

# General Specifications

## Model SPCM Pulse Computing Unit

YEW SERIES 80

The SPCM Pulse Computing Unit can handle computations such as conversion between pulse and voltage signals, scaling, addition or subtraction and temperature compensation of flow signals. Pulse and analog (1 to 5 V DC) flow inputs and outputs are supported.

- There can be up to three inputs (three pulse inputs, or two pulse inputs and one analog output depending on version); these can be added or subtracted.
- With a temperature input from either an external Pt RTD or from a 1 to 5 V DC temperature converter (used with appropriate temperature sensor) the two SPCM versions can handle temperature compensation of flow — the corresponding flow signal input is a 1 to 5 V DC analog signal or pulse signal respectively.
- SPCM parameters can be displayed and set by connecting the SPRG\*E Programmer.

## STANDARD SPECIFICATIONS

### Input Signals

**No. 1 Pulse Input Signal:** 0 to 6 kHz, zero elevation not possible, minimum pulse width 50  $\mu$ s. Pulse input from two-wire/three-wire transmitter, or voltage transition/contact signal.

**Input From Transmitter:** SPCM contains distributor, voltage is switch-selectable — distributor supplies 12 V/24 V  $\pm$  10%, current up to 50 mA. For two-wire transmitter, load resistance is switch selectable — 200  $\Omega$ , 510  $\Omega$  or 1 k $\Omega$ .

#### 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 k $\Omega$ .

**Contact Pulse:** Relay/switch contact or transistor switch.

Contact ON: Source resistance up to 200  $\Omega$ .  
Contact OFF: Source resistance at least 100 k $\Omega$ .  
Contact Rating: At least 30 V DC, 30 mA.

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

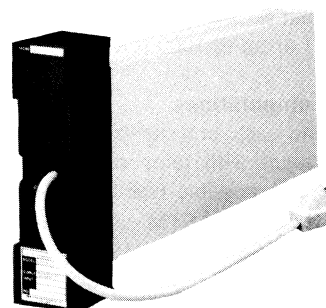
**No. 2, No. 3 Pulse Input Signals:** 0 to 1 kHz, zero elevation not possible, minimum pulse width 350  $\mu$ s.  
Voltage (level) or contact signals.

#### Voltage (Level) Input:

Voltage LOW level ( $E_L$ ): -1 V to +1 V DC.  
Voltage HIGH level ( $E_H$ ): +4.5 V to 25 V DC.

**Contact Pulse:** Relay/switch contact or transistor switch.

Contact (Status) ON: Source resistance up to 200  $\Omega$ .  
Contact (Status) OFF: Source resistance at least 100 k $\Omega$ .  
Contact Rating: At least 5 V DC, 20 mA.



**Analog Input Signal:** 1 to 5 V DC, input resistance 1 M $\Omega$ .

**Analog Input Conversion Accuracy:**  $\pm$  0.2% of span.

#### RTD Input Signal (for Temperature Compensation):

(SPCM-201 only): JIS specification Pt 100  $\Omega$  3-wire RTD, lead wire resistance up to 10  $\Omega$ /wire.

**Temperature Compensation Accuracy:**  $\pm$  0.2% of span.

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

### Output Signals

**Pulse Output Signals** (Two Points): Transistor contact signals, rating 30 V DC, 200 mA.

**Frequency:** 0 to 1 kHz; **Duty Cycle** 50% (for connecting to YewSeries BCS Instrument), or **Fixed Pulse Width** (for electromechanical counter) — selectable (for No. 1 pulse output, one of 0.5, 1, 20, 33, 50 or 100 ms; for No. 2 pulse output, one of 20, 33, 50 or 100 ms).

**Fail Signal (Status Output):** Transistor contact signal, rating 30 V DC, 200 mA.

**Analog Output Signal:** Switch selectable, either 1 to 5 V DC (load resistance at least 2 k $\Omega$ ), or 4 to 20 mA DC (load resistance 0 to 750  $\Omega$ ).

**Analog Output Conversion Accuracy:**  $\pm$  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 Conditioning Functions

Process variable and added/subtracted inputs may be either pulse signals or a voltage signal, compensation input may be either a voltage or RTD signal.

#### Input Filter (for No. 1, No. 2, and No. 3 Pulse Inputs):

First order lag filter, time constant adjustable 0 to 9999 s.

**Divider Scaling Factor for No. 1, No. 2 and No. 3 Pulse**

**Signal Inputs:** Each K (divider constant) is a 5-digit fixed point number, of maximum value 32767.

**Voltage Flow-Signal Processing:** Span setting (4-digit fixed point number) corresponding to input signal range of 1 to 5 V DC, square root function and low-input cutoff (for inputs less than 1% of span) selectable. Analog input is converted to pulse output (at No. 1 pulse output) of up to 1000 pps (span adjustable).

**Compensation Computations**

Can compensate each process-variable flow signal for liquid density changes with temperature. Other types of compensation are also possible (see below).

SPCM 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:**

Temperature unit is selectable (°C or °F).

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),  $t_0 = 15^\circ\text{C}$  for ASTM.

$t$ : Flow sensor temperature (°C).

$\alpha$ : Flow transmitter compensation coefficient, (-99.99 to +99.99).

$\beta$ : First order compensation coefficient, (-99.99 to +99.99).

$\gamma$ : Second order compensation coefficient, (-99.99 to +99.99).

$\rho$ : Specific gravity, (0.5000 to 1.2000)

Note: For density (specific gravity) compensation, coefficients  $\alpha$  and  $\rho$  are used to convert volumetric flow to ASTM standard conditions  $t_0 = 15^\circ\text{C}$ .

**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.

**No. 1 Pulse Output:**

**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).

**No. 2 Pulse Output:** Output pulse rate equals pulse rate of No. 1 output divided by a scale factor (a 5-digit fixed-point number, of maximum value 32767).

**Pulse Output ON Time:** Selectable — one of 20, 33, 50 or 100 ms.

**Analog Flow Signal Output:** 1 to 5 V DC or 4 to 20 mA, selectable. Corresponds to adding or subtracting the individual inputs (versions with either No. 3 pulse input and 1 to 5 V temperature compensation input, or analog flow input and RTD compensation input, may be selected).

**Data Display and Data Setting Functions**

An SPRG\*E Programmer is used to display inputs, outputs, and temperature — and to display and set compensation coefficients, input spans, and pulse K factors.

**Data Display:** 16-digit LCD (Liquid Crystal Display) in SPRG.

**Data Setting:** 41 keys (some of which are multi-function).

**Power Fail/Restart Functions**

All contact outputs are OFF during a power failure. Existing pulse output values and FAIL or ALM status are cleared by turning power OFF or by connecting the SPRG\*E and pressing reset.

**Self-Diagnostic Functions**

**Computation Circuit Abnormal Alarm:** FAIL lamp lights and FAIL contact output opens. (Same as for power failure).

**Input Signal Abnormal, Computational Overflow:** ALM lamp lights. The cause of an alarm or failure status may be displayed by connecting an SPRG\*E.

**Simulation Functions**

In simulation mode, a fixed pulse rate signal is internally generated, and output from the No. 1 pulse output.

**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 130V	120 to 340V
AC (47 to 63Hz)	80 to 138V	138 to 264V

**Maximum Power Consumption:**

	24 V DC	100 V AC	220 V AC
SPCM-101	400mA	18.0VA	22.5VA
SPCM-201	410mA	18.3VA	23.0VA

**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 (4mm) 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: 300 cm (approx. 10 ft).

**Mounting:**

Rack mounting.

**Housing Dimensions:** 180 (H) × 48 (W) × 300 (D) (mm) (7.1 × 1.9 × 11.8 in).

**Weight:**

Instrument body: 2.0 kg (4.4 lb).

**OPTIONS**

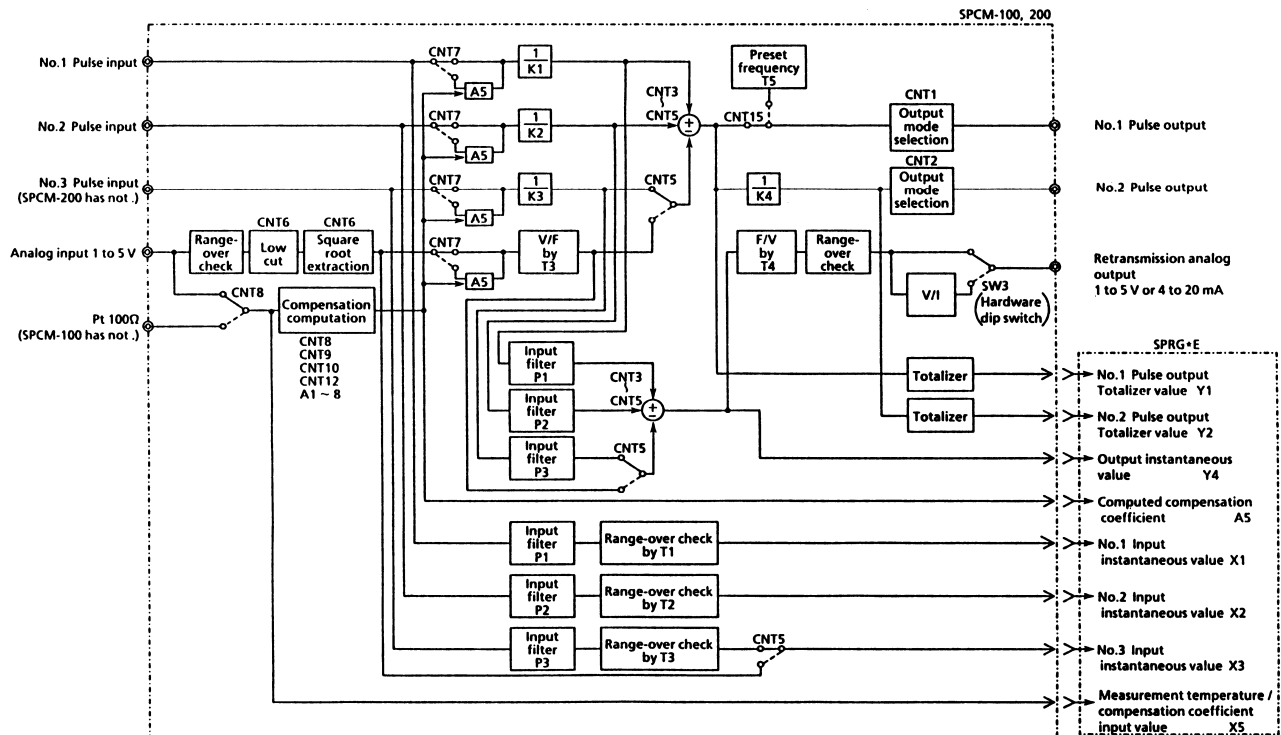
/RDL: With data set as per data sheet, and corresponding data sheet attached.

/A2ER: For “220 V version” power supply.

/NHR: No rack-mount case, plug-in instrument module only. See GS 1B4F2-E to order housing separately.

**ACCESSORIES**

1A fuse, quantity one.















**User-Selectable Combinations of Inputs:**

		SPCM-101		SPCM-201	
Pulse Input No.1		○	○	○	○
Pulse Input No.2		○	○	○	○
Pulse Input No.3		○			
Analog Input	(Add/Subtract) Flow		○	○	
	Compensation	○			○
Pt 100 Ω Compensation				○	







## MODEL AND SUFFIX CODES

Model	Suffix codes	Style	Option codes	Description
SPCM	.....	.....	.....	Pulse Computing Unit
	-1 .....	.....	.....	Three pulse inputs (compensation input 1 to 5V DC)
	-2 .....	.....	.....	Two pulse inputs, one analog input (compensation input Pt 100 Ω)
	01 .....	.....	.....	Always 01
Style code		*E .....	.....	Style E
Options			/RDL	With data sheet
Common options			/A2ER /NHR	220V power supply Without rack-mounting case

## TERMINAL CONNECTIONS

Terminal Designation	Description	Terminal Designation	Description
1	 No.1 pulse input *1	A	+  No.2 pulse input
2		B	-  No.1 pulse output
3		C	+  No.2 pulse output
4	+  No.3 pulse input *2	D	-  FAIL output
5	-  Analog input	F	+  Analog common
6	-  Analog output	H	-  Analog common
7	+  Analog input	J	+  Analog common
8	+  Analog output	K	-  Analog common
	(1 to 5V DC or 4 to 20mA DC)		

\*1:

Terminal Designation	Contact, or Voltage-Transition Pulse	2-wire Transmitter*4	3-wire Transmitter*4
1	+  Transmitter	-  Transmitter	Sig  Transmitter
2	-  Transmitter	+  Transmitter	-  Transmitter
3			+  Transmitter

\*2: Used for SPCM-101 only

\*3: Used for SPCM-201 only

\*4: 12 V/24 V distributor for transmitter built into SPCM.

## ORDERING INSTRUCTIONS

- Specify the following when ordering:
1. Model, suffix and option codes.
  2. Data sheet, when option /RDL specified.

## RELATED EQUIPMENT

Related Instruments	
SBSD Batch Set Station .....	GS 1B4E1-E
SLCC Blending Controller .....	GS 1B4E2-E
SLBC Batch Controller .....	GS 1B4E3-E
STLD Totalizer .....	GS 1B4E4-E
SPRG (Style E) Programmer .....	GS 1B4W1-E