OILFIELD MONITORING INSTRUMENTS

Technical Overview and Selection Guide

01 INSTRUMENT OVERVIEW

Oilfield production monitoring relies on specialized instruments for well condition evaluation and pumping-unit performance analysis. This guide introduces three monitoring instruments: the Acoustic Liquid Level Tester, Split-Type Dynamometer, and All-in-One Wireless Dynamometer. Together, they support liquid-level measurement, dynamometer data acquisition, and field monitoring configuration.

THREE INSTRUMENTS AT A GLANCE

Instrument	Primary Measurement	Main Purpose
Acoustic Liquid Level Tester	Well liquid-level depth	Determines liquid level inside the well through acoustic signal measurement
Split-Type Dynamometer	Polished rod load and displacement	Acquires surface dynamometer card data through a separate sensor and acquisition system
All-in-One Wireless Dynamometer	Polished rod load and displacement	Integrates digital measurement and wireless transmission in one device

TWO MONITORING CATEGORIES

WELL LIQUID-LEVEL MONITORING



Acoustic pulse generation and reflected signal analysis are used to determine liquid-level depth inside the well.

PUMPING-UNIT PERFORMANCE MONITORING



Load and displacement data are collected to generate surface dynamometer cards and review pumping-unit operating conditions.

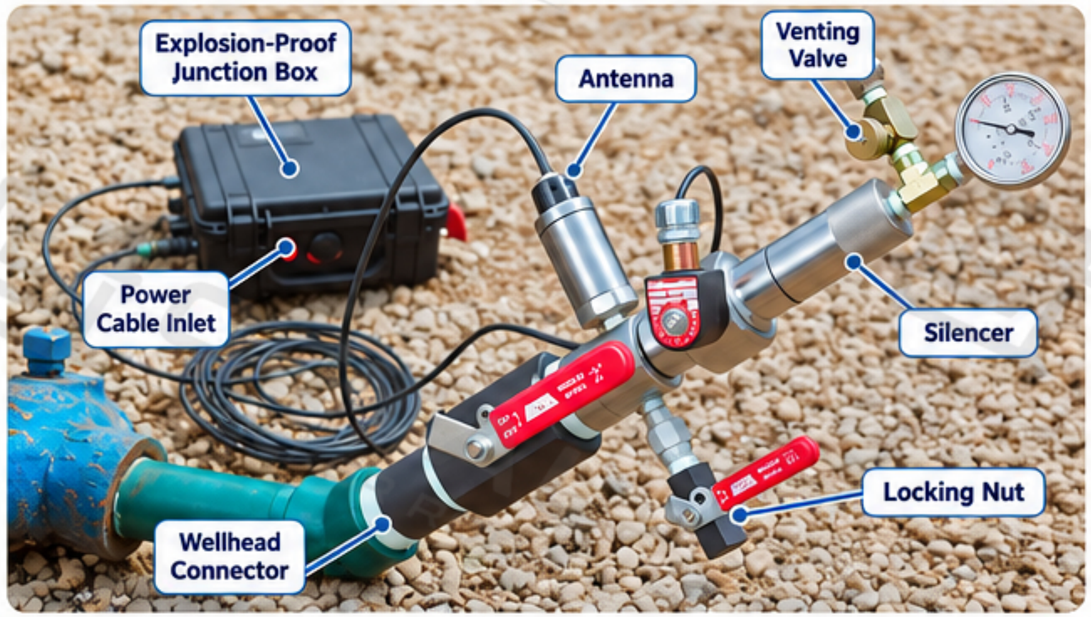
Technical Overview and Selection Guide

02 ACOUSTIC LIQUID LEVEL TESTER

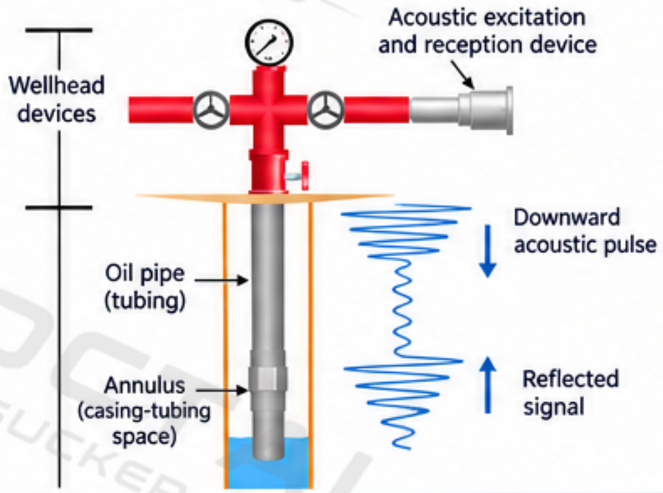
Instrument Overview: The Acoustic Liquid Level Tester measures liquid-level depth in oil wells by generating acoustic pulses and analyzing reflected signals. It uses the casing-tubing annulus as the acoustic transmission path to identify the gas-liquid interface without direct downhole mechanical contact.

The instrument is used to obtain liquid-level information for well condition review and production management. Its measurement arrangement can accommodate different well pressure conditions through corresponding acoustic pulse generation methods.

MAIN INSTRUMENT CONFIGURATION



WORKING PRINCIPLE



1 Acoustic Pulse Generation
Pressurized wells can use casing gas, while unpressurized wells require an external high-pressure gas source.

2 Reflected Signal Detection
The pulse travels downward through the annulus and reflections are produced at tubing couplings, reference markers, and the gas-liquid interface.

3 Signal Processing and Evaluation
The microphone/control circuit receives and processes the reflected signal to determine liquid-level depth.

Well-Specific Acoustic Calibration: Acoustic velocity varies with gas composition, pressure, and well operating conditions, so the tester uses well-specific acoustic information rather than one fixed value for all wells.

MAIN COMPONENTS AND FUNCTIONS

No.	Component	Function
1	Wellhead Connector	Connects the tester to the wellhead
2	Venting Valve	Provides the designated gas venting connection
3	Wellhead Connector Locking Nut	Secures the wellhead connection
4	Antenna	Provides the communication connection
5	Silencer	Reduces noise during gas release
6	Power Cable Inlet	Provides the power connection
7	Explosion-Proof Junction Box	Houses the designated electrical connections

This page highlights the instrument assembly, the practical role of each external component, and the different pulse-generation arrangements used for pressurized and unpressurized wells.

OILFIELD MONITORING INSTRUMENTS

Technical Overview and Selection Guide

03 SPLIT-TYPE DYNAMOMETER

The Split-Type Dynamometer acquires load and displacement data from beam pumping units to generate surface dynamometer cards. Its load sensor, acquisition host, and wireless receiver are separate components, allowing the measurement and communication units to be positioned independently in the field.

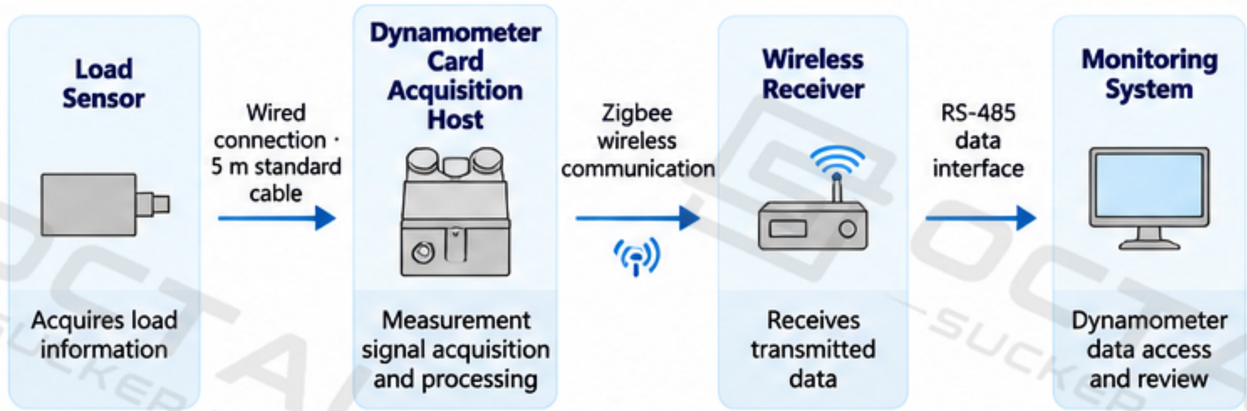
The load sensor sends measurement signals to the acquisition host through a wired connection. The host processes the data and transmits it wirelessly to the receiver for access by the monitoring system.

MAIN COMPONENTS AND CONFIGURATION



The acquisition host is supplied with a solar power unit; the load sensor is connected by cable.

MEASUREMENT AND COMMUNICATION ARRANGEMENT



COMPONENTS AND CONFIGURATION

Component	Main Function / Configuration
Dynamometer Card Acquisition Host	Main acquisition unit with solar power supply
Wireless Receiver	Receives wireless data from the acquisition host
Load Sensor	Wired sensor for load measurement
Connecting Cable	High-flexibility connection cable, 5 m standard length

AVAILABLE DYNAMOMETER DATA

Data Output	Description
Dynamometer Card Graphical Data	Surface dynamometer card information
Stroke Information	Pumping stroke data
Upper and Lower Dead-Point Switching Signals	Switching signals associated with the stroke endpoints
Real-Time Load Data	Acquired polished rod load information
Real-Time Displacement Data	Acquired displacement information

Load and displacement data are combined to generate a surface dynamometer card for reviewing the pumping-unit load-displacement relationship during the pumping cycle.

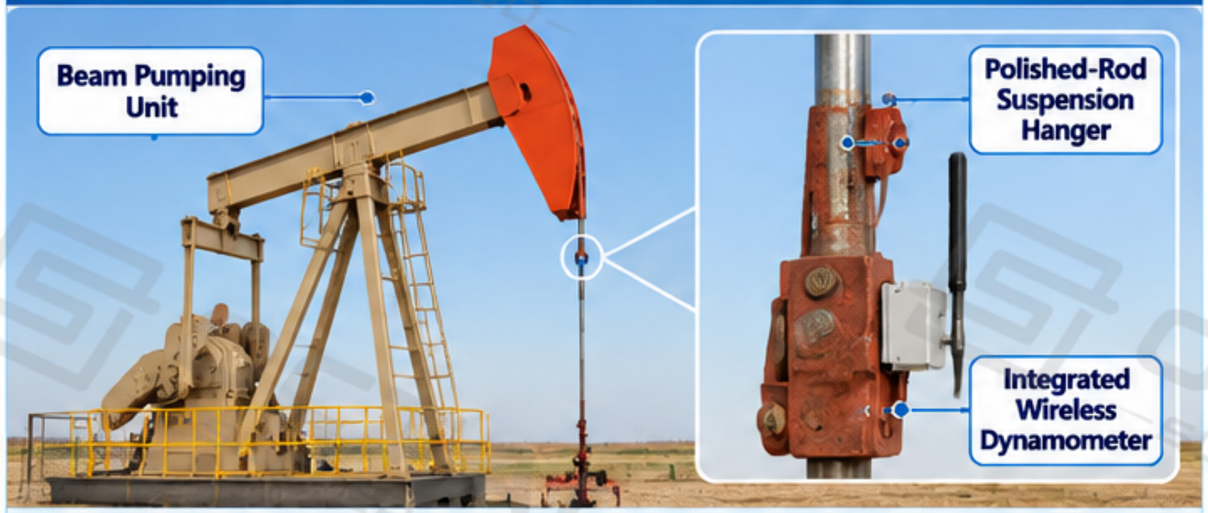
OILFIELD MONITORING INSTRUMENTS

Technical Overview and Selection Guide

04 ALL-IN-ONE WIRELESS DYNAMOMETER

The All-in-One Wireless Dynamometer combines digital measurement and wireless communication in one compact device for beam pumping units. It acquires polished-rod load and displacement data online and transmits the measurements wirelessly to the monitoring system. Unlike a split-type arrangement, measurement and communication functions are integrated in one unit, reducing field wiring and simplifying installation.

INTEGRATED DEVICE AND FIELD INSTALLATION



The integrated device can be installed without dismantling the polished-rod suspension hanger.

INTEGRATED MEASUREMENT AND DATA PATH

MEMS Motion Detection
Displacement-related measurement

Force-Sensitive Sensing
Polished-rod load measurement

→ **Low-Power Microcontroller**
Signal acquisition and management

→ **Wireless Digital Communication**
Measurement data transmission

→ **Monitoring System**
Dynamometer data review

INTEGRATED TECHNOLOGIES

Technology	Role in the Instrument
MEMS Motion Detection	Supports motion and displacement-related measurement
Force-Sensitive Sensing	Supports polished-rod load measurement
Wireless Digital Communication	Transmits acquired measurement data wirelessly
Low-Power Microcontroller	Manages data acquisition and low-power operation

SOLAR POWER AND LOW-POWER OPERATION

Function	Operating Role
Solar Power	Provides the device power source
Remote Battery-Voltage Monitoring	Allows battery-voltage status to be checked remotely
Sleep Mode	Reduces power consumption when inactive
Event-Triggered Wake-Up	Activates the device in response to configured events
Configurable Acquisition Intervals	Sets the timing of measurement collection
Scheduled Card Collection	Collects dynamometer-card data at configured times

Scheduled dynamometer-card acquisition supports data collection during normal pumping operation, while the integrated design reduces field wiring and avoids dismantling the polished-rod suspension hanger during installation.

05 INSTRUMENT COMPARISON AND SELECTION

Technical Comparison

The three instruments serve different monitoring purposes within oilfield production operations. The Acoustic Liquid Level Tester focuses on well liquid-level measurement, while the two dynamometers acquire load and displacement information from beam pumping units.

TECHNICAL COMPARISON

Comparison Item	Acoustic Liquid Level Tester	Split-Type Dynamometer	All-in-One Wireless Dynamometer
Main Measurement	Liquid-level depth	Polished rod load and displacement	Polished rod load and displacement
Measurement Approach	Acoustic pulse and reflected signal analysis	Separate load sensor and acquisition system	Integrated digital sensing
Main Configuration	Wellhead-connected acoustic tester	Sensor, acquisition host and wireless receiver	Integrated measurement and wireless device
Communication	Instrument communication arrangement	Zigbee and RS-485 interface	Wireless digital communication
Power Arrangement	Power connection through designated inlet	Solar-powered acquisition host	Solar power
Main Output	Liquid-level information	Dynamometer card and operating data	Dynamometer card and operating data
Distinctive Feature	Well-specific acoustic measurement	Separated sensing and acquisition arrangement	Integrated design and scheduled wireless data collection

WHICH INSTRUMENT SHOULD YOU CHOOSE?

For Well Liquid-Level Measurement

Choose the Acoustic Liquid Level Tester when the primary requirement is to determine liquid-level depth inside an oil well. The instrument uses acoustic pulse generation and reflected signal analysis, with the pulse-generation arrangement selected according to well pressure conditions.

For Separated Dynamometer Data Acquisition

The Split-Type Dynamometer is suitable when the project uses a separate load sensor, acquisition host, and wireless receiver arrangement. Its configuration provides a wired sensor connection and Zigbee communication between the acquisition host and receiver.

For Integrated Wireless Dynamometer Monitoring

The All-in-One Wireless Dynamometer is suitable when an integrrated measurement and wireless communication arrangement is preferred. Its scheduled data collection, low-power operation, and installation without dismantling the polished rod suspension hanger are relevant considerations for field deployment.

IMPORTANT SELECTION CONSIDERATIONS

The two dynamometers share the same general measurement objective, but their equipment configurations and installation arrangements differ. The Acoustic Liquid Level Tester performs a different measurement task and should not be considered a replacement for dynamometer monitoring.

Projects requiring both well liquid-level information and pumping-unit load-displacement data may use the acoustic tester together with a suitable dynamometer configuration.

SELECTION FOCUS

Select the instrument according to the monitoring objective first: liquid-level depth, separated dynamometer acquisition, or integrated wireless dynamometer monitoring. In many projects, the Acoustic Liquid Level Tester and a suitable dynamometer can be used together because they provide different types of production information.

The Acoustic Liquid Level Tester addresses liquid-level monitoring, while the two dynamometers address pumping-unit load and displacement monitoring; the selection between the two dynamometer types depends mainly on installation arrangement and data-acquisition method.

06 PROJECT CONFIGURATION AND TECHNICAL VERIFICATION

This page provides a practical project-review checklist for instrument selection, system matching, and pre-installation verification. It is intended to help engineers and project buyers confirm that the selected monitoring arrangement matches actual well conditions, installation constraints, and data-integration requirements.

PROJECT REQUIREMENTS

Configuration Item	Information to Confirm
Monitoring Objective	Liquid-level measurement, dynamometer monitoring, or both
Well Conditions	Well pressure status and acoustic measurement requirements
Pumping Equipment	Beam pumping-unit type and polished rod arrangement
Installation Conditions	Wellhead connections, sensor mounting position, and available installation space
Power Supply	Available power source and solar power requirements
Communication	Required communication interfaces and transmission arrangements
Data Requirements	Required measurement data and dynamometer card collection intervals
System Integration	Compatibility with the existing monitoring platform

PRE-INSTALLATION TECHNICAL VERIFICATION

Verification Item	Key Considerations
Instrument Configuration	Confirm the selected instrument type and corresponding components
Mechanical Compatibility	Check mounting arrangements and equipment connections
Electrical Compatibility	Verify power requirements and electrical connections
Communication Compatibility	Confirm communication protocols and interface requirements
Environmental Conditions	Review site temperature, weather exposure, and hazardous-area requirements
Data Integration	Confirm data formats, acquisition intervals, and monitoring system compatibility

TECHNICAL DOCUMENTATION REQUIRED

Before equipment deployment, the following documents should be reviewed where applicable:

- Instrument technical datasheets
- Equipment installation instructions
- Electrical connection diagrams
- Communication interface specifications
- Equipment configuration and component lists
- Applicable certification documents

FINAL TECHNICAL NOTE

The final instrument configuration should be verified against the actual well conditions, pumping equipment, installation environment, power supply, and monitoring system requirements. Model-specific performance limits and interface compatibility should be confirmed using the applicable manufacturer documentation.

PROJECT REVIEW FOCUS

Confirm the monitoring objective first, then verify equipment compatibility, installation constraints, available power, communication interfaces, and documentation completeness before final selection.

A complete project review should align the selected monitoring instrument with field conditions, installation requirements, and system-integration needs before deployment.