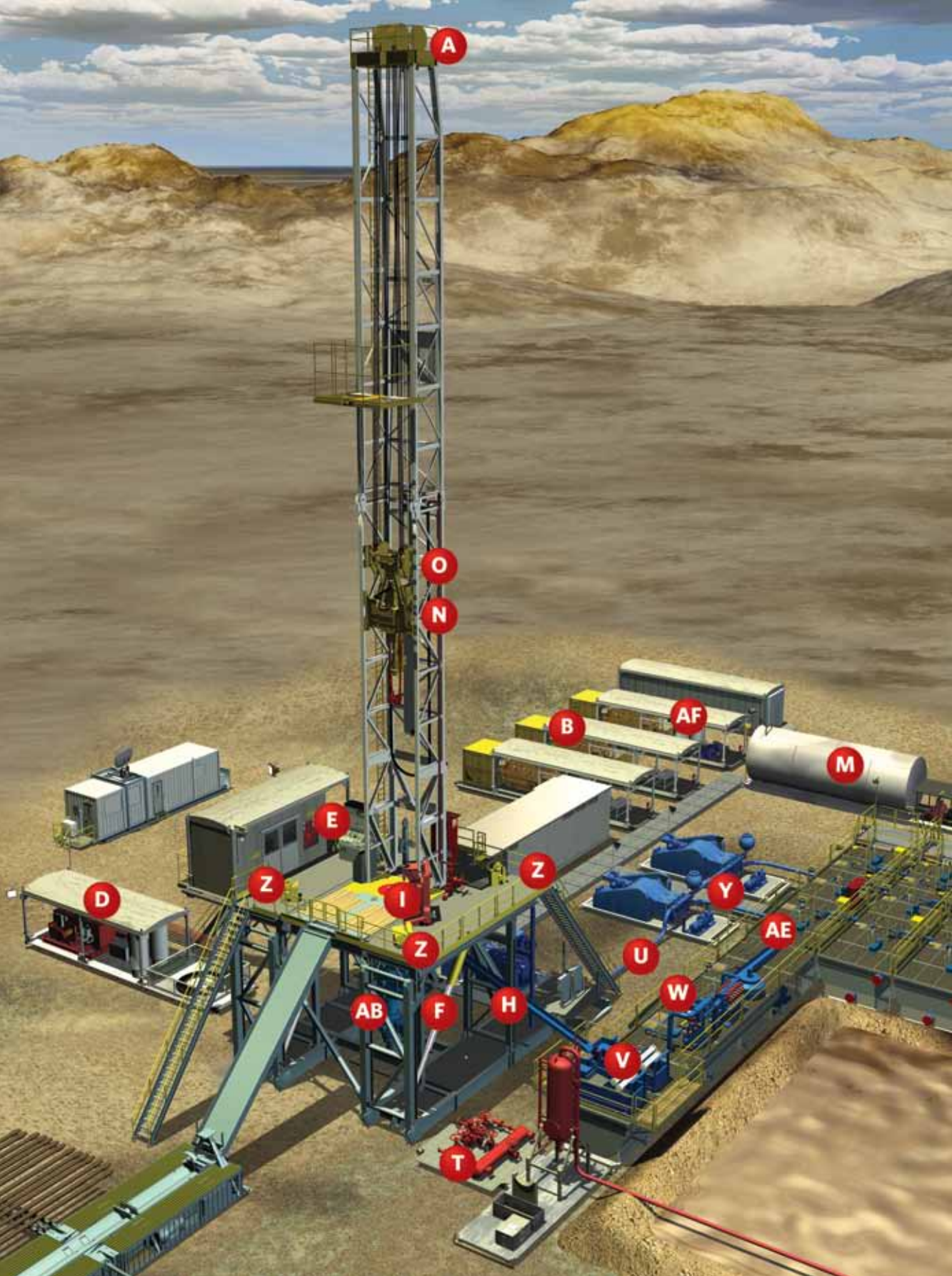


Sensors and Switches in Oil Rig Applications



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, PX2, SPT Emergency shutdown Switches for ESD: WOI
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 Limitless™ operator interface: WOI
F Rig Hydraulic Lift	Measure hydraulic pressure, weight, force/strain or movement, monitor raising or lowering deck for directional drilling Pressure sensors: FP2000, IP Load cells: 41
H Drawworks	Measure torque, load/weight/position while guiding pipe into position Load cells: 41, RM MICRO SWITCH™ switches: BX, LSX
I Iron Roughneck	Measure torque while attaching pipe using hydraulic pressure or load measurements Load cells: 41 Pressure sensors: FP2000, IP
M Water/Storage Tank	Measure tank liquid levels Switches: HDLS, WLS non-contact 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 On/off control and operator alerts to enhance safety Limitless™ operator interface: WOI
O Traveling Block	Measure weight on the drill line via cable tension 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
U Mud Return Line	Measure drilling mud pressure to monitor and control mud flow Wing Union sensors: 424, 425, 427
V Mud Shaker	Position sensing or on/off applications Switches: HDLS, WLS, WOI
W Mud Cleaner	Position sensing or on/off applications Limit switches: HDLS, WLS, WOI
Y Mud Pump	Measure pressure and flow of mud media Wing Union sensors: 424, 425, 427 On/off or emergency start/stop applications Limitless™ operator interface: WOI 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
AB BlowOut Preventor	Monitor RAM position via hydraulic volumetric or pressure behind the piston ("pinch offs") Pressure sensors: A-105, TJE
AD Drill Bit	Measure pressure or differential pressure at high temperature and pressure ranges Pressure sensors: S

AE Fluid Manifold	Measure drilling fluid pressure Pressure sensors: FP2000 Wing Union sensors: 424, 425, 427 Measure valve position Limit switches: CX, WLS
AF Mud Tank/Reservoir	Measure tank liquid levels Pressure sensors: FP2000, IP, SPT Monitor tank valve position Limit switches: BX, LSX, HDLS, WLS



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 Series**
- Rugged, all-welded stainless steel and Hastelloy® wetted parts for durability
 - Compatible with a wide variety of media (i.e. chemicals or gases)
 - Range: 50 psi to 10,000 psi; 0.5 bar to 700 bar
 - Accuracy: ±0.15 %, ±0.25 % BFSL
 - Total Error Band incl: non-linearity, repeatability, hysteresis, temperature error



- PX2 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: 100 psi to 667 psi [7 bar to 45 bar]
 - Accuracy ±0.25 %FSS; TEB 2 %



- SPT Series**
- Rugged, stainless steel in a small size package
 - Absolute, gage, sealed gage, vacuum gage
 - Range: 0 psi to 3 psi, 0 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: ±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 inH₂O to 50 psig; Accuracy: ±0.1 %



- Wing Union Pressure Sensors (Models 424, 425, 427)**
- Rugged design with Inconel® X-750 wetted parts
 - Built to provide durability with abrasive or corrosive media
 - Choose ±0.2 % BFSL accuracy or ±0.1 % BFSL high accuracy (Model 425)
 - Wide port aperture (Model 427) for use with more viscous media
 - Intrinsically safe option available

Torque Shafts



- Custom Torque Shaft**
- Modify/design existing top drive shafts to measure torque
 - 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)**
- 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 and maintainability

Load Cells



- Model 41**
- Rugged, low profile pancake style load cell
 - 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 lbs; ±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 lbs to 2,000,000 lbs
 - Accuracy: ±0.25 % full scale



- Model 3130**
- Carbon steel, fatigue-resistant load cell
 - Extremely resistant to extraneous bending and side loading forces
 - Load ranges of 500,000 lbs to 1,000,000 lbs
 - Accuracy: ±0.30 % full scale



- Model 3156**
- Carbon steel, fatigue-resistant load cell
 - Extremely resistant to extraneous bending and side loading forces
 - Load ranges of 25,000 lbs to 150,000 lbs
 - Accuracy: ±0.30 % full scale



- Model 3127**
- Carbon steel, fatigue-resistant load cell
 - Extremely resistant to extraneous bending and side loading forces
 - Load ranges up to 2,000,000 lbs.
 - Accuracy: ±0.30 % full scale

MICRO SWITCH™ Basic Switches



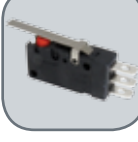
- MICRO SWITCH™ Premium Large Basic Switches**
- Accepted as the world-wide standard snap-action switch
 - Best suited for high cost-of-failure applications
 - Designed for 100k operations at full load or 10M for mechanical life
 - Current ratings from 10 A to 25 A
 - UL/CSA, CE, ENEC approvals



- MICRO SWITCH™ Premium V-Basic Switches**
- Best suited for higher cost-of-failure applications
 - Designed for 100k operations at full load or 10M for mechanical life
 - Current ratings from 0.1 A to 25 A
 - UL/CSA, ENEC approvals



- MICRO SWITCH™ Premium Miniature/Subminiature Basic Switches**
- Best suited for higher cost-of-failure applications
 - Small size and light weight
 - Current ratings from 0.1 A to 25 A
 - UL/CSA, ENEC approvals



- MICRO SWITCH™ V15W Series Watertight Miniature Switches**
- Miniature-sized basic switch designed for harsh-duty, wash down areas
 - Rugged, highly accurate machine control for turning circuits on and off
 - Compact, lightweight, and long-lasting
 - UL, cUL, ENEC, CQC approvals

MICRO SWITCH™ Limit Switches



- MICRO SWITCH™ BX and LSX Series Hazardous Area Switches**
- Designed specifically for dangerous indoor or outdoor locations
 - Superior reliability and repeatability
 - Explosion-proof design with flame path to contain and cool escaping hot gases
 - O-ring seals render switches weather-proof, water-tight, dust-tight
 - UL, CSA (BX, LSX Series); ATEX, IEC EX, NEPSI, European approvals (BX Series)



- MICRO SWITCH™ CX Series Hazardous Area Switches**
- Hazardous atmosphere outdoor use – watertight, dust-tight
 - Superior reliability and repeatability
 - 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



- MICRO SWITCH™ EX Series Hazardous Area Switches**
- Designed specifically for dangerous indoor or outdoor locations
 - Superior reliability and repeatability
 - Smallest UL-listed housings available for use in hazardous locations
 - O-ring seals render switches weather-proof, water-tight, dust-tight
 - UL, CSA, ATEX, IEC EX approvals



- MICRO SWITCH™ HDLS Heavy-Duty Limit Switches**
- 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, CCC approvals

Limitless™ Wireless Solutions



- Limitless™ WOI Series Wireless Operator Interface**
- Enables operator indication from locations where wiring is too costly or not possible
 - Flexible operator type options (push button, rotary or key switch, etc.)
 - Reduced installation/maintenance costs with no wires, conduit, connectors, etc.
 - Eliminates issues with wire connection integrity on moving equipment



- Limitless™ Wireless Non-Contact Switches - WLS Series**
- MICRO SWITCH™ HDLS heritage combined with the latest wireless technology
 - Enables presence/absence detection where wiring is an issue or not feasible
 - Reduced installation/maintenance costs due to no wires, conduit, connectors, etc.
 - Eliminates wire connection integrity issues on moving equipment

Find out more

Honeywell serves its customers through a worldwide network of sales offices, representatives and distributors. For application assistance, current specifications, pricing or name of the nearest Authorized Distributor, contact your local sales office. To learn more about Honeywell's sensing and control products, call **+1-815-235-6847/1-800-537-6945**, visit **sensing.honeywell.com**, or e-mail inquiries to **info.sc@honeywell.com**

Honeywell Sensing and Control

1985 Douglas Drive North
Golden Valley, MN 55422
sensing.honeywell.com

