XDR
Engineered For Safety

LATERAL STABILITY · REAL-TIME COG · PATENT PENDING

FITTED ACROSS · THE XDR RIG RANGE

IntelliBeam©

Workover rig stability monitoring — load cell beam and centre-of-gravity display.

API 4F	100 kPa	Real time	Xenon
COVERS THE LATERAL GAP	ALLOWABLE GROUND BEARING	COG TRACKING	TELEMETRY AND BLACK BOX

EXPLORATION DRILL RIGS PTY LTD
REDBANK, QUEENSLAND, AUSTRALIA

TECHNICAL SPECIFICATION
XDR.COM.AU

WHY IT EXISTS

API 4F stops at the *lateral load*.

API 4F requires mast and substructure designs to account for longitudinal loads and environmental wind loading, as these form part of the normal operating conditions of a certified rig. The standard does **not** provide structural design allowances for lateral operational loads — side pull forces, cross-well deviations, or off-axis pipe handling. Those forces fall outside the API 4F design envelope, because the mast and substructure are not required to resist significant sideways loading.

So even though wind is included in the certification calculations, any lateral load generated by rig operations is a non-API-compliant condition. Managing lateral stability is therefore an operational responsibility — and that is why real-time monitoring of the centre of gravity matters whenever off-axis forces may occur.

THE SYSTEM IS DESIGNED TO

- Reduce rollover risk, with the aim of eliminating rig rollover
- Provide early warning before instability develops
- Increase operator awareness and confidence
- Support controlled lateral loading where permitted
- Improve safety without reducing operational efficiency

It enhances safety but does not replace proper rig setup or operator judgement.

AT A GLANCE

GROUND BEARING

Allowable ground bearing pressure 100 kPa, verified through the full depth of the competent layer.

FITMENT

Fitted across the XDR workover rig range.

INTELLECTUAL PROPERTY

IntelliBeam© — patent pending in Australia and overseas.

CONTENTS

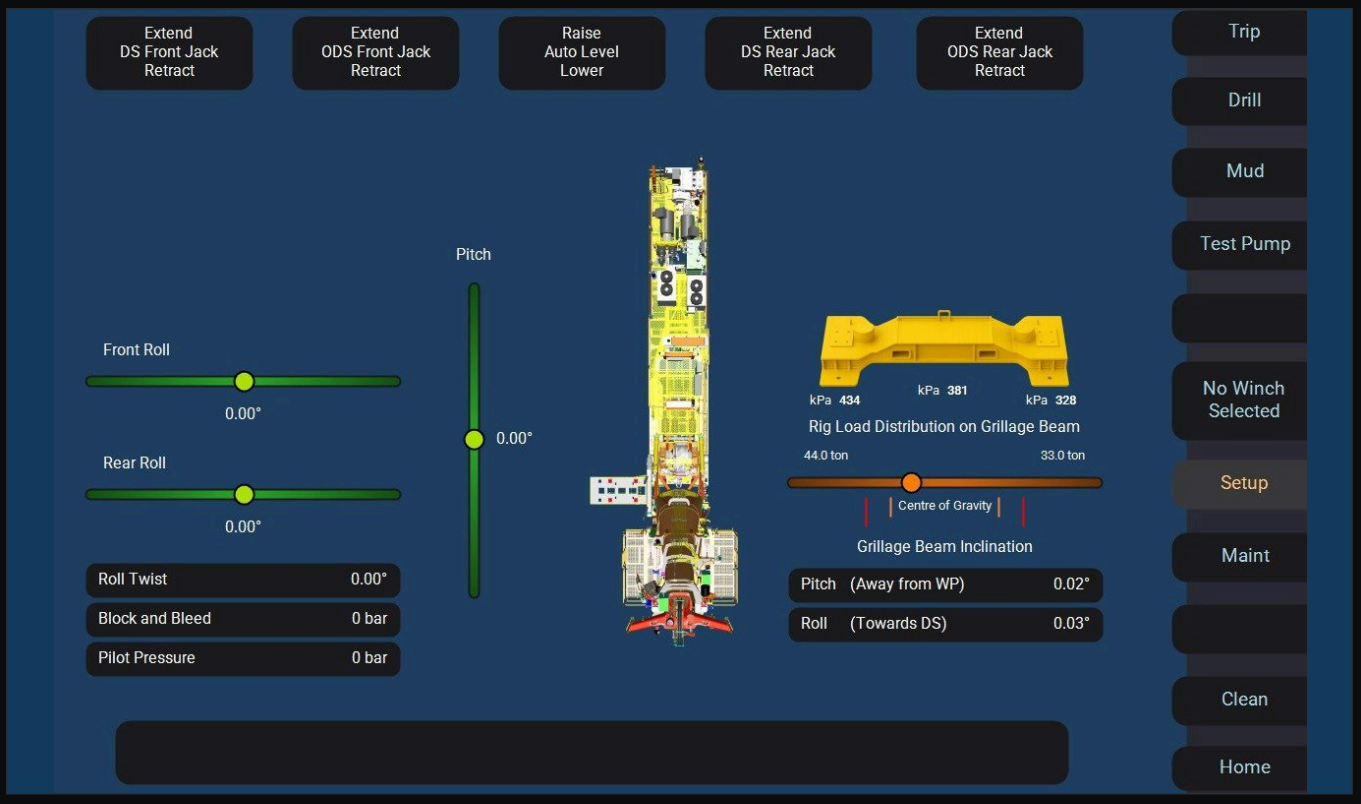
01 / HOW THE SYSTEM WORKS

ELEMENT	DESCRIPTION	NOTES
01 **Load sensing**	— Load sensing support pads beneath the rear jack legs — Each pad contains a load cell measuring the compressive force transmitted through the grillage beam into the ground	
02 **The PLC**	— Receives load data from each rear jack leg — Calculates the lateral centre of gravity — Compares it to the defined stability region — Displays the COG position on the HMI — Issues an audible alarm and warnings on the HMI if limits are exceeded	
03 **Wind is already in the reading**	— Wind acting on the mast and any suspended equipment creates a sideways overturning moment — That moment appears directly in the real-time jack-reaction values shown on the HMI — Operators see the true stability state inclusive of wind effects, without making separate wind adjustments	
04 **Rate of change**	— The system evaluates not only the magnitude of jack reactions but the rate of change of the lateral centre of gravity — Rapid COG movement is treated as a leading indicator of developing instability — sudden ground subsidence, uncontrolled lateral loading, or dynamic pipe movement — Operators receive early audible warning of developing instability	

01.1 / RIG SETUP SCREEN

Level the beam *before* you jack.

The setup screen drives the front and rear jacks, and shows the pitch and roll of the rig alongside the live load distribution across the grillage beam. The grillage-mounted inclinometer verifies that the support foundation is level and stable before jacking commences.



RIG SETUP SCREEN — FRONT AND REAR JACK CONTROL, RIG PITCH AND ROLL ON THE LEFT, GRILLAGE BEAM LOAD DISTRIBUTION ON THE RIGHT

02 / OPERATOR INTERFACE

A position, not a *number*.

Each rear jack leg shows its current load and the ground pressure beneath it. A horizontal slider represents the lateral stability zone, and an orange ball shows the real-time COG position — moving left or right as load changes. Beneath it, an independent inclinometer confirms the beam is level.

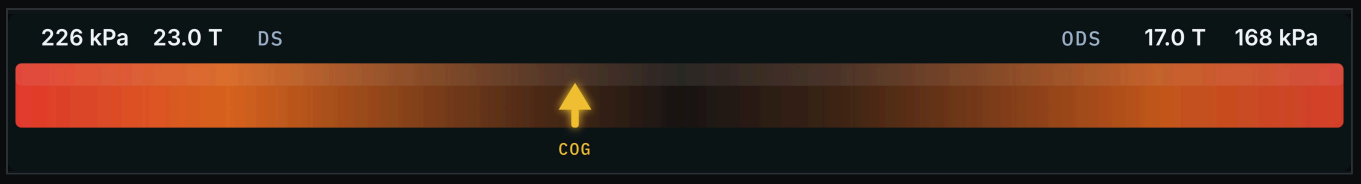
LOAD DISTRIBUTION AND COG DISPLAY

ELEMENT	DESCRIPTION	NOTES
05 **Load display**	— Each rear jack leg shows its current load, for example 44.0 t and 33.0 t — Ground pressure beneath the grillage beam is shown in kPa at each reading point	
06 **COG slider**	— A horizontal slider represents the lateral stability zone — An orange ball shows the real-time COG position, moving left or right as load changes	
07 **Stability markers**	— Normal operating zone — safe — Caution zone — approaching limits — Do not go further marker — unsafe boundary	
08 **Operator interpretation**	— Ball centred → stable — Ball drifting → caution — Ball crossing the boundary → unsafe	
09 **Grillage beam inclinometer**	— Independent inclinometer showing pitch and roll of the grillage beam before the rig is set up — Roll is the side-to-side inclination across the screen; pitch is front-to-back — Confirms the beam is level prior to loading, and forms the baseline for accurate COG calculation — If the beam is outside the specified pitch and roll tolerances, operators must not commence setup	NOTE An out-of-level beam distorts load distribution, shifts the calculated COG and significantly reduces lateral stability

02.1 / THE ALERT BAR

Ground loading and stability, *on the drilling screen*.

The lower section of the main drilling screen is the system's alert bar — interlocks, system faults and operational warnings in real time. The same bar doubles as a graphical representation of the grillage beam, using a red–orange–black gradient across the DS and ODS sides to show relative loading.



ABOVE EACH END OF THE GRADIENT THE HMI SHOWS THE LIVE REAR JACK-LEG REACTION LOAD (T) AND THE GROUND PRESSURE BENEATH THE GRILLAGE BEAM (KPA). THE YELLOW COG MARKER MOVES LATERALLY AS THE CALCULATED CENTRE OF GRAVITY SHIFTS

MAIN DRILLING SCREEN — THE ALERT BAR RUNS ACROSS THE FOOT OF THE DISPLAY, MIRRORING THE ORANGE COG BALL ON THE DEDICATED STABILITY SLIDER

03 / GROUND AND LOAD DISTRIBUTION

ELEMENT	DESCRIPTION	OPERATOR RESPONSIBILITY
10 **Load distribution platform**	— Must provide a stable, level and structurally adequate support surface, capable of sustaining the maximum jack reactions without exceeding the allowable ground bearing pressure of 100 kPa — The stability assessment does not rely on friction between the grillage beam and the distribution platform — the beam is positively restrained against sliding by being secured to the platform	NOTE Selection, configuration and verification of the platform — material, thickness, stiffness and the certified depth of competent ground beneath it — remain the responsibility of the operator
11 **Supporting ground**	— Must consist of a certified depth of competent material capable of sustaining the required 100 kPa bearing capacity — Bearing capacity must be verified through the full depth of the competent layer, not just at the surface, so loads transfer without overstressing weaker underlying strata	NOTE Verification of ground conditions — depth, strength and uniformity — is the responsibility of the operator or site geotechnical personnel
12 **Well control equipment handling**	— The rig may be operated with the work floor hydraulically packed up and the mast luffed to its maximum rated angle, to lift the BOP vertically from the wellhead and position it onto the BOP transport skid along the longitudinal axis of the rig — This falls within the rig's certified stability calculations, as the primary load path remains aligned with the mast and substructure — Wind influence, natural pendulum motion of the suspended BOP and small positional adjustments during controlled handling are expected, and are accounted for — Operators must keep ground conditions, load distribution platform configuration and jack reactions within allowable limits throughout the lift	NOTE Longitudinal handling is the approved configuration for removing or installing the BOP using the rig's lifting system

04 / XDR XENON

XDR XENON ARTIFICIAL INTELLIGENCE

Recorded, watched and *replayable*.

IntelliBeam is integrated with **XDR Xenon**, which provides continuous data capture, remote visibility and post-event analysis. Xenon's onboard black box recorder logs jack reactions, COG movement, mast loading, drawworks activity and operator inputs. The same telemetry framework supports real-time maintenance monitoring, allowing early detection of developing mechanical issues and improving overall rig reliability.

01 **Xenon Live Telemetry**	Transmits selected parameters from any piece of XDR plant on site to anywhere in the world — equipment activity, hydraulic fluid levels, mud flows, pit volume totalisation and trending graphs.
02 **Xenon Live Integration**	Gives the rig operator control of the plant on site from the rig control cabin.
03 **Xenon Live Remote Control**	Repetitive tasks — magazine to catwalk, catwalk to rig floor — run from the site office. One operator runs the magazines and catwalk from a climate-controlled environment via PC or laptop. VOIP links the site team live. Fewer people are needed at the rig site, and they work out of harm's way. Programmed in C#, ISO/IEC 23270 compliant.
04 **Xenon Live Maintenance**	Monitors the mechanical movement of moving parts and alerts the maintenance department to prepare spares — hydraulic, engine and gearbox oils, drawworks rope change and triplex pump lubrication.
05 **Xenon Live Black Box**	Tracks up to 175 data points and stores more than 12 months of operation. After an incident the CSV files graph directly, showing joystick positions, hydraulic pressures, hook loads and other parameters that contributed to it.

Xenon is XDR's control and telemetry brand — the PLC that runs the machine, the telemetry that streams off it, and **Xenon Prevent**, the back end that watches it. Prevent reads the rig's live telemetry and judges it against norms written by XDR's own engineers, working from the signal map taken from the rig's own control program. Deterministic safety checks — chassis stability, hook load against interlock state — sit above an AI layer that cross-references pressures, the loads they serve and the control states they depend on into subsystem findings. Issues become numbered cases with memory rather than alarms that fire and vanish, so the crew hears about the new, the worsening and the neglected, and is left alone otherwise.

KEY SAFETY BENEFITS

Instability you can see *developing*.

Early detection

Instability caused by side pulls, pipe movement, wind gusts and ground subsidence is detected as it develops, not after.

Real-time COG tracking

Continuous situational awareness of where the rig's lateral centre of gravity actually sits, updated as loads change.

Clear visual guidance

A moving COG marker on the HMI operating screens, mirrored on the grillage beam graphic in the alert bar.

Defined safety boundaries

Normal, caution and do-not-go-further zones, so the operator reads a position rather than interpreting a number.

Audible alarm and HMI warnings

When limits are exceeded the system raises an audible alarm and displays warnings on the HMI, giving the crew time to act.

Ground pressure visibility

Live kPa beneath the grillage beam at each reading point, against the 100 kPa allowable bearing pressure.

SUPPLIED BY

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SCOPE

IntelliBeam enhances safety but does not replace proper rig setup, site-specific safety procedures, regulatory requirements or professional engineering judgement.