

nanodac™ Recorder/Controller

MODEL

Purpose of this note

The purpose of this application note is to describe how the nanodac recorder/controller may be used to measure oxygen levels and control temperature in metal heat treatment furnaces. Using the measurements of oxygen level and temperature the nanodac recorder/controller may also be used to calculate the carbon potential levels using the Zirconia function block.

The nanodac recorder/controller may also be used to measure oxygen levels, for example in chimney stacks.

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Eurotherm



Heat/Cool with Carbon Potential or Oxygen Level Monitoring using the nanodac Recorder/Controller

Application Note

Product

The nanodac recorder/controller provides combined recording and control in a single ¼ DIN package.

There are two control loops. In this application only one of these loops is used to control the temperature. A Zirconia probe is used to measure the level of oxygen and Virtual channels are configured to display the measured values.

The nanodac recorder/controller can accommodate a range of probes from various manufacturers. A suitable probe is the Eurotherm ECprobe which is interchangeable with all other carbon sensors. It is available in 600mm or 900mm lengths with or without integral thermocouple in types K, N, S, or R. A typical order code is CP600-K.

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Introduction

When mild steels or certain low carbon steels are heated at temperatures above 900°C in a carbon rich atmosphere the surface of the steel absorbs carbon by diffusion. The depth of carbon enrichment depends on the time and temperature of the treatment known as carburising. The presence of carbon in the steel causes a change in its physical properties.

A Zirconia probe is used to measure the level of oxygen. It generates a millivolt signal based on the ratio of oxygen concentration between the reference airside of the probe (outside the furnace) and the amount of oxygen actually inside the furnace.

The temperature of the furnace is measured using a thermocouple. This may be a thermocouple mounted within the Zirconia probe or installed as a separate item.

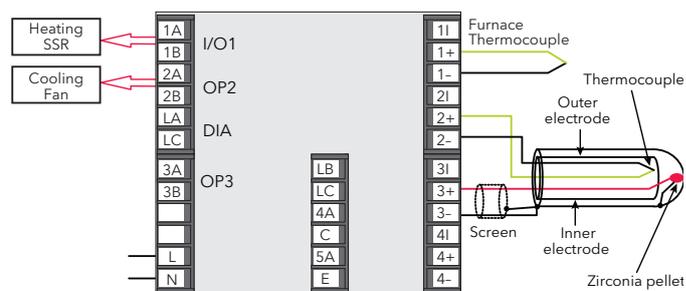
Together the temperature and oxygen level signals are used by the nanodac recorder/controller to calculate the actual percentage of carbon in the furnace atmosphere.

Application Example

Channel 1 thermocouple input.

Loop 1 heat/cool control. The heating channel is a time proportioning logic output used to drive a solid state relay or thyristor unit. The cooling channel uses a relay output, which in an oven application, would probably operate a cooling fan.

The loop wSP and wOP are charted using virtual channels. The Zirconia block measures both oxygen and temperature using input channels 2 and 3 respectively and a third virtual channel is used to chart the level of oxygen.



Physical Wiring

Internal 'Soft' Wiring

Temperature Control

Configure Channel 1 for thermocouple. Configure Loop 1 for PID heat/cool control. Wire Channel1.Main.PV to Loop.1.Main.PV. This provides the temperature measurement for the temperature control loop 1.

Configure Loop 1 for heat/cool control.

Configure Digital I/O1 and Relay output 2 for time proportioning. Wire Loop1.OP.Ch1Out to DIO_1A1B.PV. Wire Loop1.OP.Ch2Out to Relay_2A2B.PV. This provides the heating and cooling control outputs to drive an SCR and cooling solenoid respectively.

Configure Virtual channels 1 and 2 for Type = Math and Operation = Copy. Wire Loop1.Main.WorkingSP to VirtualChannel 1.Main.Input1. Wire Loop1.Main.ActiveOut to VirtualChannel 2.Main.Input1. This allows the working setpoint and working output to be charted on the recorder.

Oxygen Monitoring

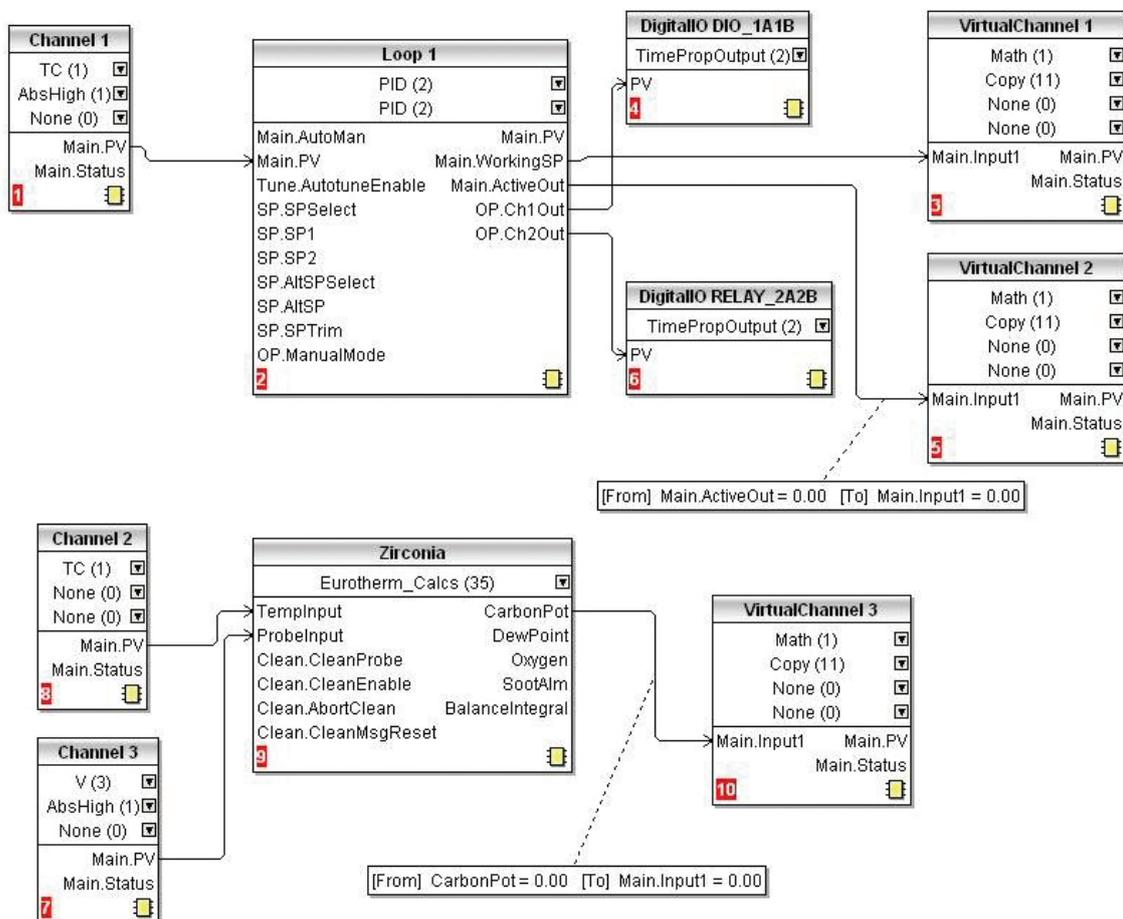
Configure Channel 2 for thermocouple. Wire Channel2.Main.PV to Zirconia.Templnput.

Configure Channel 3 for Volts input. This channel must be less than 2V and scaled in mV. Wire Channel3.Main.PV to Zirconia.ProbeInpurt.

These two actions provide the temperature and oxygen level measurements required to calculate carbon potential.

Wire Zirconia.Carbon.Pot to VirtualChannel 3.MainInput1. This allows the carbon potential to be charted and logged on one of the display channels of the recorder.

As an alternative wire the Oxygen output of the Zirconia block to the virtual channel to chart the measured oxygen level, for example, in a chimney stack.



Graphical View of 'Soft' Wiring using iTools

Further information may be downloaded
from www.eurotherm.co.uk

nanodac Recorder/Controller

User Guide HA030554
Brochure HA030685
Specification sheet HA030686

iTools Configuration & Monitoring Software

Help Manual HA028838

Eurotherm Review PC Based Software Package

Brochure HA028081

Dream Report Software

Brochure HA029515
User Friendly Reporting Software

Data Security with Store & Forward

Brochure HA029878

Environmental Quality Monitoring System

Brochure HA030142

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