Introduction
This manual outlines the procedure for using the US1000 controller in single-loop PID control. For the detailed procedure, refer to the US1000 Digital Indicating Controller instruction manual (IM 5D1A01-01E).

Factory-set Defaults
At the time of shipment, the US1000 controller is set for various applications as shown in the table below. This manual mainly describes how to change the settings for the items marked with an asterisk (*).

<table>
<thead>
<tr>
<th>Item</th>
<th>Factory-set default for US1000-00</th>
<th>US1000-00 (Basic type)</th>
<th>US1000-11 (Enhanced type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV input signal</td>
<td>1 to 5 V DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Measurement range and unit</td>
<td>0.0 to 100.0 (No unit set)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Square-root computation, 10-segment linearizer, PV filter, PV bias, burnout</td>
<td>OFF or 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loop power supply for two-wire transmitter</td>
<td>Enabled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alarm function</td>
<td>PV high limit (2 points), PV low limit (1 point)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cascade input signal</td>
<td>1 to 5 V DC (CAS mode key is disabled, however)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controller mode and MV output</td>
<td>Single-loop control, 4 to 20 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PID parameters</td>
<td>P = 999.9%, I = 1000 seconds, D = OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Control action</td>
<td>Reverse action</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PID control mode</td>
<td>Fixed-point control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output limiter</td>
<td>Upper limit = 100%, Lower limit = 0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preset MV</td>
<td>-5.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auto-tuning and SUPER function</td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control period</td>
<td>200 msec.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mode switching by external contacts</td>
<td>RUN/STOP switchover, MAN mode selection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Password</td>
<td>0: no password</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Key lock</td>
<td>CAS mode key disabled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action upon power recovery</td>
<td>Less than 2 seconds</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 seconds or longer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes
*1: RUN/STOP switchover:
Contact ON = Operation stopped
(Stops control function and outputs the preset MV.)
Contact OFF = Normal operation
*2: MAN mode selection: ON = MAN mode, OFF = No function
*3: AUTO mode selection: ON = AUTO mode, OFF = No function
*4: SV No. setting: Selects one out of 8 SV settings by combining contact input signals. For information on how to setup this function, refer to the US1000 Digital Indicating Controller Functions instruction manual (IM 5D1A01-02E).
*5: Alarm output
US1000-00: 2 setpoints for the PV high limit alarm and 1 setpoint for the PV low limit alarm
US1000-11: 2 setpoints for each of the PV high limit and PV low limit alarms
The signals assigned to “DO3 and OUT2R” and “DO4 and OUT1R” are identical.
**Terminal Arrangement**

Terminal assignments at time of shipment

- OUT1A: MV output
- OUT3A: Retransmission
- LPS1: Loop power supply
- DI2: MAN mode
- DO2: PV low limit alarm 1
- DI1: RUN/STOP
- limit alarm 2
- AIN1: PV input
- OUT1A: MV output
- 100-240 V AC Power supply selection
- switchover
- External resistor
- DO3: PV high limit alarm 2
- Power supply
- 100-240 V AC
- Grounding
- US1000-00 terminals
- US1000-11 terminals
- DO7: FAIL output

Wiring of 2-wire transmitter (for US1000-00)

- 2: PV input (Terminal No. 4 and 5 for cascade input)
- 3: Power supply for transmitter
- 5: Power supply for transmitter
- 19: 25.5 ± 1.5 V

**Setting Up Functions before Operation**

- To change the display scale from its initial 0.0 to 100.0 range to 0.0 to 500.0:
  1. Press the M key to set the controller to MAN mode.
  2. Press the [SET/ENT] key for 3 seconds to display [O.LP1].
  3. Press the [・] key to display [STUP].
  4. Press the [SET/ENT] key to display [S.LP1].
  5. Press the [・] key once to display [USMD].
  6. Press the [SET/ENT] key to display [MD].
  7. Press the [・] key once to display [IN].
  8. Press the [SET/ENT] key 5 times to display [SH1] (the maximum value of the analog input-1 scale).
  9. Press the [・][・] keys to adjust the setting to 500.0.
  10. Press the [SET/ENT] key to write the setting.
  11. To make the written value take effect, execute initialization.
  12. Press the [DISP] key once to return to [IN].

- Setting alarm setpoints, PID constants, and control action
  1. Set the controller in MAN mode, then press the [SET/ENT] key for 3 seconds to display [O.LP1].
  2. Press the [SET/ENT] key to display [PAR].
  3. Press the [・] key once to display [1.PID].
  5. Press the [・][・] keys and set the alarm setpoint.
  7. Set the alarm setpoint in the same way as step 5.
  9. Press the [・][・] keys and set the proportional band.
  10. Press the [SET/ENT] key to write the setting.
  12. Press the [・][・] keys and set the integral time.
  13. Press the [SET/ENT] key to write the setting.
  15. Press the [・][・] keys and set the derivative time.
  16. Press the [DISP] key 3 times to return to the operation display.

- Note: The following operation steps are just for initial condition. If some parameters were changed, operation steps might be different.
**Starting Operation**

1. Turn on the power to the controller, set the MAN mode (so that the M lamp is lit).
2. Press the [△] [↑] keys and set the target setpoint (SV).
3. Operate MV by pressing the [ ] [ ] keys until PV reaches SV. The SV/MV digital display automatically shows MV.
4. When you press the [A] key in a stable state, the controller switches to the AUTO mode without producing any sudden changes in MV.

**Normal Operations**

**Switching between operation modes (CAS/AUTO/MAN)**

Change the operation mode using the [C], [A], and [M] keys. The figure on the right shows how the different key operations change the operation mode. As you can see, you cannot change from MAN to CAS mode directly. You must change to AUTO mode first, and then to CAS mode. At the time of shipment, the [C] key operation is disabled. To enable the [C] key, follow the procedure on page 3.

**Switching the SV/MV digital display**

Press the [DISP] key during operation. The digital display alternates between SV and MV without changing the operation mode.

**Displaying alarms**

When either a PV high limit or PV low limit alarm occurs, the ALM lamp comes on. It goes out when the alarm returns to normal. To display the alarm numbers on the PV and SV digital displays, provide the setting for “To display activated alarm numbers” on page 2.

**Changing output limiter**

You can change the setting of the output limiter using the operation parameters [1.MH] and [1.ML], and following the same procedure as that under “Setting alarm setpoints, PID constants, and control action.” (Path: [O.LP1] → [1.PID] → [1.MH], [1.ML], [1.PM])

The output limiter is effective in AUTO and CAS mode. (In the MAN mode, manual operation takes priority and the output limiter becomes ineffective.)

**Setting Various Functions (perform as necessary)**

This section introduces the procedures for setting parameters that set up various functions. The operation procedures are the same as the example procedures described so far. (For details, refer to the US1000 Digital Indicating Controller instruction manual IM 5D1A01-01E.) It is useful to read the following procedures together with the “Operation Parameter List” on page 4 and the “Setup Parameter List” in another basic operation manual (IM 5D1A01-81E).

**To use a flow signal for PV input**

When you use an orifice flowmeter, use square-root computation, a low signal cut-off point, and a PV filter.

Setup parameters as follows:

- **A.SR1** = ON (Executes square-root extraction) (Path: [CMLP] → [AIN] → [A.SR1])
- **A.LC1** = 0 to 5% (Low signal cut-off point) (Path: This parameter appears following the A.SR1.)

Operation parameters:

- **FL** = OFF, 1 to 120 seconds (Time constant of PV filter) (Path: [O.LP1] → [PAR] → [FL])
  - The other available filter is an analog input-1 filter [A.FL1], however, the PV filter [FL] is convenient because you can change it during operation.

**To change the control period**

You can change the control period in single-loop control.

Setup parameter:

**SMP** = 100 (100 msec.) (Path: [USMD] → [MD] → [SMP])
Set:
Returns to operation display when pressed for 3 seconds.

Operation parameters

- Operation display
  - Press the SET/ENT key for 3 seconds.
  - Scroll through items using the SET/ENT key, set data with the / keys, and write the data with the SET/ENT key.
- Various parameters
  - PID values, output limiter, direct/reverse switchover, preset MV, etc.
- Same as above (for the group 2)
- Same as above (for the group 8)

- Loop-2: the same as loop-1
  - Displayed only when loop-2 is in use

- Password entry

- Operation parameter list

  - Parameters marked with an asterisk (*): Be sure to check (and change) their settings.
  - Other parameters: Use their default settings for general use, and change as necessary.
  - The controller only displays the operation parameters in use, according to the functions configured using the setup parameters.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Setting range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODE</td>
<td>Operation parameters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.OC</td>
<td>Open/Closed switcher (internal cascade loop)</td>
<td>OPEN, CLOSE</td>
<td>CLOSE</td>
</tr>
<tr>
<td>1.MV</td>
<td>SV number selection</td>
<td>1 to 8</td>
<td>1</td>
</tr>
<tr>
<td>1.MH</td>
<td>PID function selection</td>
<td>OFF, 1 to 8, 9</td>
<td>OFF</td>
</tr>
<tr>
<td>1.SU</td>
<td>SUPER function selection</td>
<td>OFF, ON</td>
<td>OFF</td>
</tr>
<tr>
<td>1.BS</td>
<td>PV bias</td>
<td>EU(-100.0 to 100.0%)</td>
<td>0.0%</td>
</tr>
<tr>
<td>1.Fl</td>
<td>Filter time</td>
<td>OFF, 1 to 120 seconds</td>
<td>OFF</td>
</tr>
<tr>
<td>1.CR</td>
<td>Setpoint ramp-up</td>
<td>OFF, EU(-100.0 to 100.0%)</td>
<td>0.0%</td>
</tr>
<tr>
<td>1.CR</td>
<td>Setpoint ramp-down</td>
<td>OFF, EU(-100.0 to 100.0%)</td>
<td>0.0%</td>
</tr>
<tr>
<td>1.CB</td>
<td>Cascade bias</td>
<td>EU(-100.0 to 100.0%)</td>
<td>0.0%</td>
</tr>
<tr>
<td>1.CI</td>
<td>Cascade input filter</td>
<td>OFF, 1 to 120 seconds</td>
<td>OFF</td>
</tr>
<tr>
<td>1.FG</td>
<td>Feedforward gain</td>
<td>OFF, 1 to 120 seconds</td>
<td>OFF</td>
</tr>
<tr>
<td>1.FG</td>
<td>Feedforward input bias</td>
<td>-100.0 to 100.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>1.FG</td>
<td>Feedforward output bias</td>
<td>OFF, 1 to 120 seconds</td>
<td>OFF</td>
</tr>
<tr>
<td>1.1V</td>
<td>Target setpoint</td>
<td>EU(-100.0 to 100.0%)</td>
<td>EU(-100.0%)</td>
</tr>
<tr>
<td>1.A1</td>
<td>Alarm 1 setpoint</td>
<td>OFF, 1 to 120 seconds</td>
<td>OFF</td>
</tr>
<tr>
<td>1.A2</td>
<td>Alarm 2 setpoint</td>
<td>OFF, 1 to 120 seconds</td>
<td>OFF</td>
</tr>
<tr>
<td>1.A3</td>
<td>Alarm 3 setpoint</td>
<td>OFF, 1 to 120 seconds</td>
<td>OFF</td>
</tr>
<tr>
<td>1.A4</td>
<td>Alarm 4 setpoint</td>
<td>OFF, 1 to 120 seconds</td>
<td>OFF</td>
</tr>
<tr>
<td>1.1P</td>
<td>Proportional band</td>
<td>0.0 to 100.0%</td>
<td>0.5%</td>
</tr>
<tr>
<td>1.1I</td>
<td>Integral time</td>
<td>OFF, 1 to 6000 seconds</td>
<td>OFF</td>
</tr>
<tr>
<td>1.1D</td>
<td>Derivative time</td>
<td>OFF, 1 to 6000 seconds</td>
<td>OFF</td>
</tr>
<tr>
<td>1.MH</td>
<td>Upper limit of output</td>
<td>OFF, 1 to 105.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>1.ML</td>
<td>Lower limit of output</td>
<td>OFF, 1 to 105.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>1.MR</td>
<td>Manual reset</td>
<td>OFF, 1 to 105.0%</td>
<td>50.0%</td>
</tr>
</tbody>
</table>

- Password input

- Set to 3000.
  - Input the password set at the setup parameter MLCK-PWD.

- Default values depend upon the mode of the controller.

<table>
<thead>
<tr>
<th>PYS1 (same for PYS2: 2.xN, 2.Yn, 2.PMD)</th>
<th>Description</th>
<th>Setting range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.XN</td>
<td>Zone PID reference deviation</td>
<td>EU(-100.0 to 100.0%)</td>
<td>EU(-100.0%)</td>
</tr>
<tr>
<td>1.YN</td>
<td>Zone PID hysteresis</td>
<td>EU(-100.0 to 100.0%)</td>
<td>EU(-100.0%)</td>
</tr>
<tr>
<td>1.PM</td>
<td>Zone PID hysteresis</td>
<td>EU(-100.0 to 100.0%)</td>
<td>EU(-100.0%)</td>
</tr>
</tbody>
</table>