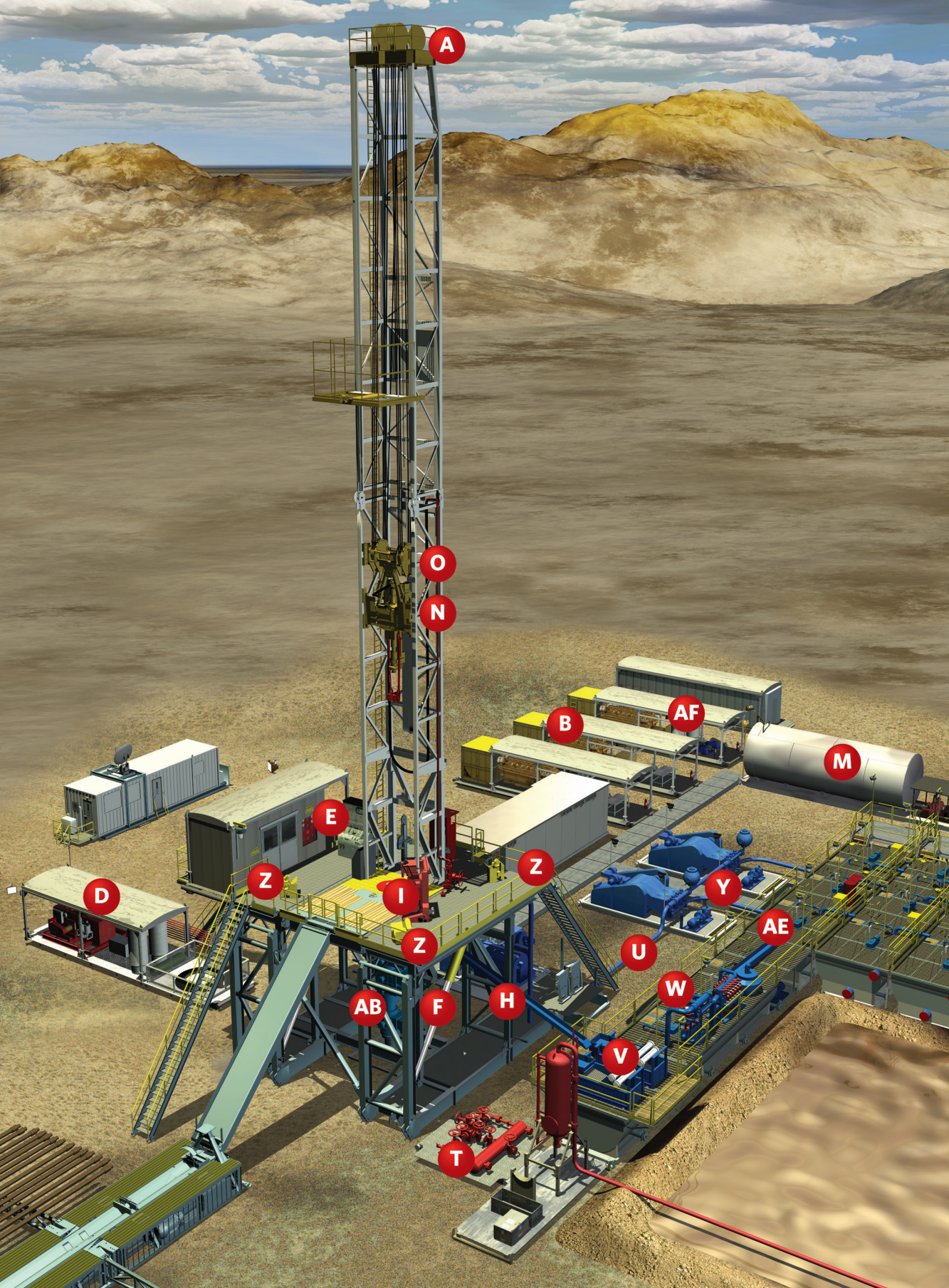


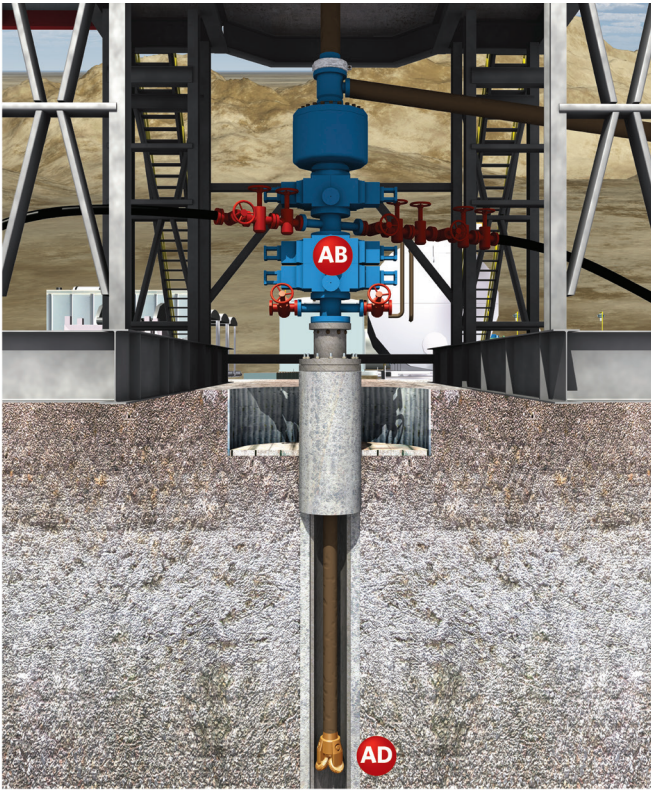
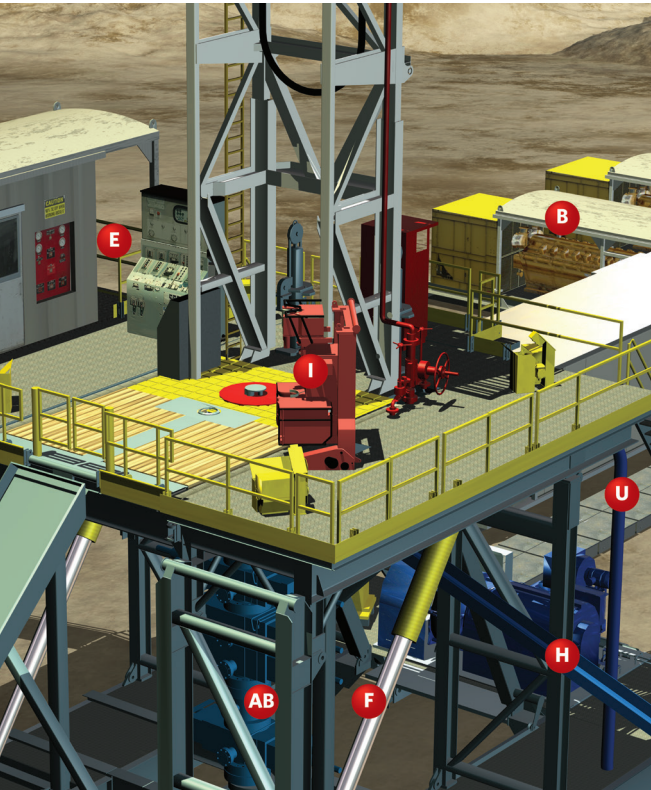
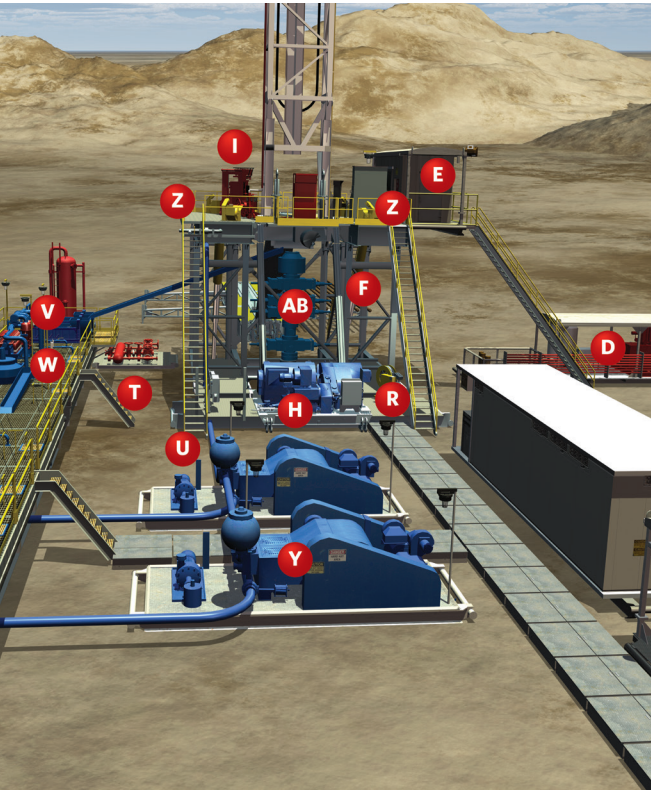
SENSORS AND SWITCHES IN OIL RIG APPLICATIONS

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 Hydraulic Lift	Measure hydraulic pressure, weight, force/strain or movement, monitor raising or lowering deck for directional drilling Pressure sensors: FP2000, IP IS 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 IS
M Water/Storage Tank	Measure tank liquid levels Switches: HDLS 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
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, 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



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: 434, 435, 437 Measure valve position Limit switches: CX, WCX, VPX
AF Mud Tank/Reservoir	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: 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 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
 - 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

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
 - Extremely resistant to extraneous bending and side loading forces
 - Load ranges of 500,000 lb to 1,000,000 lb
 - 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 lb to 150,000 lb
 - 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 lb
 - Accuracy: ±0.30 % full scale

MICRO SWITCH BASIC SWITCHES



- 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
 - Designed for 100k operations at full load or 10M for mechanical life
 - Current ratings from 10 A to 25 A
 - UL/CSA, CE, UKCA, ENEC approvals



- MICRO SWITCH Premium V-Basic Switches, V7 Series**
- 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, CE, UKCA, ENEC approvals



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



- MICRO SWITCH Watertight Miniature Switches, V15W Series**
- 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, CE, UKCA, ENEC, CQC approvals

MICRO SWITCH LIMIT SWITCHES



- MICRO SWITCH Hazardous Area Switches, BX and LSX Series**
- 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 Hazardous Area Switches, CX Series**
- 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 Hazardous Area Valve Position Indicator, VPX Series**
- Certified for ATEX, IEC Ex, CE, and cULus specifications for global applications
 - Die-cast aluminum housing and various sealing (NEMA 4, 4X, 6, and 13)
 - Versions available in both snap-action switches and intrinsically safe inductive proximity switches
 - Versions of the VPX with proximity switches carry an Intrinsically Safe (IS) rating



- MICRO SWITCH Hazardous Area Switches, EX Series**
- Designed 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 Heavy-Duty Limit Switches, HDLS Series**
- 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

Honeywell Sensing Solutions

830 East Arapaho Road
Richardson, TX 75081
www.honeywell.com

