# Worry Less and Do More

## Eurotherm nanodac™ Recorder/Controller

High integrity graphical data recording aids statutory compliance across regulated industries.

World class PID control for greater performance and process reliability

**Eurotherm**®

## Product at a glance

We combined our in depth knowledge of stringent data security requirements of regulated industries with our control expertise in specialist applications such as cascade control, sterilization and carbon control to bring you world class recording and PID control in a space-saving, small box with a superb full color display.

The recording functionality within the nanodac instrument reflects our understanding of the requirements of capturing and storing electronic data. We understand that different applications have different needs and so the nanodac recorder can store your information, either in open CSV format or in a tamper resistant, checksummed format to better maintain data integrity. Whichever format you choose for your process, we have the tools to help you keep this data more secure, get it to the place you need, and in the format you require. Digital batch recording and electronic signatures helps simplify reporting and the audit process. This aids compliance with GAMP, NADCAP and HACCP/HARPC requirements.

Add to this our commitment to technological innovation, constant reinvestment in research and development, and a team of engineers who understand your process requirements and you will find in Eurotherm a partner able to flex with the demands of your business as the regulatory and audit landscape changes.

- Tamper resistant data recording methodology trusted by auditors
- Electronic signing and authorisation compliant with FDA 21 CFR Part 11
- Powerful batch functionality
- Eurotherm PID algorithm with 2 control loops
- Cascade control with advanced autotune
- Dual programmer
- High accuracy universal inputs
- Graphical wiring
- USB removable data storage facility
- Modbus TCP/IP Master/Slave
- EtherNet/IP Client or Server
- BACnet Slave
- Sterilizer Application Block
- Relative Humidity Application Block
- Steam Flow Application Block
- Zirconia Probe Application Block
- Multi-language support
- Compact design

# nanodac™ Specification

## General Hardware and Software

| I/O Types | |
|---|---|
| Analog inputs | Four standard (eight if dual input enabled) |
| Digital inputs | Two as standard, One optional |
| Digital (logic) outputs | Two optional |
| Relay outputs | Two as standard, two optional |
| DC outputs | Three optional |

| Ethernet Communications | |
|---|---|
| Ethernet Communications | 10/100BASE-T Ethernet (IEEE802.3) |
| Protocols | Modbus TCP Slave (default), Options for Modbus TCP Master, Ethernet/IP Client or Server, BACnet,SFTP/FTP |
| Cable type | Category 5 Shielded |
| Maximum Cable length | 100 meters (110 yards) |
| Connector Type | RJ45 (Green LED illuminated = Link Connected; Amber LED Flashing = Link Activity) |
| Network Addressing | DHCP or Fixed (Static) IP Addressing |

| USB Port | |
|---|---|
| Number of ports | One at rear of instrument |
| Standard | USB1.1 |
| Transmission speed | 1.5Mbits/s (low speed device) |
| Maximum current | <100mA |
| Peripherals supported | Memory stick (8GB max), Barcode scanner, QWERTY keyboard |

| Battery Backup | |
|---|---|
| Stored Data | Time and Date only |
| Support Time | Minimum of 1 years with unit unpowered |
| Replacement period | Three years Typical |
| Temperature Stability | 0 to 55°C ≤±3.5ppm |
| RTC Aging | First year to 10 years < 5ppm |
| Battery Type | Lithium/poly-carbonmonofluoride |

| Operator Interface | |
|---|---|
| Integrated Display | 3.5" color TFT (320 pixels wide x 240 pixels high) |
| User interface | Four navigation push buttons (Page, Scroll, Lower and Raise) |

| Data Recording | |
|---|---|
| Sample Rate | 8Hz (125ms) |
| Trend Display update rate | 8Hz (125ms) |
| Recording Groups | 1 |
| Display points | 6 |
| Recording points | up to 34 (with Modbus Master Option) |
| Data Storage | 50MB |

# nanodac™ Specification

## Power supply, Isolation, Environmental and Compliance

| Power Specifications | |
|---|---|
| Supply voltage | Standard: 100 to 230V ac ±15% at 48 to 62Hz

Low voltage Option: 24V ac (+10% –15%) at 48 to 62Hz, or 24V dc (+20% –15%) |
| Power dissipation | 9W (max.) |
| Fuse type | No internal fuse fitted |
| Interrupt Protection (Standard unit) | Holdup >20ms at 85V RMS supply voltage |
| Interrupt Protection (Low voltage unit) | Holdup >20ms at 20.4V RMS supply voltage |

| Control | |
|---|---|
| Control Loops | Two, plus advanced control (cascade) loop |
| Control Types | On/Off, PID, VPU, Cascade (Advanced Loop) |
| Advance Features | |
| Application Blocks | Zirconia, Relative Humidity, Steriliser, Steam/Mass Flow |
| Batch | Single Batch, six Batch Fields |
| Auditor | Up to 25 users with individual username, password and permissions |
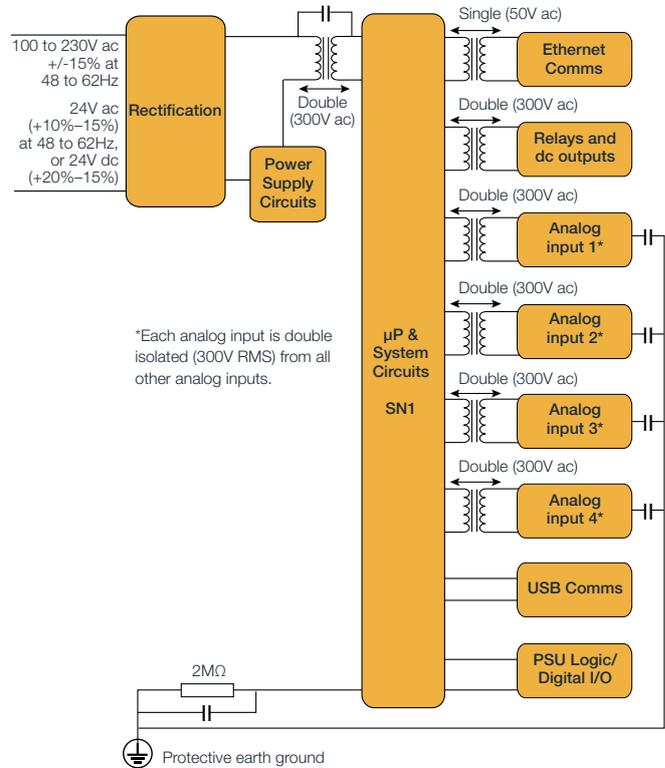
Isolation details

| Environmental Specifications, Approvals and Compliance | | |
|---|---|---|
| Operating temperature | 0 to 55°C | |
| Storage temperature | –20 to +70°C, max rate of change 1°C per minute | |
| Operating humidity | 5% to 85% RH non condensing | |
| Storage humidity | 5% to 85% RH non condensing | |
| Front of panel protection | Standard: IP65, Washdown: IP66, NEMA12 | |
| Back of panel protection | IP10 (International) | |
| Shock/vibration | To BS EN61131-2 (5 to 150 Hz. at 1g; 1 octave per min.) | |
| Altitude | <2000 meters | |
| Atmosphere | Not suitable for use in explosive or corrosive atmospheres | |
| Electrical safety | BS EN61010-1 (installation category II; Pollution degree 2) | |
| Electromagnetic compatibility (EMC) | Emissions (Standard unit) | BS EN 61326 Class B – Light industrial |
| | Emissions (Low voltage unit) | BS EN 61326 Class A – Heavy industrial |
| | Immunity | BS EN 61326 Industrial |

| Approvals and Compliance | |
|---|---|
| General | CE, UL and EN61010 |
| PV Input | AMS2750 compliant |
| RoHS | EU; China |
| Packaging | BS EN61132-2 section 2.1.3.3 |

# nanodac™ Specification

## Built in I/O

## Analog Inputs (An In 1-4)

| Analog Inputs General | |
|---|---|
| Number of inputs | Four |
| Input types | dc volts, dc mV, dc mA (external shunt required), thermocouple, linear ohms, RTD (2-wire and 3-wire) |
| Input type mix | Freely configurable |
| Update rate | 125ms max. |
| Conversion method | 16 bit delta sigma |
| Input ranges | See individual tables |
| Mains rejection (48 to 62Hz) | > 95dB series mode >179dB common mode |
| Common mode voltage | 250V ac max. |
| Series mode voltage | 280mV at lowest range; 5V peak to peak at highest range |
| Input impedance | >100MΩ (40mV, 80mV, 2V ranges only) 667kΩ for input < 5.6V, 62.5kΩ for input > 5.6V (10V range only) |
| Overvoltage protection | ±30V RMS (continuous) ±200V pk-pk between terminals (transient <1ms) |
| Sensor break detection | ac sensor break on each input giving quick response with no associated dc offset Recognition time<3 seconds Minimum break resistance:   5kΩ for 40mV and 80mV ranges; 12.5kΩ for 2V and 10V ranges |
| Isolation | 300V RMS or dc (double insulation) channel to channel 300V RMS or dc (double insulation) channel to processor electronics 300V RMS or dc (single insulation) channel to ground |
| Dielectric strength | BS EN 61010, 1 minute type test 2500V ac channel to channel 1500V ac channel to ground |

## Voltage Inputs

| mV and V inputs | | | | |
|---|---|---|---|---|
| Low range | High range | Resolution | Calibration accuracy (instrument at 25°C) | Temperature performance |
| -40mV | +40mV | 1.9µV | 4.6µV + 0.053% of reading | 13ppm of input per °C |
| -80mV | +80mV | 3.2µV | 7.5µV + 0.052% of reading | 13ppm of input per °C |
| -2V | +2V | 82µV | 420µV + 0.044% of reading | 13ppm of input per °C |
| -3V | +10V | 500µV | 1.5mV + 0.063% of reading | 45ppm of input per °C |

## Thermocouple Inputs

| Thermocouple Inputs | |
|---|---|
| Temperature scale | ITS90 |
| CJC types | Off, internal, external, remote |
| Remote CJC source | Any analog input channel |
| Internal CJC accuracy | <1°C max, with instrument at 25°C |
| Internal CJC rejection ratio | 40:1 from 25°C |
| Upscale/downscale drive | High, low or none independently configurable for each channel's sensor break detection |

| Thermocouple Types | | | |
|---|---|---|---|
| T/C type | Overall range (°C) | Standard | Linearization accuracy |
| B | 0 to +1820 | IEC584.1 | 0 to 400°C = 1.7°C 400 to 1820°C = 0.03°C |
| C | 0 to +2300 | Hoskins | 0.12°C |
| D | 0 to +2495 | Hoskins | 0.08°C |
| E | −270 to +1000 | IEC584.1 | 0.03°C |
| G2 | 0 to +2315 | Hoskins | 0.07°C |
| J | −210 to +1200 | IEC584.1 | 0.02°C |
| K | −270 to +1372 | IEC584.1 | 0.04°C |
| L | −200 to +900 | DIN43710:1985 (to IPTS68) | 0.02°C |
| N | −270 to +1300 | IEC584.1 | 0.04°C |
| R | −50 to +1768 | IEC584.1 | 0.04°C |
| S | −50 to +1768 | IEC584.1 | 0.04°C |
| T | −270 to +400 | IEC584.1 | 0.02°C |
| U | −200 to + 600 | DIN43710:1985 | 0.08°C |
| NiMo/NiCo | −50 to +1410 | ASTM E1751-95 | 0.06°C |
| Platinel | 0 to +1370 | Engelhard | 0.02°C |
| Mi/NiMo | 0 to +1406 | Ipsen | 0.14°C |
| Pt20%Rh/ Pt40%/Rh | 0 to +1888 | ASTM E1751-95 | 0.07°C |

# nanodac™ Specification

## Built in I/O

### Current Inputs

mA input accuracy is based on the shunt value and voltage range. Standard mA selection uses -3 to 10V range, therefore use -3 to 10V range specifications.

| mA Inputs | | | |
|---|---|---|---|
| Low range | High range | External shunt | Shunt accuracy |
| 0 | 20mA | 1Ω to 1kΩ | Dependent on shunt selection. 0.1% of input for shipped 2.49Ω shunt. |

### Resistance Inputs

| Linear Ohms Inputs | | | | |
|---|---|---|---|---|
| Low range | High range | Res | Calibration accuracy (Instrument at 25°C) | Temperature performance |
| 0Ω | 400Ω | 20mΩ | 120mΩ + 0.023% of reading | 25ppm of input per °C |

### RTD Inputs

| Pt100 Inputs | |
|---|---|
| Temperature scale | ITS90 |
| Maximum source current | 200µA |
| Range | 0 to 400Ω (–200 to +850°C) |
| Resolution | 0.05°C |
| Calibration accuracy | ±0.31°C ±0.023% of measurement in °C at 25°C ambient |
| Temperature coefficient | ±0.01°C/°C ±25ppm/°C measurement in °C from 25°C ambient |
| Measurement noise | 0.05°C peak-peak with 1.6s input filter |
| Linearity | 0.0033% (best fit straight line) |
| Lead resistance | 0 to 22Ω matched lead resistances |

| RTD Types | | | |
|---|---|---|---|
| RTD type | Overall range (°C) | Standard | Linearization accuracy |
| Cu10 | -20 to +400 | General Electric Co. | 0.02 °C |
| Cu53 | -70 to +200 | RC21-4-1966 | 0.01 °C |
| JPT100 | -220 to +630 | JIS C1604:1989 | 0.01 °C |
| Ni100 | -60 to +250 | DIN43760:1987 | 0.01 °C |
| Ni120 | -50 to +170 | DIN43760:1987 | 0.01 °C |
| Pt100 | -200 to +850 | IEC751 | 0.01 °C |
| Pt100A | -200 to +600 | Eurotherm Recorders SA | 0.09 °C |

### Digital Inputs (Dig in A and Dig in B only)

| Contact Closure Input | |
|---|---|
| Closed circuit sensing current (source) | 5.5mA min to 6.5mA max |
| Open circuit (inactive) resistance | >600Ω |
| Closed circuit (active) resistance | <300Ω |
| Update rate | 8ms max |

### Relay Outputs (O/P4 and O/P5 only)

| Form A N/O Relay Outputs | |
|---|---|
| Contact switching power (resistive) | 1A max at 240V RMS +/-15%, 5mA min at 5V |
| Current through terminals | 1A |
| Isolation | 300V RMS or dc, double insulated from processor/comms electronics |
| Update rate | 8ms max |

# nanodac™ Specification

## Optional I/O

| Table A1 Output Options (OPT 1 to OPT 3) | | |
|---|---|---|
| OPT 1 | OPT 2 | OPT 3 |
| L | R | R |
| L | R | D |
| L | L | R |
| R | D | D |
| D | D | D |
| L | L | D |

### Logic Input (Available in Opt 1 only)

| Active (current on) Contact Closure | |
|---|---|
| Input current (input at 12V) | 0mA min to 44mA max |
| Input current (input at 0V) | 6mA (steady state) to 44mA (switch current) |
| Open circuit input voltage | +11V to +13V |
| Open circuit (inactive) resistance | >500Ω |
| Closed circuit (active) resistance | <150Ω |
| Update rate | 8Hz (125ms) max |

### Logic Outputs (Available in Opt 1 or Opt 2)

| Logic Output (current sourcing) | |
|---|---|
| Voltage Output across terminal (current on) | +11V to +13V |
| Voltage Output across terminal (current off) | 0mV to +300mV |
| Short circuit output current (current on) | 6mA (steady state) to 44mA (switch current) |
| Output source leakage current (current off) | 0µA to 100µA |
| Update rate | 8Hz (125ms) max |

### Relay Output (Available in Opt 1, Opt 2 or Opt 3)

| Form A (N/O) Relay Outputs | |
|---|---|
| Contact switching power (resistive) | Max 2A at 230V RMS ±15%; Min 100mA at 12V |
| Current through terminals | 2A max |
| Estimated mechanical life | >10,000,000 operations |
| Update rate | 8Hz (125ms) max |
| Isolation | 300V RMS or dc, double insulated from processor electronics |

## DC Outputs (Available in Opt 1, Opt 2 or Opt 3)

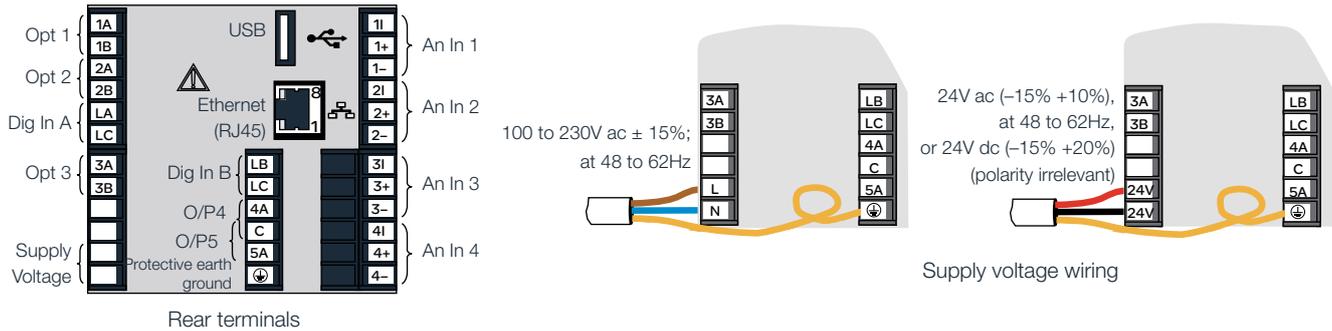| Voltage Output | |
|---|---|
| Output range (current) | Configurable within 0 to 20mA |
| Load resistance (current) | 500Ω min |
| Calibration Accuracy (current) | <±100µA ±1% of reading |
| Output range (voltage, Opt 3 only) | Configurable within 0 to 10Vdc |
| Load resistance (voltage, Opt 3 only) | 500Ω min |
| Calibration Accuracy (voltage, Opt 3 only) | <±50mV ±1% reading |
| Resolution | >11 bits |
| Thermal Drift | <100ppm/°C |
| Update Rate | 8Hz (125ms) max |
| Isolation | 300V RMS or dc, double insulated from processor electronics |

## Standard I/O

| Fixed Dig InA/Dig InB (Contact Closure) | |
|---|---|
| Short circuit sensing current source | 5.5mA (min); 6.5mA (max) |
| Open circuit (inactive) resistance | 600Ω (min); ∞ (max) |
| Closed circuit (active) resistance | 0Ω (min); 300Ω(max) |

| Fixed Form A N/O Relay Outputs (O/P4 and O/P5) | |
|---|---|
| Contact Switching Power (resistive) | Max 1A at 230V RMS ±15%; Min 100mA at 12V |
| Current through terminals | 1A max |
| Estimated mechanical life | >10,000,000 operations |
| Update Rate | 8Hz (125ms) max |
| Isolation | 300V RMS or dc, double insulated from processor electronics |

# nanodac™ Specification

## Terminal Wiring Details

| No. of wires | Wire size | | Screw terminal torque | |
|---|---|---|---|---|
| | mm2 | AWG | Nm | lb in |
| 1 wire | 0.205 to 2.08 mm2 | 24 to 14 AWG | 0.4Nm max | 3.54 lb in max |
| 2 wires | 0.205 to 1.31 mm2 (inclusive) | 24 to 16 AWG (inclusive) | 0.4Nm max | 3.54 lb in max |



Rear terminals

100 to 230V ac ± 15%; at 48 to 62Hz

24V ac (–15% +10%), at 48 to 62Hz, or 24V dc (–15% +20%) (polarity irrelevant)

Supply voltage wiring
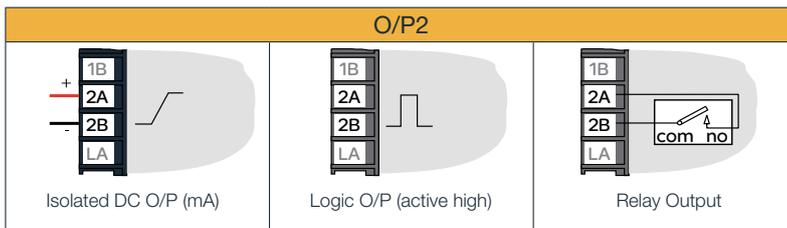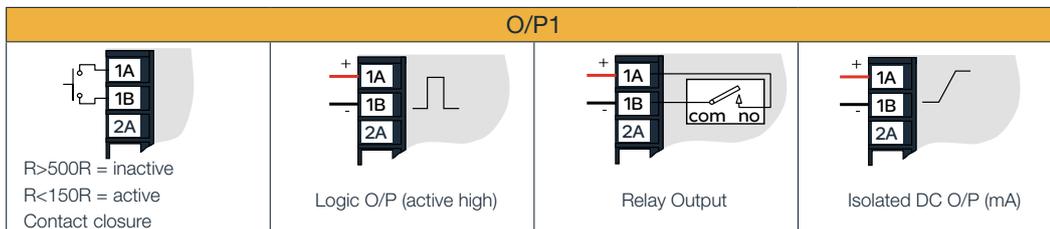
## I/O Terminations

Termination details

The screw terminals accept wire sizes in the range:

Single wire 0.205 to 2.08mm2 (14 to 24 AWG) 2 wires 0.205 to 1.31mm2 (16 to 24 AWG) inclusive.

Screw terminals should be tightened to a torque not exceeding 0.4Nm (3.54 lb in).

### O/P1



R>500R = inactive
R<150R = active
Contact closure

Logic O/P (active high)

Relay Output

Isolated DC O/P (mA)

### O/P2



Isolated DC O/P (mA)
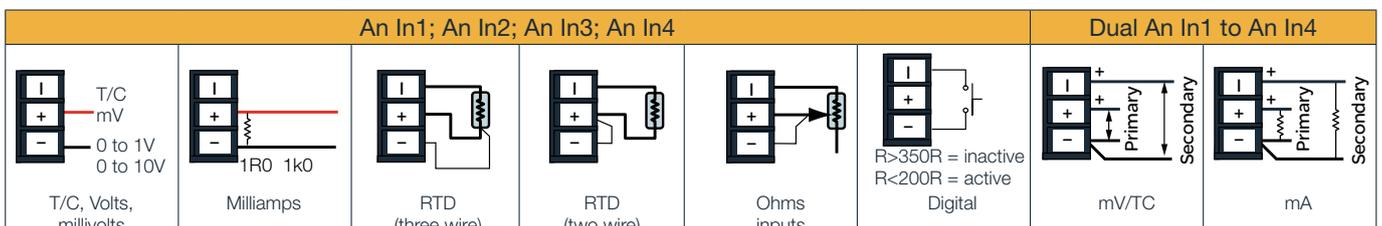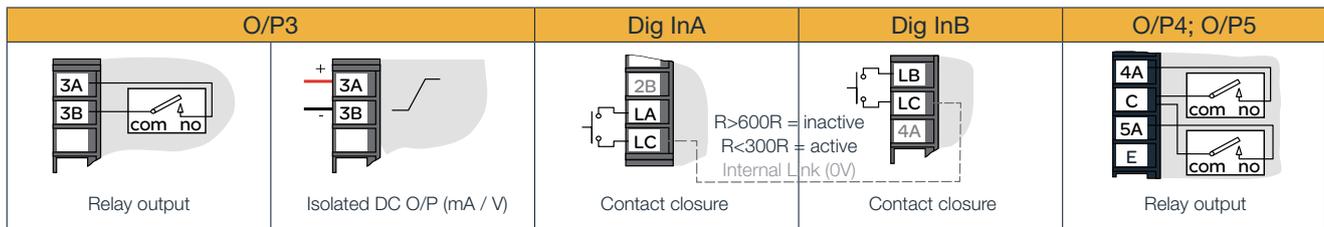
Logic O/P (active high)

Relay Output

Use copper conductors only.
The power supply input is not fuse protected.
This should be provided externally.

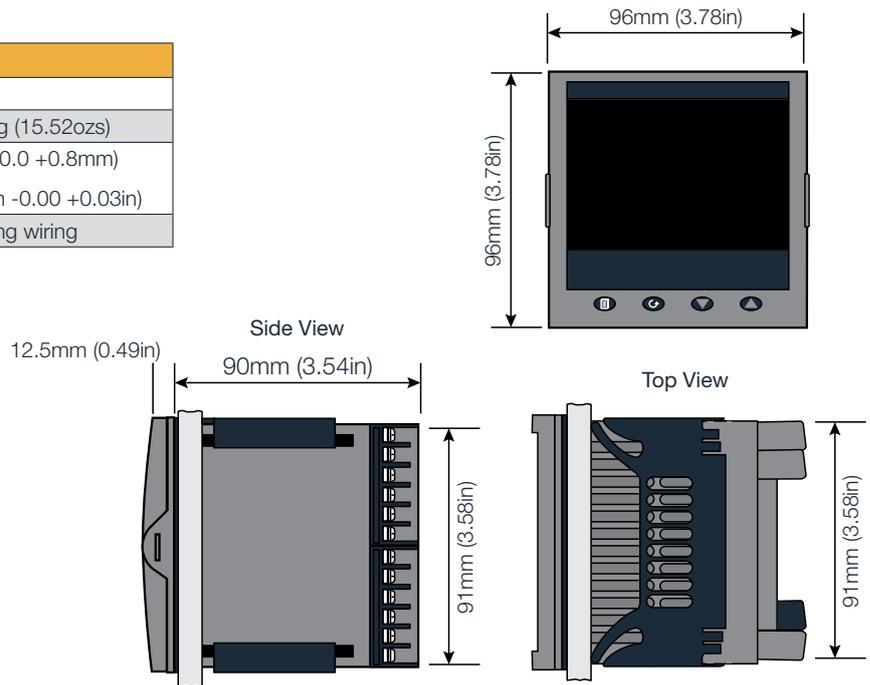Each wire connected to LA, LB and LC must be less than 30 metres in length.

| O/P3 | | Dig InA | Dig InB | O/P4; O/P5 |
|---|---|---|---|---|



Relay output

Isolated DC O/P (mA / V)

R>600R = inactive
R<300R = active
Internal Link (0V)

Contact closure

Contact closure

Relay output

| An In1; An In2; An In3; An In4 | Dual An In1 to An In4 |
|---|---|



T/C, Volts, millivolts

Milliamps

RTD (three wire)

RTD (two wire)

Ohms inputs

R>350R = inactive
R<200R = active
Digital

mV/TC

mA

# nanodac™ Specification

## Mechanical Details

| Dimensions | |
|---|---|
| Panel mounting | 1/4 DIN |
| Weight | Instrument only: 0.44kg (15.52ozs) |
| Panel cutout dimension | 92mm x 92mm (both -0.0 +0.8mm) |
| | or 3.62in x 3.62in (both -0.00 +0.03in) |
| Depth behind bezel: | 90mm (3.54in) excluding wiring |

96mm (3.78in)

96mm (3.78in)

12.5mm (0.49in)

Side View

90mm (3.54in)

91mm (3.58in)

Top View

91mm (3.58in)

## nanodac™ Order Codes
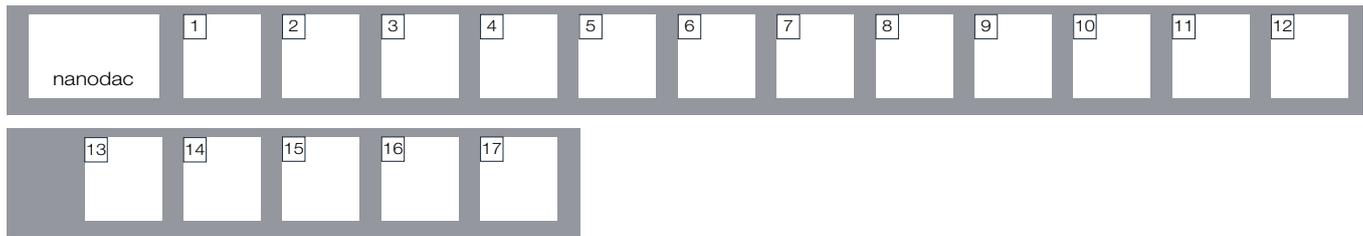


| Basic Product | |
|---|---|
| NANODAC | Graphical Recorder/ Controller |

| 1 | Supply Voltage | |
|---|---|---|
| VH | | 100-230V ac ±15% at 48-62Hz |
| VL | | 24V ac (+10% −15%) at 48-62Hz, or 24V dc (+20% −15%) |

| 2 | Controller | |
|---|---|---|
| X | | None (default) |
| C | | 2 Control loops |
| A | | Advanced control loop (includes 2 control loops) |

| 3 | Programmer | |
|---|---|---|
| X | | None (default) |
| P | | Dual programmer |

| 4 | Output Options 1-2-3 | |
|---|---|---|
| LRR | | Logic/Relay/Relay (default) |
| LRD | | Logic/Relay/Iso DC output |
| LLR | | Logic/Logic/Relay |
| RDD | | Relay/Iso DC/Iso DC |
| DDD | | Iso DC/Iso DC/Iso DC |
| LDD | | Logic/Iso DC/Iso DC |
| LLD | | Logic/Logic/Isso DC |

| 5 | Application Blocks | |
|---|---|---|
| XX | | None |
| ZC | | Zirconia |
| RH | | Humidity |
| ST | | Steriliser |

| 6 | Communications Protocol | |
|---|---|---|
| TS | | Modbus TCP/IP slave (default) |
| TM | | Modbus TCP/IP master |
| ES | | EtherNet/IP client/server |
| BS | | BACNet Server (Slave) |
| TB | | BACNet Server (Slave) & Modbus TCP Master |

| 7 | Bezel | |
|---|---|---|
| SV | | Silver (standard) |
| WD | | Wash down front |

| 8 | Toolkit Blocks | |
|---|---|---|
| XXXXX | | None |
| BASIC | | Basic toolkit blocks |

| 9 | Operating Language | |
|---|---|---|
| ENG | | English (default) |
| FRA | | French |
| GER | | German |
| ITA | | Italian |
| SPA | | Spanish |

| 10 | OEM Security | |
|---|---|---|
| XXX | | None |
| OEM | | OEM Security enabled |

| 11 | Labels | |
|---|---|---|
| XXXXX | | No custom labels |

| 12 | Special | |
|---|---|---|
| XXXXX | | Default |

| 13 | Dual Input Channels | |
|---|---|---|
| XX | | None |
| 05 | | 5 inputs enabled |
| 06 | | 6 inputs enabled |
| 07 | | 7 inputs enabled |
| 08 | | 8 inputs enabled |

| 14 | Dual Thermocouple Support | |
|---|---|---|
| XXX | | None |
| TC | | Dual T/C support enabled |

| 15 | Batch | |
|---|---|---|
| NONE | | None |
| BATCH | | Batch enabled |

| 16 | Auditor Full (21CFR11) | |
|---|---|---|
| NONE | | None |
| AFULL | | Auditor Full (21CFR11) enabled |

| 17 | Steam Flow Calculations | |
|---|---|---|
| XX | | None (Default) |
| SF | | Steam/Mass Flow Calculations |

**WATLOW** Powered by Possibility