

THERMOCHEM COMBINATION MEMORY – SRO PTS TOOL

PTS Memory and SRO Combination Tool

The Thermochem PTS tools are a true combination tool containing both Full Memory capability for slickline use and SRO Mode with real-time memory back-up capability should power to the tool from the surface be lost. The Thermochem Combination PTS tools utilize separate hardware to accommodate either a battery pack for memory only mode, or an SRO connection through the flask for the SRO mode. The tool can be a standard memory tool if batteries are installed, SRO tool with no batteries installed, or an SRO tool with battery backup if the tool is connected to the wireline with the batteries installed. This enables the SRO tool to be operated as a memory tool if the wireline is compromised due to a short or open where both power and data is no longer provided through the e-line. The tool automatically switches power from wireline to the batteries with no loss of data. In high temperature deployments, it is common to have e-line cable issues. The Thermochem PTS tool provides a reliable back-up option in circumstances when the e-line cable is compromised.



Specifications

Table 1, Dimensions and weights

Overall Length (PTS)	2.175 m
Tool OD (PTS)	54.2 mm
Assembled weight (PTS)	22.6 Kg
Overall Length (PT only)	2.0 m
Tool OD (PT only)	47.4 mm
Assembled weight (PT only)	20.9 Kg

Table 2, Electronics

Memory Storage Capability	>130 hours at 1 second data interval
Memory Mode Battery Life	>85 hours
Data Interval	1 second (standard, custom intervals available)
Internal calibrated temperature range	20 to 125°C
Internal operating temperature range	-20 to 130°C

Table 3, Wellbore Pressure

Sensor technology	Thickness Shear Mode Quartz Resonator
Pressure Range	0 to 5000 psi (0 to 344 bar)
Temperature compensated	Yes
Typical Accuracy (%FS) (25 to 150°C)	0.015%
Achievable Resolution (psi)	< 0.0006 psi
Repeatability (%FS)	< 0.01%
Nominal Sensitivity (Counts/psi)	1700
Response time to FS step (for 99.5% FS)	< 1 second
Acceleration Sensitivity (psi/g – any axis)	< 0.02
Drift at 14 psi and 25°C (% FS/year)	Negligible
Drift at Max pressure and temperature (% FS/Year)	0.02

Table 4, Wellbore Temperature

Sensor technology	Platinum Resistance
Calibrated Temperature Range (°C)	20 to 350°C
Accuracy (°C)	±0.4°C
Typical system accuracy (°C)	±0.2°C
Achievable Resolution (°C)	<0.001
Repeatability (°C)	<0.04
Drift at 150°C (°C/year)	<0.1

Table 5, Spinner

Operating Temperature Range (°C)	20 to 350°C
Available Impellers	3, 5, 10, and 20 inches of fluid per rev
Spinner sizes available	1.69", 2.125", and 3.00"
Suggested Impeller range	30RPM - 10,000 RPM
Direction indicator	Yes
Number of Reed Switches, Counts per Revolution	2, 4
Counting Gate Time (for low speed flow)	Software selectable (1 to 10 seconds)

Depth Recording – SRO System

The Depth Recording System powers the PTS tool while in SRO mode. The Depth Recording System records depth data for all operational modes (Memory only, SRO only, and SRO with Memory). An internal rechargeable battery allows for limited time use if power is interrupted when recording depth in Memory mode. For the Memory mode or when SRO memory back-up is recovered, the depth data is merged with the tool data to obtain data related to depth of the well. The Depth Recording System is a stand-alone system that has internal memory to record the depth data. The depth box includes a full-size wireless keyboard. In addition to internal memory, the depth data can also be recorded to a PC for real-time logging of depth data through a USB cable. In this case, the internal memory serves as a backup to the PC depth data. All data is viewable in graphical form, tabular form, and combinations of the two on both the display screen of the depth box and remote PC. The PC software also displays and saves all the data real-time to the PC during the log (pressure, temperature, spinner, depth, and line-speed). An HDMI output allows the data and graphics to be displayed on a remote large screen in the logging truck as well. Built-in WiFi and Internet of Things (IoT) technology can provide communications to other devices and automatic upload of logging data to a website portal. A digital encoder and the software needed are included with the Thermochem Depth Recording – SRO System.





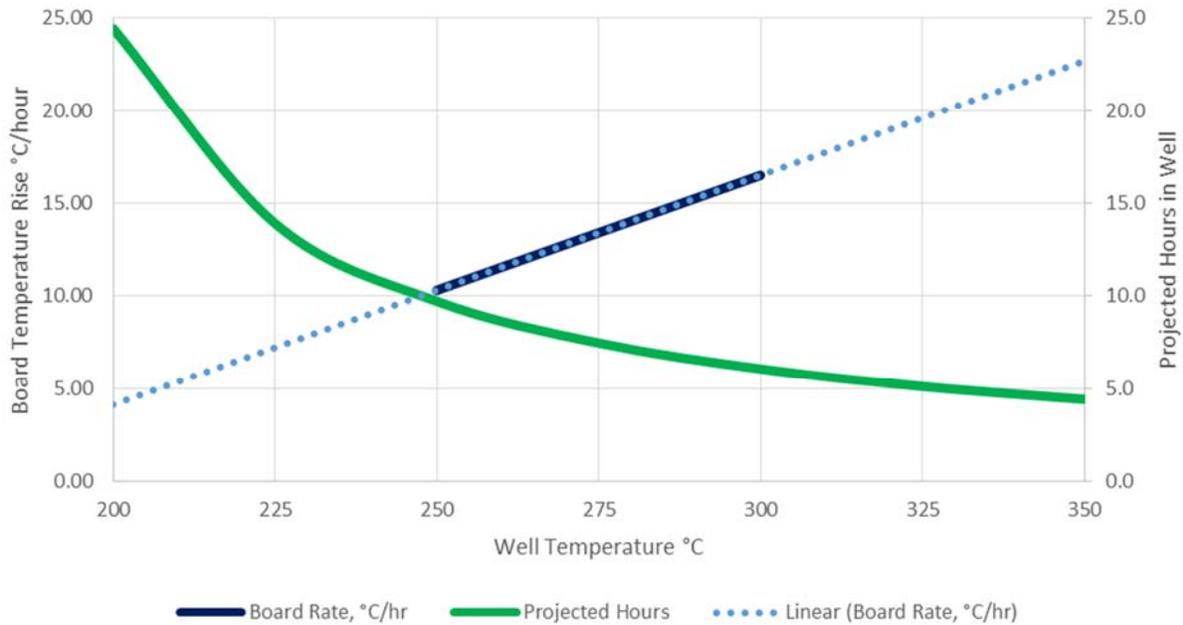
Overall Temperature Rating – Time in Hole

The internal electronics of the Thermochem Memory and SRO tools have a temperature rating of 130°C, primarily limited by the batteries. The Memory tool heat shield flask is capable of maintaining the internal tool temperature below 130°C for about 10 hours at a wellbore temperature of 250 °C, 7 hours at 300 °C and 5 hours at 350 °C. The Combination Memory - SRO (and SRO-only) tool heat shield flask is capable of maintaining the internal tool temperature below 130°C for about 10 hours at a wellbore temperature of 250 °C, 6 hours at 300 °C and 4.5 hours at 350 °C. This data is summarized in Table 6 below and the actual test data measured in a high-temperature test oven is plotted on the next page.

Table 6, Thermal Resistance

Memory-only Heat Shield	Time in Hole
250 °C	10 hours
300 °C	7 hours
350 °C	5 hours
Combination – SRO Memory Heat Shield	
250 °C	10 hours
300 °C	6 hours
350 °C	5 hours

Combination Memory-SRO Heat Shield
 Combination Tool Internal Temperature Rate, °C/hour
 vs. Time in Well, Hours



Memory only Heat Shield
 Combination Tool Internal Temperature Rate, °C/hour
 vs. Time in Well, Hours

