

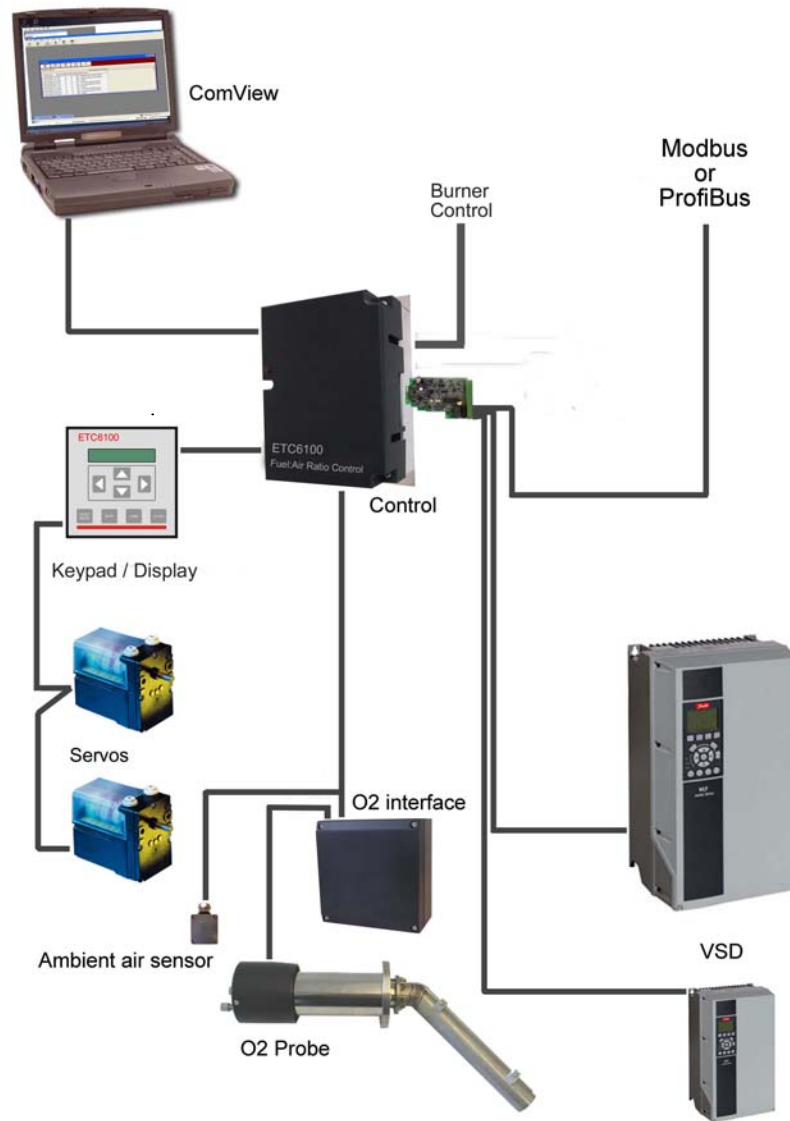


**ETC**

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# ETC6100

Fuel:Air Ratio Control



## Description

ETC6100 Fuel:Air Ratio Control (FARC) incorporates PID modulation control and is for use with a separate Burner Control. Options include Oxygen Trim, Variable Speed, and Communications. The ETC6100 is small and can be mounted on the burner or inside a control panel. CANbus simplifies wiring and is used for communication between the control, its actuators, display and peripherals.

The ETC6100 uses profiling information stored in memory to position the servo motors on the burner; These motors directly control fuel valves and air dampers and remove the need for mechanical linkages. A high resolution control algorithm is used to eliminate hysteresis and to give repeatable control of valve and damper positions. Commissioned set point positions give predictable control over all points from low to high fire. Interpolation methods give smooth and accurate transition between points. Valve positions for ignition can be set below or above the low fire position providing for safe and reliable start-up and maximum turn-down ratio.



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The basic unit will control up to 10 CANbus servo motors supporting single or dual fuel burners for liquid or gaseous fuel firing. All servo channels can be non-monotonic making the control suitable for low NO<sub>x</sub> flue gas recirculation and firing of "exotic" fuels. Boiler modulation may be performed either manually, remotely using analogue or digital signals, or automatically from pressure or temperature sensors. With such safety critical control applications design is to a high standard with protection safeguards at every level. In line with this commitment to safety the ETC6100 meets the latest European standards, Underwriters Laboratories and Factory Mutual requirements.

The multilingual full text display and its associated keypad provide valuable information to the end user and commissioning engineer; set-points, commissioned data, motor positions, time and date stamped limit and fault events and O<sub>2</sub> trim and VSD data.

"ComView" communications software is an option available for all ETC controls. This powerful package provides connection to a local or remote personal computer or terminal. Information such as set-points, profiles and engineer's data is displayed in tabular and graphic form. Dynamic plant mimics show the status of boilers/burners and other ETC products. Burner utilisation curves can be displayed as chart recorder images and alarms with time and date stamp are available.

RS485 and ModBus and ProfiBus protocol converters are available to transmit data to Building Management Systems or, via modems or local intranet to remote workstations, PC's or mobile telephones.

## Benefits

- ETC 6000 FARC reduces boiler energy costs, minimises emissions and prolongs the life of the boiler.
- Improved turndown saves up to 5% in fuel costs.
- Electronic FARC replaces characterising cams and linkages and eliminates backlash and hysteresis.
- A second boiler set-point saves energy during periods of low demand. Save up to 10%.
- Oxygen trim saves up to 3.5% in fuel costs.
- Energy savings and efficiency improvements result in reduced CO<sub>2</sub> emissions.
- Small size can remove the need for control panels.
- Functional integration of logic control, PID modulation and fuel/air ratio control into a single unit simplifies wiring and interconnections and improves reliability.
- ComView provides data for better analysis and maintenance planning.
- Sequencing (lead/lag) more closely matches boiler output to demand and gives greater flexibility in boiler utilisation. Save up to 5% in fuel costs.
- Pass code protection prevents untrained/unauthorised changes to combustion set-up.



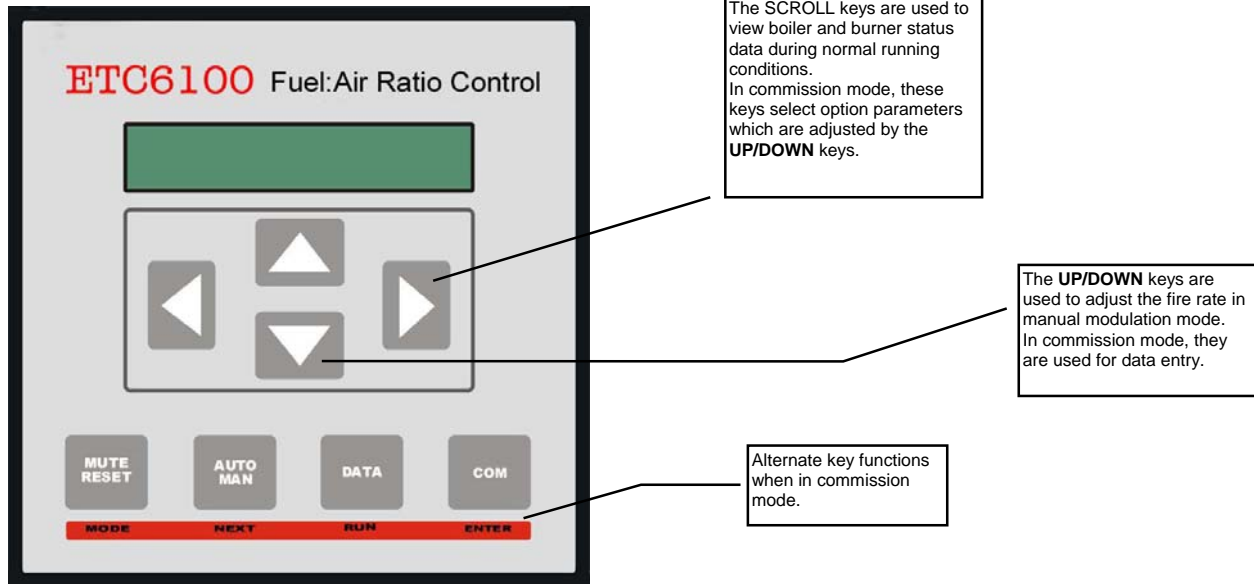
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## Functions/Features

- FARC with independent non-monotonic control of each fuel valve and air damper
- Precise positioning of valves and dampers
- Interface lines for HIGH (purge request)/ LOW (ignition request), AUTO (modulation request)
- 4 Profile selections
- Modulation sensor input
- PID for control of modulation rate
- Optional PID for remote boiler set-point and night / weekend set-back
- Fail safe digital inputs for alarm / shut-down / lockout
- Low Fire output (Ignition prove)
- High Fire output (Purge prove)
- Digital inputs for hand/auto, raise/lower, remote reset, etc.
- Adjustable warming limit and period
- Control "OK" lamp
- Simple display module with burner status indication, self diagnostics and fault history.
- Auto / Manual modulation
- Small size 150 x 100mm x 90 suitable for mounting on burner
- Simple installation and wiring requirements due to CANbus communication
- Internationally Approved to today's standards.
- Optional variable speed control
- Optional O<sub>2</sub> Trim
- Optional data logging for emissions monitoring, trending, utilisation, maintenance planning and monitoring energy savings and efficiency
- Optional ComView communications software for PC
- Optional Profibus, Modbus and DeviceNet interfaces for communication to Building and Energy Management systems

## The Display / Keypad

The display is a 2 line, 20 character per line, dot matrix vacuum fluorescent type allowing the use of plain text messages for most display parameters. The keypad is a membrane construction with tactile keys to give a positive feedback of the actuation.



### Key actions in normal operation.

<u>Key</u>	<u>Function</u>
AUTO MAN	Selects auto or manual burner modulation. In manual mode the <b>UP/DOWN</b> keys are used to alter the fire rate.
DATA	Selects different data types on the display window.
COM	Changes operation to commission mode via a passcode.
FAULT MUTE or MUTE / RESET	Press this key to mute (open) the alarm relays. Then hold the key down for approximately two seconds to remove any cleared faults.

## Start-up sequence

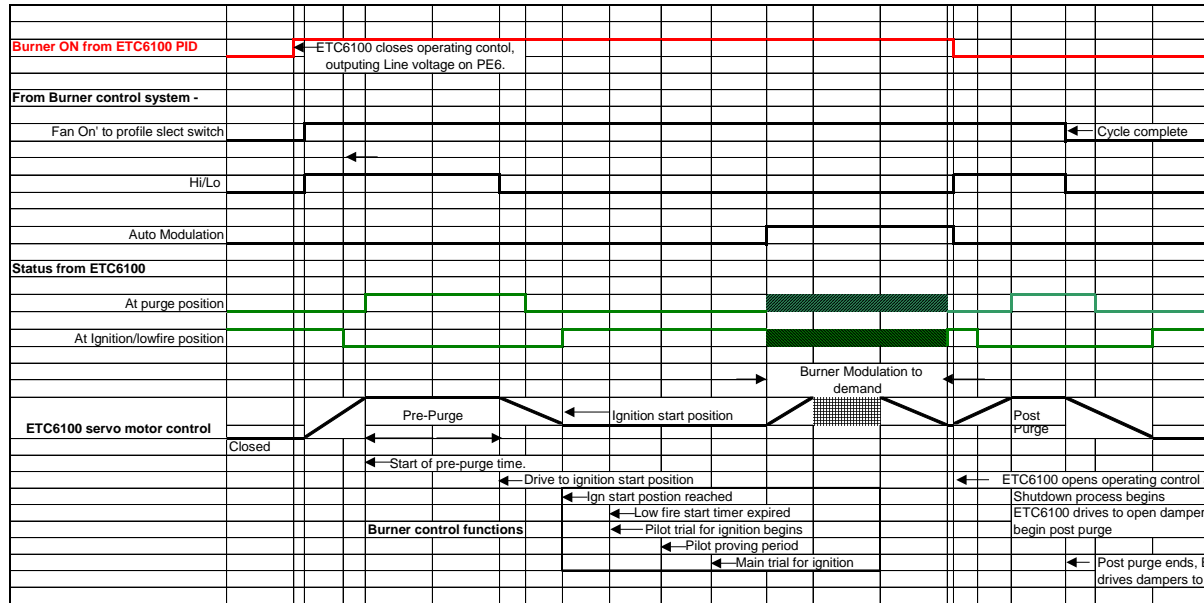
When a fuel selection is made and the 'burner select' signal is given to start up the burner, the control runs through the sequence described below. If a gas profile is selected, the control also performs safety valve pressure proving in parallel with the start-up sequence.

Stage no.	Stage name	Description
0.	<b>Non-volatile lockout</b>	The burner is held in this state until all faults are removed.
1.	<b>Burner off</b>	The control holds the burner off until a call for heat.
2.	<b>Wait for purge</b>	The control waits for a fuel selection and a HIGH input from the Burner Control.
3.		Not used
4.		Not used
5.	<b>Prove closed positions</b>	The fuel and air motors are moved down until they stop. The final positions are compared with the closed positions stored in memory.
6.		Not used
7.	<b>Prove purge positions</b>	The selected motors are moved up until they reach their respective purge positions.
8.	<b>Pre-purge</b>	HFS is sent to Burner Control. Then control waits for LOW signal.
9.	<b>Move to ignition positions</b>	On receipt of the LOW signal the control moves the drives to the ignition position for the selected profile.
10.		Not used
11.	<b>Ignition</b>	When drives reach ignition positions the control outputs LFS to Burner Control and waits for AUTO signal.
12.		Not used
13.		Not used
14.		Not used
15.	<b>Moving to low fire</b>	When AUTO signal is received from Burner Control the flame is considered established and the fuel and air motors are moved from their ignition positions to their low fire positions.
16.	<b>Modulation</b>	Once the fuel and air motors reach their low fire positions, they are modulated according to the demand placed on the burner.
17.	<b>Move to post-purge</b>	If the fuel selection is changed or the control receives a HIGH signal from Burner Control The fuel motor is moved to its closed position, the air motor is moved to its purge position.
18.	<b>Post-purge</b>	After the HIGH signal is removed and post purge attained the control outputs HFS to the Burner Control and returns to state 1 to wait for another start-up.



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## Sequence timing diagram.



## Modulation

During stage 16 (modulation), the control will position the fuel and air motors as programmed for the profile selected. In auto modulation mode, the system will modulate the burner to either track the modulation sensor input or maintain the pressure/temperature of the boiler as programmed. In manual modulation mode the system will modulate in response to the keyboard up/down keys. If boiler sequencing is enabled and active the control will start, stop and modulate according to instructions issued from the control on the lead boiler.

## Non-volatile lockout

Non Volatile lockouts cannot be cleared without operator intervention and are remembered in the event of power being removed from the control.

A non-volatile lockout will occur under the following conditions :

- In stages 5, 7 and 8, stages 10-16 (inclusive) and stage 18 if a drive is not in the correct position
- In any stage, if an internal or external fault not previously mentioned occurs which may affect the safe operation of the burner.



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## Technical specification

<b>General</b>	
Supply voltage	110/230Vac +10% -15%
CANbus supply (internal)	24V ac
Power consumption ETC6100 FARC	65VA approx.
Supply frequency	50/60Hz $\pm$ 5%
Ambient operating temperature range	0 to 60°C
Protection category	IP00
Display	Optional 2 x 20 full text VFD
<b>Servo motor control</b>	
Type	ETC CANbus
Number of drives	4 servos and optional 2 x VSD's
Number of profiles	4
Positioning accuracy	$\pm$ 0.1°
<b>Digital out</b>	
Relay: Safety Shutdown: line output	
maximum current	8A rms (fused at 8 A maximum)
maximum voltage	250Vac rms
Relay: Controlled Shutdown: Volt Free	
maximum current	8A rms (fused at 8 A maximum)
maximum voltage	250Vac rms
Relay: Alarm: line output	
maximum current	2A rms (fused at 2 A maximum)
maximum voltage	250Vac rms
2 x Triac: IGN Prove and PURGE Prove	
maximum current	0.5A rms maximum)
maximum voltage	250Vac rms
Optional Additional Alarm Relay set comprising 1 x Volt Free and 1 x Interdependent pair (Display module)	
maximum current	1A rms maximum)
maximum voltage	250Vac rms
<b>Analogue inputs</b>	
Type	2 x (4 to 20mA) or 2 x (0 to 5V) Optional 2 x (4 to 20mA).
	Optional i/ps unavailable if used for VSD feedback.
<b>Analogue outputs</b>	
Type	Optional 2 x (4 to 20mA)
Note	Maximum loop impedance 250 ohms. Unavailable if used for VSD





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<b>Digital inputs Hi/ Lo and Auto</b>	
Maximum current	< 5mA
Maximum Voltage	±20Vac absolute max
<b>Digital inputs profile 1 to 4</b>	
Type	OFF < 90Vac ON > 90Vac
<b>Pressure/temperature input 0 to 5V</b>	
Maximum current	<2mA
Input accuracy	±0.2%
<b>Pressure/temperature input 4 to 20mA</b>	
Burden resistor	220Ω
Input accuracy	±1.2%
<b>Communications interfaces</b>	
3-wire RS485, with selectable termination resistor.	
Isolated 3-wire RS485	Optional
Profibus / Modbus	Optional

### Display Text Messages:

*** LOCKOUT ***	(in lockout)	Jan
%Modulation LEAD	(off, control limit)	Feb
%Modulation SLAV	(off,no fuel select)	Mar
%Modulation AUTO	(off, waiting...)	Apr
% Modulation	(power switched off)	May
PSI Actual	off,no fuel select)	Jul
bar Actual	Stand-by	Aug
°F Actual	(off,from keyboard )	Sep
°C Actual	(off,from remote )	Oct
PSI Set-point	(in startup / purge)	Nov
bar Set-point	(in normal run)	Dec
°F Set-point	(in startup / purge)	NONE
°C Set-point	FUEL PROFILE IS	GAS1
Hours run Oil	,Mod Rate	OIL1
Hours run Gas	,Fuel Flow	GAS2
Burner Off	Normal Run	OIL2
Wait for purge	MV HiLimit	not used
Proving closed	Safe Limit	,Mod Rate
Proving purge	LoFireHold	,Meas. Val
Pre-purge	ManualMode	,Set-point
Moving to ign	Gas Select	,Efficiency
Main ignition	Oil Select	,Inlet Temp
Move to low fire	Sequencing	,Flue Temp
Modulating	Seq.Lead	,O2 Level
Moving to post	Off	,CO2 Level
Post purge	Jun	

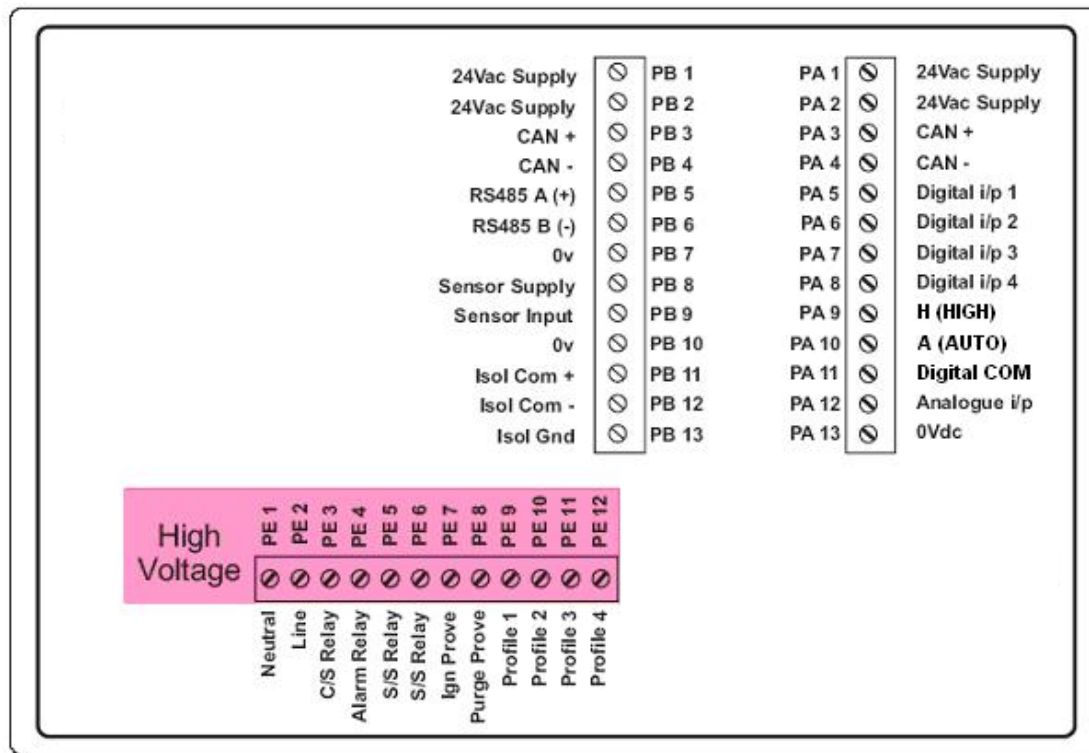


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### Fault messages:

Re-start (Mute) Drive 0 position Drive 1 position Drive 2 position Drive 3 position Drive 4 position Drive 5 position Drive Selection	Relay Test Fail EPROM Test Fail Watchdog Test EPROM Failed Safety Limit Forced Shutdown Forced Limit O2 Probe Heater	O2 Probe Cal. O2 Low Limit O2 High Limit O2 Trim Limit O2 Purge Check Auto Trim Setup Flue TempLoLimit Flue TempHiLimit
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### Terminal Layout:



  
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**NOTES**