

Specification DataFile

- **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



COMMANDER 355 – advanced single loop controller in a short case, 1/4 DIN format

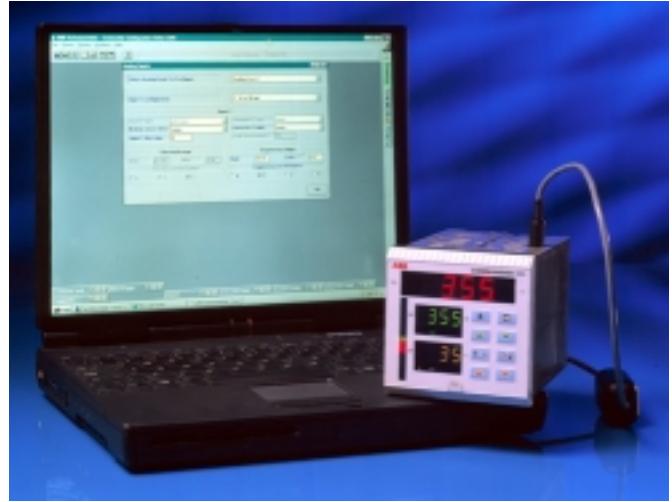
COMMANDER 355

The **COMMANDER 355** Advanced Universal Process controller is a multi role unit with the capability of handling single loop, feedforward and cascade applications.

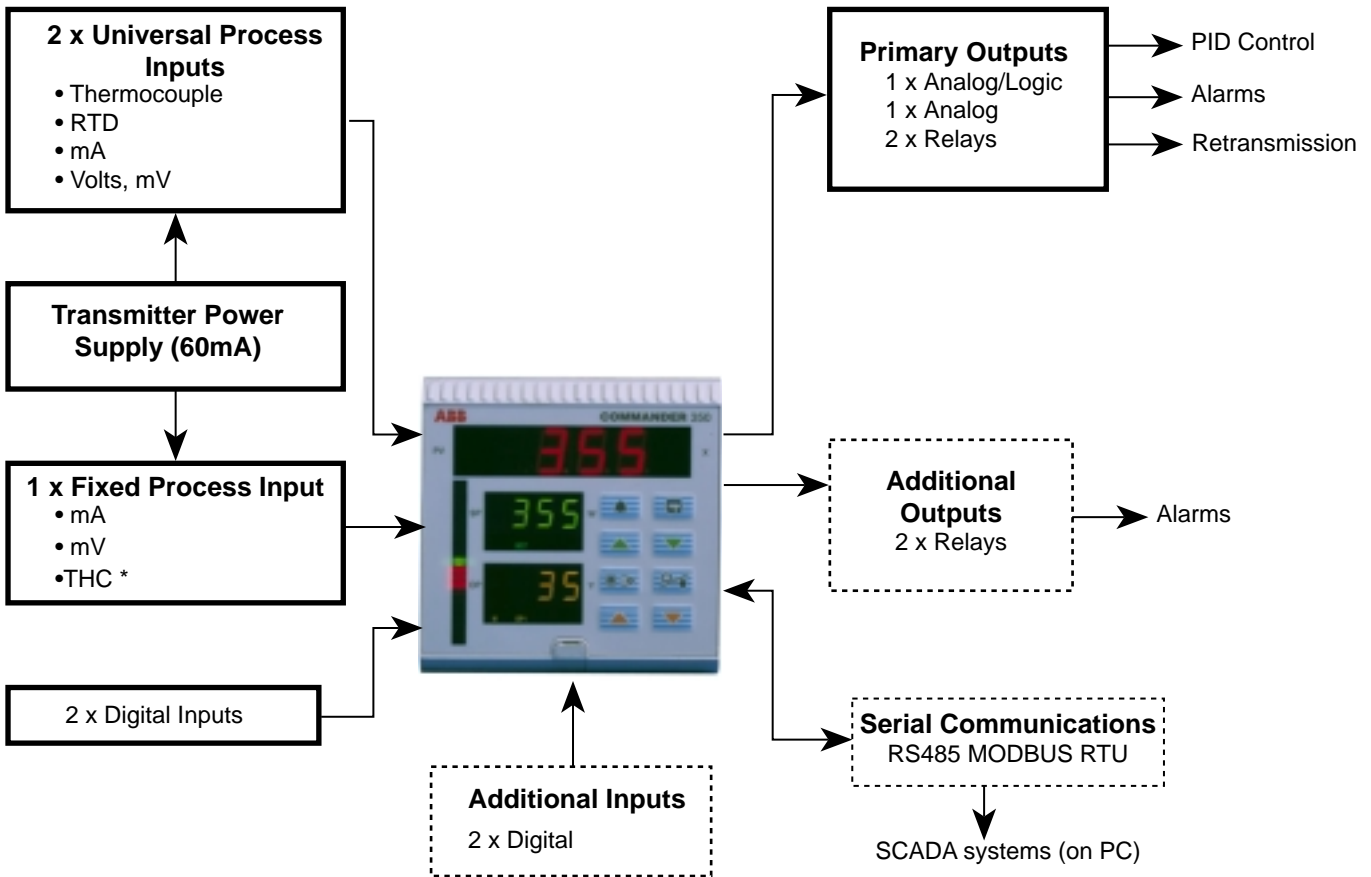
The C355 can be configured for complex applications such as three element boiler drum level, in minutes, by using the inbuilt library of **application templates**. This combined with the advanced autotune facility makes the C355 one of the easiest and fastest controllers to set up on the market. To make 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 COMMANDER 355 an extremely robust controller, suitable for use in a wide variety of industrial environments.



Process Connections



KEY: Standard Option

* Only if standard universal input is THC

Protecting Your Process

To keep your process stable and secure, the COMMANDER 355 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.

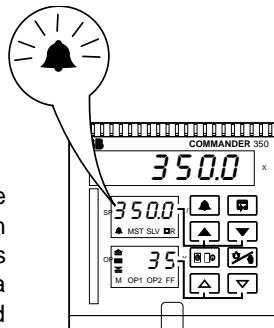
Eight individual tactile front panel keys make the controller very operator-friendly, with one-touch access to local/remote set point adjustment, alarm acknowledgment, auto/manual and output adjustment.

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

Process Alarms

The COMMANDER 355 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.

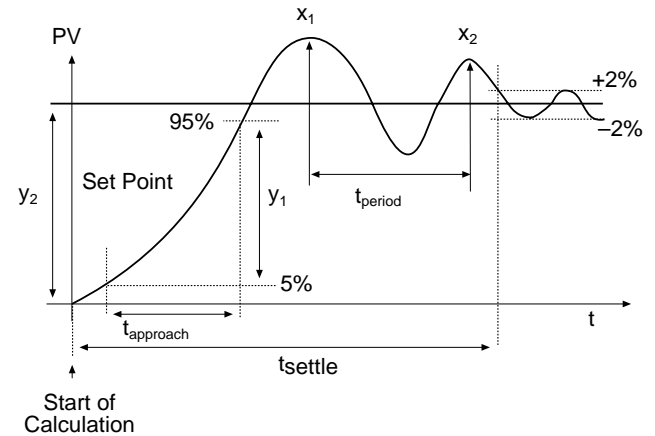


Maths and Soft-Wiring

Four individual math blocks, each having 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.

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.

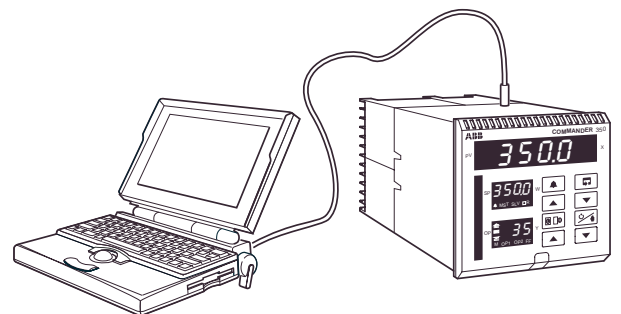


Configuration and Start Up Made Easy

The COMMANDER 355 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 COMMANDER 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.

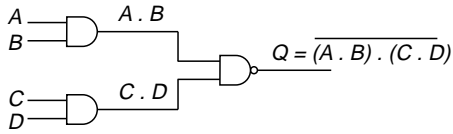


Custom Linearizer

The COMMANDER 355 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 COMMANDER 355 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 COMMANDER 355 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 COMMANDER 355 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.

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 COMMANDER 355 offers the following templates:

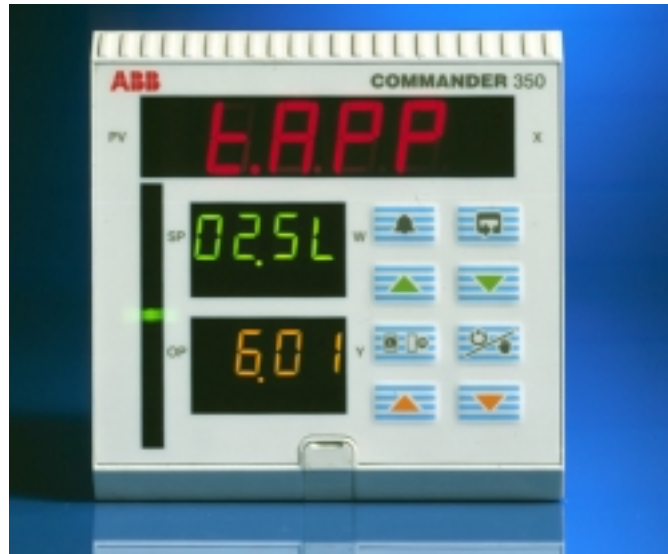
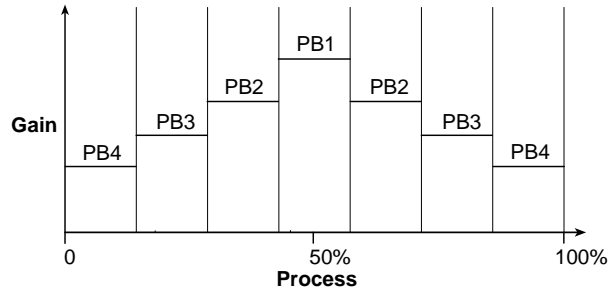
- 1 Single loop controller with local set point
- 2 Single loop controller with remote set point
- 3 Auto Manual station (low signal detection)
- 4 Auto Manual station (digital signal selection)
- 5 Analog Backup station (low signal detection)
- 6 Analog Backup station (digital signal selection)
- 7 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

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.

Gain Scheduling

To optimize your process control, and the response of the COMMANDER 355, 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.

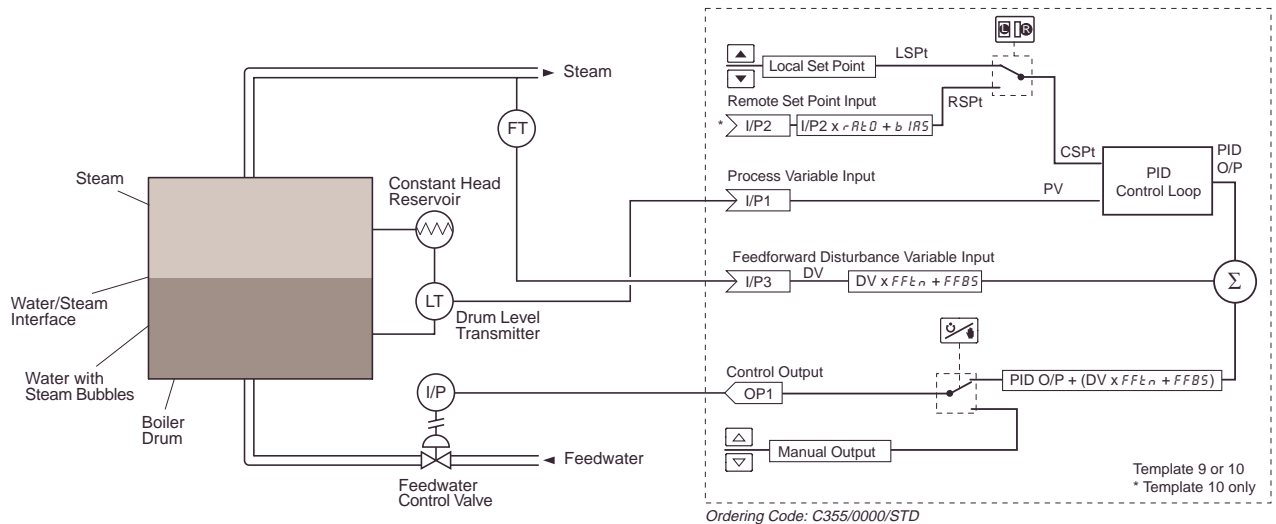


Template Examples

Boiler drum level control is a good example of the power and flexibility of the COMMANDER 355 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 feedwater to the drum. The COMMANDER 355 offers you these alternative control strategies, and many more, in preconfigured templates.

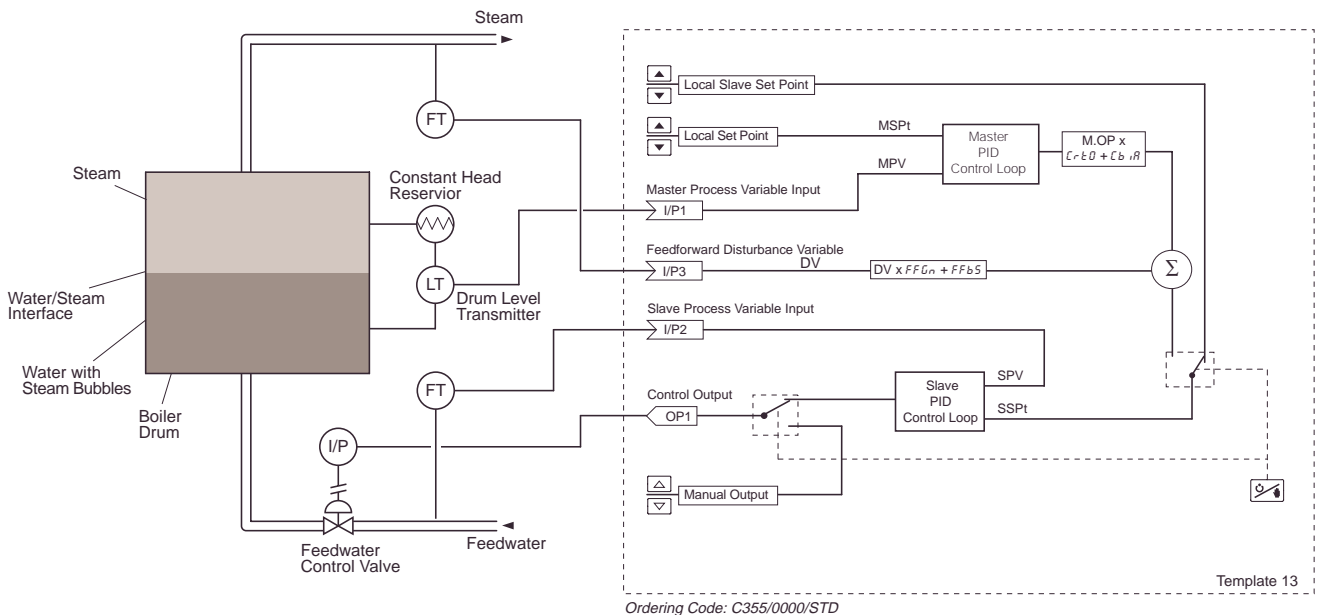
Single Loop with Feedforward – Two-element Boiler Drum

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.



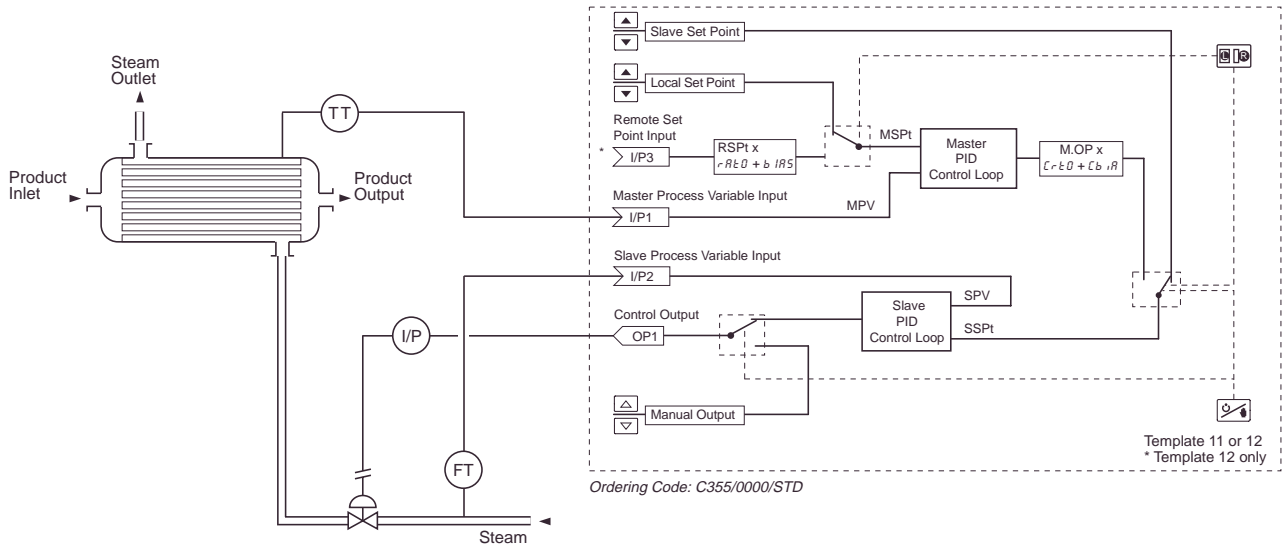
Cascade with Feedforward – Three-element Boiler Drum

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.



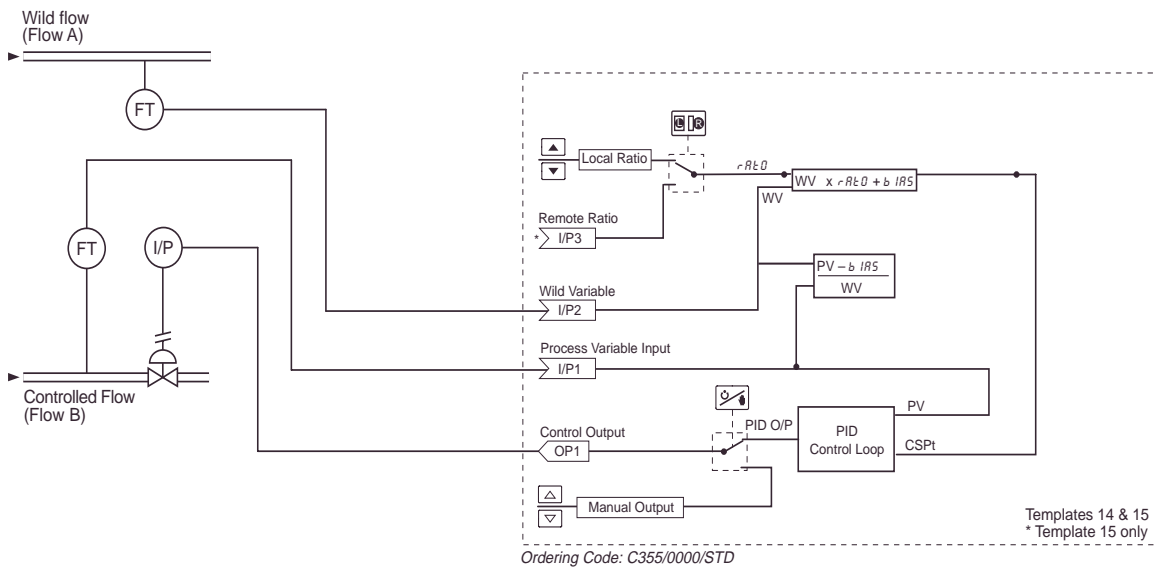
Cascade Control – Heat Exchangers

A heat exchanger is used to heat, or cool, a process fluid to a desired temperature by another stream. In this cascade example the output of the master loop (temperature) manipulates the set point of the slave loop (flow). The purpose of cascade control is to eliminate the effects of feed or product disturbances and improve dynamic performance of the control loop. Ideally the slave loop should be a considerably faster response loop than the master.



Ratio Controller – Mixers

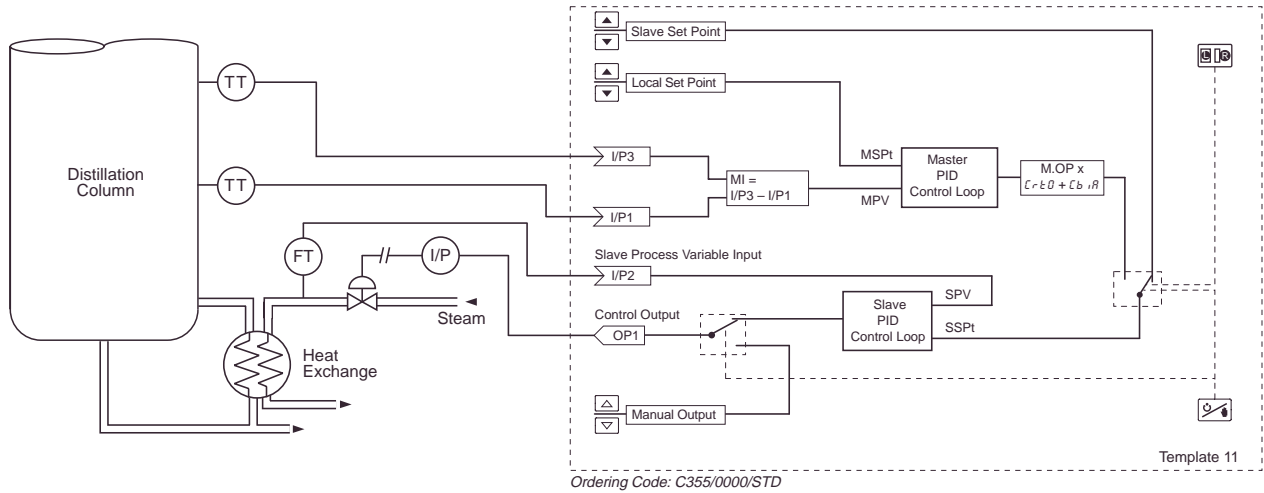
Ratio Control is a technique in which the ratio between two process variables is constantly controlled. It is often applied to control of flow in blending systems, where as displayed below, a controllable flow is maintained in constant proportion to the wild flow or uncontrolled stream.



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 COMMANDER 355 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.

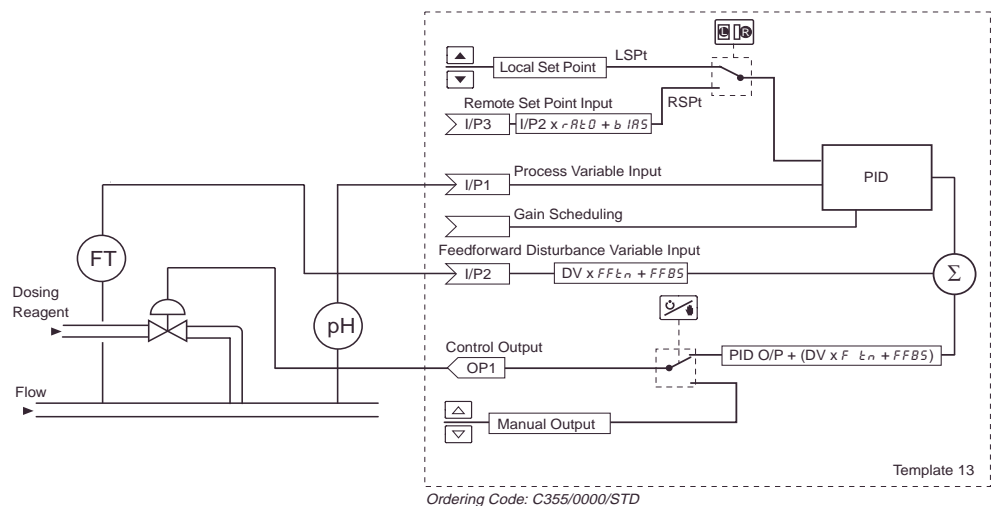


pH Neutralization – Feedforward/Gain Scheduling

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 C505 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)
- 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

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: | 24Vd.c. nominal |
| Drive: | Up to 60mA, (3 loops) |

EMC

Emissions

- Meets requirements of EN50081-2

Immunity

- Meets requirements of EN50082-2

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. 750Ω accuracy: 0.25%
Digital voltage	17V @ 20mA

Relay Outputs

Number	2 standard,
Type	SPCO, rated 5A at 115/230V a.c.

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, √, 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

Standard Analog Input Ranges

Thermocouple	Maximum Range °C	Maximum Range °F	Accuracy (% of reading)
B	-18 to 1800	0 to 3270	0.1% or ±1°C (1.8°F) [above 200°C (392°F)]
E	-100 to 900	-140 to 1650	0.1% or ±0.5°C (0.9°F)
J	-100 to 900	-140 to 1650	0.1% or ±0.5°C (0.9°F)
K	-100 to 1300	-140 to 2350	0.1% or ±0.5°C (0.9°F)
L	-100 to 900	-140 to 1650	0.1% or ±1.5°C (2.7°F)
N	-200 to 1300	-325 to 2350	0.1% or ±0.5°C (0.9°F)
R	-18 to 1700	0 to 3000	0.1% or ±0.5°C (0.9°F) [above 300°C (540°F)]
S	-18 to 1700	0 to 3000	0.1% or ±0.5°C (0.9°F) [above 200°C(392°F)]
T	-250 to 300	-400 to 550	0.1% or ±0.5°C (0.9°F)

RTD	Maximum Range °C	Maximum Range °F	Accuracy (% of reading)
PT100	-200 to 600	-325 to 1100	0.1% or ±0.5°C (0.9°F)

Linear Inputs	Range	Accuracy (% of reading)
Millivolts	0 to 500 mV	0.1% or ±10µA
Milliamps	0 to 50 mA	0.2% or ±2µA
Volts	0 to 5V	0.2% or ±2mV
Resistance	0 to 5000Ω	0.2% or ±0.08Ω

Notes.

Performance accuracy is not guaranteed at extreme low end of thermocouple and sq. root ranges.
RTD, 3-wire platinum, 100Ω per DIN 43760 standard (IEC751), with range of 0 to 400Ω.

Min. span below zero

THC standards
RTD standards

Type T 70°C/126°F
Type N 105°C/189°F
DIN 43710 IEC 584
DIN 43760 IEC 751

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 to 265V a.c. 50/60Hz
24V d.c.

Power consumption

<10VA

Power interruption protection

Up to 60ms

Safety

General safety EN 61010-1

Isolation

All inputs/outputs to earth: 500V d.c.
Analog/digital output 1 to rest of the circuitry:
500V d.c. for 1 minute
Analog/digital output 2 to rest of the circuitry:
500V d.c. for 1 minute
Serial communications to rest of the circuitry:
500V d.c. for 1 minute

Environmental

Operating Limits

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

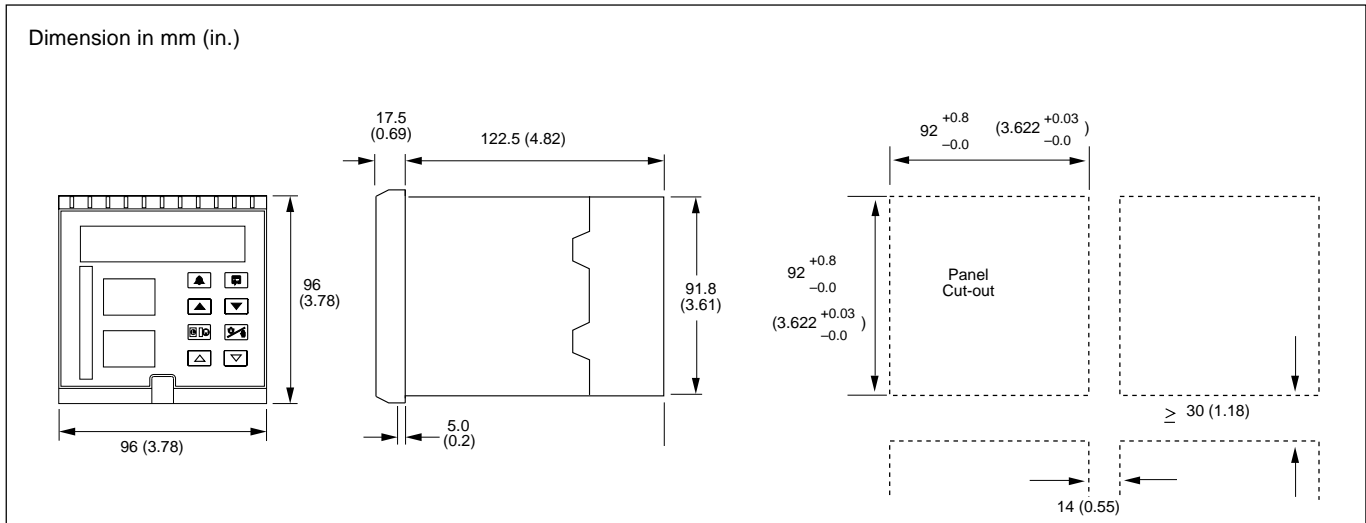
Temperature stability

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

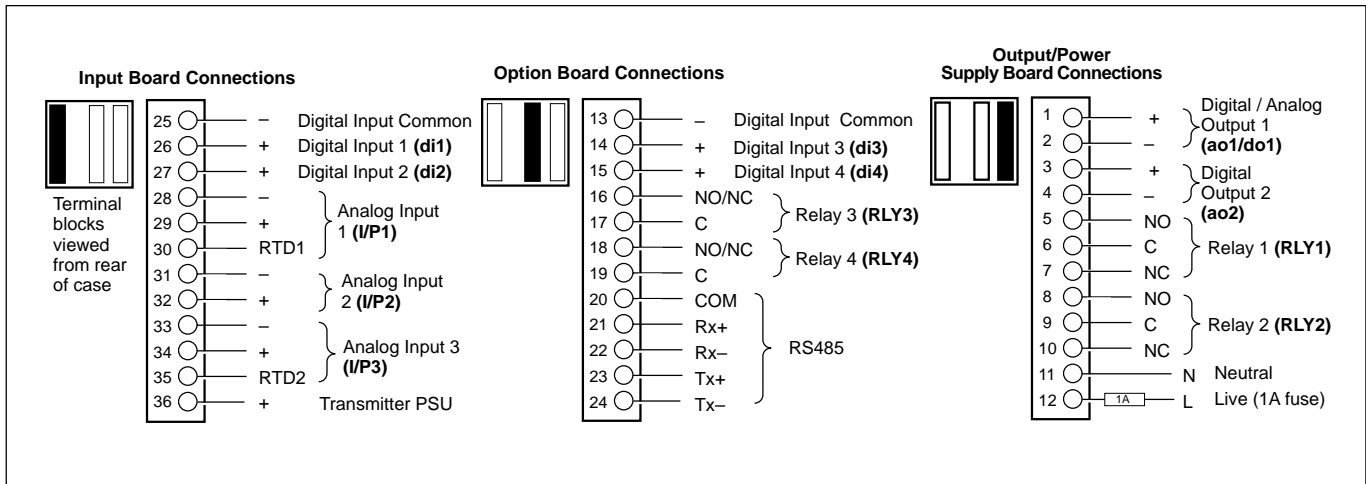
Front face

NEMA4X (IP66)

Overall Dimensions



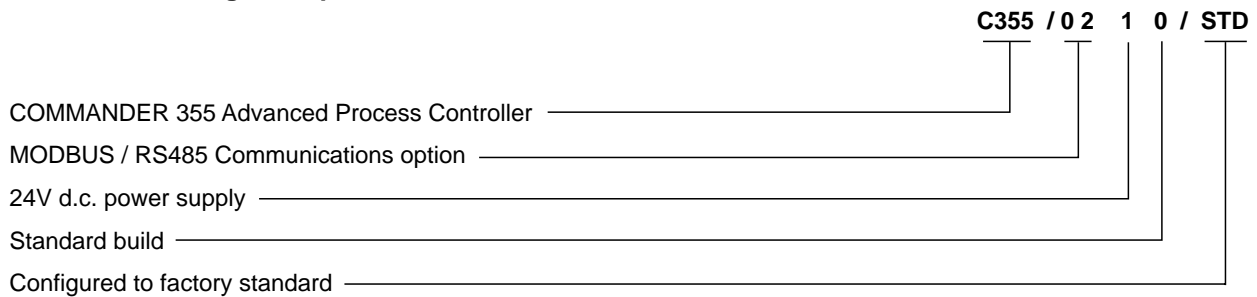
Electrical Connections



Ordering Guide

COMMANDER 355 Advanced Process Controller	C355 /	X X	X	X /	X X X X
Option Board					
None		0 0			
Two digital inputs + Two relays		0 1			
Two digital inputs + Two relays + RS485 MODBUS		0 2			
Power Supply					
85V to 265V a.c.			0		
24V d.c.			1		
Build					
ABB Standard				0	
CSA approval (pending)				1	
UL approval (pending)				2	
Programming/Special Features					
Configured to factory standard					S T D
Configured to customer detail					C U S
Agreed special features					S P X X

Instrument Coding Example



Accessories

PC Configurator kit (including Software and cable) Part No.C100/0700

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ABB Instrumentation Ltd

Howard Road
St. Neots, Cambs.
England, PE19 3EU
Tel: +44 (0)1480-475-321
Fax: +44 (0)1480-217-948

ABB Automation Inc Instrumentation Division

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

ABB Instrumentation

22016 Lenno
Como
Italy
Tel: +39 (0)344-58111
Fax: +39 (0)344-58278