

# General Specifications

## GX90UT PID Control Module **SMARTDAC+**

GX10/GX20/GP10/GP20 Paperless Recorder  
Data Acquisition System GM

GS 04L53B01-31EN

Loop Control Function, Program Control Function (/PG Option)

### Overview

The GX90UT is a PID control module that connects to the GX/GP, expandable I/O units, and GM main units and sub units.

- The GX90UT PID Control Module can perform PID control on up to two loops. It is equipped with two control inputs, two control outputs, eight digital inputs, and eight digital outputs. In addition to single loop control, cascade control and loop control with PV switching are possible. For the control output, you can select current output or voltage pulse for each loop.
- Installing the PID Control Module in the GX/GP/GM enables PID control of up to 20 loops/system (up to 6 loops/system for the GX10/GP10/GX20-1/GP20-1/GM10-1). In addition to control loop monitoring and the control group screen for convenient operation, adjustment using the tuning screen is available.
- Adding the /PG option to the GX/GP/GM main unit allows 99 patterns and 99 segments (1 pattern) of program patterns to be stored in the main unit. Further, up to 32 time events and 32 PV events can be set for each segment.
- The GX90UT control data can be acquired and recorded in the GX/GP/GM main unit.

### PID Control Module Specifications (Model: GX90UT)

#### Use

Controlling temperature, flow rate, pressure, etc.

#### Analog Input

- Measurement types: DC voltage (DCV), standard signal, type (TC), resistance temperature detector (RTD), DI (LEVEL, no-voltage contact), DC current (when external shunt resistor is connected)
- Number of measurement points: 2
- Scan period: Same as the control period
- Input format: Floating unbalanced input, isolation between channels
- Measuring range/accuracy:  
See the table in "Measuring Range/Accuracy" (page 3).
- Burnout detection: Upscale, downscale, and off can be specified (for each channel).  
Detectable inputs: Thermocouple, resistance temperature detector, standard signal  
Detection condition:  
Thermocouple: Detection current: approx. 100 nA, superposed electric current system  
RTD: Detection current: approx. 100 nA, superposed electric current system



GX90UT

Standard signal: Normal: within measurement range  
Disconnection: based on the burnout criteria setting

The criteria is set as a percentage of the specified span width.

Lower limit: -20.0 to -5.0%

Upper limit: 105 to 120%

- External input resistance:  
DC voltage, thermocouple: 2 k $\Omega$  or less  
RTD: 10  $\Omega$  or less per line (the same resistance for all three lines)
- Input bias current:  $\pm 10$  nA or less (except when burnout detection is set)
- Measurement current (RTD): Approx. 1 mA, approx. 1.6 mA
- Input resistance:  
10 M $\Omega$  or more for thermocouple/DC voltage (1 V range or lower)  
About 1 M $\Omega$  for DC voltage (2 V range or higher)/standard signal
- Allowable signal source resistance  
2 k $\Omega$  or less for thermocouple/DC voltage (1 V range or less)
- Effect of signal source resistance:  
 $\pm 10$   $\mu$ V/1 k $\Omega$  or less for thermocouple/DC voltage (1 V range or less)  
 $\pm 0.15\%$ /1 k $\Omega$  or less for DC voltage (2 V range or higher)/standard signal
- Effect of wiring resistance:  
Fluctuation per 10  $\Omega$  change per line (the same resistance for all three lines)  
RTD (100  $\Omega$  type or higher):  $\pm 0.1^\circ\text{C}/10$   $\Omega$   
RTD (50  $\Omega$  type or lower):  $\pm 1^\circ\text{C}/10$   $\Omega$
- Allowable input voltage:  
Thermocouple, DC voltage (1 V range or lower), RTD, DI(contact input):  $\pm 10$  VDC  
DC voltage (2 V range or higher), DI (level):  $\pm 60$  VDC
- Normal-mode rejection ratio: 40 dB or more
- Common mode rejection ratio: 120 dB or more

- Normal mode voltage:
  - Thermocouple, DC voltage, DI (voltage): 1.2 times the range rating or less
  - Standard signal 0.4-2 V range: 2.4 V
  - Standard signal 1-5 V range: 6 V
  - RTD 100  $\Omega$  type or higher: 50 mV peak
  - RTD 50  $\Omega$  type or lower: 10 mV peak
- Common mode voltage:
  - 30 VACrms or  $\pm 60$  VDC
  - Maximum common mode noise voltage: 250 VACrms
- Common mode voltage between channels:
  - 30 VACrms or  $\pm 60$  VDC
  - Maximum common mode noise voltage: 250 VACrms
- Reference junction compensation accuracy:
  - When measuring temperature greater than or equal to 0  $^{\circ}\text{C}$ , using a power supply frequency noise reduction filter, and when the temperature of the input terminal is balanced
  - Type K, E, J, T, N, XK GOST:
    - $\pm 0.5^{\circ}\text{C}$  ( $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ )
    - $\pm 0.7^{\circ}\text{C}$  (0 to  $50^{\circ}\text{C}$ )
    - $\pm 1.0^{\circ}\text{C}$  ( $-20$  to  $60^{\circ}\text{C}$ )
  - Type R, S, W, L, U, WRe3-25, PLATINEL II, NiNiMo, W/WRe26, N (AWG14):
    - $\pm 1.0^{\circ}\text{C}$  ( $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ )
    - $\pm 1.4^{\circ}\text{C}$  (0 to  $50^{\circ}\text{C}$ )
    - $\pm 2.0^{\circ}\text{C}$  ( $-20$  to  $60^{\circ}\text{C}$ )
  - Type KpvsAu7Fe:
    - $\pm 1.0$  K ( $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ )
    - $\pm 1.4$  K (0 to  $50^{\circ}\text{C}$ )
    - $\pm 2.0$  K ( $-20$  to  $60^{\circ}\text{C}$ )
  - Type B, PR20-40: internal RJC fixed at  $0^{\circ}\text{C}$
- Calibration correction function:
  - Mode: Linearizer approximation, linearizer bias (number of correction points: 12), correction factor
- First-order lag input filter: on/off switchable (for each channel)
  - Time constant: 1 to 120 s
- Reference junction compensation:
  - internal/external switchable (for each channel)
- Input calculation: off, linear scaling, square root calculation (for each channel)\*DC voltage/standard signal
- Bias function: Bias to add to input values can be specified (for each channel).

Measuring Range/Accuracy<sup>1</sup>

Input type	Range	Measurement range	Measurement accuracy (digital display)	Digital display highest resolution
DC voltage	20 mV	-20.000 to 20.000 mV	±(0.05% of rdg+12μV)	1 μV
	60 mV	-60.00 to 60.00 mV	±(0.05% of rdg+0.02 mV)	10 μV
	200 mV	-200.00 to 200.00 mV	±(0.05% of rdg+0.03 mV)	10 μV
	1 V	-1.0000 to 1.0000 V	±(0.05% of rdg+0.2 mV)	100 μV
	2 V	-2.0000 to 2.0000 V	±(0.05% of rdg+1.2 mV)	100 μV
	6 V	-6.000 to 6.000 V	±(0.05% of rdg+2 mV)	1 mV
	20 V	-20.000 to 20.000 V	±(0.05% of rdg+3 mV)	1 mV
	50 V	-50.00 to 50.00 V	±(0.05% of rdg+0.02 V)	10 mV
Standard signal	0.4-2V	0.3200 to 2.0800 V	±(0.05% of rdg+1.2 mV)	100 μV
	1-5V	0.800 to 5.200 V	±(0.05% of rdg+2 mV)	1 mV
Thermocouple (does not include reference junction compensation accuracy)	R <sup>2</sup>	0.0 to 1760.0°C	±(0.05% of rdg+1.0°C)	0.1°C
	S <sup>2</sup>	0.0 to 1760.0°C	Except R and S; 0.0 to 800.0°C: ±1.4°C	
	B <sup>2</sup>	0.0 to 1820.0°C	B; 400.0 to 800.0°C: ±3.0°C Accuracy not guaranteed for temperatures less than 400.0°C	
	K <sup>2</sup>	-270.0 to 1370.0°C	±(0.05% of rdg+0.7°C)	0.1°C
		-200.0 to 500.0°C	Except -200.0 to 0.0°C: ±(0.2% of rdg + 0.7°C) Accuracy not guaranteed for temperatures less than -200.0°C	
	E <sup>2</sup>	-270.0 to 800.0°C	±(0.05% of rdg+0.5°C)	0.1°C
	J <sup>2</sup>	-200.0 to 1100.0°C	Except -200.0 to 0.0°C: ±(0.2% of rdg + 0.5°C) Accuracy not guaranteed for temperatures less than -200.0°C	0.1°C
	T <sup>2</sup>	-270.0 to 400.0°C	±(0.05% of rdg+0.5°C) Except -200.0 to 0.0°C: ±(0.2% of rdg + 0.5°C) Accuracy not guaranteed for temperatures less than -200.0°C	0.1°C
	N <sup>2</sup>	-270.0 to 1300.0°C	±(0.05% of rdg+0.7°C) Except -200.0 to 0.0°C: ±(0.5% of rdg + 0.7°C) Accuracy not guaranteed for temperatures less than -200.0°C	0.1°C
	W <sup>3</sup>	0.0 to 2315.0°C	±(0.05% of rdg+1.0°C) 1000.0 °C or more: ±0.15% of rdg	0.1°C
L <sup>4</sup>	-200.0 to 900.0°C	±(0.05% of rdg+0.5°C) Less than 0.0°C: ±(0.25% of rdg + 0.5°C)	0.1°C	
U <sup>4</sup>	-200.0 to 400.0°C	±(0.05% of rdg+0.5°C) Less than 0.0°C: ±(0.5% of rdg + 0.5°C)	0.1°C	
Thermocouple (does not include reference junction compensation accuracy)	WRe3-25 <sup>5</sup>	0.0 to 2320.0°C	±(0.05% of rdg+2.0°C) 2000.0 °C or more: ±0.15% of rdg	0.1°C
	KpvsAu7Fe <sup>6</sup>	0.0 to 300.0 K	±(0.05% of rdg+2.0 K)	0.1 K
	PLATINEL II <sup>6</sup>	0.0 to 1395.0°C	±(0.05% of rdg+1.0°C)	0.1°C
	PR20-40 <sup>7</sup>	0.0 to 1900.0°C	±(0.05% of rdg+5.5°C) Accuracy not guaranteed for temperatures less than 800.0°C	0.1°C
	NiNiMo <sup>6</sup>	0.0 to 1310.0°C	±(0.05% of rdg+0.7°C)	0.1°C
	W/WRe26 <sup>8</sup>	0.0 to 2320.0°C	±(0.05% of rdg+2.0°C) Accuracy not guaranteed for temperatures less than 300.0°C	0.1°C
	N(AWG14) <sup>9</sup>	0.0 to 1300.0°C	±(0.05% of rdg+0.7°C)	0.1°C
XK GOST <sup>10</sup>	-200.0 to 600.0°C	±(0.05% of rdg+0.5°C) Less than 0.0°C: ±(0.2% of rdg + 0.5°C)	0.1°C	
RTD (measurement current 1 mA)	Pt100 <sup>11</sup>	-200.0 to 850.0°C	±(0.05% of rdg+0.3°C)	0.1°C
		-150.00 to 150.00°C		0.01°C
	JPt100 <sup>11</sup>	-200.0 to 550.0°C	±(0.05% of rdg+0.3°C)	0.1°C
		-150.00 to 150.00°C		0.01°C
	Cu100 at 0°C α=0.00425	-50.0 to 150.0°C	±(0.05% of rdg+0.3°C)	0.1°C
	Cu25 at 0°C α=0.00425	-200.0 to 300.0°C	±(0.1% of rdg+0.8°C)	0.1°C
	Cu53 at 0°C α=0.00426035	-50.0 to 150.0°C	±(0.05% of rdg+0.6°C)	0.1°C
	J263B <sup>17</sup>	0.0 to 300.0 K	±0.4 K Less than 40.0 K: ±0.8 K	0.1 K
	Pt25 <sup>18</sup>	-200.0 to 550.0°C	±(0.1% of rdg+0.8°C)	0.1°C
	Ni100 (SAMA)	-200.0 to 250.0°C	±(0.05% of rdg+0.3°C)	0.1°C
	Ni100 (DIN) <sup>12</sup>	-60.0 to 180.0°C		
	Ni120 <sup>13</sup>	-70.0 to 200.0°C		
	Pt50 <sup>14</sup>	-200.0 to 550.0°C	±(0.05% of rdg+0.6°C)	0.1°C
	Pt200 WEED	-100.0 to 250.0°C	±(0.05% of rdg+1.0°C)	0.1°C
	Cu100 GOST <sup>15</sup>	-200.0 to 200.0°C	±(0.05% of rdg+0.3°C)	0.1°C
Pt46 GOST <sup>16</sup>	-200.0 to 550.0°C	±(0.05% of rdg+0.6°C)	0.1°C	
Pt100 GOST <sup>15</sup>	-200.0 to 600.0°C	±(0.05% of rdg+0.3°C)	0.1°C	

rdg: reading

Continued

Input type	Range	Measurement range	Measurement accuracy (digital display)	Digital display highest resolution
RTD (measurement current 1.6mA)	Cu10 GE	-200.0 to 300.0°C	±(0.1% of rdg+2.0°C)	0.1°C
	Cu10 L&N	-200.0 to 300.0°C	Guaranteed accuracy range	
	Cu10 WEED	-200.0 to 300.0°C	Cu10 GE: -70.0 to 170.0°C	
	Cu10 BAILEY	-200.0 to 300.0°C	Cu10 L&N: -75.0 to 150.0°C	
	Cu10 at 20°C α=0.00392	-200.0 to 300.0°C	Cu10 WEED: -200.0 to 260.0°C	
	Cu10 at 20°C α=0.00393	-200.0 to 300.0°C	Other than above: -200.0 to 300.0°C	
	Cu10 GOST <sup>19</sup>	-200.0 to 200.0°C	±(0.1% of rdg+2.0°C)	0.1°C
Cu50 GOST <sup>16</sup>	-200.0 to 200.0°C	±(0.05% of rdg+0.6°C)	0.1°C	
DI	Level		Threshold level (V <sub>th</sub> = 2.4 V) accuracy ± 0.1 V	-
	Contact <sup>20</sup>		100 Ω or less: 1 (ON), 10 kΩ or more: 0 (OFF)	-

rdg: reading

1 Under standard operating conditions: 23±2°C, 55±10% RH, supply voltage 90–132, 180–264 V AC, supply frequency within 50/60 Hz ±1%, warm-up of 30 minutes or more, no vibrations or other hindrances to performance.

2 R, S, B, K, E, J, T, N: IEC 60584-1, DIN EN 60584, JIS1602

3 W: W-5%Re/W-26%Re(Hoskins Mfg.Co.) ASTM E988-96

4 L: Fe-CuNi, DIN43710, U: Cu-CuNi, DIN43710

5 WRe3-25: W-3%Re/W-25%Re(Hoskins Mfg.Co.) ASTM E988-96

6 KpvsAu7Fe, PLATINEL II, NiNiMo: ASTM E1751

7 PR20-40: PtRh20%-PtRh40%(Johnson Matthey Plc) ASTM E1751

8 W/WRe26: W/W-26%Re(Hoskins Mfg.Co.) ASTM E1751

9 N(AWG14): NBS

10 XK GOST: Type L (GOST R 8.525-2001)

11 Pt100: JIS C 1604, IEC 60751, DIN EN 60751

JPt100: JIS C1604, JIS C1606

12 Ni100 (DIN): DIN 43760

13 Ni120: McGRAW EDISON COMPANY

14 Pt50: JIS C1604, JIS C1606

15 Cu100 GOST, Pt100 GOST: GOST 6651-2009

16 Cu50 GOST, Pt46 GOST: GOST 6651-94

17 J263B: YOKOGAWA J263\*B

18 Pt25: 1/4 the JPt100 resistance

19 Cu10 GOST: 1/10 the Cu100 GOST resistance

20 Detected current value: approx. 10 μA

Measuring accuracy when scaling:

Measuring accuracy when scaling (digits) = measuring accuracy (digits) × scaling span (digits)/measurement span (digits) + 2 digits

\* Fractions rounded up

## Analog output

- Number of outputs: 2
- Output types: Current, voltage pulse, or DC loop power supply (15 VDC)
  - Current output:
    - Output signal: 4 to 20 mA or 0 to 20 mA (reverse output possible)
    - Load resistance: 600  $\Omega$  or less
    - Output:  $\pm 0.1\%$  of F.S. Except  $\pm 5\%$  of F.S. (F.S.: 20 mA) for 1 mA or less
    - Temperature effect:  $\pm 200$  ppm/ $^{\circ}\text{C}$
    - Humidity effect:  $\pm 0.05\%$  of F.S. @ $40^{\circ}\text{C}$ , 93%RH
    - Long-term drift:  $\pm 0.05\%$  of F.S.
  - Voltage pulse output:
    - ON voltage: 12 VDC or more (load resistance of 600  $\Omega$  or more)
    - OFF voltage: 0.1 VDC or less
    - Cycle time: 0.5 to 1000.0 s
    - Time resolution: 10 ms or 0.1% of output value, whichever is larger
  - DC loop power supply:
    - Supply voltage: 13.0 to 18.3 V
    - Maximum supply current: about 22 mA (with short-circuit current limiting circuit)
- Output calculation: split computation

## Digital Input/Output

### Digital Input

- Number of inputs: 8
- Status detection minimum hold time: control period + 50 ms
- Input type: no-voltage contact or open collector
- Isolation type: photocoupler isolation
- Contact rating: 12 VDC or more, 20 mA or more
  - Using a contact with a minimum ON current of 1 mA or less
- Input resistance: about 2.4 k $\Omega$
- Allowable input voltage: 10 V
- Input detection:
  - For open collector contact input
    - ON voltage: 0.5 VDC or less
    - Leakage current when turned off: 0.5 mA or less
  - For no-voltage contact input
    - Contact resistance when turned on: 200  $\Omega$  or less
    - Contact resistance when turned off: 50 k $\Omega$  or more
- Number of commons: 1
- Application: SP switching, operation mode switching, event input

### Digital Output

- Number of outputs: 8
- Output time resolution: 100 ms min.
- Output type: open collector (sink type)
- Isolation type: photocoupler isolation
- Output contact capacity: 24 V DC max., 50 mA
- Application: alarm output, FAIL output, etc.

## Withstand voltage

- Between analog input terminals and internal circuit: 1500 V AC for 1 minute
- Between analog output terminals and internal circuit: 1500 V AC for 1 minute
- Between digital input terminals and internal circuit: 1500 V AC for 1 minute
- Between digital output terminals and internal circuit: 1500 V AC for 1 minute

- Between input terminals and output terminals: 1000 V AC for 1 minute
- Between analog input channels: 1000 V AC for 1 minute
- Between analog output channels: 20 M $\Omega$  or more at 500 V AC
- Between analog I/O terminals and digital I/O terminals: 1000 V AC for 1 minute

## Insulation resistance

- Between analog input terminals and internal circuit: 20 M $\Omega$  or more at 500 V DC
- Between analog output terminals and internal circuit: 20 M $\Omega$  or more at 500 V DC
- Between digital input terminals and internal circuit: 20 M $\Omega$  or more at 500 V DC
- Between digital output terminals and internal circuit: 20 M $\Omega$  or more at 500 V DC
- Between input terminals and output terminals: 20 M $\Omega$  or more at 500 V DC
- Between analog input channels: 20 M $\Omega$  or more at 500 V DC
- Between analog output channels: 20 M $\Omega$  or more at 500 V DC
- Between analog I/O terminals and digital I/O terminals: 20 M $\Omega$  or more at 500 V DC

## Standards Compliance

- CSA:
  - CAN/CSA-C22.2 No. 61010-1, installation category II,<sup>1</sup> pollution degree 2<sup>2</sup>
  - CAN/CSA-C22.2 No. 61010-2-030
  - CAN/CSA-IEC 61010-2-201<sup>4</sup>
- UL:
  - UL 61010-1, UL 61010-2-030 (CSA NRTL/C)
  - UL 61010-2-201(CSA NRTL/C)<sup>4</sup>
- CE/EMC directives:
  - EN 61326-1 compliance, Class A Table 2
  - EN 61000-3-2 compliance
  - EN 61000-3-3 compliance
  - EN 55011 Class A Group 1
- CE/Low-voltage directives:
  - EN 61010-1, EN 61010-2-030 compliance
  - installation category II,<sup>1</sup> pollution degree 2,<sup>2</sup> measurement category II<sup>3</sup>
  - EN 61010-2-201 compliance<sup>4</sup>
- Australia, New Zealand EMC standard (RCM):
  - EN55011 compliance, Class A Group 1
- KC mark:
  - Electromagnetic wave interference prevention standard, electromagnetic wave protection standard compliance
- \*1 Installation category (overvoltage category) II: Describes a number which defines a transient overvoltage condition. Implies the regulation for impulse withstand voltage. "II" applies to electrical equipment which is supplied from the fixed installation like a distribution board.
- \*2 Pollution degree 2: Describes the degree to which a solid, liquid, or gas which deteriorates dielectric strength or surface resistivity is adhering. "2" applies to normal indoor atmosphere. Normally, only non-conductive pollution occurs.
- \*3 Measurement category II (CAT II): Available in the testing and measuring circuits directly connected to a usage location (receptacle or the like) of a low-voltage main power supply facility. Appliances, portable equipment, etc.

- \*4 This product is designed as open equipment under the relevant standard, install it as follows:
- The GX10/GX20 is designed to be installed in an instrumentation panel. Install it in a location where people cannot touch the terminals carelessly.
  - To make the GP10/GP20 comply with the relevant standard, support the parts of the device other than the front-panel control area with an instrumentation panel or the like, and install it in a location where people cannot touch the terminals carelessly or in a panel.
  - Install the GX60/GM unit in a panel with a door.
  - The instrumentation panel or panel used for support must comply with CSA/UL/EN 61010-2-201 or must be at least IP1X (degrees of protection) and at least IK09.
  - To comply with the relevant standard, make sure that the style numbers of the GX/GP main unit, GM90PS power supply module, and GX60 I/O base unit are at least 2.
- WEEE Directive Compliant

### Construction

- Front panel (terminal) area: Dust-proof and drip-proof, IEC529-IP20
- Material: Polycarbonate
- Color:
  - Front panel: Light charcoal gray (Munsell 10B 3.6/0.3 equivalent)
  - Case: Smoke gray (Munsell 4.1PB 6.0/4.5 equivalent)
- External dimensions: 45.2 (W) x 111 (H) x 133.1 (D) mm (D: depth including the terminal cover)
- Terminal type: M3 screw terminal
- Weight: Approx. 0.3 kg

### Power supply

- Supplied from GX/GP, GX60, GM90PS
- Power consumption: 2.8 W or less

### Isolation

Analog input CH1	Internal circuit
Analog input CH2	
Analog output CH1	
Analog output CH2	
Digital input CH1 to 8	
Digital output CH1 to 8	

— Functional isolation

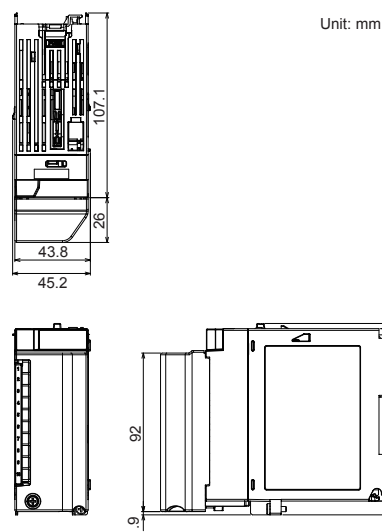
### Terminal arrangement: M3 screw terminal

No.	Symbol	No.	Symbol	No.	Symbol
301	DI3	201	DI2	101	DI1
302	DI6	202	DI5	102	DI4
303	DI-COM	203	DI8	103	DI7
304	DO3	204	DO2	104	DO1
305	DO6	205	DO5	105	DO4
306	DO-COM	206	DO8	106	DO7
307	AI1(/A)	207	AI1(-/b)	107	AI1(+/B)
308	AI2(/A)	208	AI2(-/b)	108	AI2(+/B)
309	N.C.	209	AO1(-)	109	AO1(+)
310	N.C.	210	AO2(-)	110	AO2(+)

### A/D Calibration Value

You can save two types of AD calibration values: factory default values and user-defined values. If there is a problem with user-defined values, they can be reset to factory default calibration values.

### External Dimensions



### Normal Operating Conditions

- Ambient temperature:  $-20$  to  $50^{\circ}\text{C}$   
However, use it within the ambient temperature range defined for the GX/GP/GM main unit.  
For the normal operating conditions of this module, see the specifications of the instrument (GX/GP, expandable I/O, GM) that this module is installed in.  
GX specifications: GS 04L51B01-01EN  
GP specifications: GS 04L52B01-01EN  
Expandable I/O specifications: GS 04L53B00-01EN  
GM specifications: GS 04L55B01-01EN

### Transport and Storage Conditions

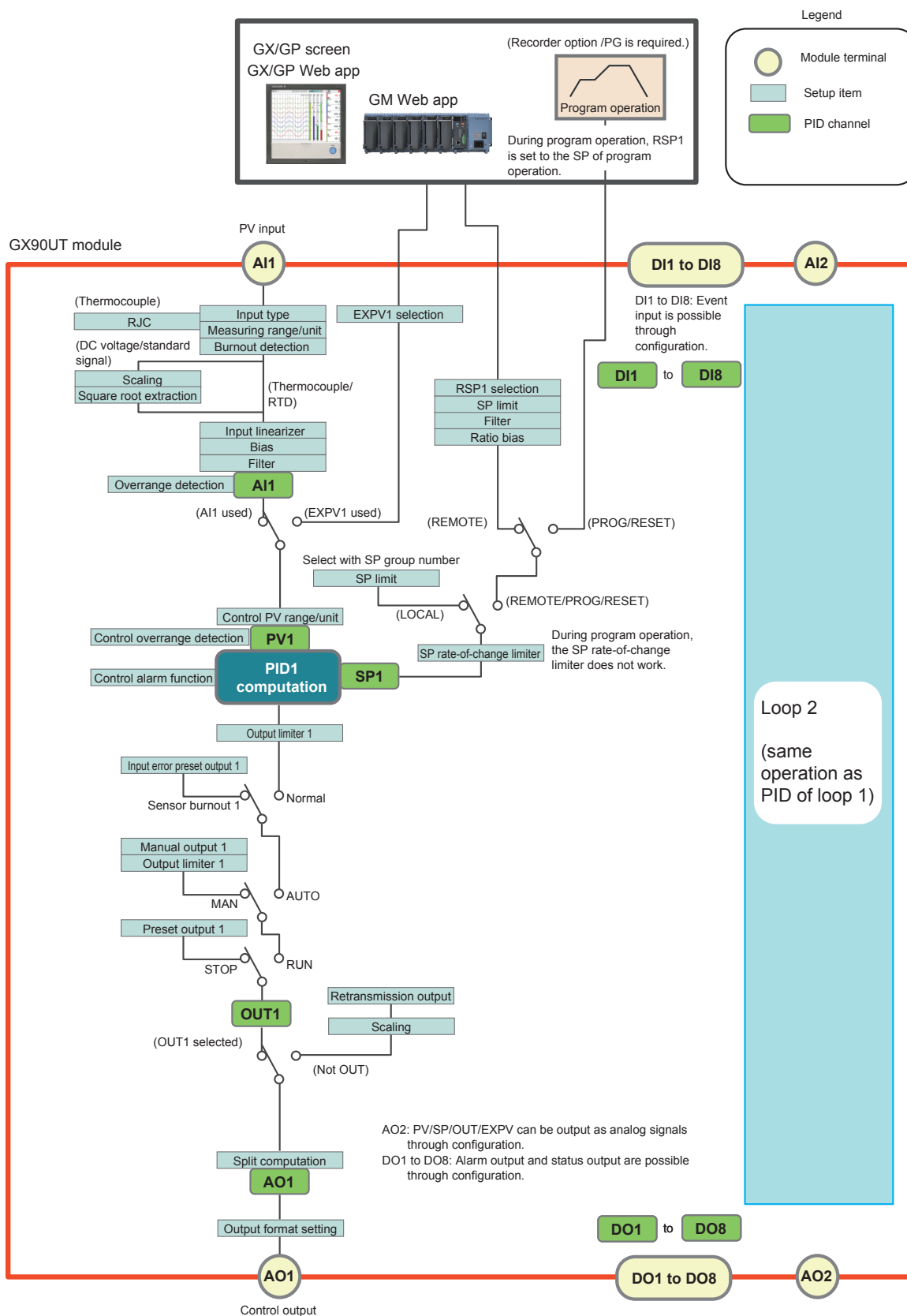
- Ambient temperature:  $-25$  to  $70^{\circ}\text{C}$
- Ambient humidity: 5 to 95% RH (no condensation)
- Vibration: 10 to 60 Hz,  $4.9\text{ m/s}^2$  or less
- Shock:  $392\text{ m/s}^2$  maximum (in packaged condition)

### Effects of Operating Conditions

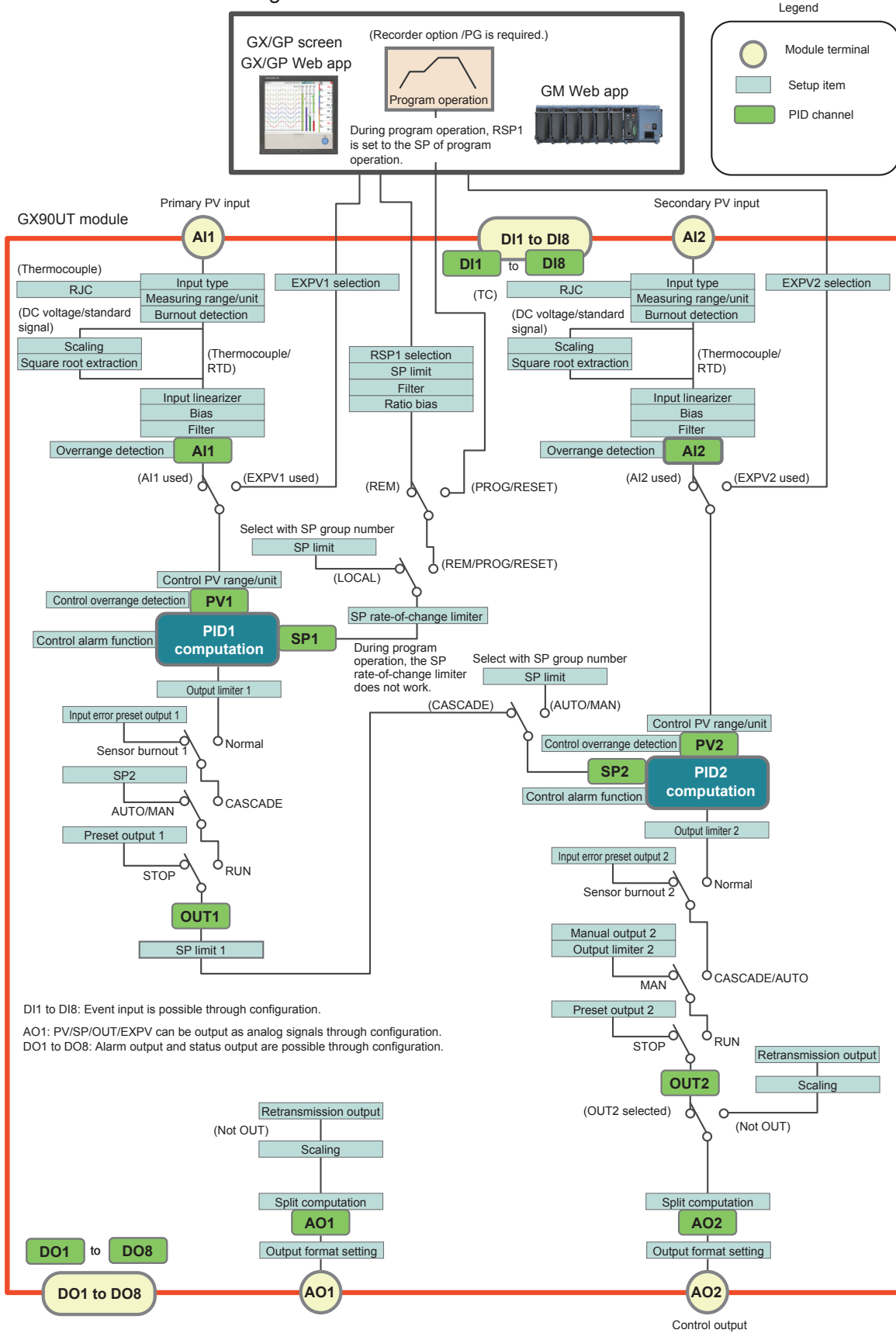
- Effects of ambient temperature:
  - Fluctuation per  $10^{\circ}\text{C}$  change  $\pm(0.05\%$  of rdg +  $0.05\%$  of range) or less  
However, for KpvsAu7Fe, PR20-40:  $\pm(0.05\%$  of rdg +  $0.1\%$  of range) or less
  - Cu10 $\Omega$  or less:  $\pm(0.2\%$  of range +  $0.1^{\circ}\text{C}$ ) or less
- Effects of power fluctuation:
  - Meets the accuracy specifications in the rated power supply range
- Effects of magnetic field:
  - Fluctuation in response to a magnetic field of AC (50/60 Hz) 400 A/m is  $\pm(0.1\%$  of rdg +  $0.1\%$  of range) or less.

Block Diagram

Single Loop Control Block Diagram

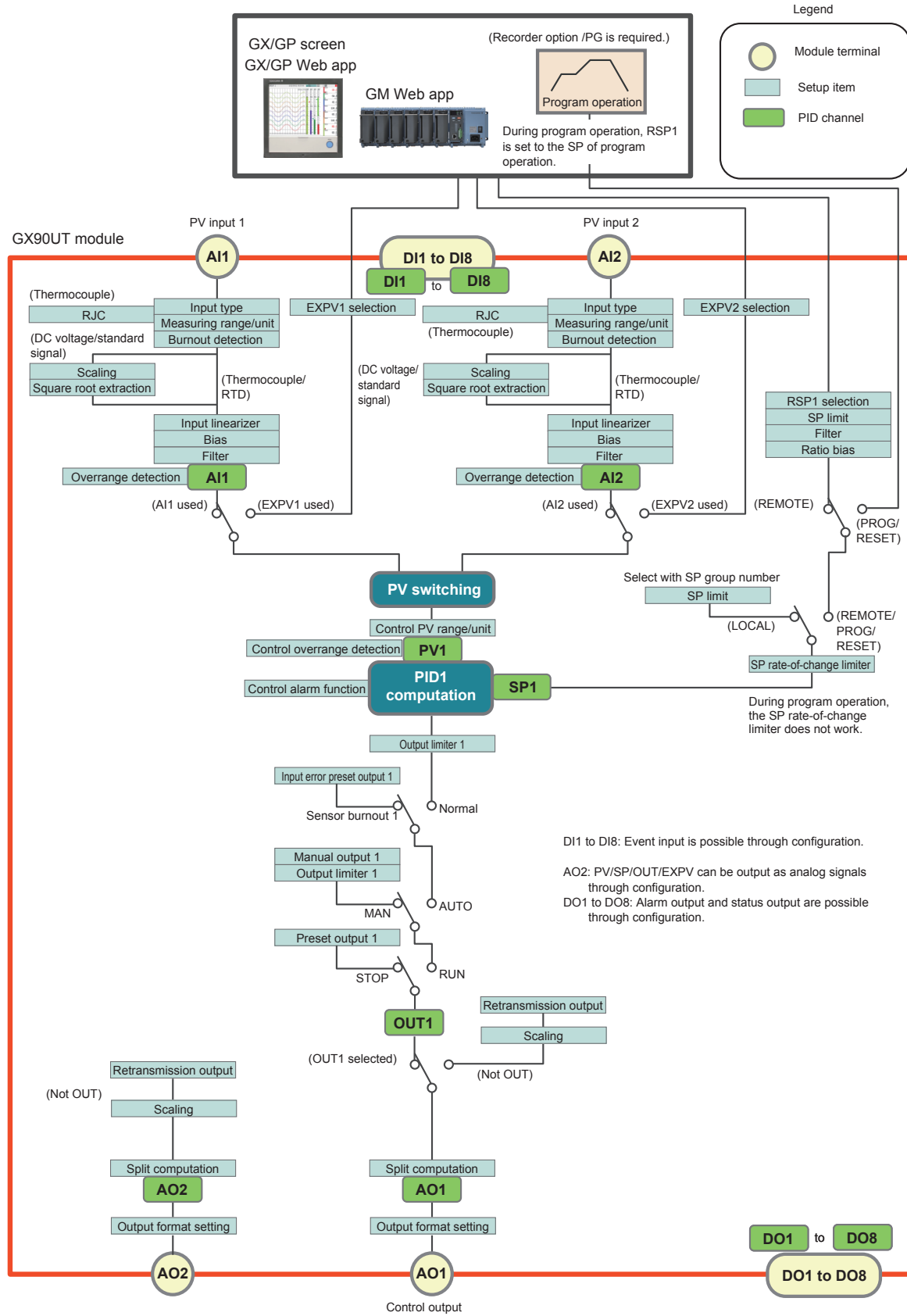


### Cascade Control Block Diagram





# Loop Control with PV Switching Block Diagram



## Loop Control Function (Function of the GX/GP/GM Main Unit)

This function can be used when a PID Control Module is installed in GX/GP main unit, expandable I/O, GM main unit, or sub unit.

### Control Screen

Display update interval (GX/GP): 500 ms (fixed)

On the GM, a Web application is used to perform operations similar to those performed on the GX/GP main unit's screen.

### Control Group Screen

Multiple loops can be shown as a group (control group) on a single screen.

Controller style: A screen that emphasizes PV values as on a digital indicating controller

Display items: Tag No., tag string, operation mode, operating status, control alarm status, PV value, PV unit string, deviation status, SP value, OUT value, OUT unit string, error display

Faceplate style: A screen that shows control values graphically.

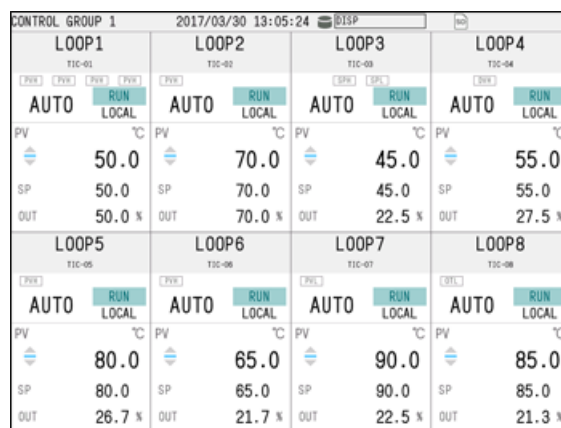
Display items: Same items shown on the controller style display as well as PV scale high and low limits, bar graph of PV value, PV alarm high and low limit marks, bar graph of OUT value, SP pointer



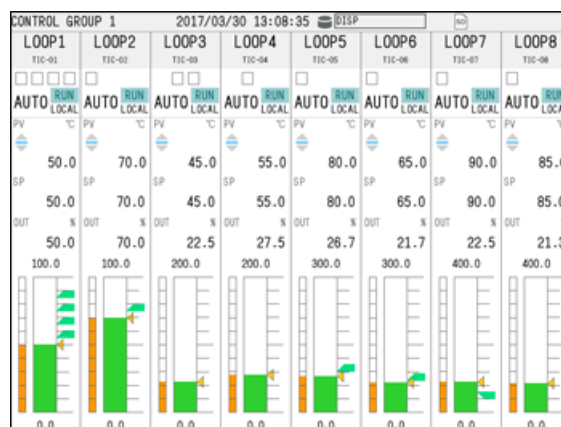
### Control Group Screen

#### Number of Control Groups and Number of Loops That Can Be Registered

Model	Number of Groups (max.)	Number of Loops (max.)/Group
GX10/GP10	5	6
GX20-1/GP20-1 (standard type)	5	8
GM10-1 (standard type)	5	8
GX20-2/GP20-2 (large memory type)	10	8
GM10-2 (large memory type)	10	8



Controller style display example

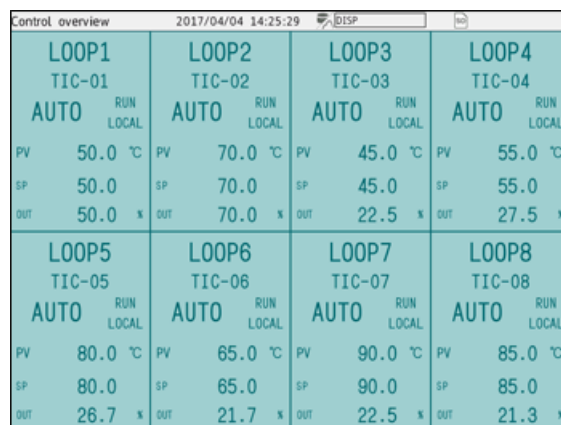


Faceplate style display example

### Control Overview Screen

The control overview screen shows on a single screen the alarm status of all loops.

When an alarm occurs, the background color turns red and the text color white.



### Tuning Screen

The tuning screen can be used to set or adjust PID constants and the like while viewing process data during operation.



### Control Summary Screen

The control summary screen shows a history of control operations (run/stop, auto/manual, etc.). You can select a historical entry and jump to the historical trend of that section.

- Displayed contents: name, status, time
- Maximum number of summaries: 1000 (if the maximum number is exceeded, the oldest event is deleted)

UP	DOWN	Name	Status	Time
		LOOP7	RUN	2017/03/30 12:36:03
		LOOP3	AUTO	2017/03/30 12:36:00
		LOOP7	STOP	2017/03/30 12:35:37
		LOOP3	MANUAL	2017/03/30 12:35:24
		LOOP8	RUN	2017/03/30 11:08:19
		LOOP8	AUTO	2017/03/30 11:08:18
		LOOP7	RUN	2017/03/30 11:08:15
		LOOP7	AUTO	2017/03/30 11:08:14
		LOOP6	RUN	2017/03/30 11:08:11
		LOOP6	AUTO	2017/03/30 11:08:10
		LOOP5	RUN	2017/03/30 11:08:08

### Control Alarm Summary Screen

The control alarm summary screen shows a history of control alarms. You can select a historical entry and jump to the historical trend of that section.

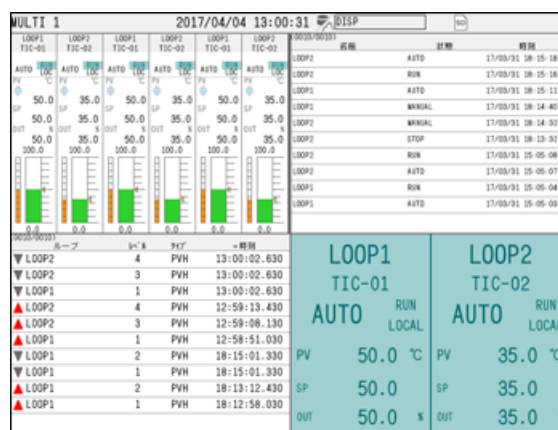
- Displayed contents: loop, level, type, time
- Maximum number of summaries: 500 (if the maximum number is exceeded, the oldest event is deleted)

UP	DOWN	Loop	Level	Type	Alarm time
		LOOP4	2	DVH	2017/03/30 12:18:33.730
		LOOP4	2	DVH	2017/03/30 11:56:10.730
		LOOP4	2	DVO	2017/03/30 11:45:37.130
		LOOP4	2	DVO	2017/03/30 11:45:13.430
		LOOP7	1	PVL	2017/03/30 11:40:55.130
		LOOP8	1	OTL	2017/03/30 11:40:09.230
		LOOP8	1	OTL	2017/03/30 11:39:55.830
		LOOP4	2	DVL	2017/03/30 11:39:30.330
		LOOP7	1	PVL	2017/03/30 11:39:30.230
		LOOP7	1	PVL	2017/03/30 11:39:30.110
		LOOP4	2	DVL	2017/03/30 11:36:09.330

### Multi Panel Screen

You can assign a control group screen, control overview screen, control alarm summary screen, and control summary screen to the multi panel screen.

The control group screen and control overview screen may not be displayed depending on the size of the multi panel area that they are assigned to.



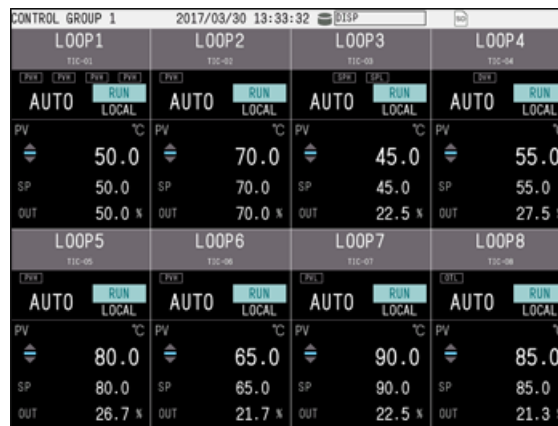
### Favorite and Standard Screens

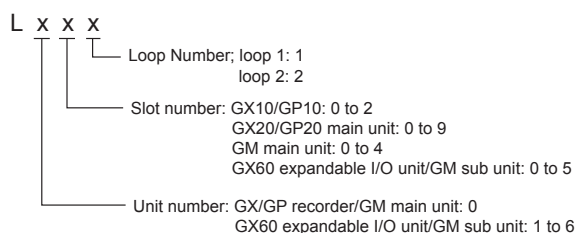
Control screens can be registered to favorite and standard screens.

### Background Color

The background color of control screens can be set to white or black.

(Controller style display example)



**Loop Number:****Tag:**

Tag strings and tag numbers can be assigned to loop numbers.

- Tag string: up to 32 characters  
Displayable characters: English, Japanese, and Chinese characters
- Tag No.: up to 16 characters  
Displayable characters: Alphanumeric and symbols

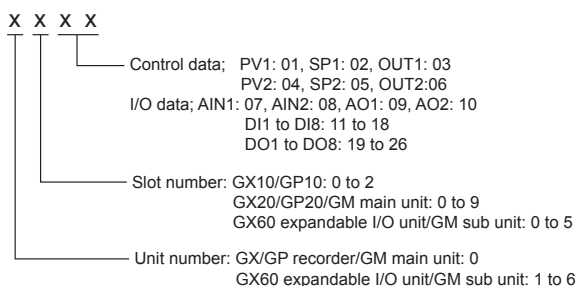
**PID Channel:**

PID channels are used to display control data and I/O data of PID control modules on trend or digital displays and save the data as recorded data.

- PID channel:  
analog input (AI1/AI2), digital input (DI1 to DI8), analog output (AO1/AO2), digital output (DO1 to DO8), control data (PV1/PV2, SP1/SP2, OUT1/OUT2)
- PID channel recording interval: depends on the recorder's recording interval

**PID Channel Display Settings:**

tag, color, zone, scale, bar graph

**Number of PID Channels:**

The number of channels of the GX90UT module is 26 (fixed).

When choosing the type of GX / GP / GM main unit (Standard / Large memory), please calculate it as 26 channels per one unit.

**Control Functions****Control Mode**

Select from single loop control, cascade control, and loop control with PV switching

- \* Two single loops can run on a single unit. (Dual-loop control is possible.)

**Number of Control Loops**

2 loops/ module (single loop control×2, cascade control)

1 loop/module (loop control with PV switching)

- GX/GP/GM system (standard type): 6 loops max.
- GX/GP/GM system (large memory type): 20 loops max.

**Control Period (Input Sampling Period)**

100 ms or 200 ms (system global setting)

**Control Computation Function**

- Control type: PID control, on/off control
- Target setpoint (SP): up to 8 per loop
- PID parameter: 8 groups/loop
- PID parameter group selection:  
Using target setpoint numbers (SPNO) (PID numbers can be assigned as you like) or segment PIDs (during program control)  
Using PV input zones (zone PIDs)\*  
Using target setpoint zones (zone PIDs)\*  
Using final target setpoint zones (zone PIDs)\*  
Externally (using the contact input)  
\* If the deviation exceeds the reference deviation setpoint during constant preset control, the PID constant switches automatically to the preset PID parameter group.

- Zone PID switches: 7 max.
- PID default setting function: The controlled target can be set to a PID constant suitable for the temperature or that suitable for the pressure or flow rate.
- PID control mode:  
fixed-point control mode or constant preset control
- SP limiter function: A high limit or low limit can be set.
- SP ramp rate setting function: A rising ramp rate or falling ramp rate can be set.
- Tracking function:  
SP tracking, PV tracking
- Auto-tuning function
- "Super" function (overshoot-suppressing function)
- Anti-reset windup (over-integration prevention function)
- Preset function (when operation is stopped)
- Input error preset function

**Operation Mode Switching**

Remote/local (R/L), auto/manual (A/M), run/stop (R/S), cascade/auto/manual (CAS/AUTO/MAN), auto tuning (AT) run/stop

**Control Parameter Setting Range**

- Proportional band (P): 0.0 to 999.9%
- Integral time (I): 0 to 6,000 s
- Derivative time (D): 0 to 6,000 s
- ON/OFF control hysteresis: 0.0 to 100.0% of measuring range (high and low can be set separately)
- Preset output value: -5.0 to 105.0%
- Output limiter setting range: -5.0 to 105.0% (limiter low limit < limiter high limit)
- Normal/reverse operation switching: normal or reverse
- Tight shut function: When manual control is carried out with 4 to 20 mA output, control output can be reduced to about 0 mA.
- Rate-of-change limiter of output: Off or 0.1 to 100.0%/s

**External PV (EXPV)**

External PV can be turned on and off. An I/O, math, or communication channel can be assigned to PV. EXPV send period: 100ms to 500ms (depends on the system configuration.)

**Remote SP (RSP)**

Remote SP can be turned on and off. An I/O, math, or communication channel or the analog input of a PID control module can be assigned to SP. A filter and ratio bias can be set on the remote SP. Remote SP send period: 100ms to 500ms (depends on the system configuration.)

**Retransmission Output (Analog Retransmission) Function**

Output function: current output (reverse output possible)  
PV, SP, or OUT can be retransmitted from analog output.

**Math Function**

CP computation (zirconia O<sub>2</sub> sensor electromotive force, CO<sub>2</sub> partial pressure), special CLOG.AVE computation, magic number

- \* The math function is a recorder option (/MT). For details, see the general specifications of the GX/GP/GM recorder.

**Alarm Function**

- Control alarm types  
PV high limit, PV low limit, SP high limit, SP low limit, deviation high limit, deviation low limit, deviation high and low limits, deviation within high and low limits, control output high limit, control output low limit, PV rate-of-change
- Alarm action  
Standby action, relay action (hold/nonhold, reset on ACK, normal action on ACK), hysteresis, ON-delay timer, Off-delay timer
- Number of alarm setpoints: 4 per loop
- Standby action  
Turns off alarms from the start of control (power-on) until a stable condition is reached.
- Hysteresis: Hysteresis can be set for each alarm setting.
- Display: status display in the digital display area when an alarm occurs. Common alarm display can be switched between hold and nonhold.

**Other Functions**

- Recorder operation  
Operation  
Operation security settings

**Control Event Action**

Control action or status output can be performed using DI, DO, and internal switch.

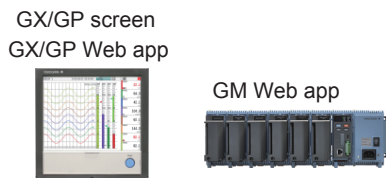
- Action

All loop control operation start
All loop control operation stop
Control operation start/stop (specified loop)
Auto/manual switch (specified loop)
Remote/local switch (specified loop)
Auto switch (specified loop)
Manual switch (specified loop)
Cascade switch (specified loop)
Remote switch (specified loop)
Local switch (specified loop)
Hold operation
Advance operation
Program operation start
Program operation stop
Program operation mode change
Hold operation (specified loop, specified program pattern)
Advance operation (specified loop, specified program pattern)
Program operation start (specified loop, specified program pattern)
Program operation stop (specified loop, specified program pattern)
Pattern number switch (BIN, BCD)

- Status output
  - Notification during control operation
  - Segment number (BIN, BCD)
  - Pattern number (BIN, BCD)
  - PROG/RESET monitoring
  - Wait end signal (1s, 3s, 5s)
  - Pattern end signal (1s, 3s, 5s)
  - PV event status
  - Time event status
  - Wait flag
  - Hold-on flag

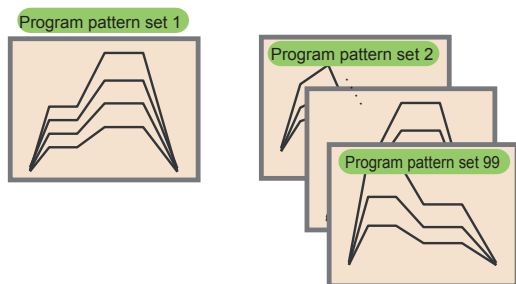
## ■ Program Control Function (/PG GX/GP/GM recorder option)

With the program control function, a PID control module installed in the GX/GP main unit, expandable I/O, GM main unit or sub unit can control a system according to time varying setpoints sent from the GX/GP/GM main unit.



(Recorder option /PG is required.)

Program patterns are executed by operating the GX/GP or GM recorder or Web app.



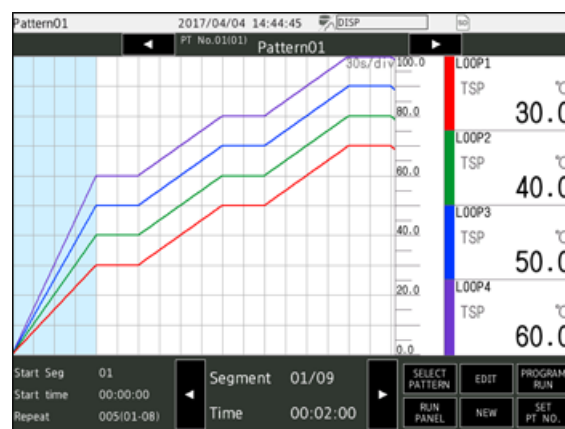
99 program pattern sets

- Number of program pattern sets: 99
- Program pattern name: up to 20 characters
- Number of segments: 99 segments/pattern
- Number of simultaneous execution: 1 pattern only
- SP update period: 100 to 500 ms (depends on the system configuration)
- PV events:
  - PV alarms, deviation alarms, and the like in program patterns
  - Maximum number of events: 32 per segment
  - Type: PV high limit, PV low limit, SP high limit, SP low limit, deviation high limit, deviation low limit, deviation high and low limits, deviation within high and low limits, control output high limit, control output low limit
- Time event:
  - Status output is possible according to the progress of program patterns.
  - Maximum number of events: 32 per segment
  - Time setting: 0 to (segment time - 1 s)
- Operation mode switching:
  - Program run/reset, hold/release hold, advance execute, local operation
- Number of pattern repetitions:
  - 999 max. or infinite
- Segment time:
  - 0 hours 0 minutes 1 second to 99 hours 59 minutes 59 seconds

- Program pattern start/stop:
  - Program pattern start, stop, hold, and advance can be controlled from digital input, communication, or recorder's screen.
- Program pattern selection:
  - can be controlled from digital input, communication, or recorder's screen.
- Advance function: forcibly moves to the next segment
- Wait function:
  - Wait time:
    - off, 0 hours 0 minutes 1 second to 99 hours 59 minutes 59 seconds
  - Wait zone: 0.0 to 10.0% of PV range span
- Hold function: available
- PID parameter switching:
  - Segment PID switching:
    - PID parameter number can be switched for each segment.
  - Zone PID switching:
    - PID parameters can be switched using PV values and the like.
- Status output through digital output (control event action)
  - Status monitoring is possible using digital output.
    - Program pattern number monitoring,
    - program end (pattern end) notification,
    - segment number monitoring, operation mode monitoring (PROG/REST), wait end notification, PV/time event notification, waiting notification, holding notification, local operation

### Program Selection Screen

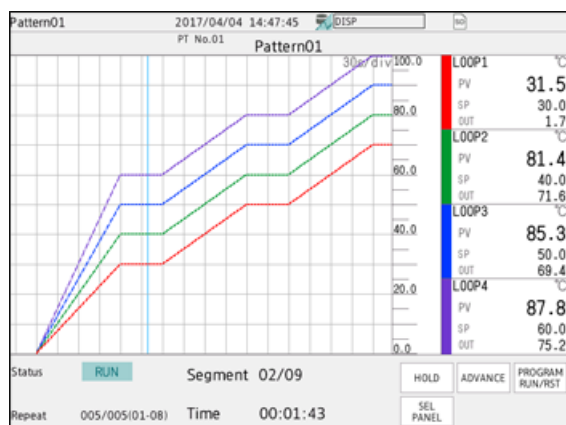
The program selection screen is for selecting the program pattern to start operations and viewing pattern settings.



- Program screen display:
  - Program operation status display screen:
    - displays the program operating status and the current PV simultaneously (GX/GP only)
    - Number of display loops: 20 max.
    - Number of screens: 1
    - Display update interval:
      - Digital display area: 500 ms fixed
      - Trend display area: according to the trend interval
  - Program event display: possible

### Program Operation Screen

The program operation screen is for displaying the program pattern that is currently running.



- Other recorder operations:
  - Save each program pattern to file
  - Load program patterns
  - Delete program patterns

### Control Data Acquisition/Recording Function (GX/GP/GM recorder function)

- Acquires/records control data (PV, SP, OUT, etc.)
  - Acquisition/recording is possible by installing a PID Control Module and reconfiguring the system.
  - PID channel data can be used as an I/O channel to be saved in data files or used in computation and reports.
- Control operation summary (number of saved files: up to 3000 data values, number of display data values: up to 1000 data values)
- Control alarm summary (number of saved files: up to 1000, number of display data entries: up to 500)

## Installation Conditions

### Systematic PID Control Module Limitations

<b>GX/GP/GM system (Standard type)</b>	Max. 3 devices
<b>GX/GP/GM system (Large memory type)</b>	Max. 10 devices

However, if the system includes PID control modules (GX90UT), digital output modules (GX90YD), and digital input/output modules (GX90WD), the maximum total number of these modules is 10.

If the recorder's measurement operation mode is high speed or dual interval, PID control modules will not work. (For details, see the general specifications of the GX/GP/GM recorder.)

### Input/Output Module Limitations on Recorders and Units When Using the PID Control Module

<b>GX10/GP10 recorder (Standard type)</b>	Max. 3 devices* Note:
<b>GX20/GP20 recorder (Standard type)</b>	Max. 8 devices*
<b>GX20/GP20 recorder (Large memory type)</b>	Max. 8 devices*
<b>GM single unit configuration, main (standard type)</b>	Max. 5 devices*
<b>GM single unit configuration, main (large memory type)</b>	Max. 5 devices*
<b>GM multi unit configuration, main (standard type)</b>	Max. 5 devices*
<b>GM multi unit configuration, main (large memory type)</b>	Max. 5 devices*
<b>GX60 expandable I/O</b>	Installable within the system limitations
<b>GM multi unit configuration, sub unit</b>	Installable within the system limitations

\* This is the number of devices including the expansion modules (GX90EX) installed in the GX/GP/GM recorder when an expandable I/O unit (GX60) or GM sub unit is used.

Note: The maximum number is 2 when the GP10 supply voltage is 12 VDC.

## ■ Model and Suffix Codes

### Model and Suffix Codes (GX90UT)

Model	Suffix code			Description
GX90UT				PID Control Module
Number of loops	-02			2 loops
Function		-11		DI 8 points, DO 8 points
-		N		Always N
Terminal type			-3	Screw terminal (M3)
Region			N	General

## ■ Optional Accessories (Sold separately)

Name	Type
Shunt resistor for current input (for M3 screw terminal) ( $250 \Omega \pm 0.1\%$ )	415940
Shunt resistor for current input (for M3 screw terminal) ( $100 \Omega \pm 0.1\%$ )	415941
Shunt resistor for current input (for M3 screw terminal) ( $10 \Omega \pm 0.1\%$ )	415942

### Calibration Certificate (Sold separately)

When you order PID control modules, each module gets its own calibration certificate.

### Test Certificate (QIC, sold separately)

When you order PID control modules, each module gets its own QIC.

### User's Manual

You can download the product user's manuals from the following URL. You will need Adobe Reader 7 or later (latest version recommended) by Adobe Systems.

**URL:** [www.smartdacplus.com/manual/ja/](http://www.smartdacplus.com/manual/ja/)

### Trademarks

The TCP/IP software used in this product and the document for that TCP/IP software are based in part on BSD networking software, Release 1 licensed from The Regents of the University of California. SMARTDAC+ and SMARTDACPLUS are trademarks of Yokogawa Electric Corporation.

Microsoft, MS, and Windows are trademarks or registered trademarks of Microsoft Corporation in the United States and other countries.

Pentium is a registered trademark of Intel Corporation.

Modbus is a registered trademark of AEG Schneider. Other company names and product names appearing in this document are registered trademarks or trademarks of their respective holders.

The company and product names used in this manual are not accompanied by the registered trademark or trademark symbols (® and ™).