

“SMARTDRILL 21”

Intelligent Automatic Drilling & Block Safety System



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Pioneering In Drilling Automation

INTRODUCTION

Rigserv “SmartDrill 21” is the most advanced and comprehensive Integrated Automatic Drilling & Travelling Block Safety System. It utilizes state-of-the-art PLC and Touchscreen Control Technology with comprehensive software designed to optimize drilling control and drilling safety, complete with reliable sensors and control interfaces. Normal steady drilling functions carried out by the Driller can be performed by the “SmartDrill 21” with far more precision, consistency, and safer, due to the fact that all related drilling variables are integrated and interacting simultaneously.



(Driller's Display & Control Panel)



(Touchscreen Menu Driven Control)

The “SmartDrill 21” System can be installed on Drawworks with Disc Brake or Band Brake and provides 3 important functions related to drill penetration and block movement: Autodriller, Kinetic Energy monitoring and Crown Block saving.

Like all Rigserv equipment, the “SmartDrill 21 “ is designed with open architecture hardware and software. The hardware is very powerful that it can cope with different rig types and operation environment, while the software and settings can be changed to meet present and future drilling needs.

AUTODRILLER FUNCTIONS

The Rigserv “SmartDrill 21” is designed to ensure continuous drill penetration by automatically controlling the WOB (Weight On Bit) and/or ROP (Rate Of Penetration).

Interface with the Driller is via a colour touchscreen LCD (display) and includes an intuitive, easy to use MMI (Man Machine Interface). All aspects of usage and configuration of the “SmartDrill 21” can be carried out at the display, as well as calibration of the various sensor interface.



The main mode of operation of the “SmartDrill 21” is “WOB Mode” where it automatically controls the selected Target WOB to ensure continuous drilling penetration. In unconsolidated formations, a secondary mode of the “SmartDrill 21”, “ROP Mode”, allows a continuous drill rate to be selected by the driller, and thus irrespective of WOB. In all operational modes a maximum ROP and WOB limit can be set, as well as Torque & RPM limits etc. in order to prevent damage to the well or the equipment.

Block movement, and thus ROP, is detected via a Drawworks Mounted Encoder, and the Total Weight/WOB is obtained from the Weight Indicator system or the hook-load sensor.

The “SmartDrill 21” can achieve a smooth drilling penetration rate by the control outputs to the Mechanical and Electric brake, according to the settings and the sensor feed-back. Interface to the Electric brake is usually achieved via a direct analogue signal to the brake control. Interface to the Mechanical brake is usually achieved via proportional valves connected to the brake control hydraulic circuit.



“SmartDrill 21” System

A Lower Block Limit sensor detects the block at its lowest position and will automatically engage the Mechanical brake, preventing further descent of the travelling block.

An Emergency Stop Button on the panel will engage the brakes to full-on at any time. The Autodriller On/Off switch allows the driller to release the “SmartDrill 21” momentarily from control of the brakes.

KINETIC ENERGY MONITORING FUNCTIONS

Through downward motion of the travelling block, the SmartDrill 21 works in parallel with the Driller's manual braking. The system continuously monitors the position, downward speed and weight hanging on the block, thus the block's Kinetic Energy, and by comparing this to the braking torque/force available will effectively act as a floor saver. The Electric brake is initially applied by the system if it fails to be brought in by the Driller, and secondarily the mechanical brake will be applied to automatically maintain a safe speed and stop the elevator above the drillfloor.



CROWN BLOCK SAVER FUNCTIONS

Through upward motion of the travelling block, the “SmartDrill 21” continuously monitors the position and upward speed of the block and will apply the brakes automatically, thus always ensuring the travelling block does not collide with the crown. Much in the same way as the downwards motion Kinetic Energy functions does, the Electric brake is initially applied by the system to slow the block before the Main brake stops it. This ensures that the wirelines do not 'jump' the pulleys.

“SmartDrill 21” System

SYSTEM CONFIGURATION

The “SmartDrill 21” System is configured generally with the following components:-

(1). Touchscreen Display & Control unit.

Mounted in a position convenient to the Driller, it is a modern “State-of-the-Art “ touchscreen control, Menu select multi-functions and multi-tasking Display & Control Panel. The Display Screen delivers both AutoDriller functions and Kinetic Energy/Floor & Crown Block Saver functions by selecting the appropriate menu. It is an intuitive and easy to use MMI (Man Machine Interface) Mimic with on-screen instructions, and enables the Driller or the technician to operate and configure the “SmartDrill 21”, as well as to calibrate the various sensor interface.

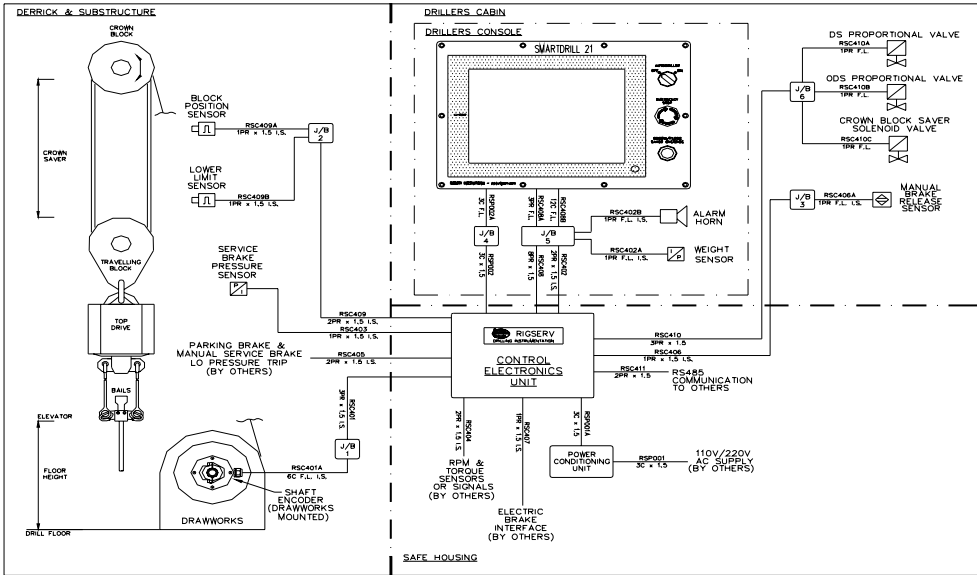
(2). Control Electronics Unit.

A powerful multi-processor capable PLC (Programmable Logic Controller) based unit which provides the interface to the brakes and the system sensors, and also the program for the entire system.

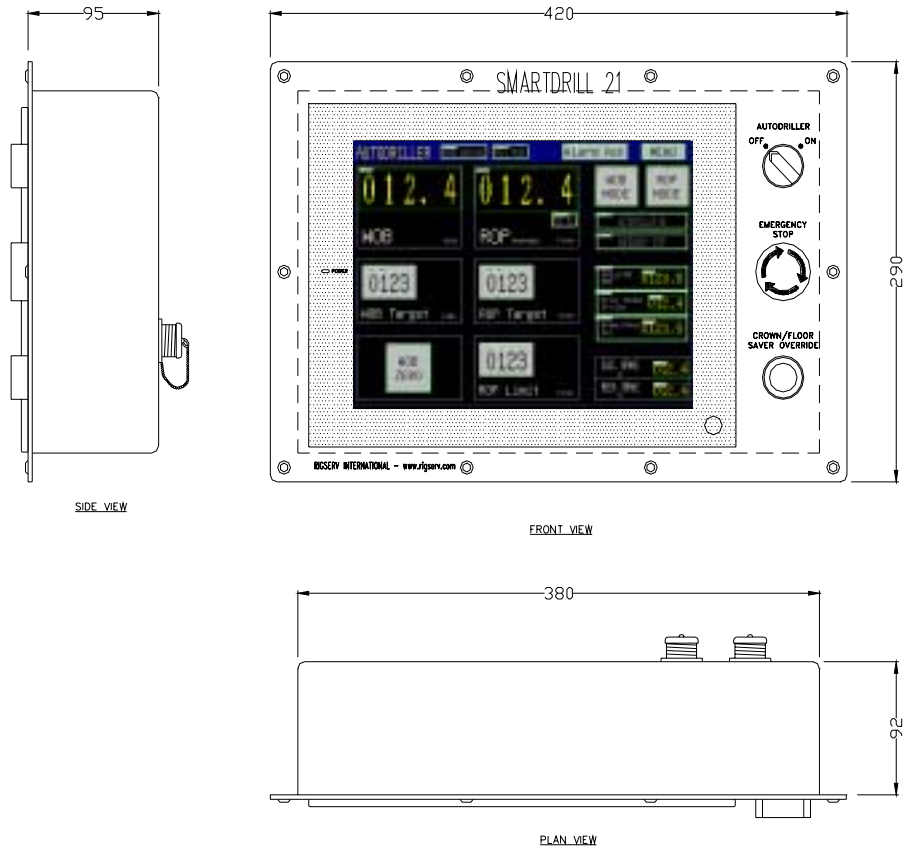
(3). Sensors and Control Interface package.

Sensors for the “SmartDrill 21” system, consists of a Block Position Sensor and Block Lower Limit Sensor on the derrick, Drum Movement Encoder, Brake Pressure Sensor and Brake handle detector on the Drawworks. A Weight Sensor is provided for the WOB and Kinetic Energy calculation, the rotating Speed and Torque Signals are obtained from the Drilling Instrumentation System or Sensors provided by the “SmartDrill 21”.

Control Interface consists of Proportional Pressure Solenoid Valves, Crown Saver Solenoid Valve, Analogue Output to the Auxiliary Brake and a Communication Port to interface with other computer based drilling equipment or data networks.



“SmartDrill 21” System



TECHNICAL INFORMATION

INSTRUMENT / EQUIPMENT DATA SHEET

INSTRUMENT NAME : “SmartDrill 21 Comprehensive Driller” -
An Automatic Drilling and Block Safety Control System.

SERVICE : To provide safe and automated control/movement of the Travelling Block and Drill penetration.

AREA / MODULE : Drill Floor - Safe area purged as part of a drillers console or as a standalone unit.

GENERAL

1. MANUFACTURER : Rigserv International
2. MODEL : P/N = 1014-071-X



“SmartDrill 21” System

SPECIFICATION

SYSTEM OPERATING VOLTAGE :	100-240vac / 24vdc
TOUCHSCREEN DISPLAY (LCD) :	Color TFT LCD (nominal 312 * 238mm) with “Oilfield Friendly” Resistive Touchscreen overlay. Bi-directional RS422 comms to the Touchscreen LCD panel. Protection (without purge etc.) = IP65F. System calibration and setup carried out through the LCD.
PLC :	'State-of-the-Art' Programmable Logic Controller.
BRAKE OUTPUTS :	Electric Brake = 4-20mA analogue interface or relay contact. Mech. Brake = Proportional valve control – analogue. or relay contact – digital.
WEIGHT SENSOR :	Pressure transducer to hydraulic weight Indicator or load Pin on topdrive/crown.
BLOCK MOVEMENT SENSOR :	Drawworks mounted Shaft encoder for ROP/Block Position.
BLOCK REFERENCE SENSOR :	Provides a reference point for continuous block position height calibration.
LOWER BLOCK LIMIT SENSOR :	Provides an automatic ‘full-on brake’ at lowest block position.
ALARM HORN OUTPUT :	Relay contact for optional alarm horn.
BRAKE PRESSURE SENSOR :	Optional analogue input for expanded functionality.
DRILL TORQUE SENSOR :	Optional analogue input for expanded functionality.
RS232/ETHERNET COMMS:	Optional networking capability.
OTHER I/O :	By adding I/O (analogue or digital) flexibility for additional interface or functionality is ensured.
MATERIAL :	Stainless Steel panel with LCD cut-out. PLC mounted in Steel enclosure.
ASSEMBLY WEIGHT :	Drillfloor mounted panel (LCD's, etc) - 5kg (approx.) PLC = 10kg (subject to enclosure used)