A-5   4 Loops

A-5-1   Description

The following drawings below are provided to help the user to better understand all the information concerning the specific control strategy and, in particular:

- Project Tasks (POU) Organization and Order;
- Block diagram representation;
- Set of display panels used within the application;
- Application examples;
- I/O table related to the signals managed from/to the field.

A-5-2   Project Tasks (POU) Organization and Order

In order to obtain the proper operations coming with the functions of the strategy, it is necessary to link the tasks that have been developed as follows:

1. **Four_Loops_Vars.STD.POE**   Global Variables declaration file;
2. **Four_Loops_Vars.DIR.POE**   Direct Variables declaration file;
3. **Four_Loops_Values_Mngt.ST**   Variables application pre-set operations;
4. **Four_Loops_IO_Mngt.CFC**   I/O conditioning operations;
5. **Four_Loops_Common_Oprs.ST** Application overhall general operations;
6. **Four_Loops_1_Mngt.CFC**   Specific 4 loops process control operations;
7. **Four_Loops_2_Mngt.CFC**   Specific 4 loops process control operations;
8. **Four_Loops_3_Mngt.CFC**   Specific 4 loops process control operations;
9. **Four_Loops_4_Mngt.CFC**   Specific 4 loops process control operations;
10. **Four_Loops_Pages.CFC**   Overhall display Pages management
11. **Four_Loops_Tags.CSV**   Display pages specific tags excel CSV file.

A-5-3   Block Diagram

The following diagram provides an overall understanding of the process control and logic that have been arranged for the specific purpose. For this reasons the function block representation has been simplified to enhance readability and the specific functionalities meaning.
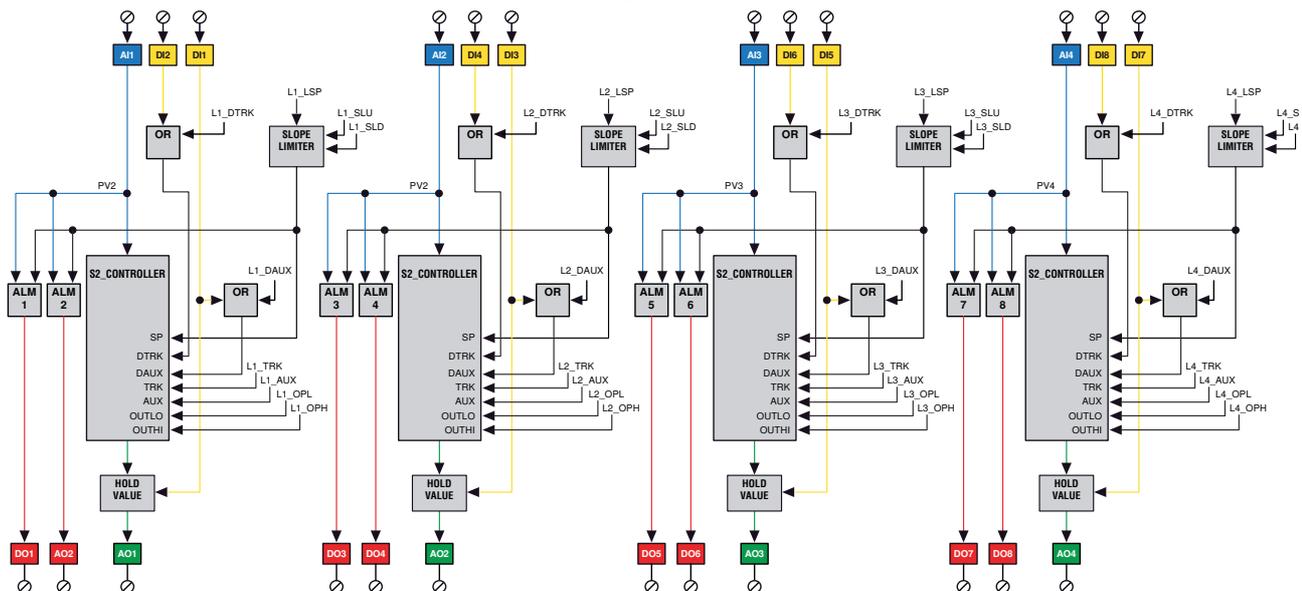
This configuration provides a 4 independent basic PID loops, including output forcing mode and 2 alarms that behave according to the working mode desired for each of the ALARM_ADV function block.

The descriptions that follow refer to Loop1 only due to the fact all of them are idencical. They differ only by the specific I/O managed by themselves.

Control The AI1 Controlled variable is acquired, filtered, corrected and converted into the desired engineering unit by the specific and dedicated MP_AI_MNGT_ADV function block with Out of Range detection. Then, it is managed by the dedicated S2_CONTROLLER function block which performs the PID calculation accordingly to the desired SP. It generates the control output value to drive the actuator which has to be connected to the AO1 analogue output.

Forcing These operations are alternative to the S2_CONTROLLER PID output calculation.
Modes The Tracking mode sets the control output to the constant value, editable from the specific Configuration page, until the DI2 is activated or the DTRK command coming from the dedicated front panel page whilst the Hold function freezes the loop control output while the DI1 digital input is activated.

DI1	DI2	Selected Value
OFF	OFF	No forcing
OFF	ON	Output Tracking
ON	OFF	Output Hold
ON	ON	Output Tracking

Alarms Two alarms are implemented by additional ALARM_ADV function blocks on the AI1 Controlled variable. The status is reported as digital output through DO1 and DO2.

A-5-4 Graphic Displays

The pictures above show the different types of display panels, providing the most effective interface for this strategy configuration. After the Custom page, XXX

more panel pages consisting in a 4 bargraph display, the alarm list and the Forcing mode list are intended to provide a quite complete interface for this configuration.

The panel with the 4 bargraphs provides a complete view of all the 4 loops, with a fine level of details on the most important parameters.

If you want to operate on a loop, first you have to select it, by pressing the button. The loop selected is highlighted by the background colour of the specific Tag that changes from dark grey to light blue. Once the loop has been selected, it is possible to change the SP and/or the A/M station operating mode. Furthermore, the parameters shown in the upper part of the panel relates to the selected loop.

The status of the alarms is displayed by the scrolling bar present on all the pages available within an application. When an alarm becomes active, the related alarm description scrolls continuously, to alert the operator. Anyway, the operator can get a more detailed view of the alarms, looking at the specific "Alarms & Events" panel pages.

A-5-5 Applications

This easy to use configuration is for simple applications, where standard PIDs are required to control up to 4 independent variables in just one box, with perfectly identical characteristics.

Furthermore, the loops have some additional functionalities, such as alarms and output forcing modes, to achieve more advanced results than a basic PID.

A typical example of a process where this configuration can be applied, is the control of a combustion heating furnace. The loops could be used to control:

- Air pressure;
- Air temperature;
- Furnace pressure;

- Co-generator flue gas temperature.

AI1   Air Temperature

AI2   Air Pressure

AI3   Flue Gas Temperature

AI4   Furnace pressure

AO4   Actuator for Flue Gas diluition - Flue Gas temperature control

AO3   Actuator to Fan - Air pressure control

AO2   Actuator Air Outlet - Air temperature control

AO1   Flue Gas Valve Actuator - Furnace pressure control
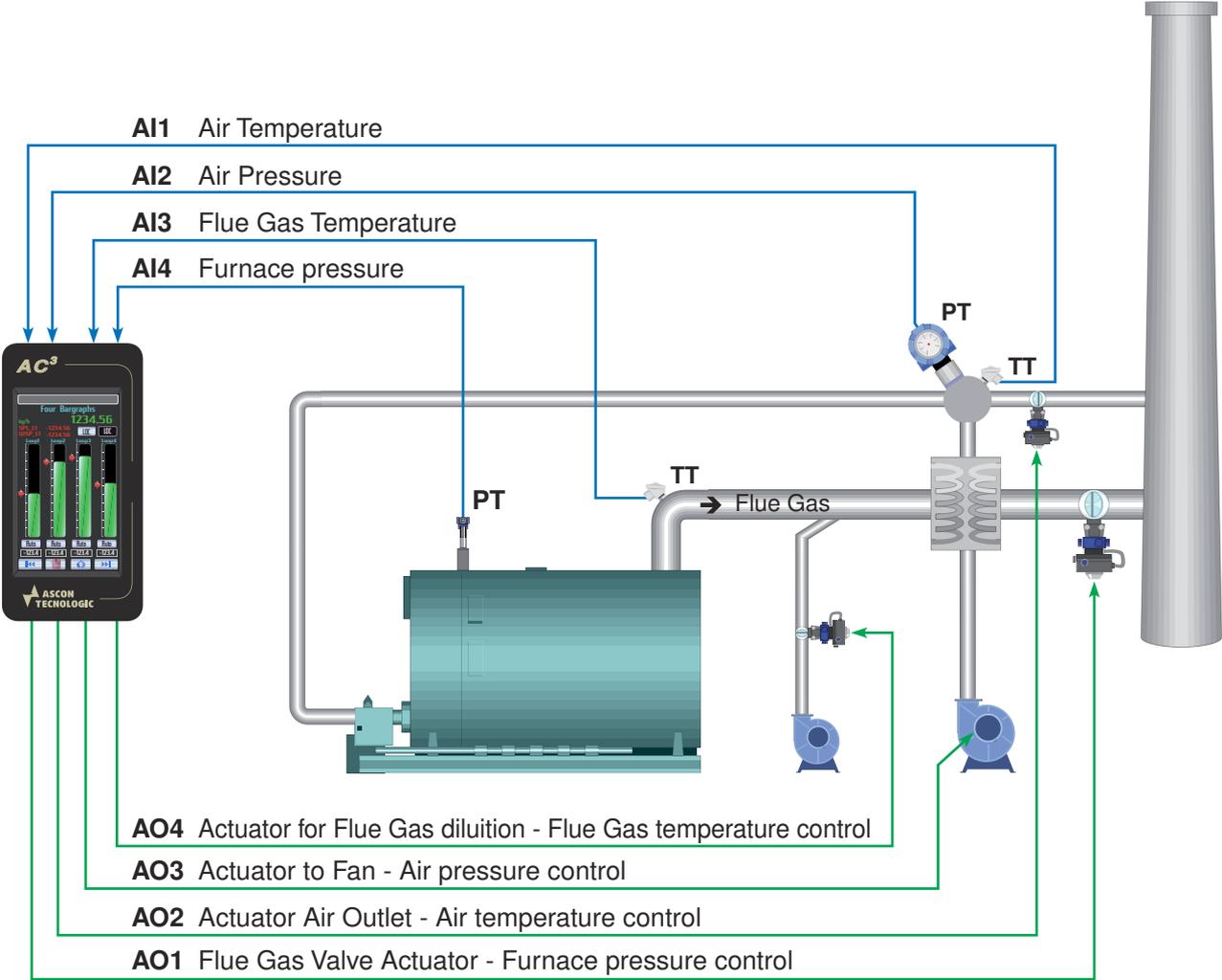
A-5-6 Signals I/O Table

I/O	Terminals	Type	Meaning
AI1	E1 +/F1 -	4... 20 mA	Loop1 Controlled Variable
AI2	E2 +/F2 -	4... 20 mA	Loop2 Controlled Variable
AI3	E3 +/F3 -	4... 20 mA	Loop3 Controlled Variable
AI4	E4 +/F4 -	4... 20 mA	Loop4 Controlled Variable
AI5	E5 +/F5 -	4... 20 mA	Not Used - Available
AI6	E6 +/F6 -	4... 20 mA	Not Used - Available
AI7	E8 +/F8 -	4... 20 mA	Not Used - Available
AI8	E10 +/F10 -	4... 20 mA	Not Used - Available
AO1	E11 +/F11 -	4... 20 mA	Loop1 Control Output
AO2	E12 +/F12 -	4... 20 mA	Loop2 Control Output
AO3	E13 +/F13 -	4... 20 mA	Loop3 Control Output
AO4	E14 +/F14 -	4... 20 mA	Loop4 Control Output
DI1	A2	NO Digital Input	Loop1 Control Output Hold
DI2	A3	NO Digital Input	Loop1 Control Output Tracking
DI3	A4	NO Digital Input	Loop2 Control Output Hold
DI4	A5	NO Digital Input	Loop2 Control Output Tracking
DI5	B2	NO Digital Input	Loop3 Control Output Hold
DI6	B3	NO Digital Input	Loop3 Control Output Tracking
DI7	B4	NO Digital Input	Loop4 Control Output Hold
DI8	B5	NO Digital Input	Loop4 Control Output Tracking
DO1	A6	NO Digital Output	Loop1 Alarm_1 Status
DO2	A7	NO Digital Output	Loop1 Alarm_2 Status
DO3	A8	NO Digital Output	Loop2 Alarm_3 Status
DO4	A9	NO Digital Output	Loop2 Alarm_4 Status
DO5	B6	NO Digital Output	Loop3 Alarm_5 Status
DO6	B7	NO Digital Output	Loop3 Alarm_6 Status
DO7	B8	NO Digital Output	Loop4 Alarm_7 Status
DO8	B9	NO Digital Output	Loop4 Alarm_8 Status