1 YEAR WARRANTY

CE

OMEGA®

User's Guide

Shop online at omega.com®

e-mail: info@omega.com
For latest product manuals: omegamanual.info

ISO 9001 CERTIFIED CORPORATE QUALITY STAMFORD, CT

ISO 9001 CERTIFIED CORPORATE QUALITY MANCHESTER, UK

MADE IN UNITED KINGDOM

CN2300 Graphical 1/4 DIN Process Controller

OMEGA®

OMEGAnet® Online Service omega.com	Internet e-mail info@omega.com

Servicing North America:

U.S.A.: ISO 9001 Certified
Omega Engineering, Inc., One Omega Drive, P.O. Box 4047
Stamford, CT 06907-0047
Toll-Free: 1-800-826-6342 Tel: (203) 359-1660
FAX: (203) 359-7700 e-mail: info@omega.com

Canada:
976 Bergar
Laval (Quebec), H7L 5A1 Canada
Toll-Free: 1-800-826-6342 TEL: (514) 856-6928
FAX: (514) 856-6886 e-mail: info@omega.ca

For immediate technical or application assistance:

U.S.A. and Canada:
Sales Service: 1-800-826-6342/1-800-TC-OMEGA®
Customer Service: 1-800-622-2378/1-800-622-BEST®
Engineering Service: 1-800-872-9436/1-800-USA-WHEN®

Mexico/ Latin America
En Español: 001 (203) 359-7803 FAX: 001 (203) 359-7807
info@omega.com.mx e-mail:espanol@omega.com

Servicing Europe:

Benelux:
Managed by the United Kingdom Office
Toll-Free: 0800 099 3344 TEL: +31 20 347 21 21
FAX: +31 20 643 46 43 e-mail: sales@omegaeng.nl

Czech Republic:
Frystatska 184
733 01 Karviná, Czech Republic
Toll-Free: 0800-1-66342 TEL: +420-59-6311899
FAX: +420-59-6311114 e-mail: info@omegashop.cz

France:
Managed by the United Kingdom Office
Toll-Free: 0800 466 342 TEL: +33 (0) 161 37 29 00
FAX: +33 (0) 130 57 54 27 e-mail: sales@omega.fr

Germany/Austria:
Daimlerstrasse 26, D-75392 Deckenpfronn, Germany
Toll-Free: 0800 6397678 TEL: +49 (0) 7056 9398-0
FAX: +49 (0) 7056 9398-29 e-mail: info@omega.de

United Kingdom: ISO 9001 Certified
OMEGA Engineering Ltd.
One Omega Drive, River Bend Technology Centre, Northbank
Irlam, Manchester M44 5BD United Kingdom
Toll-Free: 0800-488-488 TEL: +44 (0) 161 777-6611
FAX: +44 (0) 161 777-6622 e-mail: sales@omega.co.uk

It is the policy of OMEGA Engineering, Inc. to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

The information contained in this document is believed to be correct, but OMEGA accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.
WARNING: These products are not designed for use in, and should not be used for, human applications.

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering. OMEGA is a registered trademark of OMEGA ENGINEERING, INC.

M5112/1012

GRAPHICAL ¼ DIN PROCESS CONTROLLER CONCISE PRODUCT MANUAL M5112

An additional manual M5113 is supplied for the CN2300 Profiler & Data Recorder features.
For complete, comprehensive operator's manual, visit omega.com/CN2300.

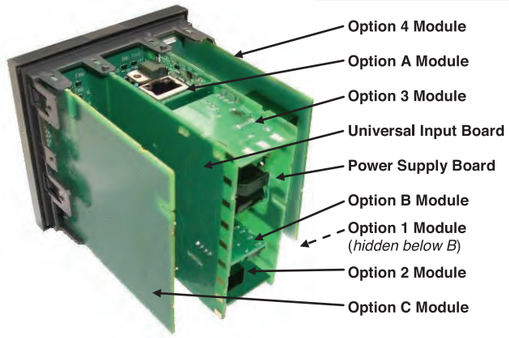
The following symbols are use on the product labels:

⚠	***Caution, refer to installation manual when connecting***	⎓	***Equipment protected through-out by double insulation***
~	***Alternating current***	⎓ ~	***Both direct and alternating current***

1. INSTALLATION

⚠ **CAUTION: Installation should be only performed by technically competent personnel. It is the responsibility of the installing engineer to ensure that the configuration is safe. Local regulations regarding electrical installation & safety must be observed - e.g. US National Electrical Code (NEC) and/or Canadian Electrical Code.**

Installing Option Modules



To access the option modules, first pull the instrument from the housing.

a. Detach the main boards by lifting first the upper, and lower mounting struts.
b. Plug the required option modules into the correct connectors, as shown below.
c. Locate the module tongues in the corresponding slot on the opposite board.
d. Hold the Power and Input boards together while relocating on their mountings.
e. Push the boards forward to ensure correct connection to the Display board.
f. Replace the instrument by aligning the boards with the guides in the housing, then slowly push the instrument back into position.

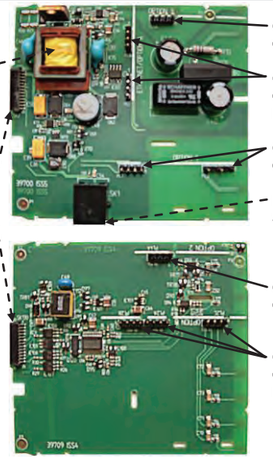
Note: Option modules are automatically detected at power up.

Main Board Connectors

POWER SUPPLY BOARD
Transformer Colour Code
100-240V (Yellow)
24-48V(Blue)

Display Board Connections

UNIVERSAL INPUT BOARD



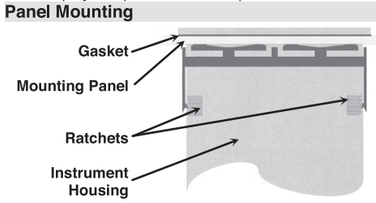
***Note:** Plastic pegs prevent fitting of older non-reinforced single relay modules – remove the peg to fit dual relays*

Replacement of Main Boards

⚠ **CAUTION: Replacement of main boards should only be carried out if unavoidable, and must only be carried out by trained personnel.**

When replacing the power supply board, observe the transformer colour and case labelling to **check the supply voltage**, otherwise irreparable damage may occur. If the display or input boards are replaced, a full recalibration **must** be carried out

Panel Mounting



Slide mounting clamp over the instrument housing towards rear face of mounting panel until the tongues engage in ratchets and instrument is clamped in position.

Hold instrument firmly in position (apply pressure to bezel only)

⚠ **CAUTION: Do not remove the panel gasket; it is a seal against dust and moisture.**

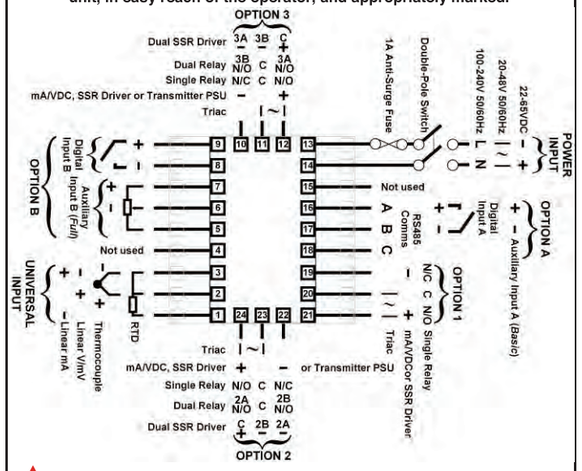
Rear Terminal Wiring

⚠ **CAUTION: The instrument is double insulated. All external circuits connected must provide double insulation.**
Failure to comply with the installation instructions may impact the protection provided by the unit.

Note: The wiring diagrams show all possible option combinations. The connections required depend on the options fitted. Use single strand (1.2mm / AWG18 max size) copper wire, except for the thermocouple input, where the correct thermocouple or compensating cable and connectors should be used.

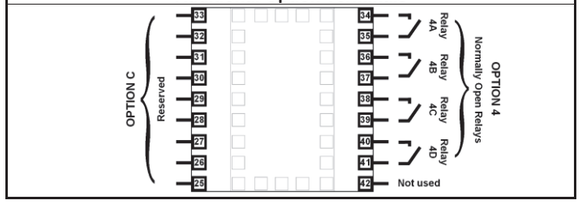
Main Terminals

⚠ **CAUTION: Check correct operating voltage on the side label before connecting power. A UL listed 1A anti-surge fuse, rated 250V (for AC) 65V (for DC) should be fitted to the power input. An IEC60947-1 & IEC60947-3 compliant isolation switch should be fitted close to the unit, in easy reach of the operator, and appropriately marked.**



⚠ **CAUTION: External computing devices connected to the communications port must comply with the standard, UL 60950.**

Additional Option Terminals



2. SPECIFICATIONS

PROCESS INPUT

Sampling Rate:	10 per second.
Resolution:	16 bits. Always four times better than display resolution.
Impedance:	>10MΩ resistive, except DC mA (5Ω) and V (47kΩ).
Temp Stability:	Error <0.01% of span per °C change in ambient temperature.
Supply Variation:	Supply voltage influence negligible within supply limits.
Humidity Influence:	Negligible if non-condensing.
Process Display:	Displays up to 5% over and 5% under span limits.
Process Variable Input Offset:	Reading adjustable ± Controller Span. +ve values added to Process Variable, -ve values subtracted from Process Variable
Sensor Break Detection:	Thermocouple & RTD - *Control goes to pre-set power value. High & Sensor Break alarms activate.* Linear (4 to 20mA, 2 to 10V and 1 to 5V only) - *Control goes to pre-set power value. Low & Sensor Break alarms activate.*
Isolation:	Isolated from all outputs (except SSR driver) at 240V AC.

Supported Thermocouple Types & Ranges:

Type	Range °C	Range °F	
B	+100 to 1824°C	+211 to 3315°F	
C	0 to 2320°C	32 to 4208°F	
D	0 to 2315°C	32 to 4199°F	
E	-240 to 1000°C	-400 to 1832°F	
J	-200 to 1200°C	-328 to 2192°F	*
K	-240 to 1373°C	-400 to 2503°F	*
L	0 to 762°C	32 to 1402°F	*
N	0 to 1399°C	32 to 2551°F	*
PtRh 20%:40%	0 to 1850°C	32 to 3362°F	
R	0 to 1759°C	32 to 3198°F	
S	0 to 1762°C	32 to 3204°F	
T	-240 to 400°C	-400 to 752°F	*

Optional decimal place can be displayed up to 999.9°C/F

Thermocouple Calibration: ±0.1% of full range, ±1LSD (±1°C for internal CJC if enabled). Linearization better than better ±0.2°C (±0.05 typical) on ranges marked * in the table above. Linearization for other ranges is better than better than ±0.5°C. BS4937, NBS125 & IEC584

Supported RTD Types & Ranges:

Type	Range °C	Range °F
3-Wire PT100	-199 to 800°C	-328 to 1472°F
NI120	-80 to 240°C	-112 to 464°F

Optional decimal place can be displayed up to 999.9°C/F

RTD Calibration: 0.1% of full range, ±1LSD. Linearization better than ±0.2°C (±0.05 typical). PT100 input to BS1904 & DIN43760 *(0.00385Ω/Ω/°C).*

RTD Excitation: Sensor current 150µA ±10%.

Lead Resistance: <0.5% of span error for max 50Ω per lead, balanced.

Supported Linear Types & Ranges:

Type	Range	Offset Range
mA DC	0 to 20mA DC	4 to 20mA DC
mV DC	0 to 50mV DC	10 to 50mV DC
V DC	0 to 5V DC	1 to 5V DC
V DC	0 to 10V DC	2 to 10V DC

Scalable from -9999 to 10000. Decimal point selectable from 0 to 3 places, but limited to 5 display digits (e.g. 9999.9)

Maximum Overload: 1A on mA input terminals, 30V on voltage input terminals.

DC Calibration: ±0.1% of full range, ±1LSD.

DC Input Multi-Point Linearization: Up to 15 scaling values can be defined anywhere between 0.1 and 100% of input.

AUXILIARY INPUTS

Supported Input Types & Ranges:

Type	Slot A Ranges	Slot B Ranges
MA DC	0 to 20, 4 to 20	0 to 20, 4 to 20
mV DC		0 to 50, 10 to 50, 0 to 100
V DC	0 to 5, 1 to 5, 0 to 10, 2 to 10	0 to 5, 1 to 5, 0 to 10, 2 to 10
Potentiometer		>2000Ω

Accuracy: ±0.25% of input range ±1 LSD.

Sampling Rate: 4 per second.

Resolution: 16 bits.

Impedance: >10MΩ resistive, except DC mA (10Ω) and V (47kΩ).

Sensor Break Detection: 4 to 20mA, 2 to 10V and 1 to 5V ranges only. *Control goes to pre-set power value if Aux Input is the active setpoint source.*

Isolation: Reinforced safety isolation from outputs and inputs (except to Digital Input B).

Auxiliary Input Scaling: Scalable as Remote Setpoint (RSP) input between –9999 and 10000, but is constrained by the setpoint limit settings.

DIGITAL INPUTS

Volt-free contacts (or TTL): Open contacts (>5000Ω) or 2 to 24VDC signal = Logic High
Closed contacts (<50Ω) or -0.6 to +0.8VDC signal = Logic Low.

Isolation: Reinforced safety isolation from inputs and other outputs.

Digital Input Sensitivity: Edge Sensitive. Requires High-Low or Low-High transition to change function.

Response Time: Slot A <0.25 second, Slot B <1.5 seconds.

Selectable Digital Input Functions:

Function	Logic High	Logic Low
Internal Setpoint Select	Local SP1	Alternate SP
Auto/Manual Control Select	Automatic	Manual Mode
Control Outputs	Enabled	Disabled

See the Supplementary Manual for extra options on Profiler or Recorder versions

OUTPUTS

Caution: *Plastic pegs prevent fitting of older non-reinforced single relay modules – Remove the peg to fit dual relays (all dual relay modules have reinforced isolation)*

Single Relay
Type & Rating: Single pole double throw (SPDT); 2A resistive at 120/240VAC.
Lifetime: >500,000 operations at rated voltage/current.
Isolation: Reinforced safety isolation from inputs and other outputs.

Dual Relay
Type & Rating: Single pole single throw (SPST),2A resistive at 120/240VAC. Dual relay modules have shared common.
Lifetime: >200,000 operations at rated voltage/current.
Isolation: Reinforced safety isolation from inputs and other outputs.

Quad Relay
Type & Rating: Single pole single throw (SPST),2A resistive at 120/240VAC.
Lifetime: >500,000 operations at rated voltage/current.
Isolation: Reinforced safety isolation from inputs and other outputs.

SSR Driver
Drive Capability: SSR driver voltage >10V into 500Ω minimum.
Isolation: Not isolated from the universal input, Ethernet communications or other SSR driver outputs.

Triac
Operating Voltage: 20 to 280Vrms (47 to 63Hz)
Current Rating: 0.01 to 1A (full cycle rms on-state @ 25°C); de-rates linearly above 40°C to 0.5A @ 80°C.
Isolation: Reinforced safety isolation from inputs and other outputs.

Linear DC
Ranges: 0 to 5, 0 to 10, 1-5, 2 to 10V & 0 to 20, 4 to 20mA (selectable) with 2% over/under-drive when used for control outputs.
Resolution: 8 bits in 250mS (10 bits in 1s typical, >10 bits in >1s typical).
Accuracy: ±0.25% of range, (mA @ 250Ω, V @ 2kΩ). Degrades linearly to ±0.5% for increasing burden (to specification limits).
Isolation: Reinforced safety isolation from inputs and other outputs.

Transmitter PSU
Power Rating: 24V nominal (19 to 28V DC) into 910Ω minimum resistance. (*Option to use DC Linear output as 0-10V stabilised PSU*).
Isolation: Reinforced safety isolation from inputs and other outputs.

COMMUNICATIONS

PC Configuration
Connection: RS232 via PC Configurator Cable to RJ11 socket under case.
Isolation: Not isolated from input or SSR Driver outputs. For bench configuration only. **CAUTION:** Do not use in live applications.

RS485
Connection: Locates in Option Slot A. Connection via rear terminals (*refer to wiring diagram*).
Protocol: Modbus RTU.
Slave/Master Mode: Slave address range 1-255 or Setpoint master mode.
Supported Speeds: 4800, 9600, 19200, 38400, 57600 or 115200 bps.
Data Type: 8 data bits and 1 stop bit. Odd, even or no parity.
Isolation: 240V reinforced safety isolation from all inputs and outputs.

Ethernet
Connection: Locates in Option Slot A. Connection via RJ45 connector on top of case.
Protocol: Modbus TCP. Slave only.
Supported Speed: 10BaseT or 100BaseT
Isolation: 240 V reinforced safety isolation from the supply, inputs and outputs (except SSR Drivers).

See the Supplementary Manual for extra options on USB/Recorder versions

LOOP CONTROL

Tuning Types: Pre-Tune, Auto Pre-Tune, Self-Tune or Manual Tuning.
Proportional Bands: Primary & Secondary (e.g. Heat & Cool) 0.5% to 999.9% of input span in 0.1% increments, or On/Off control.
Automatic Reset: Integral Time Constant, 1s to 99min 59s and OFF
Rate: Derivative Time Constant, 1s to 99 min 59s and OFF
Manual Reset: Bias 0 to 100% (-100% to +100% Primary & Secondary).
Deadband/Overlap: –20% to +20% of Primary + Secondary Proportional Band.
Differential: ON/OFF switching differential 0.1% to 10.0% of input span
Auto/Manual Control: Selectable with "bumpless" transfer when switching between Automatic and Manual control.
Cycle Times: Selectable from 0.5s to 512s.
Setpoint Ramp: Ramp rate selectable 1 to 9999 LSDs per hour and infinite.

ALARMS

Alarm Types: Up to 5 alarms selectable as Process High, Process Low, Band, Deviation, Rate of Signal Change (per minute), Sensor/input Break, Loop Alarm. Band and Deviation (high or low) alarm values are relative to the current setpoint value.

Alarm Hysteresis: A deadband from 1 LSD to full span (in display units) for Process, Band or Deviation Alarms.
Rate Of Change Alarm hysteresis is the shortest time (1 to 9999 secs) the rate of change must be above the threshold for the alarm activate, or fall below the threshold to deactivate.
Note: If the duration is less than this time, the alarm will not activate no matter how fast the rate of rise.

Combined Outputs: Logical OR of alarms 1 & 2, 1 to 3, 1 to 4 or 1 to 5.

See the Supplementary Manual for extra options on Profiler or Recorder versions

OPERATING CONDITIONS (FOR INDOOR USE)

Temperature: 0°C to 55°C (Operating), –20°C to 80°C (Storage).
Relative Humidity: 20% to 95% non-condensing.
Supply Voltage and Power: *Mains versions:* 100 to 240VAC ±10%, 50/60Hz, 20VA. *Low voltage versions:* 20 to 48VC 50/60Hz 15VA or 22 to 65VDC 12W.

CONFORMANCE NORMS

EMI: CE: Complies with EN61326.
Safety Considerations: CE: Complies with EN61010-1. UL, cUL to UL61010C-1. Pollution Degree 2, Installation Category II.
Front Panel Sealing: To IP66 (IP65 front USB connector). *IP20 behind the panel. (IP rating not recognised / approved by UL).*
Front Panel Cleaning: Wash with warm soapy water and dry immediately. *Close the USB cover (if fitted) before cleaning.*

DISPLAY

Display Type: 160 x 80 pixel, monochrome graphic LCD with a dual colour (red/green) backlight.
Display Area: 66.54mm (W) x 37.42mm (H).
Display Characters: 0 to 9, a to z, A to Z, plus ( ) - and _
Trend View: 120 of 240 data points shown in a scrollable window. Data is not retained when power turned off or if time base is changed.
Trend Data: Any active alarm plus PV (solid) & SP (dotted) at sample time or Max/Min PV between samples (candle-stick graph). Auto scales from 2 to 100% of Input Span.
Trend Sample Rate: 1; 2; 5; 10; 15; 30 seconds or 1; 2; 5; 10; 15; 30 minutes.

DATA RECORDER

Refer to the Supplementary Product Manual for information.

PROFILER

Profiler option can be purchased from your supplier if required. *Refer to the Supplementary Product Manual for information.*

DIMENSIONS

Weight: 0.65kg maximum.
Size: 96 x 96mm (Front Bezel). 117mm (Depth Behind Panel).
Mounting Panel: Panel must be rigid. Maximum thickness 6.0mm (0.25inch).
Panel Cut-out Size: 92mm x 92mm. Tolerance +0.5, -0.0mm.
Ventilation 20mm gap required above, below and behind.

3. POWER UP SEQUENCE

Following the power-up self-test and logo screen, the instrument normally enters Operation Mode, from which the user can select the instrument's Main Menu (*refer to the Screen Sequence list*). The exceptions to this are the first power-up after purchase, when option modules have been changed or if an error is detected.

Setup Wizard

An easy **Setup Wizard** runs automatically at first ever power-up. Follow the Wizard to setup parameters required for typical applications (*screens marked* **w** *in the Screen Sequence list*). A partial Wizard also runs whenever option modules have been changed, this only shows parameters affected by the changes. The Wizard can also be run from the Main Menu. It exits to Operation Mode once completed.

Start-Up Errors

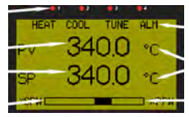
These messages indicate that a hardware or configuration an error has occurred.
***Caution:* Do not continue with the process until the issue is resolved.**

Message Displayed	Reason
Option Slot *n* Error	Fault detected. Replace the module in slot *n*
Configuration Problem	Check all instrument parameters before using
For Service Contact	Details of who to contact if a fault persists

4. OPERATION MODE

This mode is entered at power on, or accessed from the Main Menu. If required, all Operation Mode parameters can be made read only *(see Display Configuration)*.
Note: Configuration must be completed before starting normal operations.

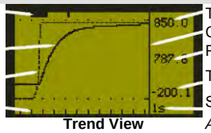
Normal Operation



LED Indicators — LED Function Labels
Process Variable Value — Engineering Units
Actual Setpoint Value
Secondary Power or — Primary Power or
-ve Deviation Bar Graph **Typical Operation Screen** *+ve Deviation Bar Graph*

Subsequent screens allow the display and selection/adjustment* of Setpoint(s), setpoint ramps, auto/manual control, enable/disable control, alarm status and trends.
Press ▶■ or ■◀ to move forward or back though the screens.
Where adjustment is possible*, press ▼ or ▲ to alter the values.
**If adjustment is not disabled in Configuration.*

Trend View



Active Alarm(s) — Trend Upper Scale Value
Cursor Line
Process Variable Trend — PV Value At Cursor Line
Setpoint Trend (*dotted*) — Trend Lower Scale Value
Time Markers — Sample Interval *(or Time*
(10 samples per marker) **Trend View** *At Cursor Line)*

Trend View graphs PV; PV & SP; or Max/Min PV between samples, plus active alarms. Trend Scale Values adjust automatically to visible data (between 2 to 100% of the input span). Sample intervals are set in Display Configuration.
Pressing ▼ or ▲ moves the Cursor Line back through the last 240 data points.
Note: Data is not retained at power down or the Sample Interval is changed.

Manual Control

Depending on the Control Configuration settings, automatic or manual control can be selected from the Auto/Manual selection screen, or via a digital input. Switching to or from manual mode is via Bumpless Transfer. In Manual mode the Setpoint display is replaced by a 0 to 100% power output level, labelled "**Man**".
Press ▼ or ▲ to set the required manual power.
Caution: Manual power level is not restricted by the output power limits.

Over/Under Range & Input Fail Indications

If the process or auxiliary inputs are >5% above or below the scale max/min, their displayed value is replaced with the word "**HIGH**" or "**LOW**".
If a signal break is detected, their value is replaced with "**OPEN**" and an un-calibrated input is replaced by "**ERROR**". In OPEN or ERROR conditions, the *Control Outputs go to the pre-set power value (see Control Config).*.
Caution: Correct the problem before continuing normal operation.

5. AUTOMATIC TUNING MODE

Engage Pre-Tune, Self-Tune or Auto Pre-Tune as required, from the Automatic Tuning Menu. Pre-tune is a "single-shot" routine that disengages when complete.
Note: Automatic tuning will not engage if either proportional band is set to On/Off control. Also, Pre-tune (inc. Auto Pre-Tune) will not engage if the setpoint is ramping, or the Process Variable is <5% of span from setpoint.
If Auto Pre-Tune is selected, Pre-tune will attempt to run at every power up. Refer to the full user guide (available from your supplier) for details on tuning.

6. SERIAL COMMUNICATIONS

Set Ethernet option IP address with supplied software for networks without DHCP.
Refer to the User guide (from your supplier) for help with communications .

7. SCREEN SEQUENCES

The parameters displayed depend on how the instrument has been configured. After 2 minutes without key activity, most screens revert to the next higher menu level, until reaching the base Operation Mode display. **Note:** Additional screens will be displayed if the USB, Profiler or Recorder Options are fitted - *Refer to the Supplementary Manual*.
Screens marked ◷ persist unless changed by the user. Screens marked **W** are also included in the Setup Wizard. Menus marked 🔒 = Require an un-lock code for access.

Screen Navigation

■◀ = Accept Value & Move Back ▼ = Next Item/Increment ▲ = Prior Item/Decrement ▶■ = Accept Value & Move Forward ▲+▶■ = Move Up One Menu Level
The symbols ▲▼ are showed to the right of the lists when more menu options are available above ▲ or below ▼.

Select Main MenuS Option from list. Press ▶■ to continue. - Press ■◀ + ▶■ to move from Operation Mode to Main Menu

	Operation Mode:		
	Base operating screen. *LED Labels; PV value; SP value & Bar Graph*		◷ LED Labels = LED indicator functions. Defaults are HEAT, COOL, TUNE & ALARM - *these labels can be altered with configuration software* Bar Graph = Primary/Secondary Power or Control Deviation. - *see Bar Graph Format screen.*
	Auto/Manual Control Mode Selection		Switch between automatic and manual control. - *if enabled in Control Configuration.*
	Setpoint Value Display & Adjustment		View and alter local (internal) setpoint(s). *Remote setpoints are read only.*
	Setpoint Ramp Rate		Setpoint Ramp Rate adjustment (in Display Units per hour). - *if enabled in Control Configuration.*
	Select Setpoint Source		Select if local setpoint 1 or the alternate setpoint is active. - *if enabled in Control Configuration.*
	Control Enable		Enables/disables control outputs. - *if enabled in Control Configuration.*
	Alarm Status		Active / inactive status of all configured Alarms.
	Trend View		◷ A trend graph of PV & SP, or the Max/Min value of the PV between samples. Any active alarm(s) are indicated at the top of the graph.
	- Custom Display screens …		Up to 50 Configuration parameters can be copied into Operation Mode using the PC software. In this mode they are **not pass code protected**.
	Note: ***Operation Mode screens can be made globally read only from Display Configuration***		
🔒	**Setup Wizard:**		
	Setup Wizard Unlocking	w	Enter correct code number to access Setup Wizard. *Default Value = 10*
	- Screens marked **w** *…*	w	Press ▶■ to select each major configuration parameter in turn. Follow the on-screen prompts to alter the values.
	Setup Wizard Completed	w	Confirms completion of the Setup Wizard. Exits to Operation Mode.
🔒	**Supervisor Mode:**		
	Supervisor Mode Unlocking		If Supervisor Mode is configured (*requires PC software*), enter correct code number to continue. *Default Value = 10*
	- Supervisor Mode Screens …		Press ▶■ to select up to 50 Configuration parameters in turn. Follow on-screen prompts to alter the values.
🔒	**Configuration Menu:**		
	Configuration Mode Unlocking		Enter correct code number to access Configuration Mode. *Default Value = 10*
	Configuration Options		Select required Configuration Menu Option from list. Press ▶■ to continue.
	Refer to the Configuration Menu screens sequences opposite for information about the Configuration Sub-Menus.		
🔒	**Automatic Tuning Menu:**		
	Automatic Tuning Mode Unlocking		Enter correct code number to access Automatic Tuning Menu.
	Pre-Tune	w	Turn Pre-Tune on/off. Pre-Tune is disabled in On-Off Mode; if PV <5% of span from SP; during Profiles or if a Ramping Setpoint is set.
	Pre-Tune Status		Shows current Pre-Tune status. Active or Inactive.
	Self-Tune		Turn Self-Tune on/off. Self-Tune is disabled in On-Off Mode and is suspended during setpoint ramping or profile ramp segments.
	Self-Tune Status		Shows current Self-Tune status. Active or Inactive.
	Auto Pre-Tune Enable		Enables/Disables Automatic Pre-Tune attempt at power-up. Normal Pre-Tune engagement rules are applied.
🔒	**Profile Setup Menu:**		*Refer to the Supplementary Product Manual for information about the additional screens when the Profiler feature is fitted.*
🔒	**Profile Control Menu:**		*Refer to the Supplementary Product Manual for information about the additional screens when the Profiler feature is fitted.*
🔒	**USB Menu:**		*Refer to the Supplementary Product Manual for information about the additional screens when the USB or Data Recorder features are fitted.*
🔒	**Recorder Menu:**		*Refer to the Supplementary Product Manual for information about the additional screens when Data Recorder is fitted.*
	Product Information Mode:		
	Input Calibration Status		Calibration status of mVDC, VDC, mADC, RTD and Thermocouple CJC inputs. *All should be "Calibrated".*
	Calibration Check Due Date		Date re-calibration is due. - *if Calibration Reminder Enabled in Inputs Configuration.*
	Option Slot *n* Information		Type of Option Modules (*if any*) fitted in Option Slot s 1-4, A or B
	Controller Feature Information		Controller Only; USB Port; Data Recorder (*includes USB Port*) or Profiler.
	Firmware Information		Type and version of firmware.
	Serial Number Information		Instrument serial number.
	Date of Manufacture		Date of Manufacture
	Service Information Mode:		
	For Service Contact		Contact information for Service, Sales or Technical Support.

Select required Main Menu Option from list. Press ▶■ + ■◀ to move back to Main Menu

Input Configuration:		
Process Variable Input Type	w	From Thermocouple, RTD and Linear inputs. - *see specifications section for details.*
Engineering Units	w	Select display units from: °C; °F; °K; bar; %; %RH; pH; psi or none.
Decimal Point Position	w	Display resolution with 0; 1; 2 or 3 decimal places. Temperature inputs are limited to 1 decimal place.
Multi-Point Scaling Enable		Enables/disables Linear Input Multi-Point Scaling.
Scale Range Lower Limit	w	Sets the usable span (min = 100 units, max = range limits - *see specs)* for temperature inputs. For Linear inputs, Upper & Lower Limits define the
Multi-Point Scale Point(s)		values shown (-1999 to 9999) when input is at minimum and maximum values. Min span = 100 units. If Multi-Point Scaling is enabled, up to 15
Scale Range Upper Limit	w	breakpoints* can scale input vs. displayed value, between the linear input scale limits. *A breakpoint set at 100% input ends the sequence.
CJC Enable/Disable		Enables/disables internal Thermocouple Cold Junction Compensation. The default value is Enabled.
Process Variable Offset		Trims the PV. +Ve values add to, –Ve values subtract from measured input. **Caution:** Use with care!
Input Filter Time		Filter unwanted noise from input signal. Adjustable from 0.1 to 100.0 seconds or OFF (default = 2s). **Caution:** Use with care!
Auxiliary Input *n* Type	w	From: 0-10V; 2-10V; 0-5V; 1-5V, 0-20mA or 4-20mA DC. Aux B also allows 2KΩ Pot and 0-100mV
Auxiliary Input *n* Scaling Lower Limit	w	Scales Aux Input A or B to show a value between -9999 and 10000 when this input is at or below it's lower limit. Constrained by the Setpoint Limits.
Auxiliary Input *n* Scaling Upper Limit	w	Scales Aux Input A or B to show a value between -9999 and 10000 when this input is at or above it's upper limit. Constrained by the Setpoint Limits.
Auxiliary Input *n* Offset		Trims the Aux Input A or B. +Ve values are added to, –Ve values subtracted from the measured auxiliary input.
Control Configuration:		
Control Enable/Disable		From: Enabled; Disabled; Digital Input A, or B or Operator Selectable - Allows the control output(s) to be turned off.
Auto/Manual Mode Access	w	From: Automatic Control; Manual Control; Operator Selectable; Digital Input A or B Selectable.
Control Type	w	Single - *Primary Control Output only (e.g. Heating or Cooling only)* or Dual - *Primary & Secondary (e.g. Heating & Cooling).*
Primary Control Action	w	Reverse or Direct. Reverse = "apply primary power when below setpoint". *Secondary output action always opposite to Primary*.
Control Status		Display of the current process variable and setpoint values – *Read Only*.
Power Output Level		Primary and Secondary control % output power levels – *Read Only*.
Primary Proportional Band		From: On-Off control or 0.1% to 999.9% proportional band. *Read Only during automatic tuning*.
Secondary Proportional Band		From: On-Off control or 0.1% to 999.9% proportional band. *Read Only during automatic tuning*.
Integral Time Constant		Integral Time value (Automatic Reset) from 1s to 99min 59s or OFF. *Read Only during automatic tuning*
Derivative Time Constant		Derivative Time value (Rate) from 1s to 99 min 59s or OFF. *Read Only during automatic tuning*
Manual Reset (Bias)		Manual Reset value (Bias) from 0-100% (-100 to +100% for Primary & Secondary control type).
Overlap / Deadband		Overlap (+ve values) or Deadband (-ve values) between Primary & Secondary Proportional Bands.
Primary On-Off Differential		Primary On-Off control hysteresis (deadband) from 0.1 to 10.0% of Span (*centred about setpoint*).
Secondary On-Off Differential		Secondary On-Off control hysteresis (deadband) from 0.1 to 10.0% of Span (*centred about setpoint*).
Pri. & Sec. On-Off Differential		Combined Primary & Secondary On-Off Control hysteresis (deadband) from 0.1 to 10.0% of Span.
Primary Cycle Time		Primary Power Cycle Time from 0.5s to 512s. *Relay, SSR Driver or Triac Control Outputs only.*
Secondary Cycle Time		Secondary Power Cycle Time from 0.5s to 512s. *Relay, SSR Driver or Triac Control Outputs only.*
Primary Power Lower Limit		Minimum Primary Output Power limit, from 0 to 90%. *Must be 10 or more % less than the upper limit.* **Caution:** Use with care
Primary Power Upper Limit		Maximum Primary Output Power limit, from 10 to 100%. *Must be 10 or more % higher than the lower limit.* **Caution:** Use with care
Secondary Power Lower Limit		Minimum Secondary Output Power limit, from 0 to 90%. *Must be 10 or more % less than the upper limit.* **Caution:** Use with care
Secondary Power Upper Limit		Maximum Secondary Output Power limit, from 10 to 100%. *Must be 10 or more % higher than the lower limit.* **Caution:** Use with care
Sensor Break Pre-set Power Output		The power level (-100 to +100%) applied if the PV input (or active RSP) is lost. Default value is OFF (0% power).
Setpoint Selection	w	From: Local SP1; Alternate SP; Operator Selectable; Digital Input A or B Selectable.
Alternate Setpoint Source	w	From: Local SP2; Auxiliary Input A or B Remote SP Selectable.
Setpoint Upper Limit		Maximum allowable setpoint values. Adjustable within Input Span limits. *Applies to local and remote setpoints*. **Caution:** Use with care!
Setpoint Lower Limit		Minimum allowable setpoint values. Adjustable within Input Span limits. *Applies to local and remote setpoints*. **Caution:** Use with care!
Setpoint Ramp Editing		Enables/disables changing of Setpoint Ramp Rate in Operation Mode – *Note: this does not turn off an active ramp*.
Setpoint Ramp Rate		Setpoint Ramp Rate value (1 to 9999 LSDs per hour or OFF). *Applied at start-up and SP changes.*
Local Setpoint 1 Value	w	Local Setpoint 1 value, between the Setpoint Upper and Lower Limits.
Local Setpoint 1 Offset		+ve values added to / -ve values subtracted from Setpoint 1 value when instrument is a slave in multi-zone applications. Otherwise set to zero.
Local Setpoint 2 Value	w	Local Setpoint 2 value, between the Setpoint Upper and Lower Limits.
Local Setpoint 2 Offset		+ve values added to / -ve values subtracted from Setpoint 2 value when instrument is a slave in multi-zone applications. Otherwise set to zero.
Output Configuration:		
No Outputs Warning		If Outputs Configuration menu is entered without any output modules fitted.
Linear Output *n* Type	w	From: 0-5, 0-10, 1-5, 2-10V & 0-20, 4-20mA or 0-10VDC adjustable Transmitter PSU.
Adjustable 0-10V Transmitter PSU *n*	w	Voltage required if Output *n* is 0-10VDC adjustable Transmitter PSU.
Output *n* Usage	w	From: Primary or Secondary Control; Alarms; Profile Events & Alarms; Retransmit Process Variable or Setpoint.
Output *n* Alarm Selection	w	Alarm 1; 2; 3; 4; 5 or Logical OR of alarms 1 to 2; 1 to 3; 1 to 4 or 1 to 5. Selectable Direct or Reverse Action.
Retransmit Output *n* Scale Low	w	Displayed value at which the retransmission output = minimum. Adjustable from -1999 to 9999.
Retransmit Output *n* Scale High	w	Displayed value at which the retransmission output = maximum. Adjustable from -1999 to 9999.
Alarm Configuration:		
Alarm *n* Type	w	From: Unused; High; Low; Deviation; Band; Control Loop; Rate Of Signal Change per minute; PV Signal Break; Aux. Input A or B Break.
Alarm *n* Value	w	Alarm activation point. – *applicable if type is High; Low; Deviation (+ve above, -ve below SP) or Band (above or below SP).*
Alarm *n* Hysteresis		Deadband on "safe" side of alarm, through which the signal must pass before alarm deactivates.
Signal change Alarm *n* Min. Duration		Minimum time the rate of PV change must be above the alarm threshold for a Rate Of Change Alarm to change state (on or off). 1 to 9999 secs.
Alarm *n* Inhibit		Prevents alarm activation if the alarm condition is true at power up. *Activation occurs only after the condition has passed and then reoccurred.*
Loop Alarm Type		From: Automatic (*2x Integral Time Constant*) or Manual (*from Loop Alarm Time screen*).
Manual Loop Alarm Time		Time allowed (after PID power output reaches min or max), for process to begin responding. Alarm activates if no response.
Communications Configuration:		
No Comms Warning		If Communications Configuration menu is entered without a communications module fitted.
Modbus RTU Parity	w	From: Odd; Even or None.
Modbus RTU Data Rate	w	From: 9600; 19200; 57600 or 115200 bps.
Master Mode, or Slave Address	w	Slave address (1 to 255), or multi-zone Setpoint Master Mode.
Target Register In Slave		Target register for Setpoint value in attached setpoint slave controllers.
Master Mode Format		The data format required by the attached setpoint slaves. From: Integer; integer with 1 decimal place & float.
Serial Communications Write Enable		Enables/disables writing via RS485 or Ethernet (*if fitted*). When disabled, all parameters are read only.
Recorder Configuration:		*Refer to the Supplementary Product Manual for information about the additional screens when Data Recorder is fitted.*
Recorder Clock Configuration:		*Refer to the Supplementary Product Manual for information about the additional screens when Data Recorder is fitted.*
Display Configuration:		
Enable Custom Display Mode		Enables/disables Custom Operation Mode, if configured (*requires PC configuration software*).
Read Only Operation Mode?		Allows Operation Mode to be Read-Only or Read/Write. Screens can be seen but, values cannot be changed if Read-Only.
Operation Mode Bar Graph Format		From: PID Power or Control Deviation or.
Trend Sample Interval		Interval between display of next value on the trend graph From: Every 1; 2; 5; 10; 15; 30 Seconds, or Every 1; 2; 5; 10; 15; 30 Minutes.
Select Trend Mode		From: PV only, PV (solid) & SP (dotted) at sample time or Max/Min PV between samples (candle-stick graph). Alarm activity is always shown.
Display Colour		From: Red only; Green only; Red to Green on Alarm or Green to Red on Alarm.
Invert Display		Standard or Negative display image.
Display Contrast		Screen contrast (0 and 100) to improve clarity. 100 = maximum contrast.
Language		Select English or the alternate local language. The alternate language type can be changed using the PC software.
Lock Code Configuration:		
Lock Code View 1		View and edit the Setup Wizard; Configuration Mode; Tuning Menu and Supervisor Mode Lock Codes (1-9999 or OFF). *Default Values = 10*
Reset To Defaults:		
Reset To Defaults		Set all parameters to default values. **Caution:** User must reconfigure all required settings before using the instrument following a reset.