

Model: ST-1/P

**User's Manual for the**  
**ST-1/P**  
**Digital Joulemeter Readout**



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ST-1/P

# 1.0 INTRODUCTION

The ST-1 is a high-speed, peak-hold, digital display for converting the output from a Star Tech Instruments energy probe, or any passive pyroelectric probe, to a DC voltage and a digitally displayed energy reading.

## 1.1 Laser Pulse Measurement Functions

Average Pulse Energy (1 Hz to 10 KHz)

Individual Pulse Energies (a DC level proportional to the pulse energy which updates with every pulse; 1Hz to 10 KHz)

## 1.2 Front Panel

4-digit, backlit LED display, with units.

A flashing Green TRIGGER LED that indicates a valid pulse has been detected.

Red OVER (-RANGE) LED that indicates when the input signal has exceeded its maximum linear output.

Convenient front-panel probe-responsivity input allows rapid setting for different probe responsivities.

## 1.3 Rear Panel

Probe input terminal with over-voltage protection (up to  $\pm 30$  V)

Input Impedance Switch: switch between 1 M $\Omega$  and 50  $\Omega$  input impedance.

Input Range Switch- switch between 0-2 V input range and 0-200 mV input range

Power Connector- 5.5 mm X 2.1 mm power jack for 12 V AC/DC, 200 mA

## 15 Pin Female D-Sub Connector- Pinouts

- 1) **Average Pulse Energy.** The voltage at Pin 1 is proportional to the average pulse energy and ranges from 0 to 4.096 V. The averaging time constant is 1 second.
- 2) **Individual Pulse Energy.** The voltage at pin 2 varies from 0 to 4.096 V and is proportional to the individual pulse energy. This value updates whenever another pulse is received by the ST-1.
- 3) and 4) **Analog Ground.**
- 5) **Input Over-range.** Pin 5 is a CMOS output which goes HIGH when the input signal exceeds the range set by the Input Range switch. It indicates that the output signal from the probe may no longer be within the linear range of the probe.
- 6) **Output Over-range.** Pin 6 is a CMOS output which goes LOW when the average pulse energy output exceeds 4.096 V.
- 7) **Data Valid.** Pin 7 is a CMOS output which goes LOW for 10  $\mu$ s after a pulse has been registered by the ST-1 and the Individual Pulse Energy pin has been updated. This pin can be used for timing and triggering devices such as A/D converters and CCD cameras.
- 8) **+5 VDC.** Pin 8 reads 5 V when the unit is powered on.
- 9) **/Hold.** Grounding Pin 9 disables the internal trigger and causes the ST-1 to stop acquiring data. Readings will be held until the pin is allowed to return HIGH.
- 10, 11), 12), 13), 14), 15) **Digital Ground.**

### 1.4 Other Benefits

Convenient tilt stand/handle

Available with power supplies for use worldwide

### 1.5 Optional Features

Single or dual channel 19" rack mount, with the readout for each channel individually removable.

Available in rechargeable version for approximately 15 hours run time.

## 2.0 FRONT PANEL

### 2.1 Probe Responsivity Input Thumbwheel

#### 2.1.1 Entering the Probe Responsivity

Use the thumbwheel (Fig. 1) to enter the responsivity of the probe. This will convert the voltage output from the probe to the correct corresponding value in joules, both on the display and in the ST-1 output voltages. Press the “+” button below each digit to increase its value and the “-“ button above each digit to decrease it. The two rightmost thumbwheels are the sign and base-10 exponent of the responsivity. Examples: a responsivity of 1250 volts/joule may be entered as 1.250+3, or 0.125+4. A responsivity of 0.027 volts/joule may be entered as 2.700-2 or 0.270-1. The exponent may be any value from -7 to +7.

#### 2.1.2 Setting the number of significant digits

The responsivity thumbwheel can be used to set the number of significant digits of the displayed energy value. Example: a 300 mJ pulse used with a probe responsivity of 0.08 V/J, entered as 8.000-2, will produce a displayed value of 0.300 J (three significant digits). However, with the same probe, entering the responsivity as 0.800-1 will produce a reading of 300.0 mJ (four significant digits).

### 2.2 LED Indicators

#### 2.2.1 Red OVER LED

The red OVER LED lights when the peak input signal approaches the maximum of the input range. This value is approximately 180 mV on the 0-200 mV range and approximately 1.8 V on the 0-2 V range.

#### 2.2.2 Green TRIG LED

The green TRIG LED will flash whenever a pulse is received which exceeds the trigger threshold of the ST-1. This value is approximately 5 mV on the 0-200 mV range and approximately 50 mV on the 0-2 V range.

## 2.3 Display

The large 4-digit display reads from 0 to 4096 with floating decimal point and variable units. The exponent and input range settings are detected by the ST-1 and the decimal point and units are automatically adjusted. The time constant of the display is approximately one second.

# 3.0 BACK PANEL

The back panel (Fig. 2) contains the power jack and all input and output terminals.

## 3.1 Power Input Jack

The power input jack is located on the left side. The ST-1 requires 12 V AC/DC at 200 mA, and the jack is 5.5 X 2.1 mm. A UL/CSA approved wall transformer is supplied with the ST-1.

## 3.2 Signal Input

The signal input terminal is a female BNC connector on the right side of the back panel.

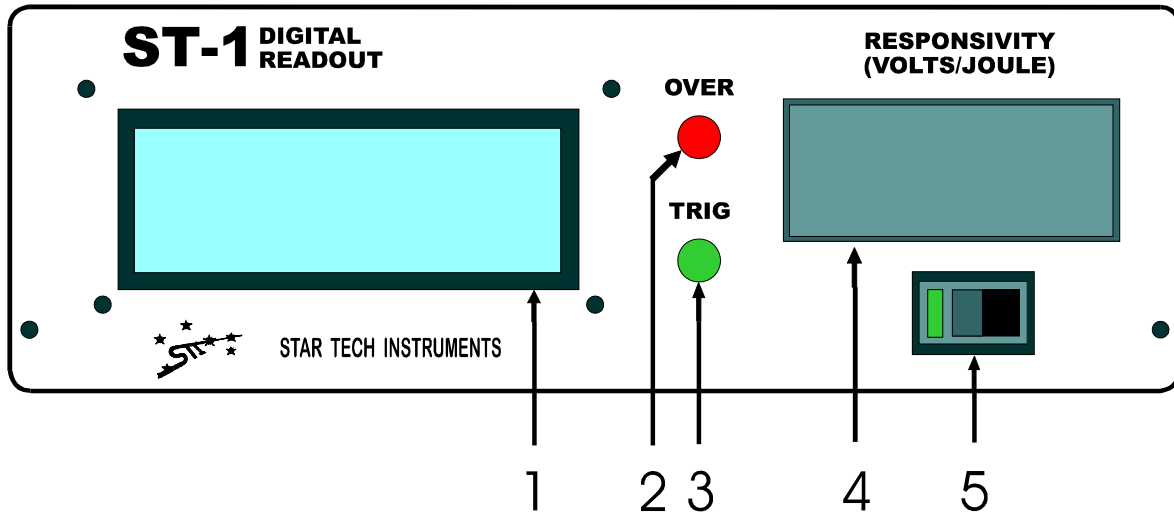
## 3.3 Input Range Switch

The Input Range toggle switch switches the acceptable range of inputs from 0-2 V to 0-200 mV. Toggling this switch changes the internal gain of the ST-1, so it also changes the minimum trigger threshold and system responsivity. The display and output units automatically adjust for the change in responsivity.

## 3.4 Input Impedance Switch

The Input Impedance toggle switch changes the input impedance between 1 M $\Omega$  and 50  $\Omega$ . Most Star Tech Instruments and pyroelectric probes are intended for use in the 1 M $\Omega$  position. Some amplified probes are intended for use with 50  $\Omega$  loads.

Figure 1. FRONT PANEL, ST-1/P DIGITAL DISPLAY



- 1) Display, Supertwist LCD Module with LED backlighting, character height- 9.5 mm
  - a- Units (J, mJ,  $\mu$ J, or nJ)
  - b- Decimal position shifts with responsivity exponent value.
  - c- Input pulse energy value
- 2) Over-range indicator

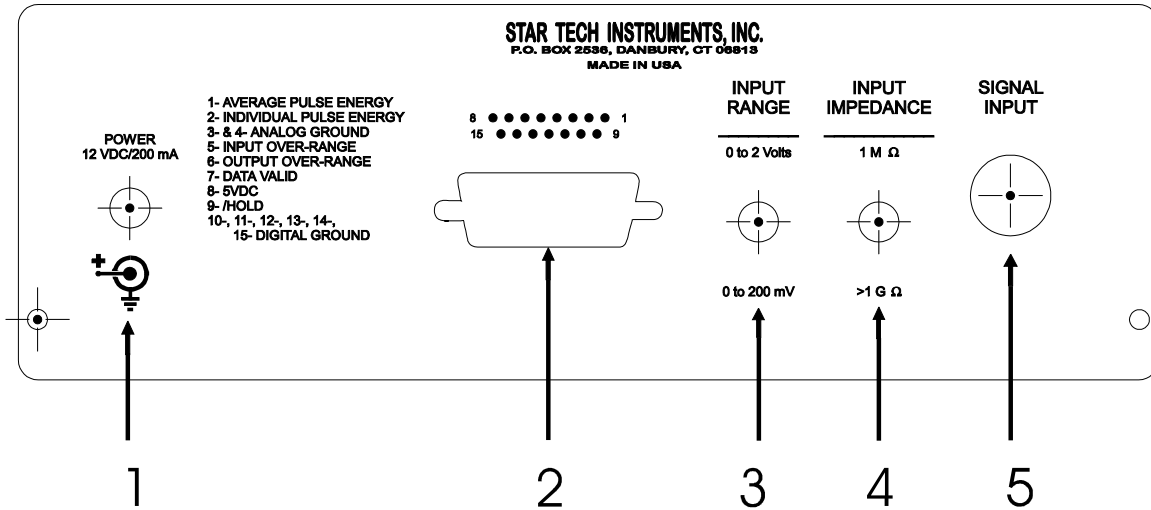
The OVER-RANGE indicator flashes RED whenever the input signal exceeds the value set by the *Input Range* Switch. It indicates that the output signal from the probe may no longer be in the linear range of the probe.
- 3) Trigger indicator

The TRIGGER INDICATOR flashes GREEN whenever the voltage of an input pulse exceeds threshold.
- 4) Probe responsivity thumbwheel

Set this thumbwheel to the probe responsivity in order to display the input probe pulse energy, e.g., if the probe responsivity is  $2.36 \times 10^{-2}$  Volts/Joule

  - a- Set the *Value* to "2.360"
  - b- Set the *Exponent* to "-2"
- 5) Lighted power switch.

Figure 2. Rear Panel, ST-1/P Digital Display



- 1) Power input: 12V AC/DC, 200 mA, connector type:5.5 mm x 2.1 mm, Male
- 2) 15 Pin DIN Connector

1) **AVERAGE PULSE ENERGY**

The voltage at Pin 1 is proportional to the average pulse energy. The averaging time constant is 1 sec and is updated continuously.

2) **INDIVIDUAL PULSE ENERGY**

The voltage at Pin 2 is proportional to the pulse energy of the last pulse input. The value is updated whenever a new pulse triggers the threshold.

**TRIGGER THRESHOLD:**

Internally set at 5 mV for the 0 to 200 mV range and 50 mV for the 0 to 2 Volt range.

This voltage is reset to zero if no pulses are input for 1.5 seconds.

3), & 4) **ANALOG GROUND**

5) **INPUT OVER-RANGE**

The voltage on this pin goes high whenever the input signal exceeds the value set by the *Input Range* Switch. It indicates that the output signal from the probe may no longer be in the linear range of the probe.

6) **OUTPUT OVER-RANGE**

The OUTPUT OVER-RANGE pin goes LOW when the average pulse energy voltage exceeds 4.096 Volts.

7) **DATA VALID**

The voltage on the DATA VALID pin goes low for approx. 10 micro-seconds whenever an input pulse exceeds threshold. This pin can be used for timing and triggering events depending on the arrival of a pulse, such as triggering an A/D converter or gating a CCD camera.

8) **+5VDC**

This pin is high (5 VDC) when the unit is on

9) **/HOLD**

Driving this pin LOW disables the trigger causing the current readings to be held until the pin is again allowed to go high.

10), 11), 12), 13), 14), and 15) **DIGITAL GROUND**

3) Input Voltage Range select switch

The input range switch enables you to change the input signal range from 0 to 200 mV (typical range for STI probes) to 0 to 2 Volts (needed for other probes from other manufacturers). The setting of this switch does not affect the pulse energy reading; e.g., a 100 mV input signal will produce the same pulse energy indication on the display, regardless of the position of this switch.

4) Input impedance select switch

The input impedance of the SIGNAL INPUT terminal can be set at 1 M Ohm or >1G Ohm. The >1G Ohm setting should be used unless your probe requires a 1 M Ohm input impedance. All STI probes will give the best performance when this switch is in the >1G Ohm position.

5) Signal Input (BNC)

The pulsed input signal goes here. Since the ST-1 is a peak-to-peak reading device and is AC coupled, a DC signal input will produce an erroneous indication. The input terminal is protected against large input voltages (up to 30 V continuous, 50 V single pulse).

## 4.0 Option Select Switch

The Option Select Switch is a 4-position DIP switch located on the circuit board inside the ST-1. It is used to adjust certain operating parameters of the ST-1. It is necessary to open the ST-1 to access it.

To open the ST-1: from the back cover remove two jack screws, one nut and washer from the BNC connector, and two Phillips head screws. Remove the back cover. Carefully slide the outer cover of the ST-1 backwards and off the unit. Reassembly is the opposite of disassembly. Take care when reassembling not to pinch or disconnect any wires.

Switch	1	2	3	4
0	Data triggered	Positive-going DAV signal	100 $\mu$ s DAV signal	Hold data indefinitely at end of pulsetrain
1	Externally Triggered	Negative-going DAV signal	10 $\mu$ s DAV signal	Reset to zero at end of pulsetrain

The standard factory settings for the Option Select Switch are 0-1-1-1.

Figure 3. Circuit Board of ST-1 Showing Option Select Switch

