General Specifications

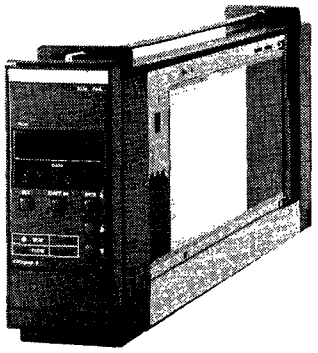
Model STLD (Style E) Totalizer

YEWSERIES 80

The STLD Totalizer is capable of totalizing not only pulse signal inputs but also analog signal inputs.

The totalizer functions include:

- *Scaling, addition or subtraction of pulse signals, instantaneous flow display, repeater for flow signal.*
- *Analog inputs and outputs, and compensation computation functions.*
- *Various totalizer functions. Totalizer parameters are easy to set, and totalizer totals may be viewed.*
- *Communications functions — the instrument is easy to design into a system, it can communicate with a central operator station or supervisory computer.*
- *Self-diagnostic functions.*



STANDARD SPECIFICATIONS

Input Signals

Process Variable Pulse Input Signal: 0 to 6 kHz, zero elevation not possible, minimum pulse width 50 μs. Pulse input from two-wire/three-wire transmitter, or voltage transition/contact signal.

Input From Transmitter: STLD contains distributor, voltage is switch-selectable — distributor supplies 12 V/24 V ±10%, current up to 50 mA. For two-wire transmitter, load resistance is switch selectable — 200 Ω, 510 Ω or 1 kΩ.

Voltage (Transition) Pulse:

Voltage LOW Level (E_L): −1 V to +8 V DC.

Voltage HIGH Level (E_H): +3 V to +24 V DC.

Amplitude of Pulse Signal ($E_H - E_L$): At least 3 V.

Input Resistance: At least 10 kΩ.

Contact Pulse: Relay/switch contact or transistor switch.

Contact ON: Source resistance up to 200 Ω.

Contact OFF: Source resistance at least 100 kΩ.

Contact Rating: At least 30 V DC, 30 mA.

Filter for Contact Pulse Input: Switch-selectable, time constant 10 ms.

Auxiliary Pulse Input Signal (Added to/Subtracted from Process Variable), and Status Select Contact Inputs: Auxiliary pulse input is 0 to 1 kHz, zero elevation not possible, minimum pulse width 350 μs. Status input minimum pulse width 220 ms. Voltage (level) or contact signals.

Voltage (Level) Input:

Voltage LOW Level (E_L): −1 V to +1 V DC (status ON).

Voltage HIGH Level (E_H): +4.5 V to +25 V DC (status OFF).

Contact Input: Relay/switch contact or transistor switch.

Contact (Status) ON: Source resistance up to 200 Ω.

Contact (Status) OFF: Source resistance at least 100 kΩ.

Contact Rating: At least 5 V DC, 20 mA.

Analog Input Signals (Process Variable or Auxiliary Flow and Compensation Signals: (STLD-201 and -301 only): 1 to 5 V DC, input resistance 1 MΩ.

Analog Input Conversion Accuracy: ±0.2% of span.

RTD Input Signal (for Temperature Compensation): (STLD-301 only): JIS specification Pt 100 Ω 3-wire RTD, lead wire resistance up to 10 Ω/wire.

Temperature Compensation Accuracy: ±0.2% of span.

Burnout Function: Provided; scaleout time up to 60 s.

Output Signals

Pulse Output Signal (Flow Repeater Signal): Transistor contact signal, rating 30 V DC, 200 mA.

Frequency: 0 to 1 kHz; **Duty Cycle** 50% (for connecting to YewSeries BCS Instrument), or **Fixed Pulse Width** — selectable (one of 0.5, 1, 20, 33, 50 or 100 ms) — for electromechanical counter.

Fail Output Signal: Transistor contact signal, rating 30 V DC, 200 mA.

Analog Output Signal (Flow Repeater Signal): 1 to 5 V DC, load resistance at least 2 kΩ.

Analog Output Conversion Accuracy: ±0.3% of span.

Isolation

Contact (pulse/status) I/O signals are isolated from internal circuitry; analog signals are not. Pulse I/O signals are isolated from each other; status inputs, status outputs and analog I/O signals use separate common negative lines. Power supply is isolated from internal circuitry.

Input Processing Functions

Process variable and auxiliary flow inputs may be either voltage or pulse signals, compensation input may be either a voltage or RTD signal.

Auxiliary Flow Signal Processing: (STLD-201 and -301 only):

Auxiliary flow signal can be added to or subtracted from process variable signal. Range of analog output (to display and repeater) is adjustable.

Voltage Flow Signal Processing: Span setting (4-digit fixed point number) corresponding to input signal range of 1 to 5 V DC; low-input cutoff (for inputs under 1% of span) and square root function selectable.

Input Filters (for Process Variable Pulse Input and Auxiliary Pulse Input): First order lag filters, time constant adjustable 0 to 9999 s.

Totalizer Scale Factors: Scaler for pulse signal input (constant K number of pulses for every flow unit totalized). Totalizer scale factor for analog signal input. K (K_1, K_2) are 5-digit fixed point numbers, of maximum value 32767.

Compensation Computations (STLD-201 and -301 only)

Can compensate the process variable and auxiliary flow signals for liquid density changes with temperature. Other types of compensation are also possible (see below). For temperature or temperature-pressure compensation, temperature unit is selectable (°C or °F).

STLD has the following 4 ASTM compensation.

- Old ASTM No. D1250 (edit in 1952)
- New ASTM No. D1250 (edit in 1980)

for crude oils, fuels & solvents and lubricating oils.

Temperature Compensation:

Input Signal: Platinum RTD (Pt 100 Ω) or 1 to 5 V DC.

Temperature Range: For platinum RTD (Pt 100 Ω); −50 to +250°C.

For a 1 to 5 V DC signal: Arbitrary.

Computation Format: ASTM equation or general quadratic equation.

ASTM Equation: $V_0 = V[(1 + \alpha) f(\rho, t)]$

General Quadratic Equation:

$$V_0 = V[(1+\alpha)\{1+\beta(t-t_0)\times 10^{-2}+\gamma(t-t_0)^2\times 10^{-6}\}]$$

V_0: Volumetric flow at reference temperature t_0.

V: Volumetric flow (process variable flow signal) at temperature t.

t_0: Reference temperature (°C), t_0 = 15°C for ASTM.

t: Flow sensor temperature (°C).

α: Flow transmitter compensation coefficient, (−99.99 to +99.99).

β: First order compensation coefficient, (−99.99 to +99.99).

γ: Second order compensation coefficient, (−99.99 to +99.99).

ρ: Specific gravity, (0.5000 to 1.2000)

Note: For density (specific gravity) compensation, coefficients α and ρ are used to convert volumetric flow to ASTM standard conditions t_0 = 15°C.

Temperature-Pressure Compensation Computation:

Input Signal: Platinum RTD (Pt 100 Ω) or 1 to 5 V DC.

Temperature Range: For Pt RTD; −50 to 250°C.

For 1 to 5 V signal: Arbitrary.

Pressure signal: 1 to 5 V DC

$$Q_T = N \cdot \frac{1}{K_F} \cdot k$$

$$Q_R = f \cdot \frac{1}{K_F} \cdot k \cdot R_I$$

In the above equations, the compensation coefficient k may be as follows:

(1) For Natural Gas: Compensation according to AGA Report No.3/NX-19.
Compensation range: Pressure; 0 to 140 kg/cm² abs.
Temperature; −40 to 115°C
Specific gravity; 0.554 to 0.750, N_2 and CO_2 mol %; 0 to 15%

$$k = \frac{P}{Pb} \cdot \frac{Tb}{T} \cdot (F_{PV})^2$$

(2) For Steam: Compensation by IFC Formula for Industry (Steam Tables, 1967).
Compensation range:
Pressure; 1 to 100 kg/cm² abs;
Temperature; 100 to 400°C
Specific weight; 0.1 to 100 kg/m³
Specific enthalpy; 600 to 800 kcal/kg
For steam, instead of obtaining compensation coefficient, the specific weight and specific enthalpy is obtained by the formula shown above to calculate weight and heat flows.

$$W = Q \cdot \gamma$$

$$H = Q \cdot \gamma \cdot h = W \cdot h$$

(3) General Gas: To compensate for the deviation from ideal gas behaviour,
Compensation range: Pressure; 0 to 140 kg/cm² abs,
Temperature; −40 to 400°C
Ratio of critical pressure to pressure; 0.01 to 30.0, and ratio of critical temperature to temperature; 0.60 to 15.0°C

$$k = \frac{P}{Pb} \cdot \frac{Tb}{T} \cdot \frac{1}{K}$$

$$K = \frac{Z}{Zb}$$

K can either be set manually, or the ratio Z/Zb can be entered to derive K (compressibility factors Z and Zb are obtained from Z tables).

where,

Q_T: Totalizer volumetric flow
Q_R: Instantaneous volumetric flow
Q: Steam volumetric flow
k: Compensation coefficient
K_F: Flowmeter K-factor
K: Gas deviation coefficient
N: Number of input pulses
f: Frequency
R_I: Flow unit time
P: Flow pressure
Pb: Reference pressure
T: Fluid temperature
Tb: Reference temperature
F_{PV}: Natural gas super compressibility factor
W: Steam weight flow
H: Steam heat flow
h: Specific enthalpy
γ: Steam specific weight

General Compensation Computations:

Computation Format: $V_0 = V[(C_{max} - C_{min})\ C + C_{min}]$, C ranges from 0 to 1 — its value corresponds to the compensation input signal: a voltage in the range 1 to 5 V DC. C_{max} and C_{min} are maximum and minimum compensation coefficients respectively, and may be set independently in the range 0 to 9999.

Flow Signal Repeater Function

Outputs pulse and analog* signals corresponding to the flow signal process variable input (the instrument can

also add or subtract an auxiliary flow signal input — in this case, the span of analog output (to display and repeater) is adjustable).

* (STLD-201 and -301 only).

Pulse Output: Output pulse rate may be scaled by a factor K'. K' (K_3, K_4) are 5-digit fixed point numbers, of maximum value 32767.

Pulse Output ON Time: Selectable — one of 0.5, 1, 20, 33, 50 or 100 ms — or duty cycle of 50% (for Yew-Series BCS Instruments; up to ten may be connected in parallel with output).

Analog Output (Flow Signal Repeater Signal): 1 to 5 V DC.

Totalizer Functions

Five 8-digit totalizers are built in — three flow totalizers and two (cumulative) totalizers:

- Flow totalizer (process variable only).
- Flow totalizer (process variable, with compensation computation).
- Flow totalizer (process variable, with auxiliary flow signal added to or subtracted from it, and compensation computation).
- Cumulative flow totalizer (process variable, with auxiliary flow signal added to or subtracted from it).
- Cumulative flow totalizer (process variable, with auxiliary flow signal added to or subtracted from it, and compensation computation).

Flow totalizer is reset after end of each batch by reset input signal or by entering other data for totalizer value.

Data Display and Data Setting Functions

Data Display:

Upper display is the most significant two digits of totalizer.

Lower display is selectable data, 6 digits.

Selectable data (displayed in lower display) may be major data item or auxiliary data item:

Major Data Item: Displayed data type is indicated by lamp next to data item label on front panel. Value of flow totalizer (for process variable with auxiliary flow signal added to or subtracted from it, and compensation computation), instantaneous flow may be displayed.

Auxiliary Data Item: Displayed data type is indicated by code displayed in upper display. Auxiliary data includes the other four totalizer values, and compensation parameters. A table of data that may be displayed is on the instrument side panel.

Instantaneous Flow Display: 5-segment bar graph.

Data Setting:

Displayed Data Selection: Selected by push buttons.

One switch (on side panel) changes from major data display to auxiliary data display.

Data Setting: Uses push button switches. Data setting may be inhibited (disabled) by an inhibit/enable switch on the side panel.

Communication Functions

The STLD can communicate (via LCS card in field control station/unit) with a central YEWPACK/CENTUM CRT-display operator station and supervisory computer. Maximum length of (SCCD) cable to LCS card is 100 m (328 ft).

Data Transmitted: Instantaneous flow, flow totalizer value (process variable, with auxiliary flow signal added to or subtracted from it, and compensation computation), control mode, compensation coefficients etc.

Data with Remote Setting: Flow totalizer value (process variable, with auxiliary flow signal added to or subtracted from it, and compensation computation), compensation coefficients etc. Remote setting (from YEWPACK/CENTUM operator station or supervisory computer) can be disabled by "C/A" switch on side panel.

Power Fail/Restart Functions

Totalizer Value: Not changed by power failure.

Data Memory Backup During Power Failure: By internal battery. All contact outputs are OFF during a power failure.

Life of Internal Battery (temperature up to 45°C):

At least five years (normal operation).

At least one year (backup operation).

Self-Diagnostic Functions

The cause of the alarm is indicated as a numeric code.

Computation and Control Circuit Abnormal Alarm: FAIL lamp lights and fail contact output opens.

Input Signal Abnormal, Pulse Repeater Overflow, Data Setting Overrange: ALM lamp lights.

Memory Backup Battery Low: ALM lamp flashes.

Simulation Functions

In simulation mode, flow signal is internally generated, and totalizer functions may be checked.

Normal Operating Conditions

Ambient Temperature: 0 to 50°C (32 to 122°F).

Ambient Humidity: 5 to 90% Relative Humidity (non-condensing).

Power Supply: Two versions, for "100 V" (standard) or "220 V" (option /A2ER). Both versions may use AC or DC, without change to the instrument:

Version	"100 V"	"220 V"
DC (polarity reversible)	20 to 130 V	120 to 340 V
AC (47 to 63 Hz)	80 to 138 V	138 to 264 V

Maximum Power Consumption:

	24 V DC	100 V AC	220 V AC
STLD-101	420 mA	18.6 VA	23.4 VA
STLD-201	500 mA	21.2 VA	26.8 VA
STLD-301	520 mA	21.9 VA	27.7 VA

Insulation Resistance:

Between I/O Terminals and Ground: 100 MΩ /500 V DC.

Between Power and Ground: 100 MΩ/500 V DC.

Withstanding Voltage:
Between I/O Terminals and Ground: 500 V AC for one minute.
Between Power and Ground:
1000 V AC for 1 minute (100 V version).
1500 V AC for 1 minute (220 V version).

Wiring:
Signal Wiring to/from the Field: ISO M4 size (4 mm) screws on terminal block.

Power and Ground Wiring:
100 V version: JIS C 8303 two-pin plug with earthing contact. (IEC A5-15, UL498).
220 V version: CEE 7 VII (CENELEC standard) plug.
Power Cable Length: 30 cm (11.8 in).

Mounting:
Flush panel mounting. Instruments are in housings, and may be mounted individually or side-by-side.
Rear of instrument may be up to 75° below front.

Nameplate:
Size: 8 × 65.3 mm, cream semi-gloss finish.
Lettering: In black, one or two rows each up to 14 alpha-numeric characters long.

Front Panel Finish: Dark green (Munsell 2.5GY 3/1).

Bezel: Aluminium diecast, black baked-enamel finish.

Housing: Open front.

Housing Dimensions: 182.5 (H) × 87 (W) × 480 (D: depth behind panel) (mm) (7.2 × 3.4 × 18.9 in).

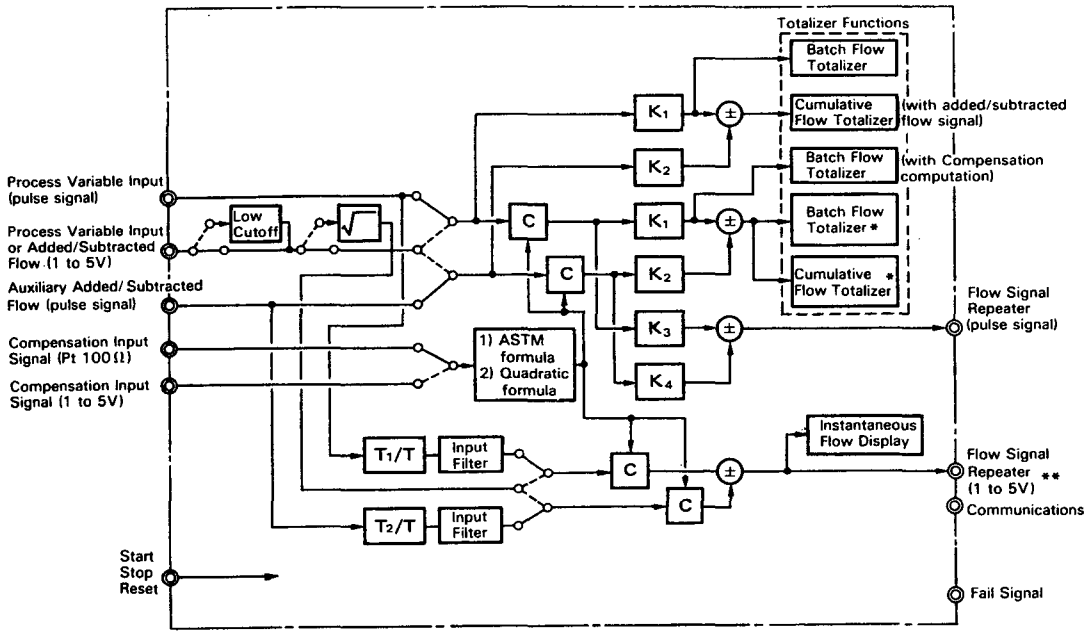
Weight:
Instrument body: 3.1 kg (6.8 lb) (excluding housing).
Housing: 2 kg (4.4 lb) (excluding mounting kit).

OPTIONS

/DL: With data set as per data sheet, and corresponding data label attached.
/A2ER: For "220 V version" power supply.
/MTS: Supplied with kit for individual mounting.
For mounting in groups, see GS 1B4F1-E.
/SCF-G□M: Mounting kit bezel color change from standard color (black). Choose color from set of optional colors (see GS 22D1F1-E). Specify color code in space □.
/NHS: No housing, plug-in instrument module only. See GS 1B4F1-E to order housing separately.
/NPE: Letters engraved on front panel nameplate.

ACCESSORIES

1A fuse, quantity one.
Engineering units labels, one set.



	Pulse input	1 to 5V input
K_1	$\frac{1}{\text{K factor for flow process variable}}$	$\frac{\text{Flow process variable span} \times \text{Totalizer scale factor}}{\text{h or min}}$
K_2	$\frac{1}{\text{K factor for added/subtracted flow}}$	$\frac{\text{Added/subtracted flow span} \times \text{Totalizer scale factor}}{\text{h or min}}$
K_3	$\frac{\text{Repeater pulse K factor}}{\text{Flow process variable K factor}}$	$\frac{\text{Flow process variable span} \times \text{Totalizer scale factor} \times \text{Repeater pulse K factor}}{\text{h or min}}$
K_4	$\frac{\text{Repeater pulse K factor}}{\text{K factor for added/subtracted flow}}$	$\frac{\text{Added/subtracted flow span} \times \text{Totalizer scale factor} \times \text{Repeater pulse K factor}}{\text{h or min}}$
T_1	$\frac{\text{h or min}}{\text{Flow process variable span} \times \text{Totalizer scale factor} \times \text{K factor for flow process variable}}$	
T_2	$\frac{\text{h or min}}{\text{Added/subtracted flow span} \times \text{Totalizer scale factor} \times \text{K factor for added/subtracted flow}}$	
T	Period of input pulse	
C	Compensation computation	

* With added/subtracted flow signal, and compensation computation.
** The span of 1 to 5 V analog output (and the input to PI algorithm, display and repeater) are also adjustable when auxiliary (added/subtracted) flow input is used.

MODEL AND SUFFIX CODES

Model	Suffix codes	Style	Option codes	Description
STLD	.....	.....	.....	Totalizer with communication functions
Compensation Input Analog I/O	-1	.....	.....	No compensation input, no analog I/O
	-2	.....	.....	1 to 5 V DC — Compensation input; also analog I/O
	-3	.....	.....	Pt 100 Ω RTD — Compensation input; also analog I/O
	01	.....	.....	Always 01
Style Code		*E ..	.....	Style E
Option			/DL	With data labels attached
Common Options			/A2ER	220V power supply*
			/MTS	With mounting kit
			/SCF-G□M	Bezel color change
			/NHS	Without housing
			/NPE	Nameplate engraving

* When ordering housing separately, specify /A2/NHS.

TERMINAL CONNECTIONS

Terminal Designation	Description	Terminal Designation	Description
1	Process variable input, pulse signal *1	17	+ Communication *2
2		18	−
3		19	+ Auxiliary pulse flow signal input
4	B	20	−
5	B RTD input*3 + Compensation input, 1 to 5 V DC *4	21	− Fail output (− terminal)
6	A −	A	
7	+ Process variable input, or auxiliary flow input, 1 to 5 V DC *5	B	
8	−	C	+ Flow signal repeater (pulse output)
9	+ Auxiliary compensation input (pressure signal) *5	D	−
10	−	F	
11	+ Reset input	H	
12		J	+ Flow signal repeater (1 to 5V output) *5
13	−	K	−
14		L	
15		M	
16		N	+ Fail output (+ terminal)

*1:

Terminal Designation	Contact, or Voltage-Transition Pulse	2-wire Transmitter *6	3-wire Transmitter *6
1	+ Transmitter	−	Sig Transmitter
2	−	+ Transmitter	− Transmitter
3			+

*2: Use shielded twisted-pair cable (SCCD see GS 34B6T1-01E).
*3: For Model STLD-301 only.
*4: For Model STLD-201 only.
*5: For Model STLD-201 and -301 only.
*6: 12V/24V distributor for transmitter built into STLD.

======== ORDERING INSTRUCTIONS ========

When ordering, specify the following:

1. Model, suffix and option codes.
2. Nameplate marking, if required (option /NPE).
3. Mounting kit (option /MTS) if the instrument is to be mounted individually.
4. Fill out the appropriate data sheet if data labels are required.

========== RELATED EQUIPMENT ==========

Related Instruments

SBSD Batch Set Station ..... GS 1B4E1-E
SLCC Blending Controller ..... GS 1B4E2-E
SPCM Pulse Computing Unit ..... GS 1B4L4-E
UFCH Field Control Unit ..... GS 34B6G1-01E
SCCD Communications Cable ..... GS 34B6T1-01E

Related Spare Parts

Memory Backup Battery ..... Part No. E9711DH