



- **PID controller with multiple control strategies**
 - single loop, feedforward, cascade, ratio, auto/manual station and analog backup controller
- **Three large LED displays with deviation bargraph**
 - clear and easy to follow display with color-coordinated function keys
- **Comprehensive input/output capabilities**
 - three analog inputs, two analog outputs, up to four relays and four digital inputs plus RS485 Modbus for total flexibility
- **Process security and plant safety**
 - loop break alarm, processor watchdog, password protection and intelligent power recovery
- **PC configuration for ease of setup**
 - access to advanced features and standard settings to reduce configuration time
- **Advanced cost-saving functions**
 - maths blocks, logic equations, real time alarms, custom linearizers and soft wiring
- **Unique Control Efficiency Monitor (CEM)**
 - two autotune algorithms plus manual fine tune using CEM for optimum performance
- **IP66/NEMA4X front face protection**
 - reliability in the harshest environments
- **Ramp/Soak profiling**
 - 30 segments and 9 profiles, setup via either the PC configurator or front face



C355 – advanced single loop controller in a short case, 1/4 DIN format



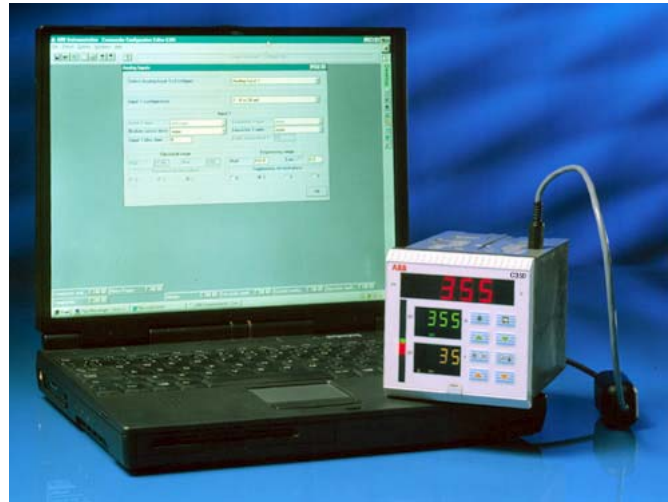
C355

The C355 Advanced Universal Process controller is a multi role unit with the capability of handling single loop, feedforward and cascade applications.

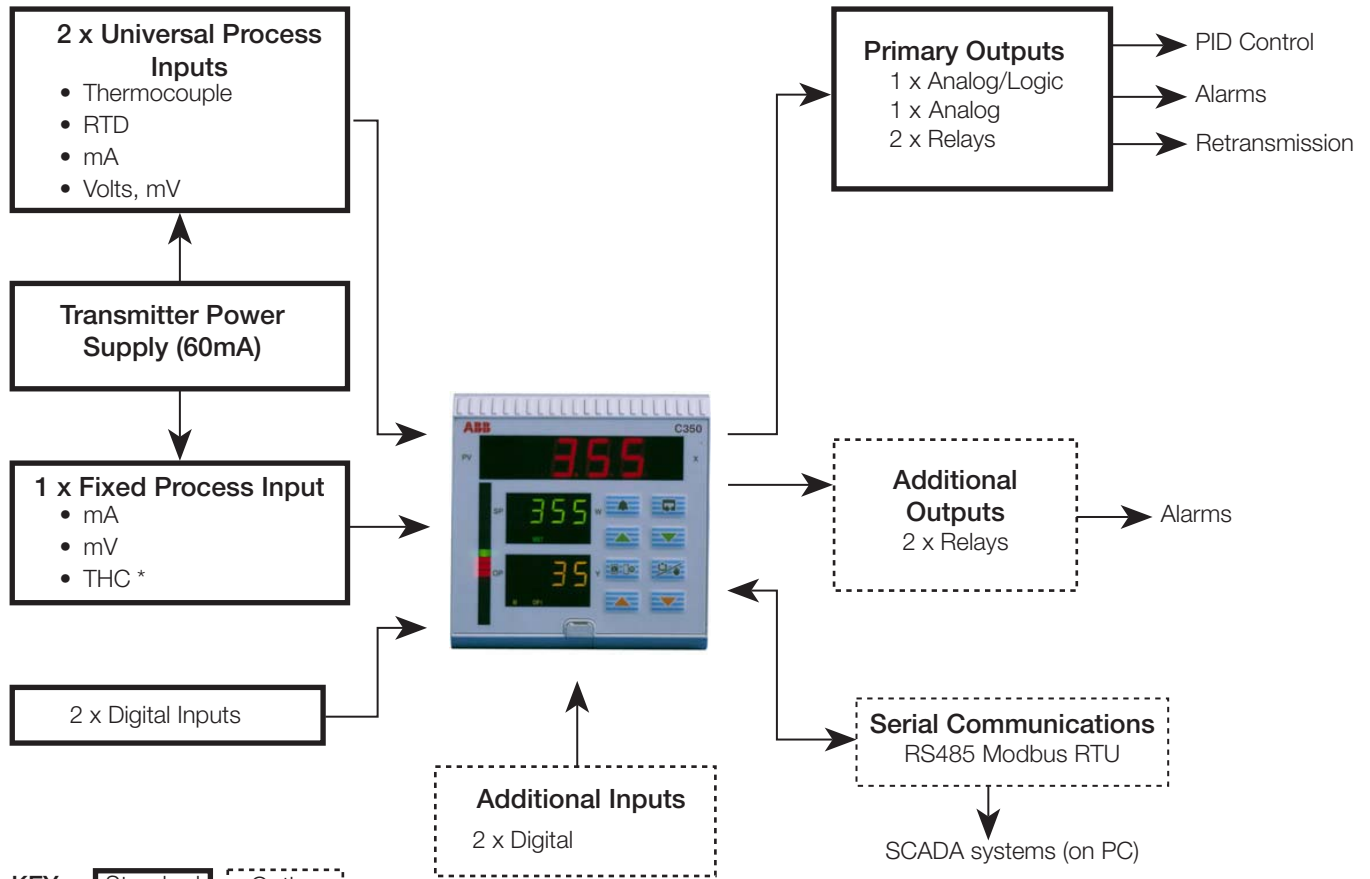
The C355 can be configured for complex applications such as three element boiler drum level, in minutes, by using the inbuilt library of application templates. This combined with the advanced autotune facility makes the C355 one of the easiest and fastest controllers to set up on the market. To make it even simpler configurations can also be edited and stored off-line using our Windows based PC Configurator software.

Analog, relay and logic control outputs are fitted as standard; plus three analog inputs with a built-in 2-wire transmitter power supply. With the option to add extra input/outputs for more complex applications, and Modbus serial communications for integration with factory automation systems.

IP66 (NEMA4X) front panel protection makes the C355 an extremely robust controller, suitable for use in a wide variety of industrial environments.



Process Connections



* Only if standard universal input is THC

Protecting Your Process

To keep your process stable and secure, the C355 has intelligent diagnostics and responses which can be used for process safety to initiate an action or to indicate a fault. A processor watchdog monitors the processor continuously; a unique loop-break alarm detects analog output failure; and there is an open circuit detector on the input. Using these signals, safety shutdown strategies can be initiated.

Advanced control features, including ramping set point, process start-up and output slew-rate, are all designed to provide you with a flexible controller that has built-in process protection as standard.

For configuration data security, there are three levels of password protection plus front panel function key lockouts, ensuring total process security.

Process Visibility and Operation

Three high-visibility, colored, digital displays show Process Variable, Set Point and Controller output simultaneously. A 21-segment deviation bargraph shows at-a-glance how close the controller is to the set point. For clarity, function keys are color coded to match their corresponding displays.

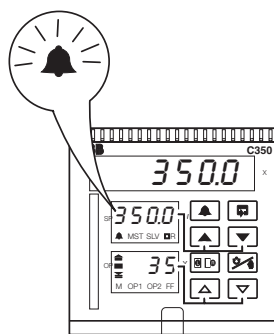
Eight individual tactile front panel keys make the controller very operator-friendly, with one-touch access to local/remote set point adjustment, alarm acknowledgment, auto/manual and output adjustment.

'Secret-til-lit' LED indicators display controller modes and alarm status, and provide extensive controller and plant diagnostics.

Process Alarms

The C355 has eight internal process alarms. These can be soft-wired to control strategies, logic equations and output relays.

Each alarm can have a separate hysteresis value, programmable in engineering units or time. Alarms can also be enabled or disabled via digital inputs and can be configured as annunciators, so the alarm may be disabled once acknowledged.



Maths and Soft -Wiring

Four individual math blocks, each with up to 7 operators and operands, provide functions such as average, maximum and minimum calculations. Square root, relative humidity and arithmetic functions are also included as standard. Inputs can be selected or switched in and out of calculations by digital signals. This allows both simple and advanced calculations to be processed and these can be soft-wired to control functions.

Dedicated Ramp/Soak Display

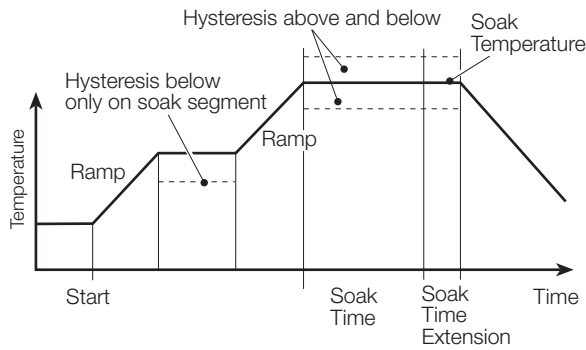
Status LEDs give a clear indication of the profile progress, showing whether a ramp or soak is being performed.

A dedicated display indicates the segment which is currently running and time remaining, together with the standard controller display, which shows the current set point and actual process value.

The profile can be Run/Hold or Stopped via the dedicated switches on the front face, by external digital inputs or Modbus.

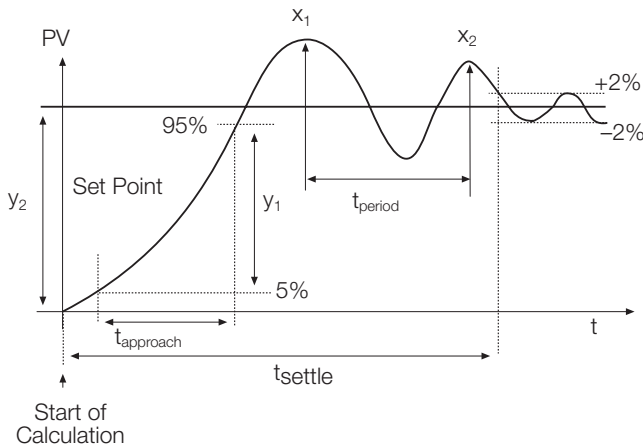
Guaranteed Ramp/Soak

This feature has been designed to make operation as flexible as possible. There are two hysteresis settings; one applicable to soak segments, the other to ramp segments.



Control Efficiency Monitor (CEM)

CEM measurements are designed to help you fine-tune your process manually. Six key-performance parameters are measured and displayed, allowing you to vary your PID settings to match the process needs and measure the results of your investment.



Configuration and Start Up Made Easy

The C355 has been designed to minimize your configuration and commissioning time, as you need only enter values that relate to your process. Application templates, offering preconfigured customized control strategies, allow rapid setup of the controller. Templates are selected via the PC configurator or the front panel keys. Alternatively the unit may be supplied preconfigured. Once a template is selected only three key settings are required and the controller is ready-to-run.

Complete configurations can be created, edited and stored off-line, using the PC Configurator. A dedicated cable connects the PC to a jack socket on the top of the controller for rapid upload, or download, of configurations. Copies of the configurations can be saved and produced as hard copy.

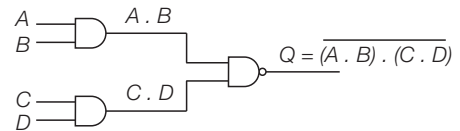
A dual mode, intelligent autotune requires no prior knowledge of PID settings and offers a choice of either fast response or minimum overshoot strategies.

Custom Linearizer

The C355 has two separate 15-breakpoint linearizers which can be programmed via the PC configurator and applied to either inputs or outputs. These can be used for nonstandard thermocouples, nonlinear tank levels or any nonlinear input. The output linearizer accommodates any nonlinear control elements.

Sequencing and Logic Control

The C355 offers comprehensive sequencing, to complement its advanced analog control features, and six logic equations, with up to fifteen elements per equation. These six logic equations, when combined with delay timers, real-time alarms and extensive I/O, make the C355 a powerful interlocking controller.



Intelligent Adjustable Power Recovery

Two forms of plant power failure recovery are available programmable between 0 and 9999s for recovery time:

'HOT' Restart – if the power is restored within the recovery time the C355 defaults to Auto mode, allowing the process to be up-and-running without delay.

'COLD' Restart – if the power is not restored within the preset recovery time, the controller defaults to Manual mode, or a predetermined control output. This ensures that after power failure the controller does not start to control the process without operator acknowledgment.

Industrial Robust Design

The front face has been designed to meet IP66/NEMA4X rating with a unique moulded case and panel seal. A chemical resistant polyester front panel makes a secure investment for any environment.

Customized Application Templates

A 'Template' is a preconfigured control strategy to match a particular application requirement. This presets the display and inputs of the controller and only the control action strategy needs to be entered. Templates can be varied from the standard configuration, if required, using our Windows-based PC Configurator software.

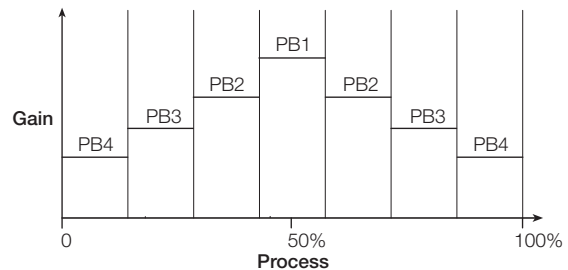
Configuration time is greatly reduced as 90% of the choices you would normally need to make in similar products are already preconfigured.

The C355 offers the following templates:

- 1 Single loop controller with local set point
- 2 Single loop controller with remote set point
- 3 Auto Manual station (low signal detection)
- 4 Auto Manual station (digital signal selection)
- 5 Analog Backup station (low signal detection)
- 6 Analog Backup station (digital signal selection)
- 7 Single Indicator/manual loader station
- 8 Dual Indicator/manual loader station
- 9 Single loop with feedforward
- 10 Single loop with feedforward and remote set point
- 11 Cascade
- 12 Cascade with remote set point
- 13 Cascade with feedforward
- 14 Ratio controller
- 15 Ratio controller with external ratio
- 16 Ratio station
- 17 Ratio station with external ratio

Gain Scheduling

To optimize your process control, and the response of the C355, four independent PI terms are available. This eliminates the need to manipulate variables as a result of process conditions and loads. These are selectable via internal process alarms or digital inputs. This ensures tighter control and better response action at a specific set point.

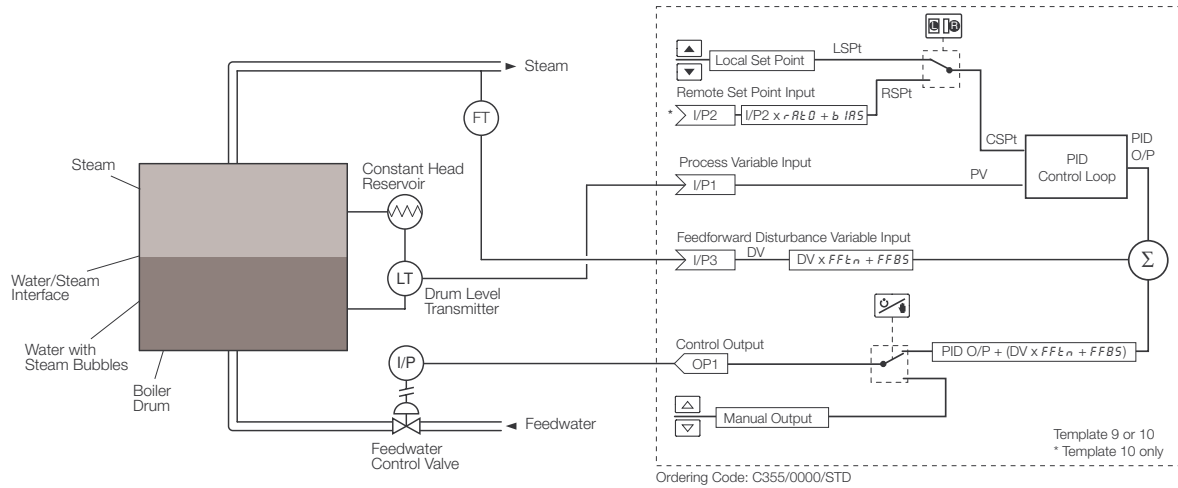


Template Examples

Boiler drum level control is a good example of the power and flexibility of the C355 Controller. Single element control may be adequate for slow changing steam demand or small boilers where, in steady state conditions, the feedwater flow always equals steam flow. However, because of the low time constants and varying dynamic response in high demand boilers, other control strategies may need to be considered for regulation of the feed water to the drum. The C355 offers you these alternative control strategies, and many more, in preconfigured templates.

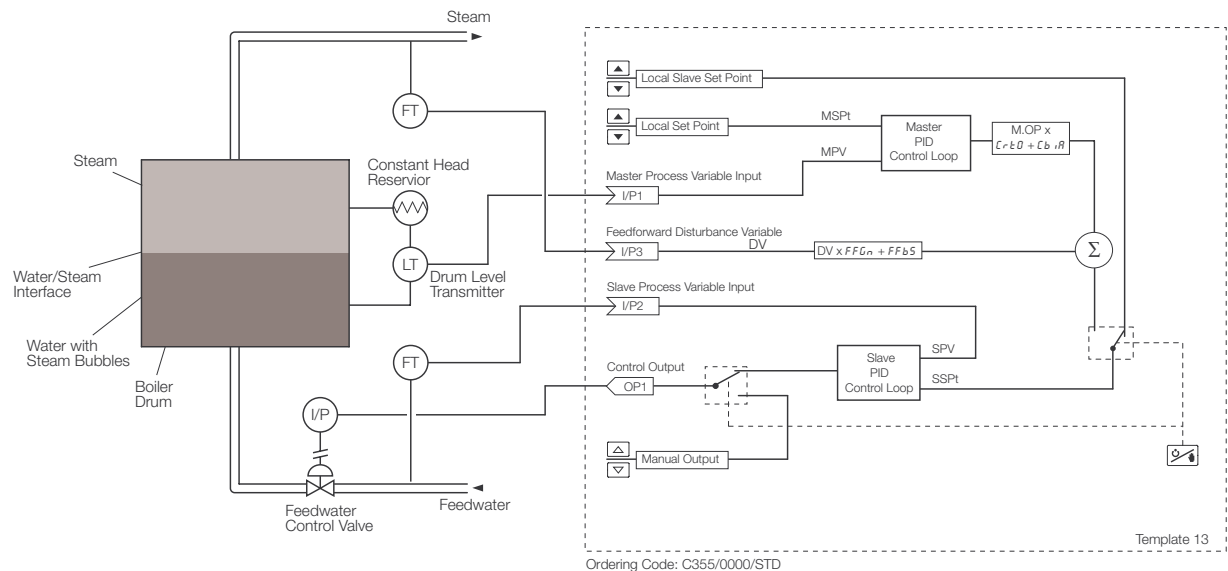
Single Loop with Feedforward – Two-element Boiler Drum

Two variables (steam flow and drum level) influence the feedwater valve position, giving tight control on steady state conditions and manipulation of the feedwater to equal any changes in steam demand.



Cascade with Feedforward – Three-element Boiler Drum

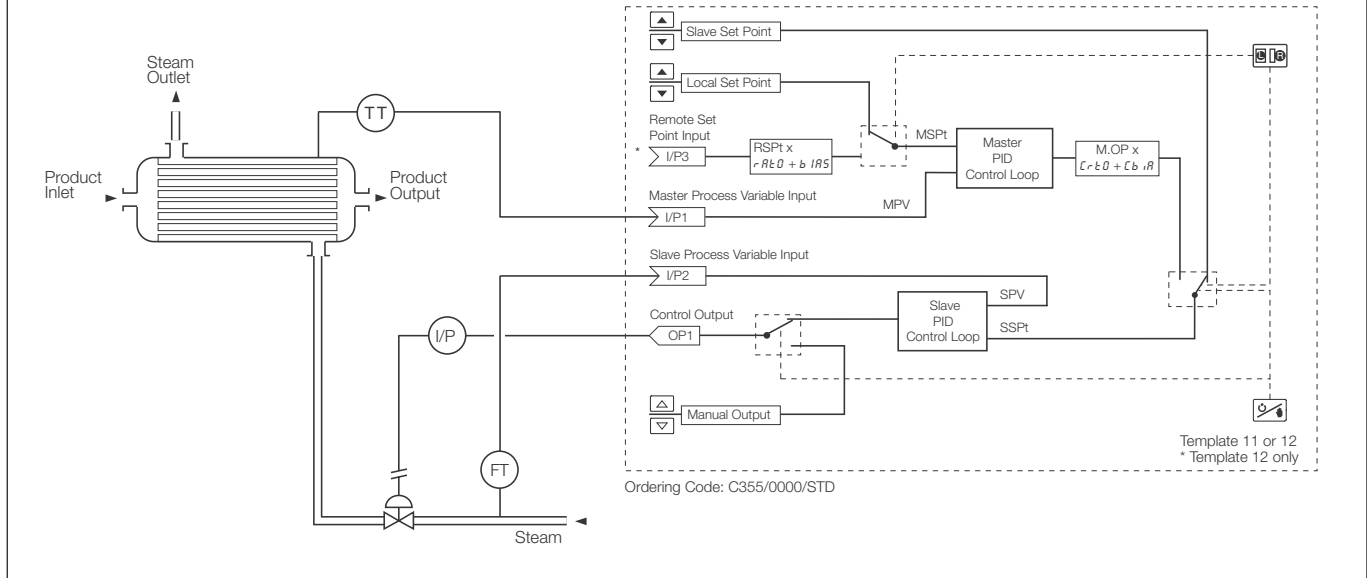
All three variables (steam flow, feedwater flow and drum level) influence the feedwater valve position, giving tight control on steady state conditions and providing control on both variations in steam demand and feedwater supply flow rates.



...Template Examples

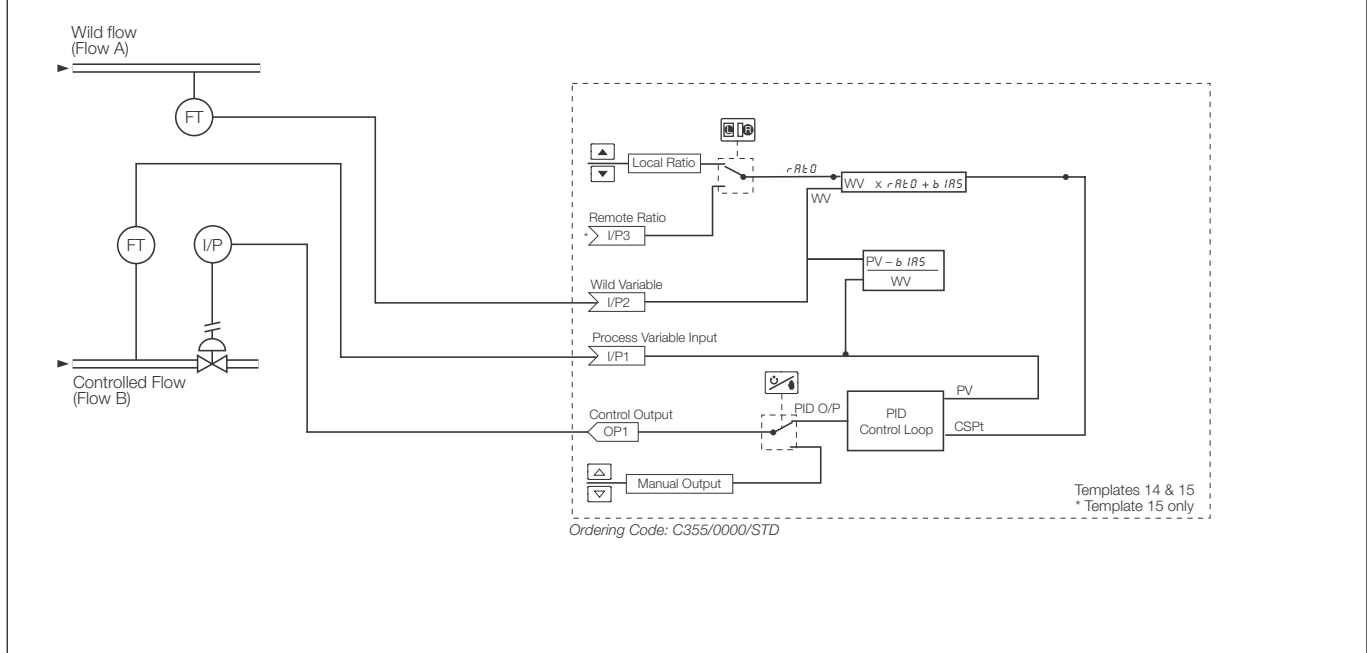
Cascade

By constantly monitoring the steam flow through the valve, any deviation in steam supply will be compensated for by the slave loop, giving tighter control of the process temperature.



Ratio Controller – Mixers

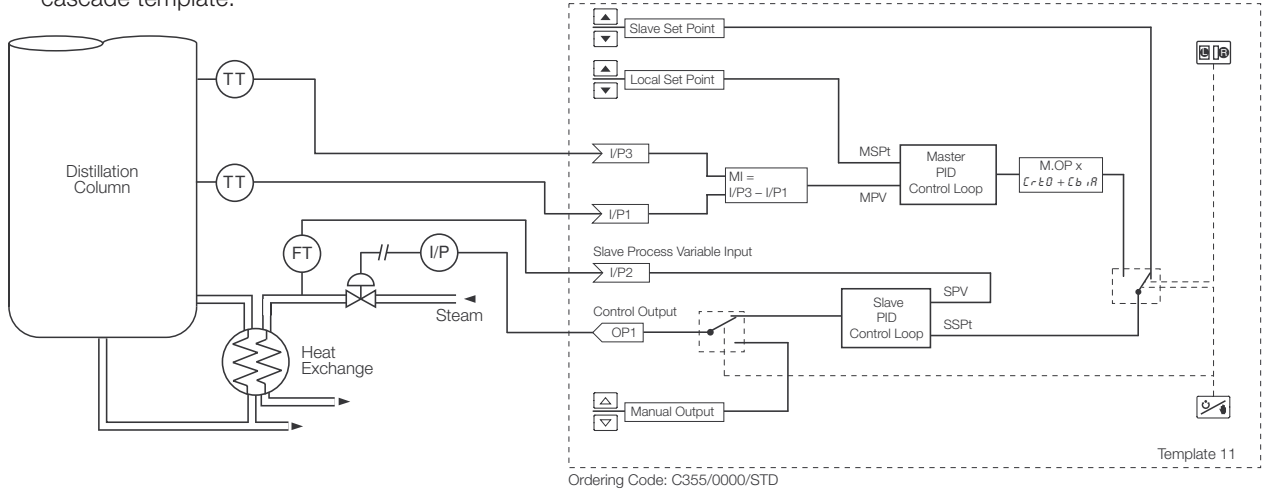
Ratio Control is a technique in which the ratio between two process variables is constantly controlled. It is often applied to control of flow in blending systems, where as displayed below, a controllable flow is maintained in constant proportion to the wild flow or uncontrolled stream.



Temperature Control by Differential

In some industrial processes, such as distillation columns, when controlling the separation of two products, measurement of one product temperature may be inadequate. Controlling by two temperatures, or temperature difference, can be a better solution. The C355 offers a math block that allows you to either average these two inputs or calculate the differential and have the result become the Process Variable input into the controller.

This example shows a differential temperature being used as the process variable input to a master controller in a cascade template.

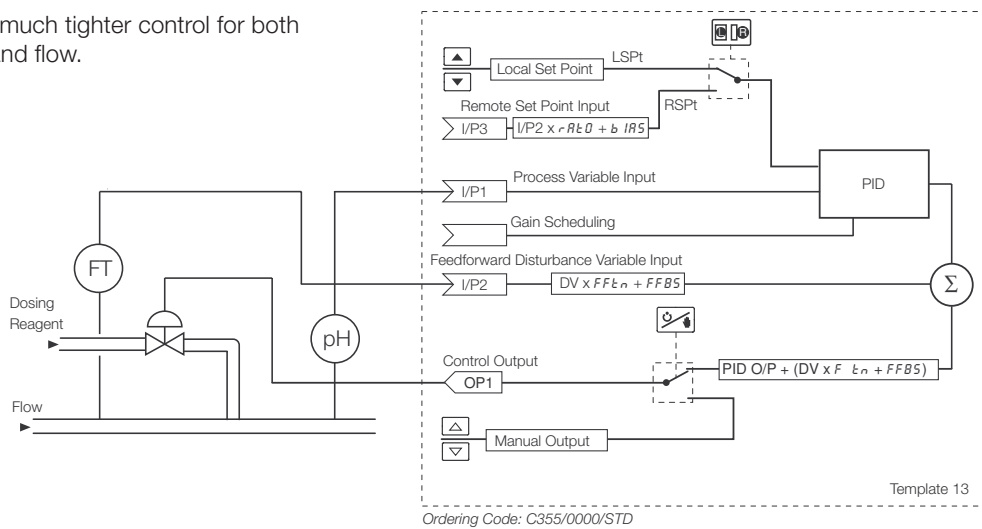


pH Neutralization – Feedforward/Gain Scheduling

pH is an example of a difficult process to control, especially when the flow also varies. There are two basic problems: pH has a logarithmic characteristic i.e. the ratio of acid/base reagent required to neutralize is not linear compared to the pH range; also, if you are dosing into a free flowing pipe the amount of dosing reagent also varies, dependent on the flow.

To control accurately under these conditions you need a switchable gain to vary dependent on the pH value you want to control to. The gain factor drops by a factor of 10 per pH unit of neutrality. Therefore a low gain is required near a pH value of 7 and high gain at a higher or lower pH value. To correct for the changing flow rate a feedforward signal can be taken into the C355 and used to correct the final control element.

This gives a much tighter control for both varying pH and flow.



Specification

Summary

17 application templates: Single loop, Cascade, Feedforward, Ratio, Auto/Manual

Two Autotune options

Control Efficiency Monitor (CEM)

30 segments, 9 profiles

PC configuration

IP66/NEMA4X front face

Operation

Display

1 x 4-digit, 14 mm (Red) LED, process variable

1 x 4-digit, 8 mm (Green) LED, set point

1 x 3-digit, 8 mm (Yellow) LED, output

1 x 21-segment deviation bargraph

Configuration

Basic configuration via front panel keys or PC

Advanced feature configuration by PC

Security

Password-protected menus

Standard Functions

Control Strategies

Single-loop, Auto/manual Station, Analog Backup, Indicator/Manual Loader, Cascade, Feedforward, Ratio

Output Types

Current proportioning, Time proportioning, On/off, Motorized valve (with and without feedback), Heat/cool.

Control Parameters

Four sets of PI settings, selectable via digital signals

Set Points

Local, remote and four local fixed set points, selectable via digital signals

30 segments, 9 profiles

Configured Outputs

Three preset output values, selectable via digital signals

Autotune

On demand for 1/4 wave or minimal overshoot

Process Alarms

Number 8

Types High/low process,
High/low output,
High/low deviation

Hysteresis Level and time *

Alarm enable/disable Enable/disable of alarms via digital signal

Real Time Alarms *

Number 2

Programmable On time/day and duration

* Accessed via PC Configurator

Analog Inputs

Universal Process Inputs

Number

2 standard

Type

Universally configurable to provide:

Thermocouple (THC)

Resistance thermometer (RTD)

mV

Volts

mA

Resistance

Non-universal Process Input

Number

1 standard

Types

mV (THC only if I/P1 is also THC)

mA

Analog Inputs – Common

Linearizer Functions

THC types B, E, J, K, L, N, R, S, T, PT100, $\sqrt{\quad}$, $3/2$, $5/2$

Input Impedance

mA 100 Ω
mV, V 10M Ω

Broken Sensor Protection

Programmable for upscale or downscale drive

Sample Interval

125ms (1 input)

Digital filter

Programmable

Cold Junction Compensation

Automatic CJC incorporated as standard

Stability 0.05°C/°C (0.05°F/°F) change in ambient temperature

Input Protection

Common mode rejection >120dB at 50/60Hz with 300 Ω imbalance resistance
Series mode rejection >60dB at 50/60Hz

Transmitter Power Supply

Voltage 24V DC nominal
Drive Up to 60mA, (3 loops)

EMC

Emissions

Meets requirements of EN50081-2

Immunity

Meets requirements of EN50082-2

Design & manufacturing standards

CSA/UL General Safety
Satisfies the requirements of –
CAN/CSA C22.2 No. 1010.1-1-92 Standard
CAN/CSA C22.2 No. 1010.1-B97
UL Standard 3121-1
FM General Safety Pending

Outputs

Control/Retransmission Outputs

Number 2 standard
Type 1 x Programmable as analog or logic (digital) output
1 x analog only
Isolation Galvanically isolated from the rest of the circuitry
Analog range 0 and 20mA (programmable), max. 750 Ω
accuracy 0.25%
Digital voltage 17V @ 20mA

Relay Outputs

Number 2 standard,
Type SPCO, rated 5A at 115/230V AC

Digital Inputs

Number 2 standard,
Type Volt-free
Minimum pulse 200ms

Advanced Features

Maths Blocks *

Number 4
Operators +, -, x, /, Average, Maximum, Minimum, High select, Low select, $\sqrt{\quad}$, Median select, Relative Humidity Input multiplexer (digitally selected)

Delay Timers *

Number 2
Programmable Delay and Duration in seconds

Logic Equations *

Number 6
Elements 15 per equation
Operators OR, AND, NOR, NAND, NOT, EXOR

Custom Linearizers *

Number 2
Breakpoints 15 per linearizer

* Accessed via PC Configurator

Options

Relay Outputs

Number	2
Type	SPST, rated 5A at 115/230V AC

Digital Inputs

Number	2
Type	Volt-free
Minimum pulse	200ms

Serial Communications

Connections	RS485, 2- or 4-wire
Protocol	Modbus RTU
Isolation	Galvanically isolated from the rest of the circuitry

Environmental

Operating Limits

0° to 55°C (32° to 130°F)
5 to 95%RH (non-condensing)

Temperature stability

<0.02%/°C or 2μV/°C (<0.011%/°F or 1.11μV/°F)
Long term drift <0.02% of reading or 20μV annually

Front face

NEMA4X (IP66)

Physical

Size

96 x 96 x 122.5mm (3.78 in. x 3.78 in. x 4.82 in.)

Weight

680g (1.5lb)

Electrical

Voltage

85 min. to 265 V max. AC 50/60Hz
24V DC

Power consumption

15VA max.

Power interruption protection

Up to 60ms

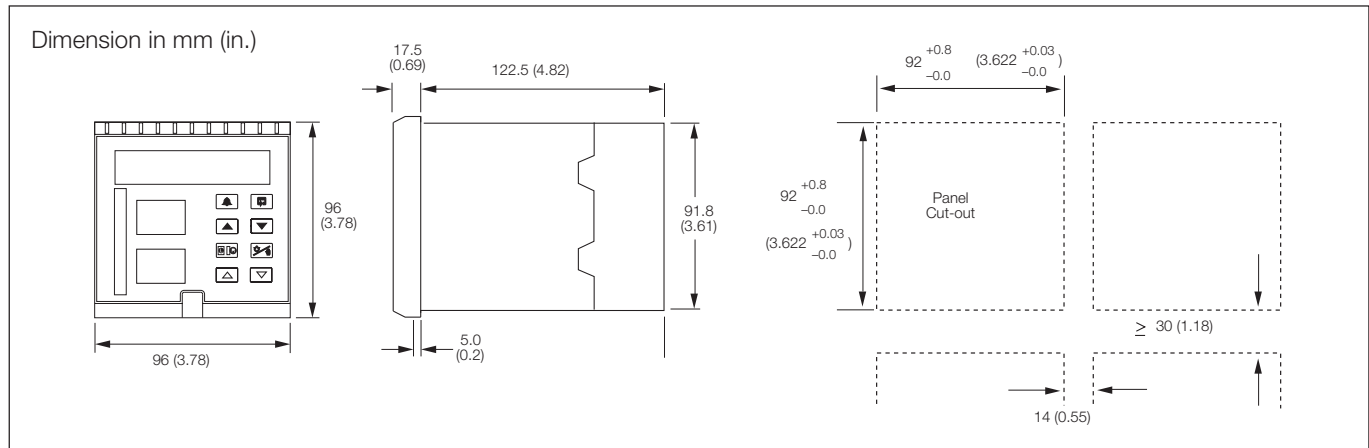
Safety

General safety EN 61010-1

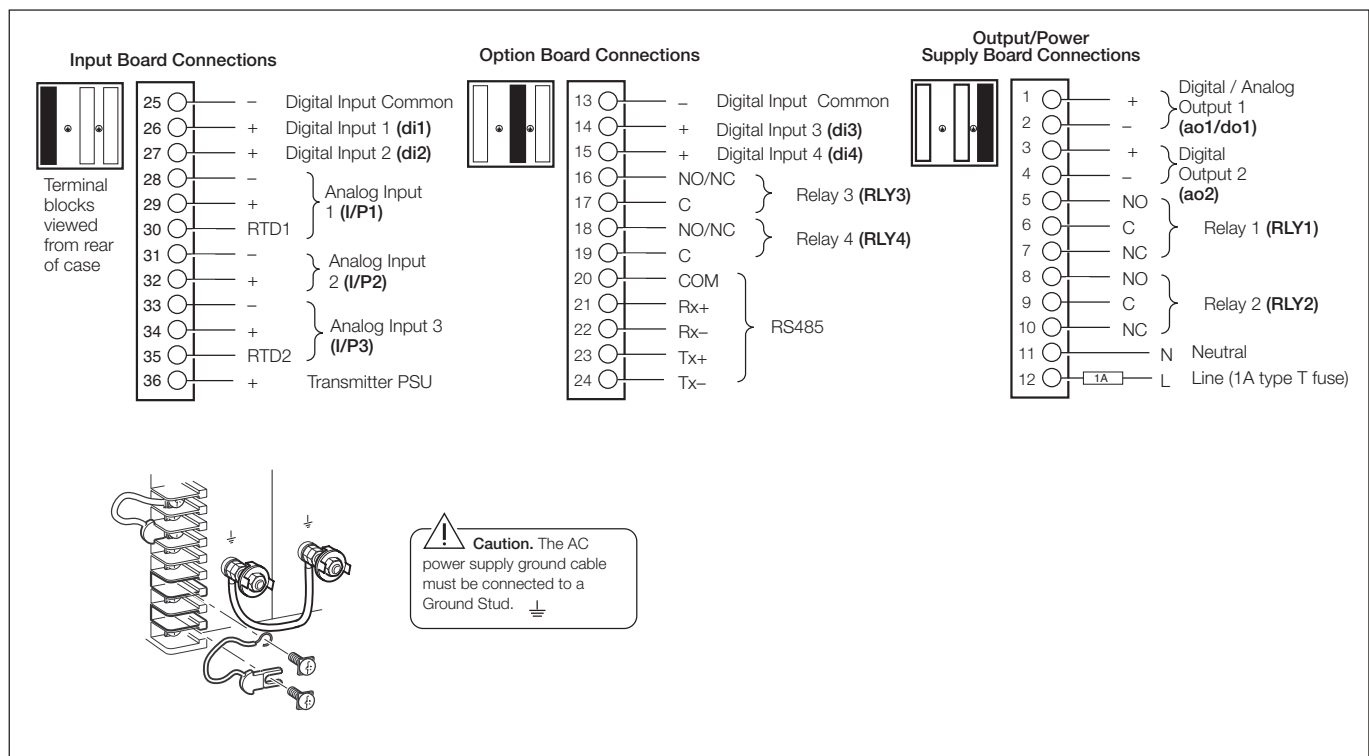
Isolation

All inputs/outputs to earth: 500V DC
Analog/Digital output 1 to rest of the circuitry:
500V DC for 1 minute
Analog/Digital output 2 to rest of the circuitry:
500V DC for 1 minute
Serial communications to rest of the circuitry:
500V DC for 1 minute

Overall Dimensions



Electrical Connections



Ordering Information

C355 1/4 DIN Advanced Process Controller	C355 /	X X	X	X /	X X X X
Option Board					
None		0 0			
2 digital inputs + 2 relays		0 1			
2 digital inputs + 2 relays + RS485 Modbus		0 2			
Power Supply					
85 V min. to 265 V max. AC			0		
24 V DC			1		
Build					
ABB Standard			0		
CSA approval			1		
UL approval			2		
Programming/Special Features					
Configured to factory standard				S	T D
Configured to customer requirements				C	U S
Special features				S	P X X

Accessories

PC Configurator Kit (part no.C100/0700)

Licensing, Trademarks and Copyrights

Modbus™ is a trademark of Modicon, Inc.

Windows™ is a trademark of the Microsoft Corp.

ABB has Sales & Customer Support
expertise in over 100 countries worldwide

www.abb.com

The Company's policy is one of continuous product
improvement and the right is reserved to modify the
information contained herein without notice.

Printed in UK (11.04)

© ABB 2004



ABB Limited
Howard Road, St Neots
Cambridgeshire
PE19 8EU
UK
Tel: +44 (0)1480 475321
Fax: +44 (0)1480 217948

ABB Inc.
125 E. County Line Road
Warminster
PA 18974
USA
Tel: +1 215 674 6000
Fax: +1 215 674 7183