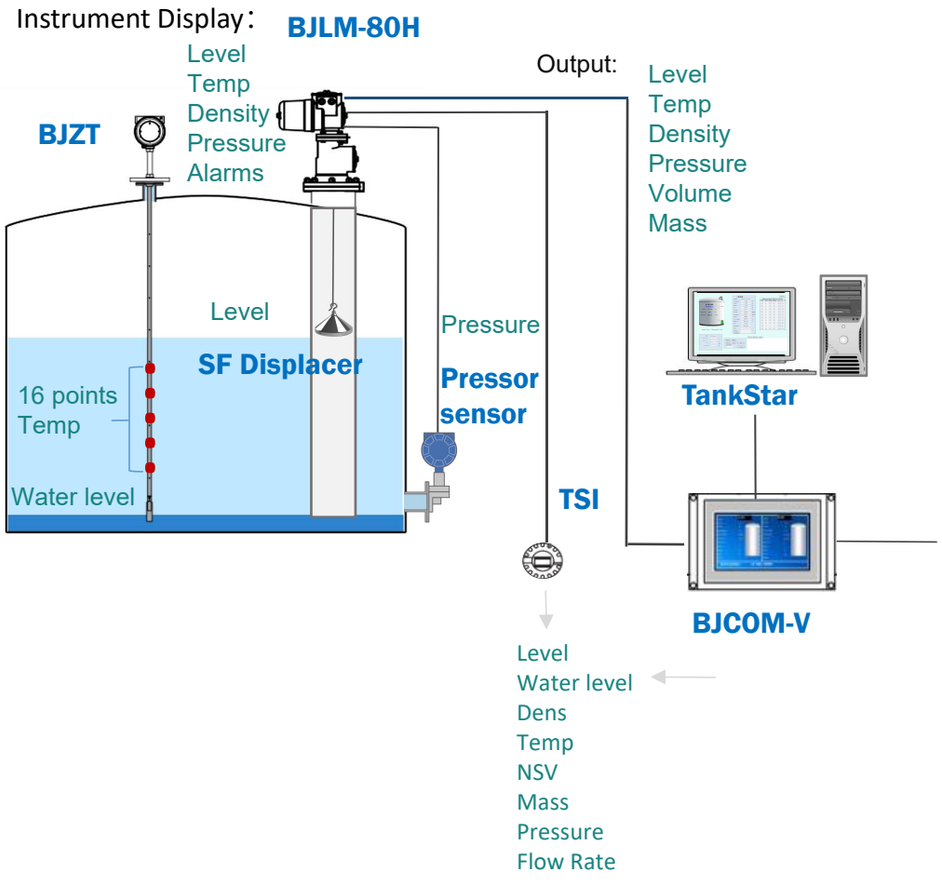
Communication with Enterprise system etc (RS232, Ethernet,OPC etc)

- RS485 Modbus or BPM wired transmission of data
- Emulation of other vendor's gauge communication
- Wireless Modubs transmission of data

2.5 BJLM-80H HTMS SystemConfiguration

BJLM-80H (SF mechanical displacer) together with BJZT Multi-point thermometer, pressor sensor and BJCOM-IV CIU and TankStar ATG management software forms a hybrid tank gauging system.

TEMPERATURE from BJZT MPT and PRESSURE from pressure sensor will be transmitted to servo gauge. All of these data together with level measured by BJLM will be calculated into VCF, VOLUME MASS in Servo gauge mainborad, and will be output to TANKSTAR ATG software and/or to DCS/PLC/SCARDA throughout BJCOM CIU.



PART 3

BJLM-80H FOR PRESSURIZED TANK (LPG))

BJLM-80H tank gauges with the SPF mechanical displacers or the MPF smart displacers are designed for the tank gauging system of the pressurIzed bulk storage tanks,ie, LPG tanks. The BJLM-80H tank gauges with the SPF displacers provide the level measurement only, and those with the MPF smart displacers provide multiple measurement functions being integrated in one gauge, including the measurement of liquid level, temperature, density and the data of tankage/inventory for custody transfers either in volume or mass upon customer's requirement.

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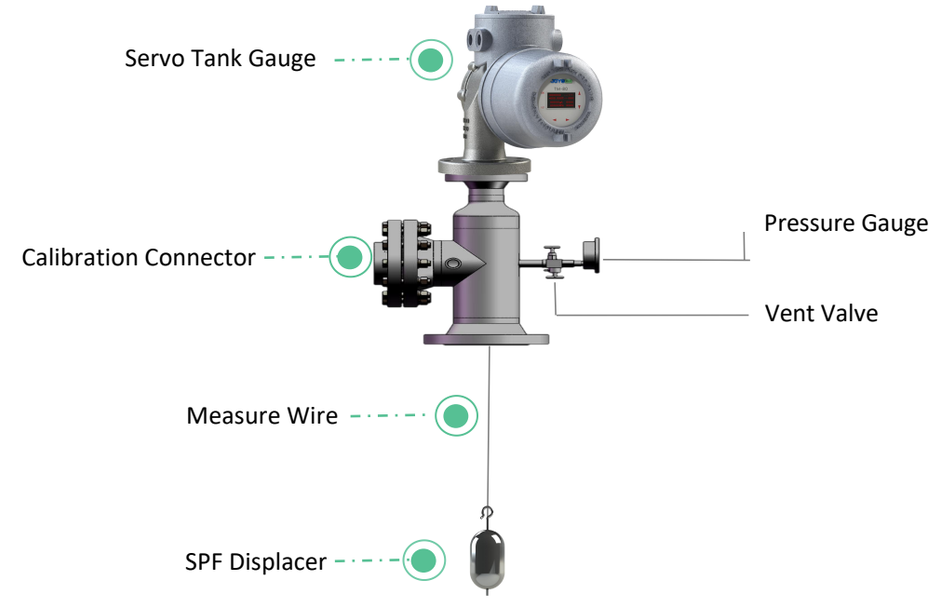
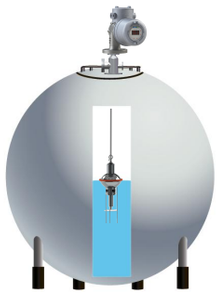
3.1 BJLM-80H With SPF Displacer

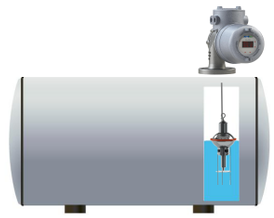
BJLM-80H tank gauges with the SPF mechanical displacers are designed to provide the level measurement for high pressure storage tanks, especially for the LPG tanks. It is a typical traditional level gauge providing the level data only without any outputs for the temperature and density measurements.

The calibration connector next to the head of the instrument is equipped with a visual inspection window , a pressure gauge and a vent valve ready for emergency safety operations.

Structure



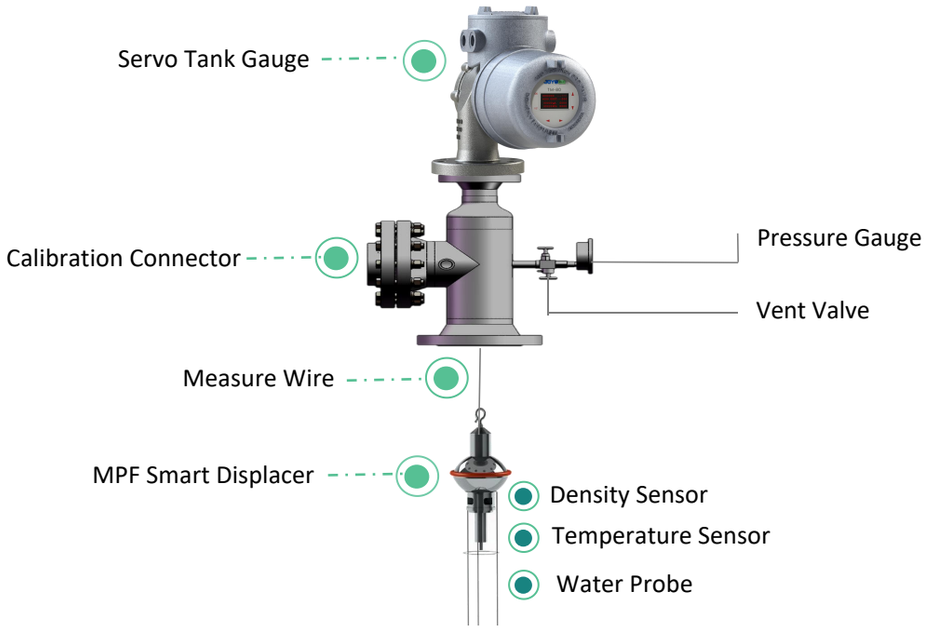




3.2 BJLM-80H With MPF Smart Displacer

BJLM-80H tank gauges with the MPF smart displacers are designed to set up a TGS for high pressure liquid stocks, ie. for the LPG tanks. It features with the multiple measurement functions being integrated in one gauge, especially for the function of measuring the density for a vaporized liquid, which is included in the calculation of the tankage/inventory in both volume and in mass, providing a more accurate data for the custody transfer.

Structure



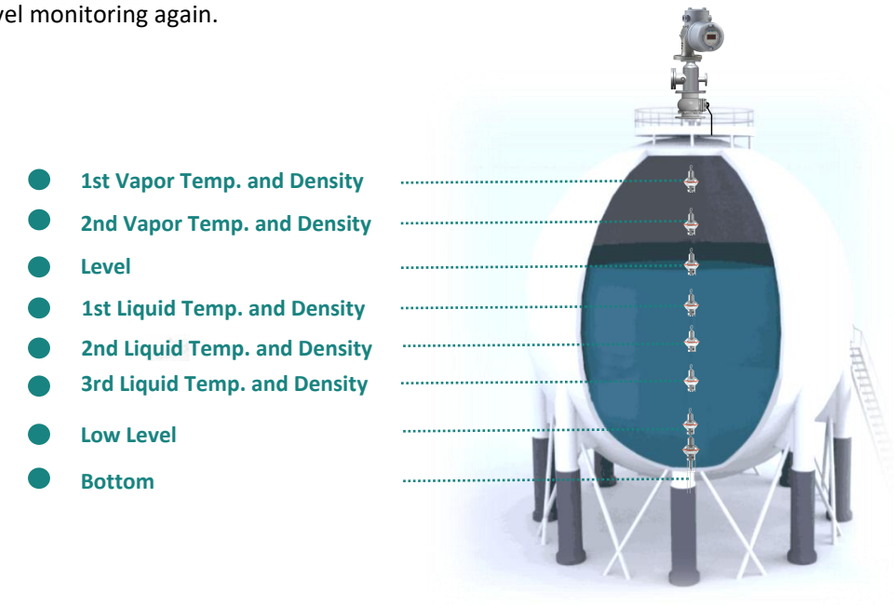
Functions Overview

Features:

- Integration of LTD (Level, Temperature, Density) measurements in one gauge, together with the water level detection as well as the calculation of the tankage/inventory in volume and mass;
- Providing data for the custody transfer either in volume or in mass;
- Especially with the measurement of the vapor density and the mass of the vapor, which is included in the volume and mass calculations. It solved the problems that the traditional tank level gauges cannot take the vaporized liquid into account in the tankage/inventory calculations.
- Less components for stronger functions, and easier installing, wiring and commissioning.

Measuring Process

The displacer normally stays on the liquid surface to monitor the liquid level in real time. It dives down into the liquid to perform the measurements specified by the commands being received from the TankStar software. It measures the oil-water interface level and the tank bottom level when it goes through the water interface and touches on the bottom, and then it moves to and stops at the set points specified by the commands and measures the temperature and density values there. For each set point, it stops for around 2 minutes. The interval for each stop can be defined by configuration. After completing the whole process of the measurements, the displacer automatically returns to the liquid surface and resumes its level monitoring again.



3.3 BJLM-80H Smart TGS (lpg) Functions

Measurement of:

Level

Water level

Temperature
- Vapor temp — 2 points of temperature of liquid Average vapor temperature
- Liquid temp — 3 points of temperature of liquid Average temperature of liquid

Density
- Vapor density — 2 points of temperature of liquid Average vapor temperature
- Liquid density — 3 points of temperature of liquid Average temperature of liquid

(by MF displacer)

Volume
- Total Volume
- Water Volume
- Net standard volume
- Volume percentage

Mass — Toal Mass= Vapor mass + Liquid mass

(by MF dispalcer)

Data communication functions

Digital communication with other systems, DCS, SCADA, PLC,

Enterprise system etc (RS232, Ethernet,OPC etc)

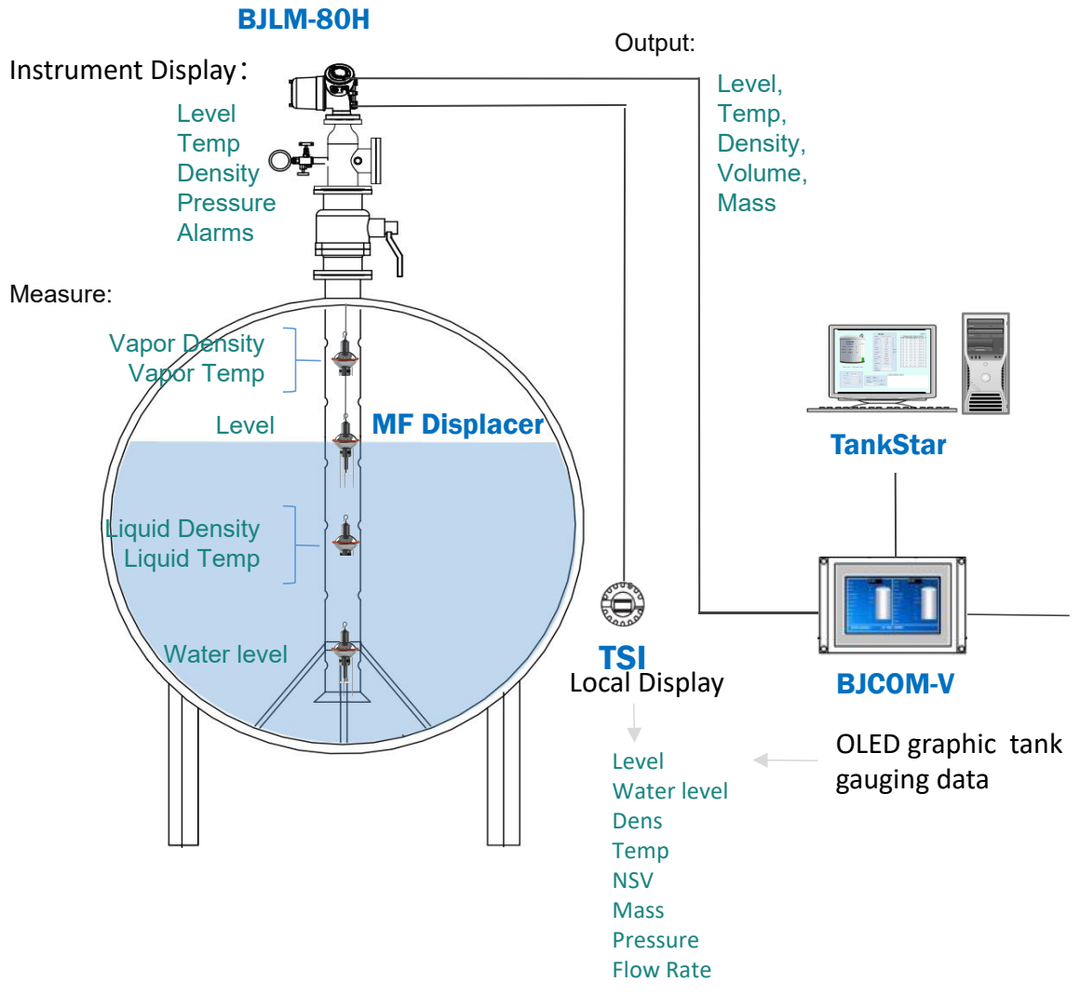
RS485 Modbus or BPM wired transmission of data

Wireless Modubs transmission of data

3.4 BJLM-80H Smart TGS(lpg) SystemConfiguration

BJLM-80H with a MF smart displacer together with BJCOM-IV CIU and TankStar ATG management software forms a smart TGS. BJLM-80H servo gauge with MF/TF dispalcer perform mulfifuntions measurement in one sigle instrument which availible to install on a single tank nozzle and transimit all of the data to BJCOM-IV CIU.

TEMPERATURE , DENSITY, WATER LEVEL measured by MPF dispalcer will be transmitted to servo gauge. Together with level measured by BJLM will be calculated into VCF, VOLUME MASS in Servo gauge mainborad, and will be output to TANKSTAR ATG software and/or to DCS/PLC/SCARDA throughout BJCOM CIU.



PART 4

TM-80N LNG TANK GAUGE

The typical LNG tank gauging system consists of the primary and secondary level gauges, primary and secondary thermometers, the LTD gauge and a radar level gauge as the HH alarming instrument. In such a system, both the level gauges and the thermometers are designed in redundancy, and all the data are linked with a PC-based monitoring platform where the LNG Manager & Rollover Predictor software is always running for the monitoring and controls of the safety of the system.

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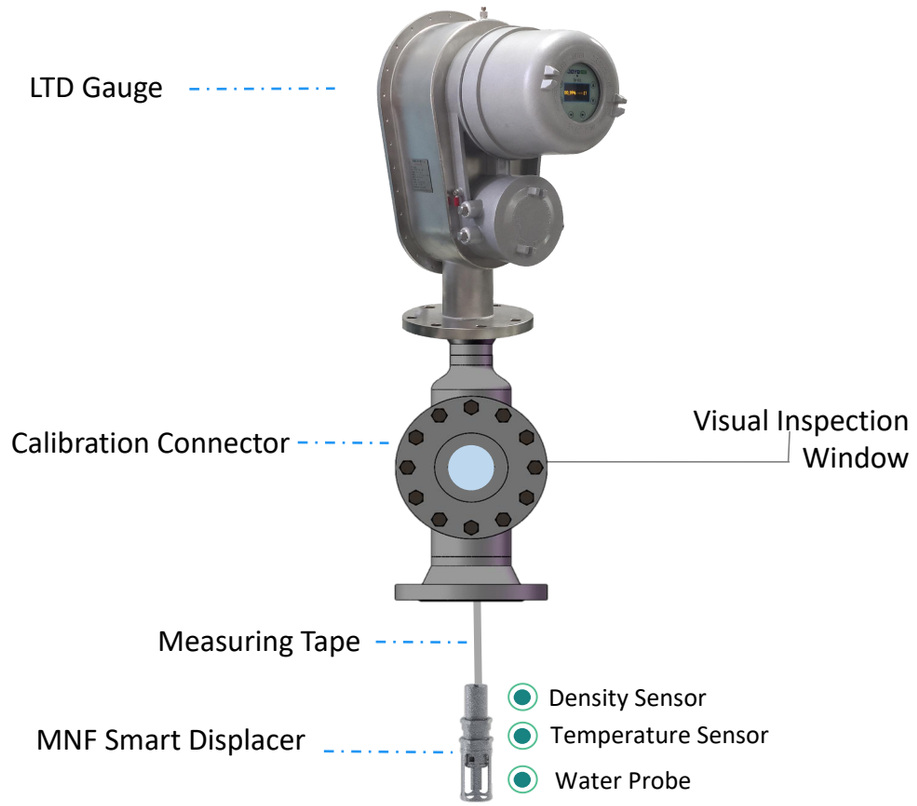
4.3 Typical LNG Tank Gauging SystemConfiguration..24

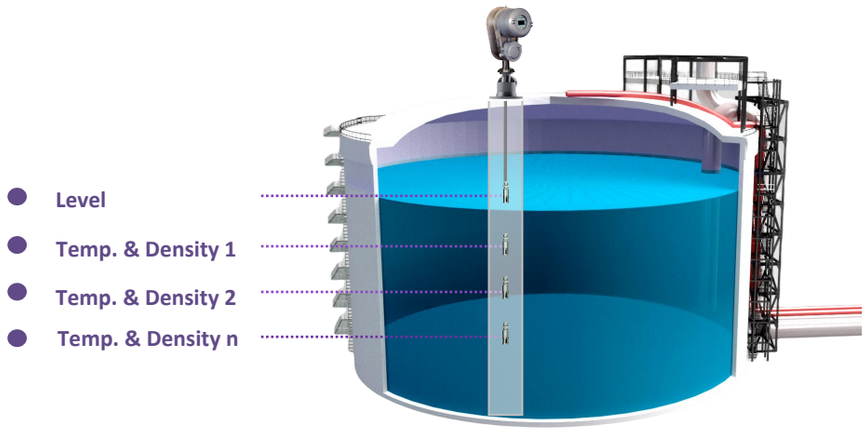
4.1 TM-80N LTD Tank Gauge

TM-80N LTD tank gauge consists of the gauge body and the MNF smart displacer. Both the density sensor and the temperature sensor are integrated inside the MNF displacer. TM-80N LTD tank gauges are designed mainly for the LTD (Level + Temperature + Density) measurements of cryogenic bulk stocks with one integrated instrument in which multiple measurement functions are involved, especially for the LNG tank gauging system, aiming at providing a detailed and accurate LTD profile measurement. It also features with a built-in LCD display showing the current process proceedings as well as the diagnostic data of the gauge. Its calibration connector is equipped with a visual inspection window through which the displacer's "home" position can be checked and verified for a secured high level operation.

Structure



4.2 TM-80N LTD Measurement

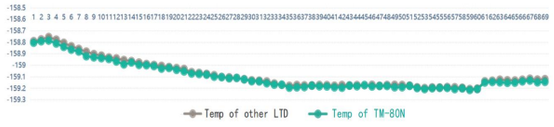


Features:

- Integration of LTD (Level, Temperature, Density) measurements in one unit;
- High accuracy for the LTD measurements;
- Updated structure based on traditional LTD with imporved effiency and better performance
- Being mounted on single flange.

Performance of TM80N vs Other LTD

Temperature comparation between TM-80N LTD and other LTD



Technical Specification of TM-80N LTD

Level Accuracy	± 1mm	**Temp. Range**	-200℃ ~ +70℃
Level resolution	± 0.1mm	**Temp accuracy**	± 0.2℃
Level Range	< 55m	**Temp Resolution**	±0.01℃
Density Accuracy	± 0.5 kg/m3	**Signal putput**	2 pcs RS485 MODBUS: 2pcs 0~20mA WM550/WM660; BPM
Density Resolution	± 0.1kg/m3	**Voltage**	220VAC
Density Range	(1~600)kg/m3	**Watts**	20W
Ingress Protection	IP 68	**Cable Entry**	3/4 NPT 4pcs
Ex rating	Ex db ia [ia Ga] IIC T4 Gb	**Flange**	ASME B16.5 6'' 150 RF

4.3 Typical LNG Tank Gauging SystemConfiguration

A solution for the typical LNG tank gauging system consists of the primary and secondary level gauges, primary and secondary thermometers, the extra LTD gauge and a radar level gauge as the HH alarming instrument. In such a system, both the level gauges and the thermometers are designed in redundancy, and all the data are linked with a PC-based monitoring platform where the LNG Manager & Rollover Predictor software is always running for the monitoring and controls of the safety of the system. It is a redundant and configurable system, and all the data can be directly linked to the upper DCS of the site, if any.

P Primary Level Gauge： BJLM-80H Servo Level Gauge；

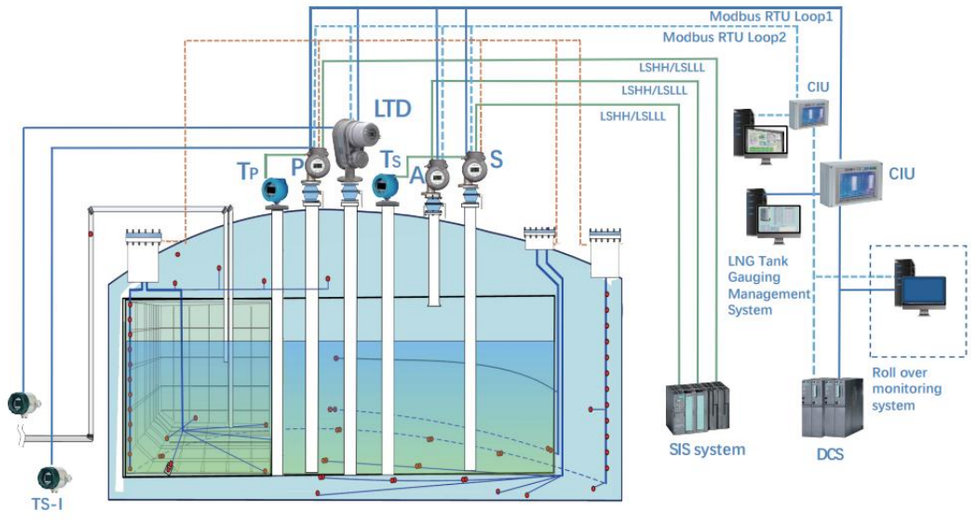
S Secondary Level Gauge： BJLM-80H Servo Level Gauge；

T_P Primary Thermometer： BJZT-V Multi-Point Thermometer;

T_S Secondary Thermometer： BJZT-V Multi-Point Thermometer;

LTD Gauge： TM-80N Servo Gauge with MNF Smart Displacer;

HH Alarming： Radar Gauge.



PART 5

TECHNICAL SPECIFICATIONS

The technical data of the BJLM-80H are listed in part 5, with OIML testing data to prove BJLM-80H precise measurement performance.

How to choose between Smart BJLM TGS and BJLM HTMS, you can refter to **Smart BJLM TGS vs BJLM HTMS** on page 29/30.

The architecture of a tank gauging system BJLM is designed to route the tank information in a fast and reliable manner

5.1 OIML Certified Precise Measurement 26
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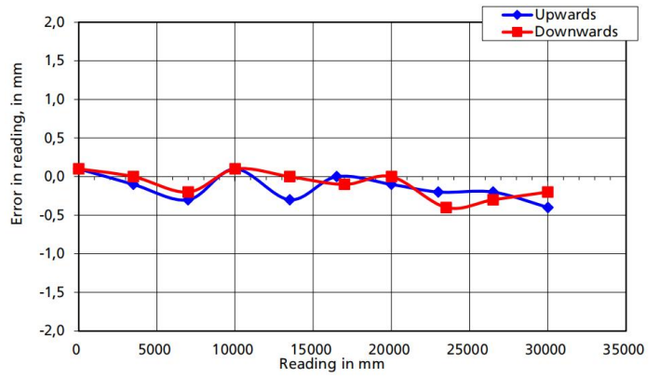
OIML Certified Precise Measurement

BJLM-80 series of Tank Gauging System was certified to complies with OIML R85(2008). The performed tests (inluding level, temperture and density tests) .providing precise measurement of Level, temperature and density.

The level measurement accuracy of ±0.4 mm showing in the following figure.

The software of BJLM-80H complies with WELMEC 7.2,2018., " Software Guide (Measuring Instruments Directive 2014/32/eu)".



Graphic showing OIML level measurement accuracy of BJLM Servo Gauge

Density and Temp Test Result from Type Evaluation Report

Liquid product	Temp. Ref. [°C]	Temp. EUT [°C]	Temp. Error [°C]	MPE [°C]	Density Ref. [kg/m3]	Density EUT [kg/m3]	Density Error [kg/m3]	MPE [kg/m3]	Result [+ / -]
Silicon oil	20,84	20,91	0,07	0,30	918,7	918,7	0,0	1,0	+
	20,84	20,91	0,07	0,30	918,7	918,7	0,0	1,0	+
	20,84	20,91	0,07	0,30	918,7	918,7	0,0	1,0	+

Overall result of the test Passed

5.2 Technical Specification of BJLM

Measuring Range

Level:	max. 30 meter
Viscosity:	max. 5 Cst (for density measurement)
Density:	650~1200kg/m3 (for density measurement)

Accuracy

Level of Liquid:	+/- 0.4 mm
Level of Oil-Water Interface:	+/- 2mm (by water probe of MF/MPF/TF/MNF dispalcer) +/- 2mm (by MPT)
Density of Liquid:	+/- 0.3 kg/m3 (by density sensor of MF/MPF dispalcer) +/- 3 kg/m3 (By pressure sensor)
Temperature of Liquid:	+/- 0.1℃

Running Environment

Ambient Temperature:	-40℃~+70℃
Working Pressure:	5 bar/ 0.5 Mpa for abiment pressure; 25 bar/2.5Mpa for high pressure;
Humidity:	90%

Communication

Input:	BPM, MODBUS RS485, HART, 4~20mA
Output:	BPM, MODBUS RTU / TCP RS485 V1, 4~20mA（SIL 2)

Power Supply

Voltage:	DC 24~48V, AC 220V/110

Cable Entry

4 pcs ¾” NPT theaded

Materials

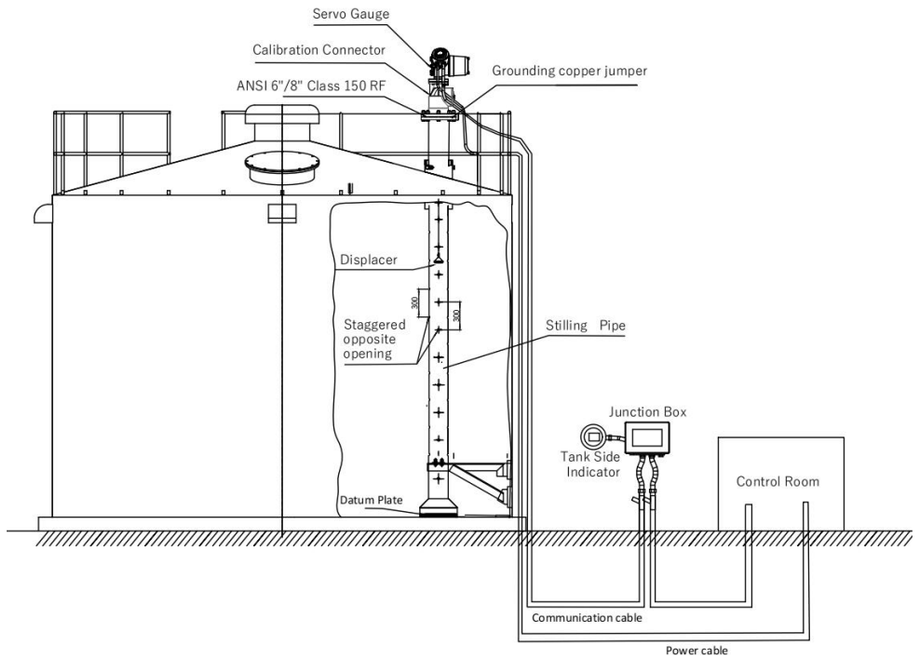
Casing:	Cast Aluminum alloy for ambient version CP8(SS304) (mechanical for high pressure version
Drum:	SS 316
Wire:	SS 316
Displacer:	SS 316

Explosion proof Rating

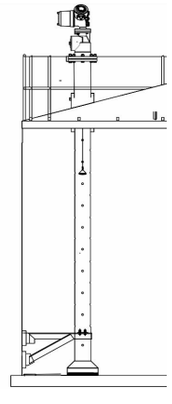
Ex d ia [ia Ga] ⅡC T4 Gb IP 68

5.3 Installation Diagram

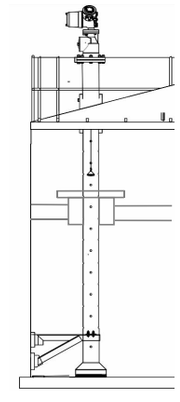
The installation is a key issue to the tank gauging system. The tank gauge must be rigidly mounted onto a mechanically stable point of the tank. Installation of still pipe is suggestive.



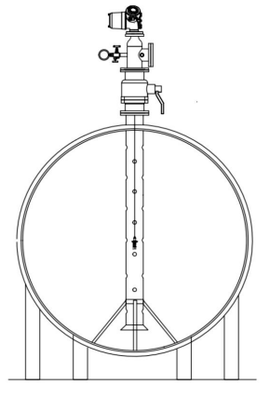
Example of installation diagram for different types of tank is shown in the following figures.It must be protected with stilling well for installation of BJLM gauge on floating roof tanks.
To install the BJLM-80H on the pressurized tank, ball valve is required for isolating the air inside of the calibration chamber from the pressurized vapor insdie the tank during operation or maintance of BJLM-80.
Another vent valve assembly is recommended on the calibration adaptor used for reducing and controling the pressure inside the calibration chamber.



Cone Roof Tank



Floating Roof Tank

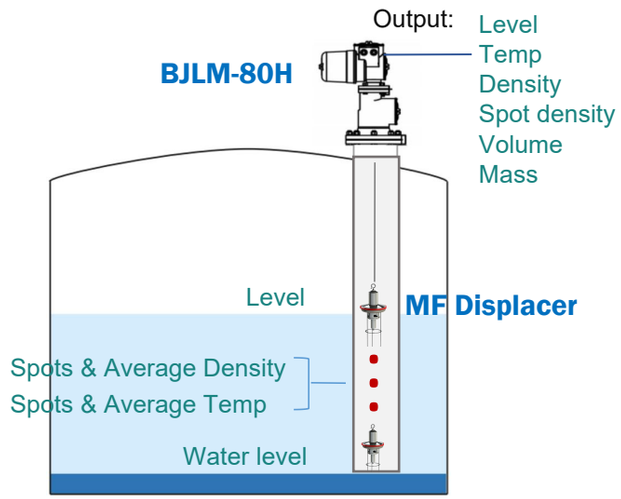


Spherical Tank

5.4 A Smart BJLM TGS vs BJLM HTMS

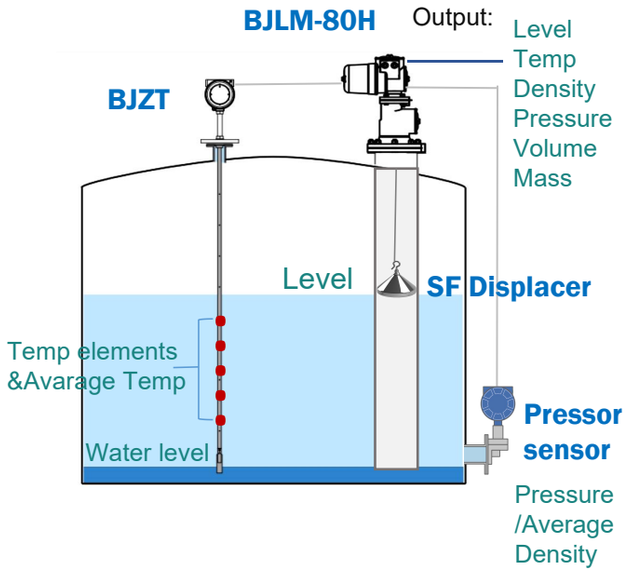
Smart TGS

BJLM-80H servo level gauge with a MF/MPF/TF smart displacer together with the TankStar software forms a smart TGS in which multiple measurement functions are integrated in one gauge, including the liquid level, density, temperature, water interface level and the tank bottom level, as well as the calculated tank gauging/inventory in volume or mass. It can measure the liquid density and temperature at different levels in very high accuracy upon the commands from the TankStar monitoring software.



HTMS (Hybrid Tank Measurement System)

The Hybrid Tank Measurement System conducts the measurements for the liquid level, temperature and density via several discrete instruments that are working together in one system. It provides the online temperature data via the MPT, and the average density data by the hi-precision pressure transmitter. Its calculated tank gauging outcome can also be used for the custody transfer, either in volume or in mass. When the liquid level is less than 3 meters, the accuracy of its density measurement will get worse or totally out of performance. The pressure transmitter frequntly needs some adjustment or recalibration work for a consistent performance. Besides, multiple discrete instruments indeed take more space for their proper installation and maintenance operations.



HTMS Measurements and Calculations

Product Level (L)	Measured by ATG
Average Temperature (t)	Measured by MPT
Average Density (D)	Calculated from P by pressure transmitter
tank gauging/Inventory in Volume (V)	Calculated from L by ATG and tank capacity table
tank gauging/Inventory in Mass (M)	Calculated from volume and density

Smart TGS Measurements and Calculations

BJLM-80H + MF/MPF Displacer

Product Level (L)	Measured by ATG
Average Temperature (t)	Measured by temperature sensor in Smart Displacer
Density at different points(D)	Measured by the density sensor in Smart Displacer
Average Density	Calculated from densities measured at different points
Density Interfaces	Measured by density sensors in Smart Displacer
tank gauging/Inventory in Volume (V)	Calculated from L by ATG and tank capacity table
tank gauging/Inventory in Mass (M)	Calculated from volume and density

BJLM-80H + TF Displacer

Product Level (L)	Measured by ATG
Average Temperature (t)	Measured by temperature sensor in Smart Displacer
tank gauging/Inventory in Volume (V)	Calculated from L by ATG and tank capacity table

Density Measurement Characteristics

MF/MPF Displacer (Smart TGS)	accuracy ± 0.3kg/ m3	measurements done upon commands
Pressure Tansmitter (HTMS)	accuracy ± 3 kg/ m3	online measuring, fully real time

Note:
Density measurement by the Pressure Transmitter has a big error when the level is below 3 meters.
Density measurement by the MF/MPF displacer is always in good performance throughout full range.

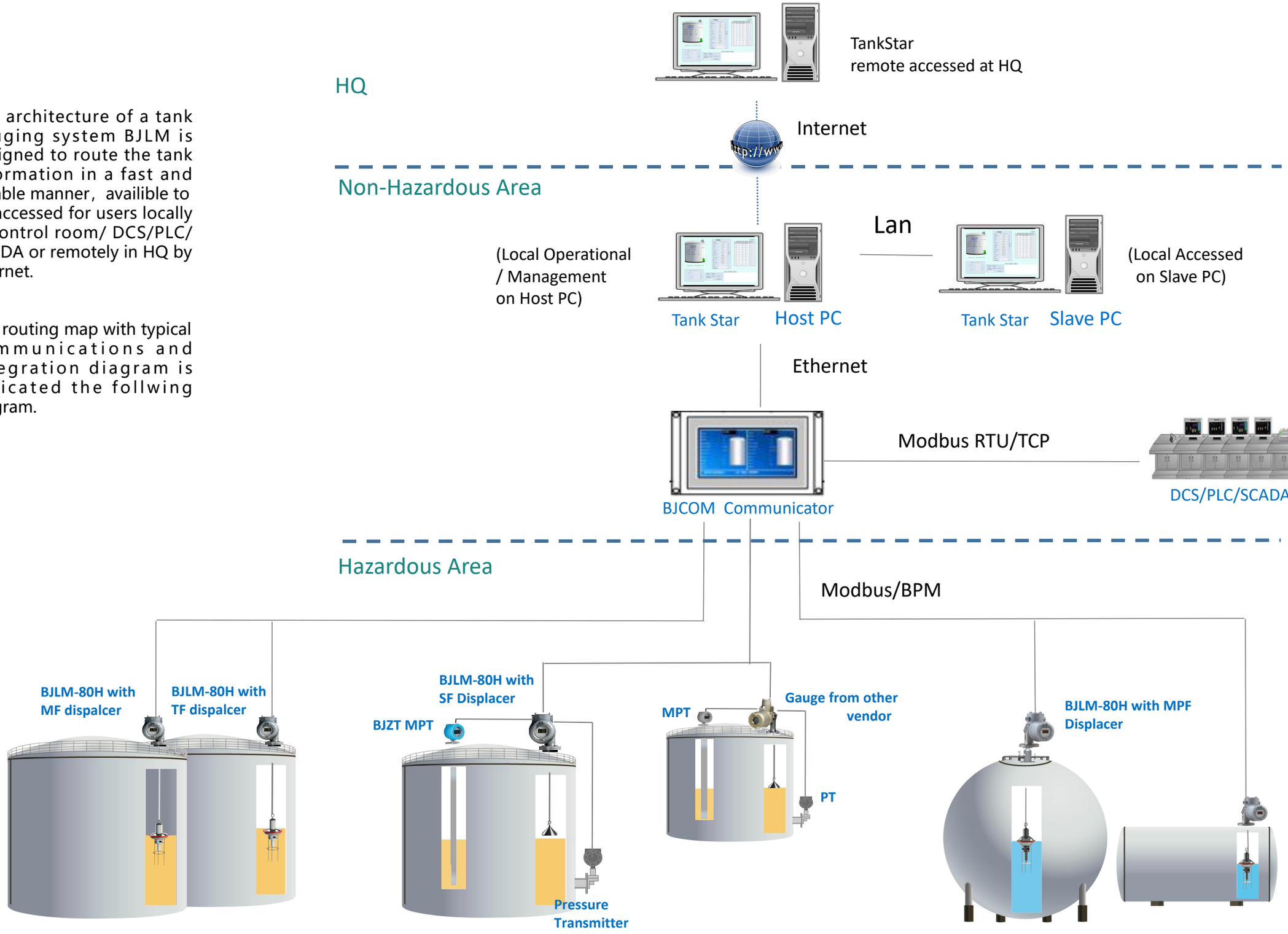
Temperature Measurement Characteristics

MF/MPF Displacer	(Smart TGS)	measurements done upon commands
TF Displacer	(Smart TGS)	measurements done upon commands
Multi-point thermometer	(HTMS)	always online measuring

5.5 BJLM-80H TGS System Architecture

The architecture of a tank gauging system BJLM is designed to route the tank information in a fast and reliable manner, availible to be accessed for users locally in control room/ DCS/PLC/ SCADA or remotely in HQ by internet.

The routing map with typical communications and integration diagram is indicated the follwing diagram.



PART 6

TYPICAL CONFIGURATIONS WITH RALATED PRODUCTS

Typically, a BJLM-80H tank gauging system consists of the BJLM-80H servo level gauge, TS-I tank-side indicator, BJCOM-IV communicator and the TANKSTAR monitoring software in one set.

All the measurement data of the BJLM-80H can be sent to their TSI where most of the data can be viewed locally onsite. BJCOM-IV communicator as a communication hub, through which the data can be sent to the upper TANKSTAR monitoring software.

TankStar is Windows PC-based ATG monitoring and management software, realizing funcitons of monitoring inventory levels, temperature, density, volume and mass custody transfer and leak detection, based on a web server technology, which allows access of ATG reports from PC software.

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6.1 TS-1 Tank-Side Indicator

TS-1 Tank-side Indicator is designed to show the tank gauging data on-site at the tank bottom area for a prompt inspection and confirmation of the outputs and status of the tank gauge being connected.

- Voltage : 10~28V/DC
- Amibient Temperature: -40℃ ~ +60℃
- Communication: HART
- Ex ia IIB T Ga, IP65

Voltage	10 ~ 28V/DC	**Ambient Temp.**	-40℃ ~ +60℃
Current	< 6mA	**Comm.**	HART
IP Protection	IP 68	**Ex Rating**	Ex ia Ⅱ C T6 Ga;

6.2 BJCOM-IV Communicator

The BJCOM-V communicator is used for data collection from automactic tank gauges and transmission of all of data to PC client end or to PLC/DCS.

- Touch screen
- Graphical displaying ATG data on built-in LCD
- Maximum 36 connections for servo tank gauges
- Output: Modbus RTU/TCP-IP

Voltage	220 V/AC
Output communication	Modbus RTU/TCP-IP
Interface	COM PORTs: 2 for Input; 4 for Output

6.3 TankStar ATG Management Software

Stay in Control with the TankStar ATG Monitoring Software

TankStar is a Windows PC-based ATG monitoring and management software that provides real-time interfaces for you to access to all the tank gauging data and the configuration of the whole ATG system. Wherever you are, the data can always be shared with you and any other authorized users at all levels.

- Real-time data and proceeding of each tank and that of the total inventory in the site as well as other related tank gauging information are checked and promptly shown up via multiple interfaces;
- GIS based terminal layout can be displayed with customized views for efficient operations;
- User can preset the alarming thresholds for the deviation of intaking quantity, sales amount and stock inventory of the whole terminal ;
- Event logs and data reports can be used for checking and tracing all the historic operations happened.

TankStar software is designed to realize the functions as follows:

- Calculating the tankage/inventory for each tank in volume and/or mass upon requirement
- Displaying ATG data in real time
- Handling the lab report data, such as the density and VCF, etc.
- Monitoring the inventory and the custody transfer process, making inventory reconciliations, and conducting the leak detection
- Alarming of high level, high high level, low level, low low level, and leaks
- Accessing to historical data
- 3 levels of user access authorities can be managed
- Events logs and alarm notices for safety reasons are always available,
- Data reports, such as the event log reports and/or the inventory reports can be generated and shared via pc visits, emails or printing.

Appendix

Certifications

IEC ex	..... International Ex Certificate
CNEX	..... China National Explosion Proof
GOST -TRCU 012 (Russia)	..... Russia Explosion Proof Certificate
INMETRO/UL Br	..... Brazil Explosion Proof Certificate
OIML R85	..... OIML Metrology Approval
MID Software Type Approval	..... Software Type Approval
Type Approval Russia	..... Metrology Type Approval in Russia
Type Approval Khazakastan Khazakastan	..... Metrology Type Approval
SIL 2	..... Functional Safety Certificate
ISO 9001	..... Quality Management System
ISO 14001	..... Environmental Management System
ISO 45001	..... Occupational Health and Safety Management System

Photo Gallery