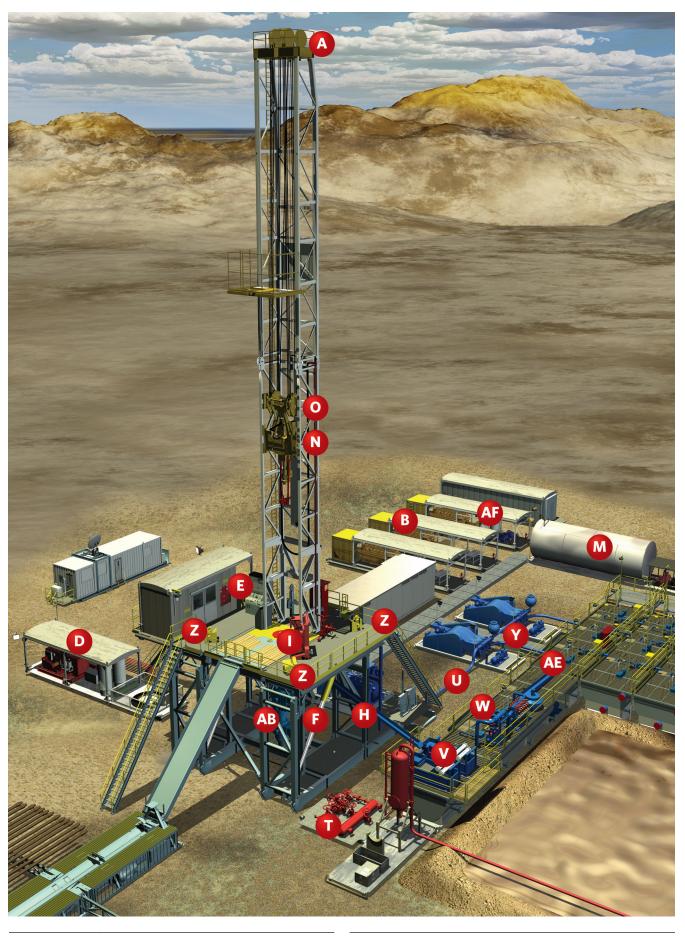
SENSORS AND SWITCHES IN OIL RIG APPLICATIONS

A Crown Block	Measure weight on drill line via cable tension Load cells: 41, RM		
B Power Generation Unit	Measure oil, water, and hydraulic fluid pressure		
	Pressure sensors: FP2000, MLH, IP IS, PX2, PX3, SPT		
	Emergency shutdown Switches for ESD: e-stop custom		
D Accumulator Unit	Measure inlet/outlet pressure with high accuracy Pressure sensors: FP2000, STJE		
E Drilling Cab	Control/monitor operations activity MICRO SWITCH basic switches: BZ, V7, V15W, SX		
	MICRO SWITCH toggle switches: TL, NT, TS, TW, ET, AT		
	Key, rotary, and e-stop switches: custom		
F Rig Hydrau- lic Lift	Measure hydraulic pressure, weight, force/strain or movement, monitor raising or lowering deck for directional drilling Pressure sensors: FP2000, IP IS		
UC LITT	Load cells: 41		
H Drawworks	Measure torque, load/weight/position while guiding pipe into position Load cells: 41, RM		
	MICRO SWITCH switches: BX, LSX		
l Iron	Measure torque while attaching pipe using hydraulic pressure or load measurements Load cells: 41		
Roughneck	Pressure sensors: FP2000, IP IS		
M Water/	Measure tank liquid levels Switches: HDLS		
Storage Tank	Pressure sensors: MLH, LL-V, SPT, PX2		
N Top Drive	Monitor torque/twisting movement to ensure right amount of force is applied Torque sensors: custom		
	Measure weight on drill bit Load cells: 41		
	Measure hydraulic pressure and feed information into control system Pressure sensors: FP2000, 811FM		
0	Measure weight on the drill line via cable tension		
Traveling Block	Load cells: 41		
R Deadline Anchor	Measure tension on deadline/drilling line cable Load cells: 41, RM		
T Choke Manifold	Measure valve position/choke valves MICRO SWITCH hazardous area switch: CX, VPX		
U Mud Return Line	Measure drilling mud pressure to monitor and control mud flow Wing Union sensors: 434, 435, 437		
V Mud Shaker	Position sensing or on/off applications Switches: HDLS		
W Mud Cleaner	Position sensing or on/off applications Limit switches: HDLS		
Y Mud Pump	Measure pressure and flow of mud media Wing Union sensors: 434, 435, 437		
	Mud pump stroke count, position sensing, or on/off applications MICRO SWITCH limits: EX, BX, HDLS		
Z Winch	Measure direct and indirect loads Canister load cells: MPB, 3130, 3156, 3127		
	,,,, 000, 0100, 0121		



AB BlowOut Preventor	Monitor RAM position via hydraulic volumetric or pressure behind the piston ("pinch offs") Pressure sensors: A-105, TJE	AE Fluid — Manifold
AD Drill Bit	Measure pressure or differential pressure at high temperature and pressure ranges Pressure sensors: S	
		AF Mud Tank/ Reservoir

Pressure sensors: FP2000
Wing Union sensors: 434, 435, 437
Measure valve position

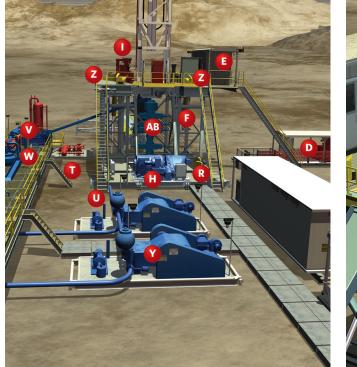
Measure drilling fluid pressure

Limit switches: CX, WCX, VPX Measure tank liquid levels

Pressure sensors: FP2000, IP IS, SPT

Monitor tank valve position Limit switches: BX, LSX, HDLS











SENSORS AND SWITCHES IN OIL RIG APPLICATIONS

PRESSURE SENSORS

FP2000 Series

- All-welded, stainless steel construction
- Gage, absolute, barometric, vacuum, differential pressure
- Range: 0.5 psi to 10,000 psi
- Accuracy range of 0.1 % or 0.25 %
- Intrinsically safe options available

MLH Series

- All metal wetted parts for use in wide variety of fluid applications
- No internal elastomeric seals mean no o-ring compatibility issues
- Range: 50 psi to 8000 psi (inclusive) Accuracy: ±0.25 %FS BFSL
- Rated IP65 or better for protection from harsh environments

IP IS Series

- Rugged, all-welded stainless steel and Hastelloy® wetted parts for durability
- Compatible with a wide variety of media
- Range: 7 bar to 350 bar | 100 psi to 5,000 psi
- Accuracy: ±0.15 %, ±0.25 % BFSL
- Fully configurable

PX2 and PX3 Series

- Cost effective, highly configurable and highly durable
- Compatible with a wide variety of harsh media
- Broad compensated temperature range with industry-leading Total Error Band
- Range: 1 bar to 46 bar | 100 kPa to 4.6 MPa | 15 psi to 667 psi (PX2)
- Range: 1 bar to 46 bar | 15 psi to 667 psi (PX3) Accuracy ±0.25 %FSS; TEB ±2 %FSS (-40°C to 125°C [-40°F to 257°F])

SPT Series

- Rugged, stainless steel in a small size package
- Absolute, gage, sealed gage, vacuum gage
- Range: O psi to 3 psi, O psi to 5000 psi; ±0.25 % accuracy
- Reliable semiconductor technology, NEMA 4 design
- Calibrated and temperature compensated

Model TJE

- Rugged, all-welded, stainless steel construction
- Built for applications requiring high accuracy and temperature stability
- Unique "true gage" design hermetically sealed against atmospheric contamination
- Range: 1 psig/a to 60000 psig/a; accuracy: ±0.10 % • Intrinsically safe available

Super TJE Series

- Ultra precision pressure sensors with up to ±0.05 % accuracy
- True gage, absolute and differential (wet/wet)
- Durable, stainless steel for use in rugged environments
- Range: 10 psig to 7500 psig (pressure); 50 psid to 750 psid (differential)
- Intrinsically safe options available

811FM Series

- All-welded, stainless steel construction for use with liquid, gas or corrosive vapors
- Range: 2 psig/a to 10000 psig/a
- Accuracy: ±0.25 %
- Dual pipe thread pressure fitting for easy bulkhead mounting
- Explosion proof

Model S

- Rugged, high-frequency stainless steel
- Extremely small size, fits into tight spaces
- Range: 100 psig to 15,000 psig
- Operating temperature range: -54°C to 149°C [-65°F to 300°F]
- Accuracy: ±1.0 %

Model A-105

- Rugged, unitized stainless steel design with heavy sidewalls
- Thin diaphragm design able to measure low pressures
- Flush mount design with miniature footprint
- Can be used in corrosive fluid environments
- Range: 100 psig to 15,000 psig; accuracy: $\pm 0.5~\%$

LL-V Series

- Designed for vertical entry into a tank .
- Complete fluid submersion; corrosion resistant to most fluids • True gage design with all welded stainless steel construction
- Range: 20 in-H₂O to 50 psig; accuracy: ±0.1 %

Models 434, 435, 437 Wing Union Pressure Sensors

- Rugged design with Inconel[®] X-750 or NACE-compliant Inconel[®] 718 wetted parts
- Built to provide durability with abrasive or corrosive media
- Accuracy: ±0.1 %FSS BFSL (Model 435) high accuracy, or
- ±0.2 %FSS BFSL (Model 434, 437) standard accuracy
- Wide port aperture (Model 437) for use with more viscous media
- Compatible with WECO® 1502, 2002, 2202; intrinsically safe option available
- Protective cage option (Model 434, 435, 437)

TORQUE SHAFTS



Custom Torque Shaft Modify/design existing top drive shafts to measure torque

LOAD CELLS

Model 41

- Rugged, low profile pancake style
- All-welded stainless steel with double diaphragm design
- Load ranges of 5 lb to 500,000 lb; Accuracy: ±0.1 %
 - Low sensitivity to extraneous loads Intrinsically safe option available

Model RM

- Rod end in-line tension load cell
- Rugged design with stainless steel, all-welded construction Load ranges from 2000 lb to 200,000 lb; ±0.22 % to 0.29 % accuracy
- Low sensitivity to extraneous loads

Model MPB

High capacity load measurements in a small size load cell

- Rugged stainless steel construction
- Load ranges from 15,000 lb to 2,000,000 lb Accuracy: ±0.25 % full scale

Model 3130

Carbon steel, fatigue-resistant load cell

Carbon steel, fatigue-resistant load cell

Extremely resistant to extraneous bending and side loading forces

Extremely resistant to extraneous bending and side loading forces Load ranges of 25,000 lb to 150,000 lb

• Extremely resistant to extraneous bending and side loading forces

MICRO SWITCH Premium Large Basic Switches, BZ Series

Accepted as the world-wide standard snap-action switch Best suited for high cost-of-failure applications

MICRO SWITCH Premium V-Basic Switches, V7 Series

Best suited for higher cost-of-failure applications

Best suited for higher cost-of-failure applications

MICRO SWITCH Watertight Miniature Switches, V15W Series

MICRO SWITCH Hazardous Area Switches, BX and LSX Series

Hazardous atmosphere outdoor use – watertight, dust-tight

MICRO SWITCH Hazardous Area Switches, CX Series

Designed specifically for dangerous indoor or outdoor locations

O-ring seals render switches weather-proof, water-tight, dust-tight

MICRO SWITCH Hazardous Area Valve Position Indicator, VPX Series

Smallest UL-listed housings available for use in hazardous locations

O-ring seals render switches weather-proof, water-tight, dust-tight

Die-cast aluminum housing and various sealing (NEMA 4, 4X, 6, and 13)

Designed for 100k operations at full load or 10M for mechanical life

Designed for 100k operations at full load or 10M for mechanical life

MICRO SWITCH Premium Miniature/Subminiature Basic Switches, SX Series

Miniature-sized basic switch designed for harsh-duty, wash down areas

Rugged, highly accurate machine control for turning circuits on and off

Explosion-proof design with flame path to contain and cool escaping hot gases

UL, CSA (BX, LSX Series); ATEX, IEC EX, NEPSI, European approvals (BX Series)

Rotary converts in seconds to clockwise, counter-clockwise, or both-way operation IP66; NEMA 1, 3, 4, 4X, 6, 6P, 13 sealing UL, CSA, ATEX, IEC Ex approvals

Certified for ATEX, IEC Ex, CE, and cULus specifications for global applications

Versions available in both snap-action switches and intrinsically safe inductive

Versions of the VPX with proximity switches carry an Intrinsically Safe (IS) rating

- Load ranges of 500,000 lb to 1,000,000 lb
- Accuracy: ±0.30 % full scale

Accuracy: ±0.30 % full scale

Load ranges up to 2,000,000 lb

Current ratings from 10 A to 25 A UL/CSA, CE, UKCA, ENEC approvals

Current ratings from 0.1 A to 25 A UL/CSA, CE, UKCA, ENEC approvals

Current ratings from 0.1 A to 25 A

UL/CSA, CE, UKCA, ENEC approvals

Compact, lightweight, and long-lasting UL, cUL, CE, UKCA, ENEC, CQC approvals

Superior reliability and repeatability

Superior reliability and repeatability

Small size and light weight

MICRO SWITCH LIMIT SWITCHES

proximity switches

• Accuracy: ±0.30 % full scale

MICRO SWITCH BASIC SWITCHES

Model 3156 Carbon steel, fatigue-resistant load cell

Model 3127



- Strain-gauge the complex large shafts found in top drives
- Calibrating to torque levels required on a top drive
- Modify/adapt the calibration rig flanges to the custom flanges on a top drive shaft

OPERATOR CONTROLS

Rotary Switches



- 3- and 4-position options
- May be engineered with lever or knob actuator
- Integral connectors (Metripak 280 and Sumitomo)
- Environmentally sealed design



e-Stop Switches

- Provides positive contact closure and opening when the switch is operated
- Environmentally sealed design (IP67 sealing)
- UV-resistant knob for outdoor use
- Knob available in a variety of colors



MICRO SWITCH Toggle Switches (Sealed and Unsealed), TL, NT, TS, TW, ET, AT Series

- Broad product range meets a variety of electrical and load requirements
- Sealed models built to withstand harsh, wet, dusty, and dirty environments
- 2 or 3 position, momentary and/or maintained action; 1-, 2- or 4-pole circuitries
- IWTS (integrated wire termination system) for ease of assembly & maintainability •

Honeywell Sensing Solutions

830 East Arapaho Road

Richardson, TX 75081

www.honeywell.com



:

UL, CSA, ATEX, IEC EX approvals

Superior reliability and repeatability

MICRO SWITCH Heavy-Duty Limit Switches, HDLS Series

MICRO SWITCH Hazardous Area Switches, EX Series Designed for dangerous indoor or outdoor locations

- Three series offer rugged, die-cast body and epoxy coating
- Boss-and-socket head design for secure head-to body retention
- Multiple mounting and actuator options
- UL, CSA, CE, UKCA, CCC approvals

