Models 701 & 711 Strain Gage Conditioners With Unmatched Performance and Productivity

Superb Instruments for load cells, scales, pressure sensors, accelerometers, reaction, slip ring and rotary transformer torquemeters

- ***rock solid readings unaffected by thermal and galvanic voltages***
- ***2000 samples/sec./channel, 0.5 to 5 mV/V and high noise immunity***
- ***6 digit engineering unit display with legends and 0.01% resolution***
- ***7 pole antialias filter and 4 pole digital filters with 10X oversampling***
- ***real-time cross channel calculations and math operations***
- ***20 built-in data acquisition and control functions***
- ***RS232, RS422 or RS485 serial communication***
- ***user assignable logic inputs and outputs***
- ***auto-scaled ±5V and/or ±10V analog outputs***
- ***no pots, batteries, fans, maintenance, or external power supplies***

These instruments are full featured strain gage conditioner/readouts; the Model 701 handles one and the Model 711 handles two transducers. Both provide fast, accurate data for each channel. What's more, 20 of the most useful processing functions and 26 real-time digital calculations are built in. Their use converts the Model 701/711 into powerful production and performance test analyzers with easily configured characteristics. You needn't write code or add hardware to be up-and-running a productive test.

The alphanumeric display can publish measured and computed data, units of measure and test status. During setup, it guides you with English language prompts. There are no manual adjustments. Calibration is simple; enter the sensor full scale in engineering units and auto-cal takes over. It provides 0.01% resolution and ±5V and/or ±10V analog outputs at the sensor full scale. The keyboard accesses measured data, derived data, stored data, limit status, and/or I/O status without test disruption. Password protection of user set values may be invoked, when needed.

Signal conditioning has the advantages of ac carriers with the operating simplicity of dc. Microprocessors eliminate manual adjustments yet provide true ac null balance. As a result, the instrument is easy to use, has superior noise immunity, is unaffected by thermal and galvanic voltages and offers high sensitivity. Use it with either directly wired or transformer coupled sensors.

Select either RS232, RS422, or RS485 communications to remotely acquire data, and setup and control the instrument modes. Input actions and output events can be controlled by user configurable logic I/O's. When used in its' State Mode, Event Driven Tests can be done. That is, the Instrument setup automatically changes as the test moves between states; up to 8 states are possible – see AN7000 for details.

Included software remotely controls all instrument functions from a Windows based PC. It displays, plots and saves real-time data, does X-Y plots, and will also save and download the instruments setup parameters.

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Model 701/711 Specifications

Transducer(s)
- Type ..... Any 80 to 2000Ω strain gage transducer, directly wired or transformer coupled.
- Connections ..... Provision for 4, 6, or 7 wire circuits.

Maximum Cable Length ..... 500ft for transducer impedance ≥100Ω and 200ft for transducer impedance <100Ω.
Transducer Excitation ..... 3Vrms, 3030Hz ± 0.01% sine wave. Regulated, and short circuit protected.
Input
- Sensitivity ..... 0.5 to 5mV/V with 50% overrange; automatically scaled.
- Impedance ..... 100MΩ in parallel with 33pF.

Automatic Null Range
- In-Phase Signals ..... ±10% of Full Scale (with 50% overrange), ±60% of Full Scale (with 0% overrange).
- Quadrature Signals ..... ±1mV/V.

Auto Calibration ..... Dual polarity shunt calibration with provision for CAL resistor feedback.
Spurious Signal Rejection ..... 60Hz: 120dB common mode, 100dB normal mode. Carrier quadrature: 60dB.
Antialias Filter ..... 200Hz, 7 pole Bessel response filter.
Low Pass Filtering ..... 4 pole Bessel response digital filters with 11 cutoff frequencies from 0.1 to 200Hz in 1-2-5 steps.
Signal-to-Noise Ratio[1] ..... @ 1mV/V F.S.: 86/76/66/62dB with 1/10/100/200Hz filters.
@ 5mV/V F.S.: 86/80/72/66dB with 1/10/100/200Hz filters.
Resolution ..... 0.01% of Full Scale.
Overall Accuracy (at 77°F/25°C) ..... 0.02% of Full Scale, worst case.
Temperature Effects ..... Zero: ±0.001% of Full Scale/°F (max); Span: ±0.001% of Full Scale/ °F (max).
Display
- Type ..... 2 line by 16 alphanumeric characters, each 0.2” wide by 0.3” high. Backlit LCD with adjustable contrast.
- Views ..... Select either 2 Channels, 1 Channel with Limit Status, or 1 Channel with I/O Status.
- Data Displayed ..... Select from Current, Max, Min, Spread, Held data and Tare value.
- Data Format ..... Engineering units with 6 digits (1-2-5 format) and 5 character user-entered legend/descriptor.

Number of Channels
- Hardware ..... Supports one (Model 701) or two input channels (Model 711).
- Calculated ..... One (CH3). Choose from 26 formulas based on CH1, CH2, and a constant.

Response (per channel)
- Data Sampling & Max/Min Update Rates ..... 2000Hz (hardware channels), 50Hz (CH3 calculation).
- Limit Checking Rate ..... 1000Hz (hardware channels), 50Hz (CH3 calculation).
- Logic I/O Response Time ..... 1ms (hardware channels), 20ms (CH3 calculation).
- Update Rate for each Analog Output ..... 1000Hz.

Control (All I/O functions can be OR’d in any combination. The *pattern* function adds ANDing capabilities.)
- Input Actions/channel ..... Logic inputs, outputs, and internal Matrix signals control following actions. Tare, Clear Tare, Hold, Clear Hold, Reset Max/Min, Clear Latched Limits, Check Limits, Do Max/Mins, Apply +CAL, Apply -CAL.
- Output Events/channel ..... The following events drive Logic outputs and internal Matrix signals. HI Limit, NOT HI Limit, IN Limit, NOT IN Limit, LO Limit, NOT LO Limit, At Max, NOT At Max, At Min, NOT At Min.
- Eight User-defined Patterns ..... Patterns drive Logic outputs and internal Matrix signals. Patterns are based on Logic inputs, outputs, and internal Matrix signals.

State Machine Capability ..... User enabled/disabled. Permits up to eight states and allows event driven testing. See AN7000 for details.
Limit Checking ..... Each channel has a HI and LO limit which may be latched or unlatched, absolute or signed, and with or without hysteresis. Select either Current, Max, Min, Spread or Held data for limit checking. Limit violations on any or all channels can be set to trigger backlight flashing in any of the display view modes.

Four Logic Inputs (each with programmable function -- destination)
- Type ..... TTL compatible, Schmitt Trigger, low-true with 47kΩ pull-up. Input current is -100µA @ 0V.
- Protection ..... to ±130VDC (or 130VAC).

Six Logic Outputs (each with programmable function -- source)
- Type ..... Open collector, low-true. Operating @ 24V (max) and 0.3A max sink current.
- Protection ..... Short circuit (current and thermal limits) and overvoltage (0.5A fuse).

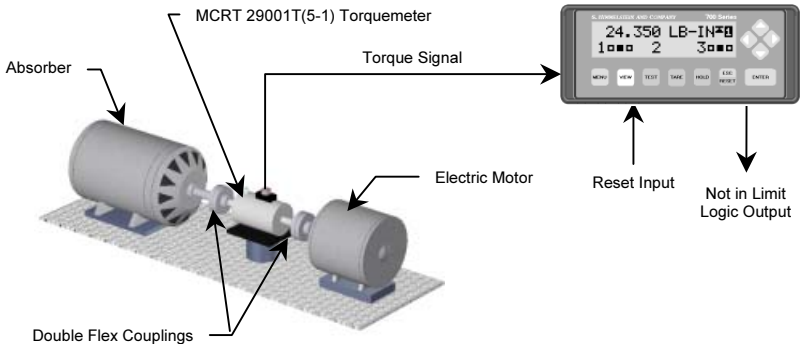
Serial Communication Port (user selectable as RS232, RS422, or RS485)
- BAUD Rate ..... 300 to 38400. Maximum Cable Length: 4000ft (RS422/RS485), 50ft (RS232).
- Maximum Number of Devices ..... 32 (RS485), 1 (RS232/422).
- 120Ω Termination Resistors (RS485) ..... User selectable for RXD and TXD.
- RS422/485 Transceivers ..... Slew-rate limited, short circuit protected (current & thermal limits).
- RS232 Drivers ..... Short circuit protected (current limit).
- Serial I/O’s ..... Use a 9 pin D connector. They are ±15kV ESD protected and float (100kΩ) with respect to Earth Ground.
- Commands ..... Control of all modes, settings, and measurements.

Non-Volatile Memory Storage for System Settings ..... EEPROM, batteries are not used.
External +5VDC Power (on I/O connector) ..... 250mA, short circuit (current limit) and overvoltage (1A fuse) protected.
Dual Analog Outputs (each assignable to any channel present)
- Output Impedance/Minimum Load Resistance ..... <1Ω/10kΩ.
- Full Scale ..... ±5V or ±10V (user selectable). Resolution is ±2mV @ ±5V FS or ±4mV @ ±10V FS.
- Overrange ..... ±8.2V @ ±5V FS or ±13.5V @ ±10V FS.
- Non-linearity ..... ±2mV @ ±5V FS or ±4mV @ ±10V FS.
- Overall Error (worst case, including temperature effects) ..... ±5mV @ ±5V FS or ±10mV @ ±10V FS.
- Filter ..... 100Hz, 5 pole Bessel response low pass filter.
- Protection ..... Short circuit (current limit) and overvoltage (0.25A fuse) protected.

Size and Weight ..... 6.5" wide, 2.9" high, 8.7" deep. Weight is 3 pounds.
Operating Temperature ..... +41 °F to +122 °F (+5°C to +50°C).
Input Power ..... 90VAC to 250VAC, 50/60Hz @ 25VA, max. Two 2A/250V fuses, line filter, and rear power switch.

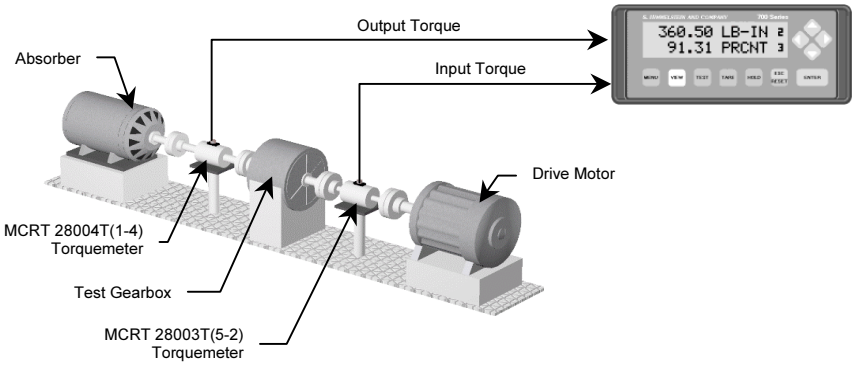
Notes: 1. The ratio expressed in decibels (dB), of Full Scale to noise spread. Measurements are made for a 1 minute interval using a 350Ω bridge.
2. Specification is subject to change without notice.

MOTOR BREAKDOWN TORQUE TEST WITH MODEL 701



After start, the motor is loaded above its BREAKDOWN TORQUE. After the test, the display, operating in its Max data mode, shows the precise BREAKDOWN TORQUE. HI and LO limits classify Max data and accept or reject the test motor. Limit status is displayed by the instrument. A valid NOT IN Limit logic output drives a reject marker. Reset is done from the front panel or via the I/O. Breakdown torque in metric units is calculated on CH 3 as KG-M = LB-IN/86.796.

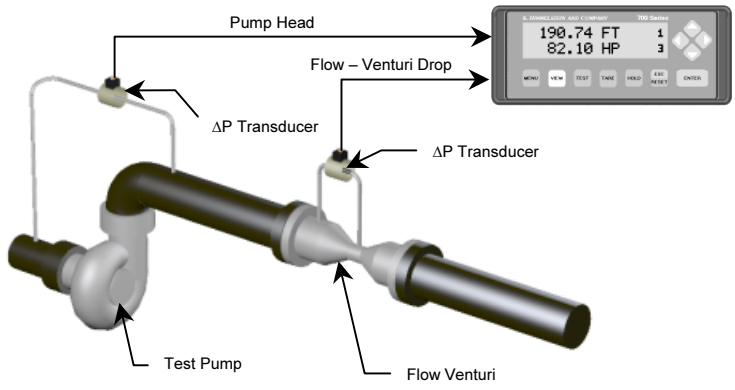
GEAR BOX TORQUE AND EFFICIENCY WITH MODEL 711



This setup classifies gear boxes on their efficiency and output. It measures INPUT (CH 1) and OUTPUT (CH 2) TORQUES and computes EFFICIENCY (CH 3). The display, which is set in the current data mode, shows OUTPUT TORQUE and EFFICIENCY. Limits, used in latching mode, classify OUTPUT TORQUE and EFFICIENCY. Finally, limit violations flash the display backlight.

$$\% \text{ Efficiency} = \frac{[\text{Output Torque} * 100]}{[\text{Input Torque} * \text{Gear Ratio}]}$$

PUMP WATER POWER WITH MODEL 711

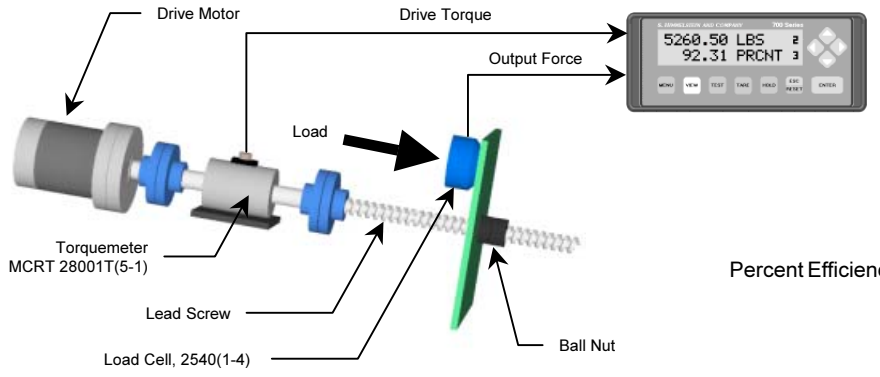


The Model 711 displays PUMP HEAD (CH 1) and WATER POWER (CH 3). Flow is determined from the pressure drop (CH 2) across a Venturi; the calculation of WATER POWER (CH 3) is indicated above. The display is set in the current data mode and non-latching limits are set to detect when the WATER POWER or HEAD goes out of limit. The same instrumentation can be configured to display FLOW instead of WATER POWER and, any of the three channels can be displayed by using front panel switches.

$$\text{Water Power} = \frac{[\text{Venturi Drop}]^{1/2}\ [\text{Pump Head}]}{K}$$

K is a constant dependent on Venturi scaling and units of measure.

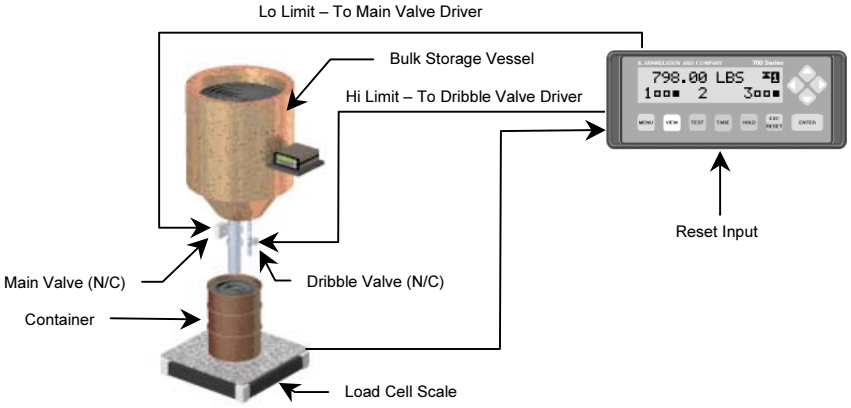
BALL SCREW EFFICIENCY TESTER USING THE MODEL 711



DRIVE TORQUE(CH 1) and OUTPUT FORCE (CH 2) are measured by strain gage transducers. The EFFICIENCY (CH 3) is displayed with either measured parameter. Analog outputs may be used to drive an X-Y recorder.

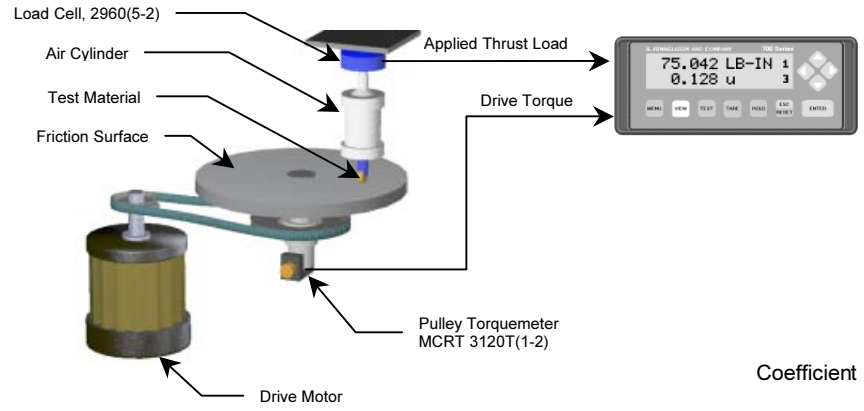
$$\text{Percent Efficiency} = \frac{[\text{Output Force} * \text{Lead} * 100]}{[2 * \pi * \text{Input Torque}]}$$

AUTOMATIC BATCH-OUT WEIGHING SYSTEM WITH MODEL 701



This system fills the container to a precise, field set, weight. At cycle start, a Reset signal TARES the 701 eliminating errors due to container variations. Filling is done in two stages; rapidly via the Main Valve, and slowly via the Dribble Valve. The LO Limit shuts the Main Valve; the HI Limit shuts the Dribble Valve. Limit checking is done on the Max data. The 701 displays Max data and retains the filled container weight until the start of the next cycle**.** Container weight in metric units is calculated on CH 3 as KG = LBS/2.2046.

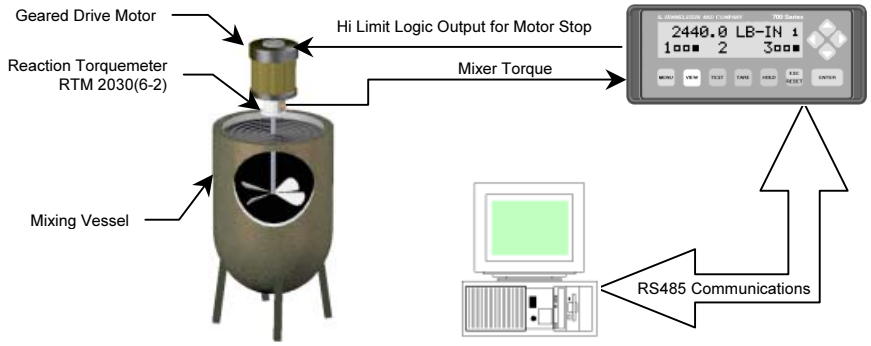
COEFFICIENT OF FRICTION TESTER WITH MODEL 711



A Pulley Torquemeter measures the input DRIVE TORQUE (CH 1). The load cell measures the applied THRUST (CH 2). The Model 711 displays the calculated COEFFICIENT OF FRICTION (CH 3) and either the applied THRUST or DRIVE TORQUE. If desired, limits can be set on any of the parameters and parameter variation (SPREAD) can be displayed. Note that the reaction thrust is taken out by a thrust bearing. Thrust is transmitted by the torquemeter shaft but is isolated from the torsion element.

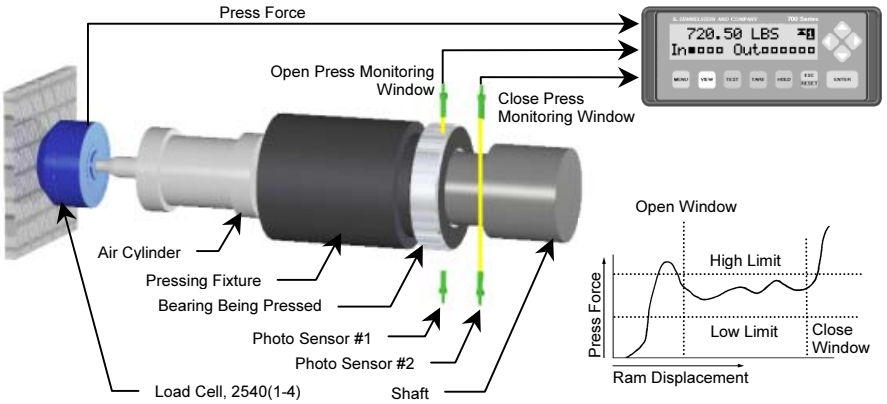
$$\text{Coefficient of Friction, } \mu = \frac{[\text{Torque}]}{[\text{Thrust} * \text{Radius}]}$$

MIXER PHASE (VISCOSITY) CHANGE DETECTION WITH MODEL 701



A Hollow, Flanged Reaction Torquemeter supports the geared vertical drive motor and measures mixer TORQUE. The Model 701's limits detect a phase change when mixing is complete, i.e. mixture viscosity is that of the final product and mixer TORQUE is at a preset level. The limit output signals motor stop and batch unload. The plant computer downloads a new set of limits when the product is changed.

PRESSING FORCE TESTING WITH MODEL 701



This system automatically measures and classifies peak pressing force while ignoring the high starting and bottoming forces. Valid pressing forces occur in a window between the TTL output photo sensors. The load cell measures pressing FORCE (CH 1). Display and Limit checking is done on the 701's Max data. Do Max/Min is invoked while sensor #1 is blocked and sensor #2 sees light. Max/Min mode is disabled when sensor #2 is blocked. Thereafter the Model 701displays and classifies the test items PEAK PRESSING FORCE.