INSTALLATION, PROGRAMMING AND OPERATION

MANUAL

Manual Number: 702683-0001 Rev.: A August, 2006

DYNAPAR brand

Series S428A

1/8 DIN Process Indicator with Alarm

IT IS BEST TO USE THIS MANUAL IN PRINTED FORM

You may conveniently and quickly print this manual using your computer and desktop printer. We suggest that you use two-sided (duplex) printing in order to keep the manual's bulk to a minimum.

If you prefer, our Customer Service Department will mail you a free, professionally printed copy, of this manual at your request. Simply phone 1-800-390-6405 and ask the representative for the S428A manual and provide your mailing address.

DANAHER INDUSTRIAL CONTROLS

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This manual supplements the Concise Product manual supplied with each instrument at the time of shipment. Information in this installation, wiring and operation manual is subject to change without notice.

A copy of this manual is available in PDF format on the Danaher Industrial Controls web site (www.dancon.com).

Note:

It is strongly recommended that applications incorporate a high or low limit protective device, which will shut down the equipment at a preset process condition in order to prevent possible damage to property or products.

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WARNING:

THE INTERNATIONAL HAZARD SYMBOL IS INSCRIBED ADJACENT TO THE REAR CONNECTION TERMINALS. IT IS IMPORTANT TO READ THIS MANUAL BEFORE INSTALLING OR COMMISSIONING THE UNIT.

Products covered by this manual are suitable for Indoor use, Installation Category II, Pollution category 2 environments.

Table of Contents

1.0 Introduction

The S428A microprocessor based indicators can measure and display process variables such as temperature, pressure, flow and level from a variety of inputs. The S428A is housed in an $^1/_8$ DIN (48 x 96mm front) enclosure.

The operating voltage is either 100-240V at 50/60 Hz or 24V-48V AC/DC depending on the model purchased. EEPROM technology protects against data or configuration loss during power outages.

The S428A Indicator can display a process value and provide multiple stage alarm outputs. Additional features include Multipoint scaling to compensate for non-linear signals and a Tare function to auto-zero the current reading.

Inputs are user configurable for connection to thermocouple and RTD probes, as well as linear process signal types such as mVDC, VDC or mADC. Output options include relays, SSR drivers, triacs or linear mA/voltage modules. These can be used for process control, alarms or retransmission of the process variable to external devices such as data recorders or PLC's.

A Transmitter Power Supply option module can provide an unregulated 24V DC (22mA) auxiliary output voltage for external signal transmitters.

Alarm indication is standard on all instruments; up to five alarms are possible on the indicators. Alarms may be set as process high or low. Control functions, alarm settings and other parameters are easily adjusted from the front keypad.

Standard Models

Code 1: Model #	Code 2: Input Type	Code 3: Option Slot 1	Code 4: Option Slot 2	Code 5: Option Slot 3	Code 6: Option Slot A	Code 7: Power Supply	Code 8: Display Color
S428A	☐	☐	☐	☐	☐	☐	☐
I/8 DIN Indicator with Alarm Function	**1** 3 Wire RTD or DC mV **2** Thermo-couple **3** DC mA **4** DC Voltage	**0** Not Fitted **1** Relay **2** DC for SSR **3** DC 0-10V **4** DC 0-20mA **5** DC 0-5V **6** DC 2-10V **7** DC 4-20mA **8** Triac*	**0** Not Fitted **1** Relay **2** DC for SSR **3** DC 0-10V **4** DC 0-20mA **5** DC 0-5V **6** DC 2-10V **7** DC 4-20mA **8** Triac* **9** Dual Relay	**0** Not Fitted **1** Relay **2** DC for SSR **3** DC 0-10V **4** DC 0-20mA **5** DC 0-5V **6** DC 2-10V **7** DC 4-20mA **8** Transmitter Power Supply **9** Dual Relay	**0** Not fitted **1** RS-485 Serial Communication **3** Remote Digital Input	**0** 100-240 AC **2** 24-48 AC or DC	**0** Red Display **1** Green Display **4** Color Change Display (Red/Green)

* Maximum of two Triac outputs per unit

The table above shows available standard model configurations that may be provided in the Series S428A when ordered from the factory. Field installation of most options is possible and a unit may be ordered with no options in slots 1, 2, 3 & A and later customized in the field per instructions in Appendix 1.

1.1 Condensed Specifications

STANDARD FEATURES

4 per second input sample rate
Universal input
NEW Improved HMI, 3 button operation, 4 digit 13mm high red, green or red/green display (color change on alarm), indicators for °C/°F, set-up, alarms (5) and max. & min. indicators.
NEW Plug-in output modules – install just the function needed
NEW Multipoint scaling & Tare functions
NEW Jumperless input configuration
NEW Auto-detection of installed output modules
NEW standard latching alarm
Rugged ABS Plastic housing

ENVIRONMENTAL CHARACTERISTICS

Operating Temp: 32° to 131°F (0° to 55°C)
Storage Temp: -4° to 176°F (-20° to 80°C)
Humidity: 20% to 95% non-condensing RH

ELECTRICAL

Supply Voltage: 100-240V, 50/60Hz, Optional 20-48VAC 50/60Hz / 22-65VDC
Power Consumption: 5W / 7.5 VA Maximum

DISPLAY

Type: Red/Green, 7 segment LED, 4 digit primary display, single digit secondary display
Height: 0.53" (13mm) primary display, 0.39" (10mm) secondary display
Annunciators: LED indicators for output and status

INPUTS

T/C's: J, T, K, L, N, B, R, S, C; Pt Rh20% vs. Pt 40% Rh
RTD: 3-wire, PT100
DC Linear (Scalable –1999 to +9999)
Volts: 0-5V, 1-5V, 0-10V, 2-10V
DC milliamps: 0-20mA or 4-20mA
DC millivolts: 0-50mV, 10-50mV

OUTPUTS

All outputs are user-selectable and customized based on desired application; choose from the following output types
Max # of Outputs: 5 for alarm, 24 VDC transmitter power supply or retransmit of process value
Single Alarm Relay: Optional SPDT; 240VAC 2A resistive; Lifetime >500,000 operations at rated voltage/current
Dual Alarm Relays: Optional, Two x SPST contacts with shared common. 2 Amp resistive at 240V AC, >200,000 operations. Latching or non-latching
SSR Drive: Optional drive capability: >10 VDC nominal into 500 ohm minimum
DC Linear: Optional 0-20mA, 4-20mA into 500 ohm max; 0-10V, 1-5V, 2-10V, 0-5V into 500 ohm min; Outputs have 2% over/under drive applied; Accuracy +-0.25% (mA into 250 ohm load, V into 2k ohm load); degrading linearity to +-0.5% for increasing burden to specified limits
Triac: Optional 0.01 to 1A AC, 20 to 280Vrms, 47-63 Hz (Limit 2)
Transmitter Power Supply: Optional 24 VDC (Limit 1)

OUTPUT FUNCTIONS

Process Alarm: (reverse or direct)
Alarm Modes (Alarm 1 through 5): High/Low, logical OR
Retransmit: Process value

ELECTRICAL PERFORMANCE

Accuracy: ± 0.1% of input range ±1 LSD (T/C CJC better than 1 degree C)
Input sample rate: 4 per second, 14 bit resolution
Impedance: >10M ohm for the thermocouple and mV ranges, 47k ohm for V ranges and 5 ohm for mA ranges
Sensor Break Detection: <2 seconds (except zero based DC ranges), high alarms activate for T/C, RTD and mV ranges, low alarms activate for mA or V ranges

COMMUNICATIONS INTERFACE

User-selectable: 2-wire, RS-485 serial communications option with choice of Modbus RTU or ASCII protocol; 1200 to 19200 baud

RATINGS/AGENCY APPROVALS

Conformance: CE, UR, cUR UL File # 67237
Safety: EN61010
EMC: EN61326

PROTECTION

IEC IP66 (NEMA 4X) front panel
IEC IP20 (behind the panel protection)

PHYSICAL DIMENSIONS

Panel Cutout: 1.77" x 3.62" (45mm x 92mm)
Width: 3.78" (96mm)
Height: 1.89" (48mm)
Depth: 3.93" (100mm)
Weight: 0.46 lbs (0.21 kg)
Mounting: Plug in panel with mounting clamp
Digital Input 1: Selects volt-free or TTL input

OPTIONS/ACCESSORIES

NEW Faster RS-485 serial communication speeds and user-selectable (Modbus/RTU or Dynapar ASCII) option
NEW 24VDC transmitter power supply option
Choice of Led colors: red or Green
Drive output: 10VDC SSR

See Appendix 3 for Complete Specification

Section 2
INSTALLATION

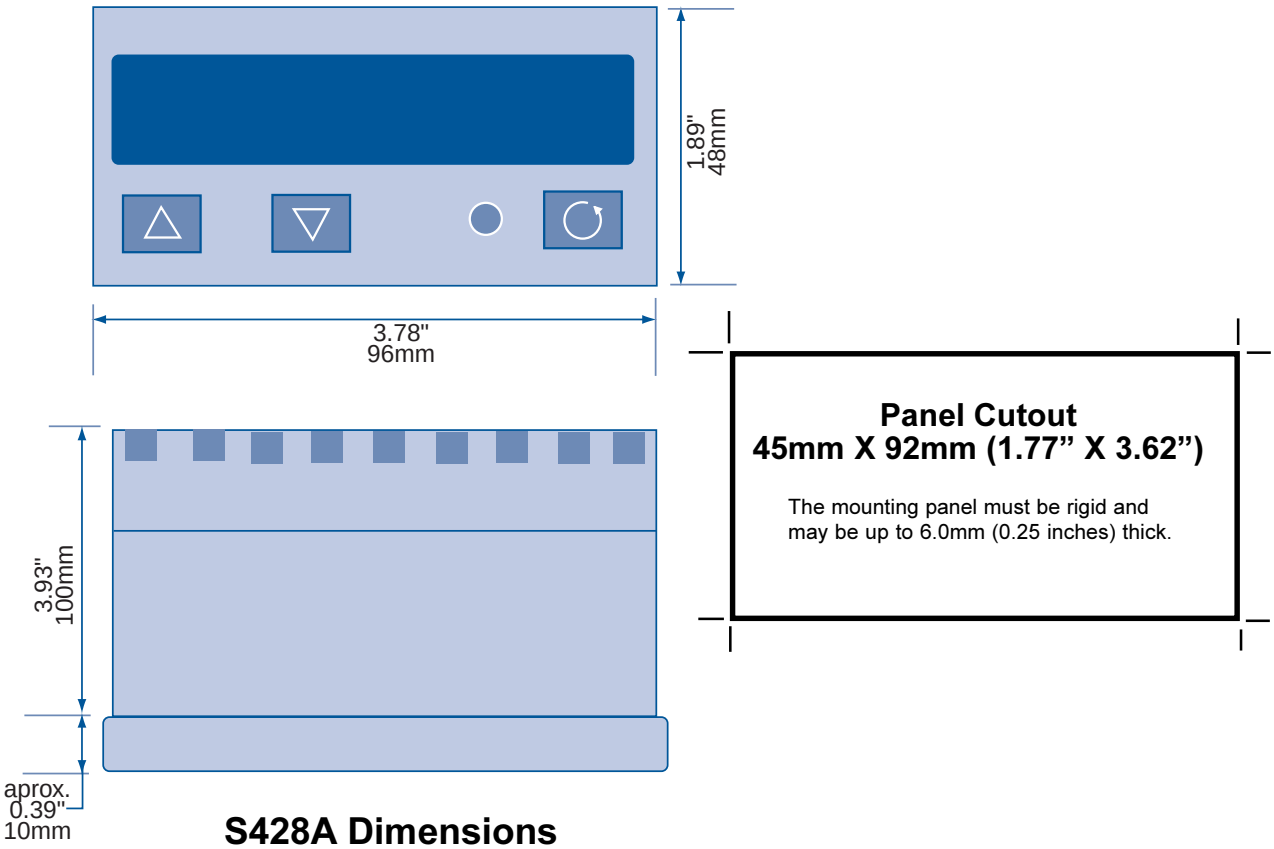
Installation

Unpacking

1. Remove the product from its packing. Retain the packing for future use, in case it is necessary to transport the instrument to a different site or to return it to the supplier for repair/testing.
2. The instrument is supplied with a panel gasket and push fit mounting clamp. A single sheet concise manual is also supplied in one or more languages. Examine the delivered items for damage or defects. If any are found, contact your supplier immediately.

CAUTION:

Installation and configuration should be performed only by personnel who are technically competent and authorised to do so. Local regulations regarding electrical installation and safety must be observed.

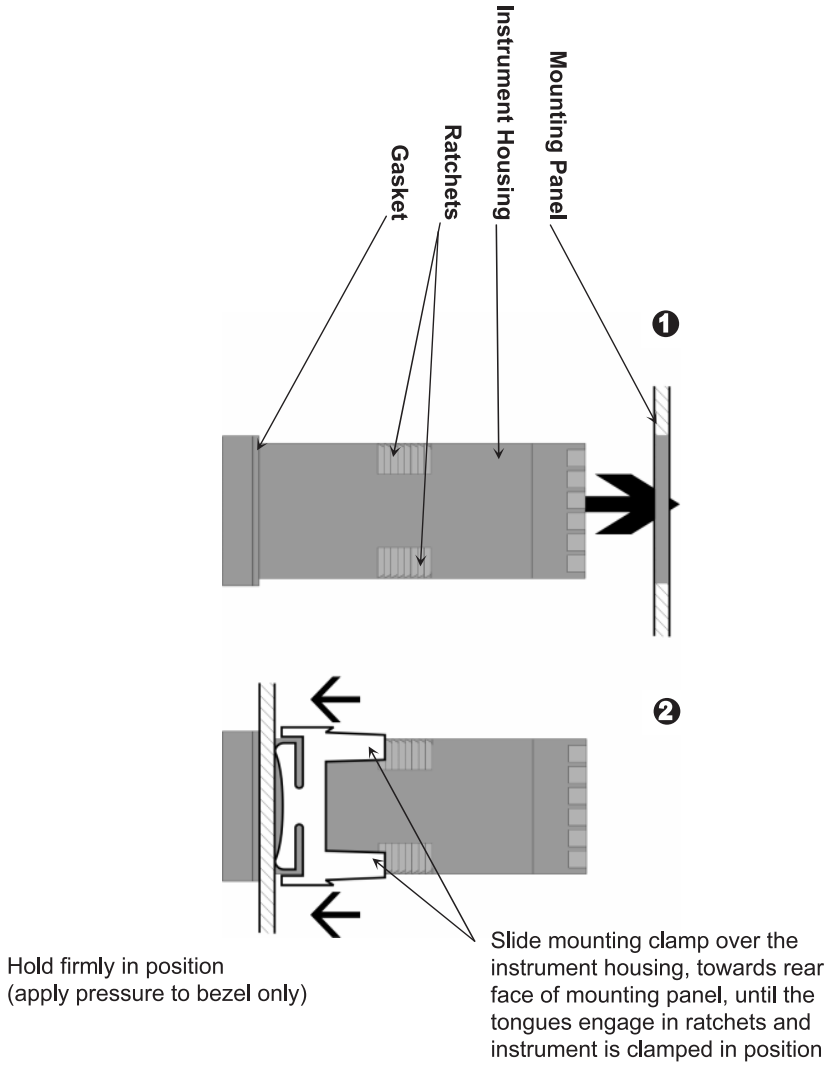


S428A Dimensions

Panel-Mounting

CAUTION:

Insure the inside of the panel is within the instrument's operating temperature specification and that there is adequate air flow to prevent overheating.



CAUTION:

Do not remove the panel gasket, as this may result in inadequate clamping and sealing of the instrument to the panel.

General Wiring Practice

Electrical noise is a phenomenon typical of industrial environments. As with any instrumentation, these guidelines should be followed to minimize the effect of noise.

Installation Considerations

Ignition transformers, arc welders, mechanical contact relays and solenoids are all common sources of electrical noise in an industrial environment and therefore the following guidelines MUST be followed.

1. If the instrument is being installed in existing equipment, the wiring in the area should be checked to ensure that good wiring practices have been followed.
2. Noise-generating devices such as those listed should be mounted in a separate enclosure. If this is not possible, separate them from the instrument, by the largest distance possible.
3. If possible, eliminate mechanical contact relays and replace with solid-state relays. If a mechanical relay being powered by an output of this instrument cannot be replaced, a solid-state relay can be used to isolate the instrument.
4. A separate isolation transformer to feed only the instrumentation should be considered. The transformer can isolate the instrument from noise found on the AC power input.

AC Power Wiring - Neutral (for 100 to 240V AC versions)

It is good practice to ensure that the AC neutral is at or near ground (earth) potential. A proper neutral will help ensure maximum performance from the instrument.

Wire Isolation

Four voltage levels of input and output wiring may be used with the unit:

1. Analogue input or output (for example thermocouple, RTD, VDC, mVDC or mADC)
2. Relays & Triac outputs
3. SSR Driver outputs
4. AC power

CAUTION:

The only wires that should run together are those of the same category.

If any wires need to run parallel with any other lines, maintain a minimum space of 150mm between them.

If wires MUST cross each other, ensure they do so at 90 degrees to minimise interference.

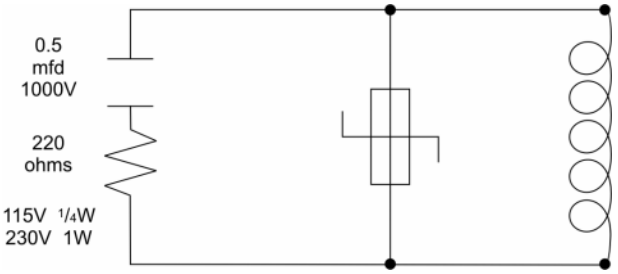
Use of Shielded Cable

All analog signals must use shielded cable. This will help eliminate electrical noise induction on the wires. Connection lead length must be kept as short as possible keeping the wires protected by the shielding. The shield should be grounded at one end only. The preferred grounding location is at the sensor, transmitter or transducer.

Noise Suppression at Source

Usually when good wiring practices are followed, no further noise protection is necessary. Sometimes in severe electrical environments, the amount of noise is so great that it has to be suppressed at source. Many manufacturers of relays, contactors etc supply 'surge suppressors' which mount on the noise source. For those devices that do not have surge suppressors supplied, Resistance-Capacitance (RC) networks and/or Metal Oxide Varistors (MOV) may be added.

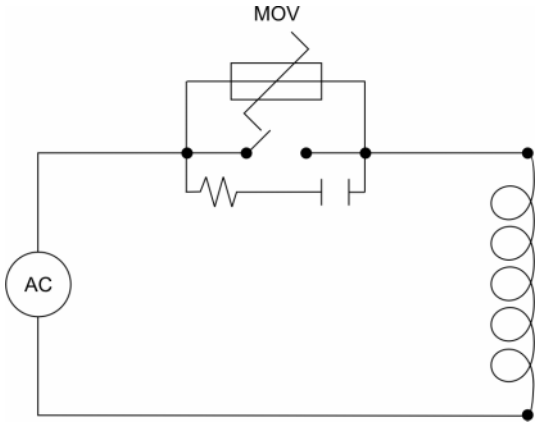
Inductive coils:- MOVs are recommended for transient suppression in inductive coils, connected in parallel and as close as possible to the coil. Additional protection may be provided by adding an RC network across the MOV.



Transient Suppression with Inductive Coils

Contacts:- Arcing may occur across contacts when they open and close. This results in electrical noise as well as damage to the contacts. Connecting a properly sized RC network can eliminate this arc.

For circuits up to 3 amps, a combination of a 47 ohm resistor and 0.1 microfarad capacitor (1000 volts) is recommended. For circuits from 3 to 5 amps, connect two of these in parallel.



Contact noise suppression

Sensor Placement (Thermocouple or RTD)

If the temperature probe is to be subjected to corrosive or abrasive conditions, it must be protected by an appropriate thermowell. The probe must be positioned to reflect true process temperature:

1. In a liquid media - the most agitated area
2. In air - the best circulated area

CAUTION:

The placement of probes into pipe work some distance from the heating vessel leads to transport delay, which results in poor control.

For a two wire RTD a wire link should be used in place of the third wire. Two wire RTDs must only be used with lead lengths less than 3 meters. Use of three wire RTDs is strongly recommended.

Thermocouple Wire Identification Chart

The different thermocouple types are identified by their wire colors, and where possible, the outer insulation (sheath) as well. There are several standards in use throughout the world.

The table below shows the wire and sheath colors used for most common thermocouple types. The format used in the table is:

+ Wire Color - Wire Color	Sheath Color

Thermocouple Wire Colors

Type		International IEC584-3		USA ANSI MC 96.1		British BS1843		French NFC 42-324		German DIN 43710	
J	+*	Black	Black	White	Black	Yellow	Black	Yellow	Black	Red	Blue
	-	White		Red		Blue		Black		Blue	
T	+	Brown	Brown	Blue	Blue	White	Blue	Yellow	Blue	Red	Brown
	-	White		Red		Blue		Blue		Brown	
K	+	Green	Green	Yellow	Yellow	Brown	Red	Yellow	Yellow	Red	Green
	-*	White		Red		Blue		Purple		Green	
N	+	Pink	Pink	Orange	Orange	Orange	Orange				
	-	White		Red		Blue					
B	+	Grey	Grey	Grey	Grey					Red	Grey
	-	White		Red						Grey	
R & S	+	Orange	Orange	Black	Green	White	Green	Yellow	Green	Red	White
	-	White		Red		Blue		Green		White	
C (W5)	+			White	White						
	-			Red							

*= Wire is magnetic

Power Connections

The rear terminal connections are illustrated in the following diagrams.

In general, all wiring connections are made to the instrument after it is mounted/installed. Copper wires must be used for all connections (except thermocouple signal wires).

WARNING:

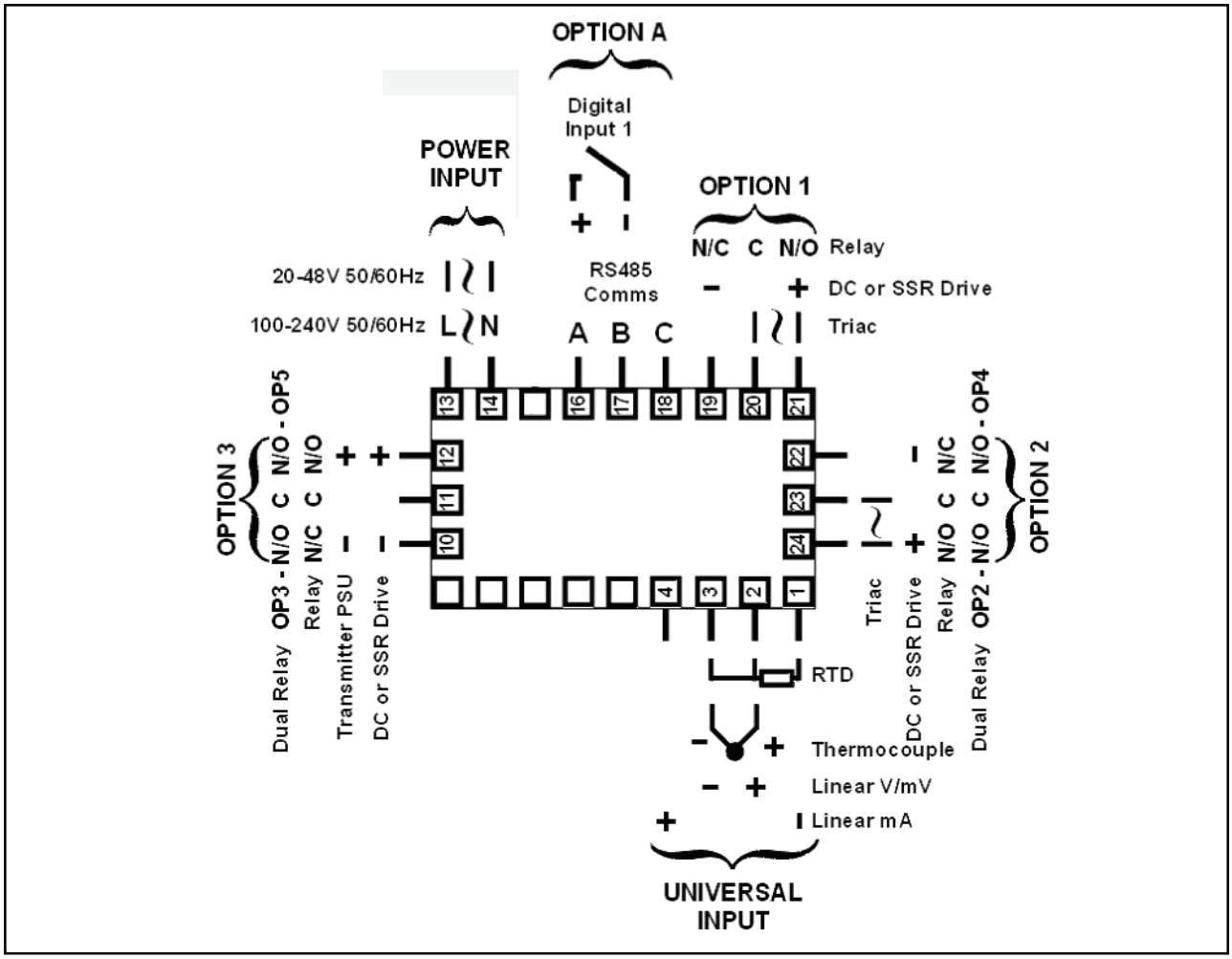
TO AVOID ELECTRICAL SHOCK, AC POWER WIRING MUST NOT BE CONNECTED TO THE SOURCE DISTRIBUTION PANEL UNTIL ALL WIRING PROCEDURES ARE COMPLETED.

WARNING:

CHECK THE INFORMATION LABEL ON THE CASE TO DETERMINE THE CORRECT VOLTAGE BEFORE CONNECTING TO A POWER SUPPLY.

Note:

The wiring diagram below shows all possible combinations. The actual connections required depend upon the features available on the model and the modules and options fitted

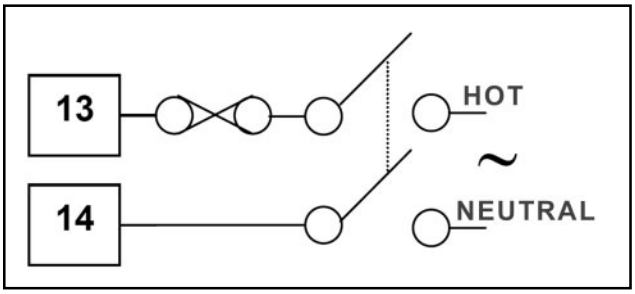


Rear Terminals

Power Connections to 100-240VAC

The S428A will operate from a 100 to 240V (±10%) 50/60Hz mains supply (power consumption is 7.5VA).

Connect the line voltage (hot and neutral) as illustrated via a two-pole isolating switch (preferably located near the equipment) and a 1amp anti-surge fuse. If the instrument has relay outputs with contacts carrying mains voltage, it is recommended that the relay contacts supply should be switched and fused in a similar manner, but should be separate from the instrument's mains supply.



AC (Mains) Connections

WARNING:

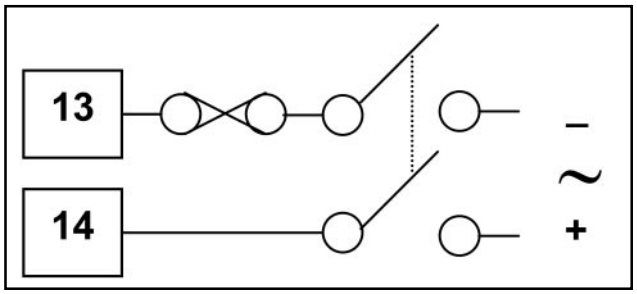
CHECK THE INFORMATION LABEL ON THE CASE TO DETERMINE THE CORRECT VOLTAGE BEFORE CONNECTING TO A LIVE SUPPLY.

CAUTION:

This equipment is designed for installation in an enclosure that provides adequate protection against electric shock

Power Connections - 24/48V AC/DC

24/48V AD/DC powered instruments will operate from a 20 to 48V AC or DC supply. AC power consumption is 7.5VA max, DC power consumption is 5 watts max. Connection should be via a two-pole isolating switch (preferably located near the equipment) and a 315mA slow-blow (anti-surge type T) fuse.



24/48 AC/DC Connections

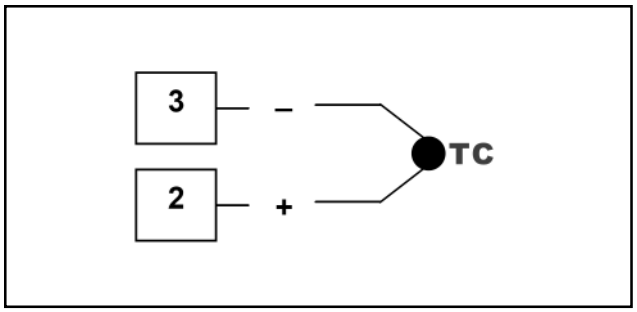
WARNING:

CHECK THE INFORMATION LABEL ON THE CASE TO DETERMINE THE CORRECT VOLTAGE BEFORE CONNECTING TO A LIVE SUPPLY.

Universal Input, Connections

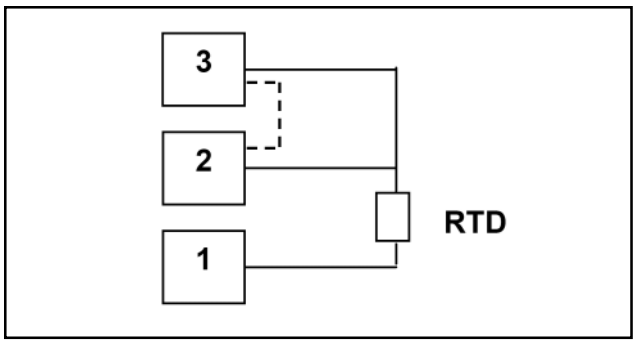
Thermocouple (T/C)

Use only the correct thermocouple wire or compensating cable from the probe to the instrument terminals avoiding joints in the cable if possible. Failure to use the correct wire type will lead to inaccurate readings. Ensure correct polarity of the wires by cross-referencing the colors with a thermocouple reference table.



RTD input

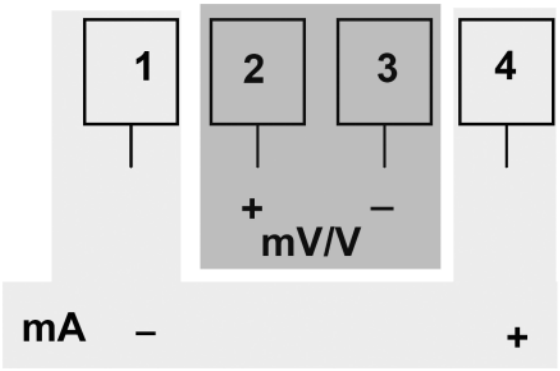
For three wire RTDs, connect the resistive leg and the common legs of the RTD as illustrated. For a two wire RTD a wire link should be used in place of the third wire (shown by dotted line). Two wire RTDs should only be used when the leads are less than 3 meters long. Avoid cable joints.



Four wire RTD's can be used, provided that the fourth wire is left unconnected. This wire should be cut short or tied back so that it cannot contact any of the terminals on the rear of the instrument.

Linear Volt, mV or mA input

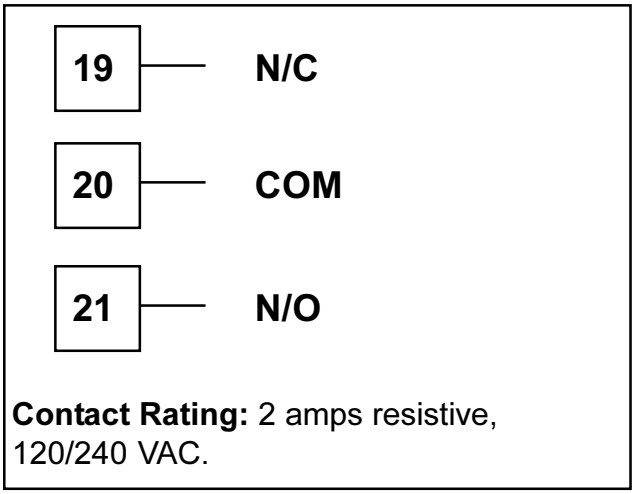
Linear DC voltage, millivolt or milliamp input connections are made as illustrated. Carefully observe the polarity of the connections.



Output Connections

Option Slot 1 - Relay Module

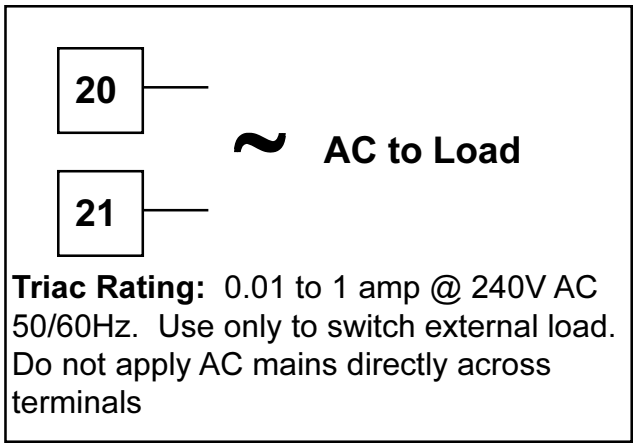
If option slot is fitted with a relay output module, make connections as illustrated.



Contact Rating: 2 amps resistive, 120/240 VAC.

Option Slot 1 - Triac Module

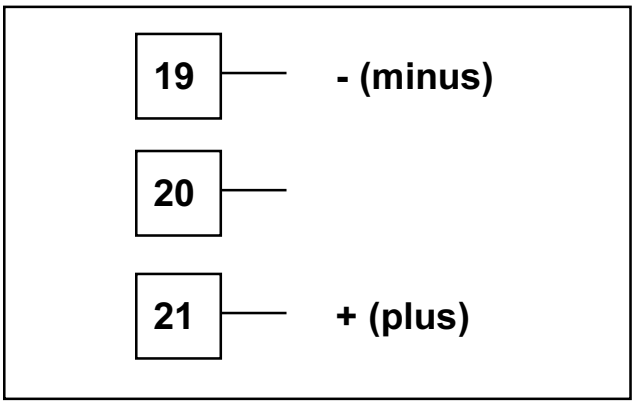
If option slot is fitted with a Triac output module, make connections as illustrated.



Triac Rating: 0.01 to 1 amp @ 240V AC 50/60Hz. Use only to switch external load. Do not apply AC mains directly across terminals

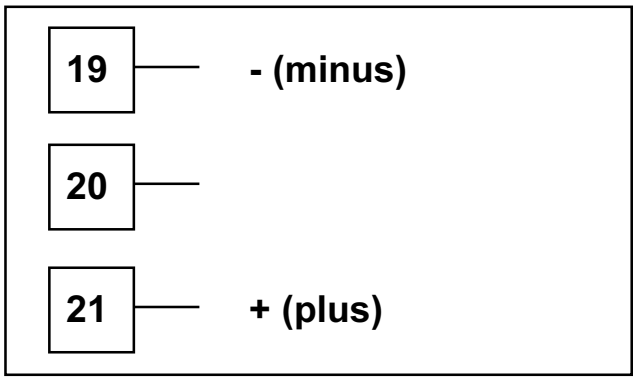
Option Slot 1 - SSR Driver Module

If option slot is fitted with an SSR driver output module, make connections as illustrated. The solid-state relay driver is a 0-10V DC signal, load impedance must be no less than 500 ohms. SSR driver outputs are not isolated from the signal input or other SSR driver outputs.



Option Slot 1 - Linear Voltage or mADC module

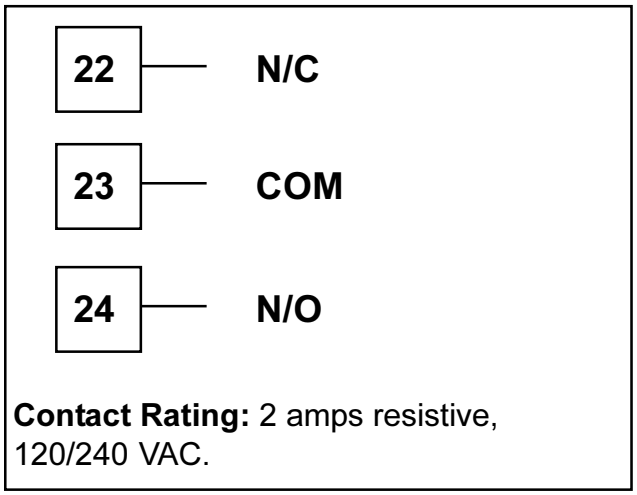
If option slot is fitted with a DC linear output module, make connections as illustrated.



Output Connections

Option Slot 2 - Relay Module

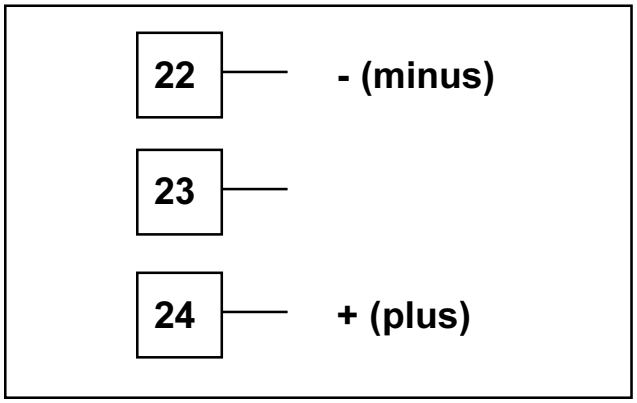
If option slot is fitted with a relay output module, make connections as illustrated.



Contact Rating: 2 amps resistive, 120/240 VAC.

Option Slot 2 - SSR Driver Module

If option slot is fitted with an SSR driver output module, make connections as illustrated. The solid-state relay driver is a 0-10V DC signal, load impedance must be no less than 500 ohms. SSR driver outputs are not isolated from the signal input or other SSR driver outputs.



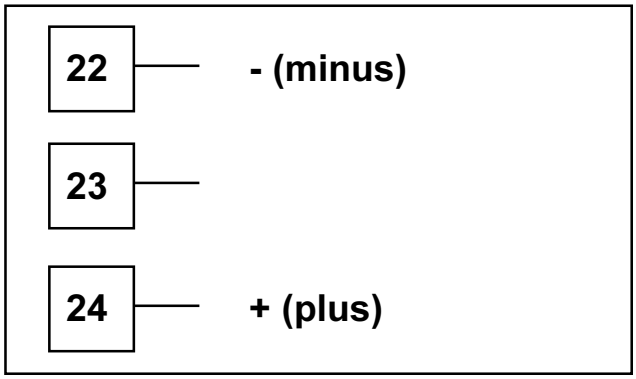
Option Slot 2 - Triac Module

If option slot is fitted with a Triac output module, make connections as illustrated.

Triac Rating: 0.01 to 1 amp @ 240V AC 50/60Hz. Use only to switch external load. Do not apply AC mains directly across terminals

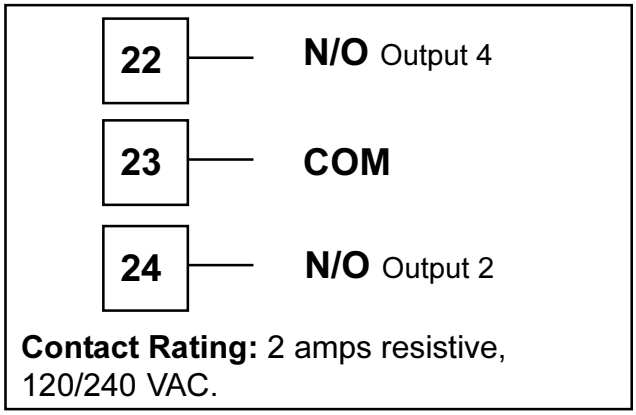
Option Slot 2 - Linear Voltage or mADC module

If option slot is fitted with a DC linear output module, make connections as illustrated.



Option Slot 2 - Dual Relay Module

If option slot is fitted with a dual relay output module, make connections as illustrated. This module has two independent relays, which share a common connection terminal.

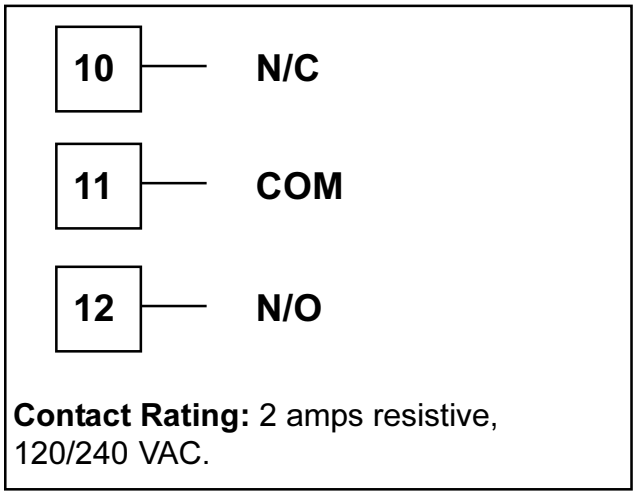


Contact Rating: 2 amps resistive, 120/240 VAC.

Output Connections

Option Slot 3 - Relay Module

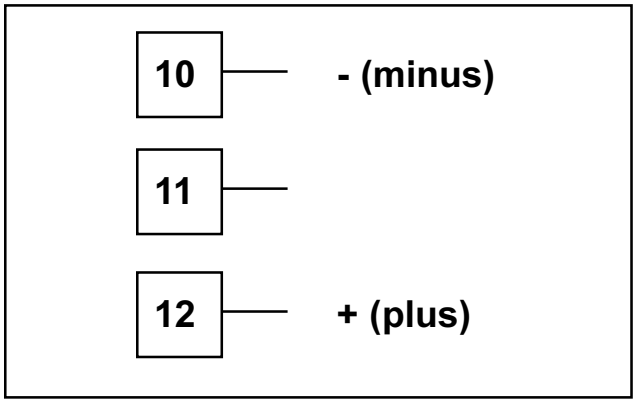
If option slot is fitted with a relay output module, make connections as illustrated.



Contact Rating: 2 amps resistive, 120/240 VAC.

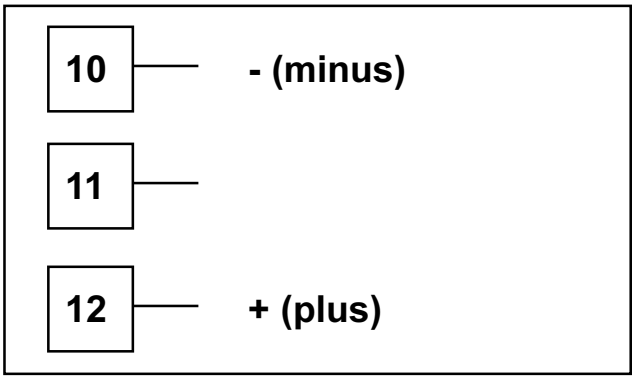
Option Slot 3 - SSR Driver Module

If option slot is fitted with an SSR driver output module, make connections as illustrated. The solid-state relay driver is a 0-10V DC signal, load impedance must be no less than 500 ohms. SSR driver outputs are not isolated from the signal input or other SSR driver outputs.



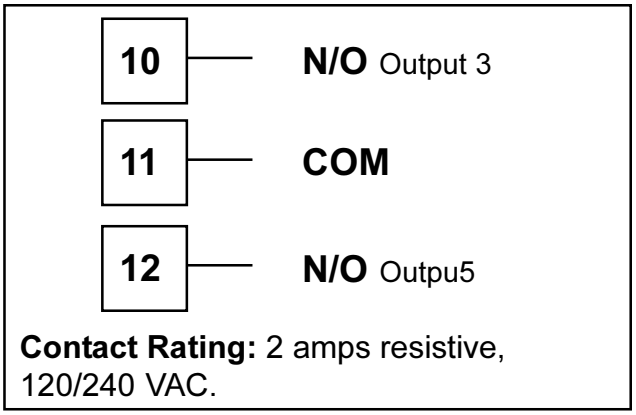
Option Slot 3 - Linear Voltage or mADC module

If option slot is fitted with a DC linear output module, make connections as illustrated.



Option Slot 3 - Dual Relay Module

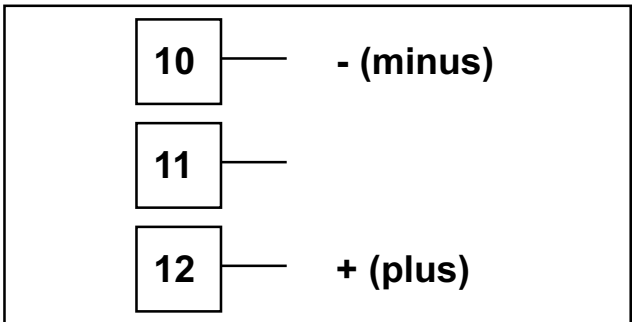
If option slot is fitted with a dual relay output module, make connections as illustrated. This module has two independent relays, which share a common connection terminal.



Contact Rating: 2 amps resistive, 120/240 VAC.

Option Slot 3 - Transmitter Power Supply Module

If option slot is fitted with a transmitter power supply module, make connections as illustrated.

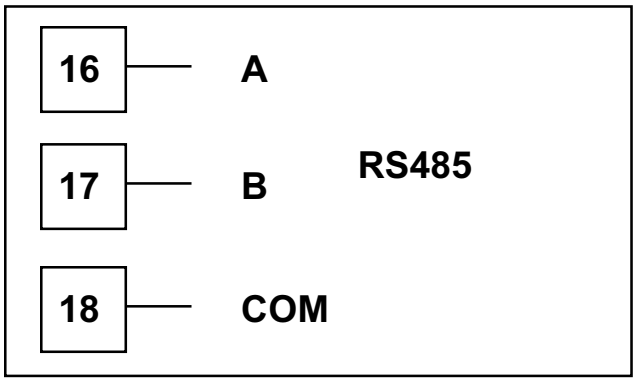


The output is an unregulated 24V DC, 22mA supply.

Communications & Digital Input Connections

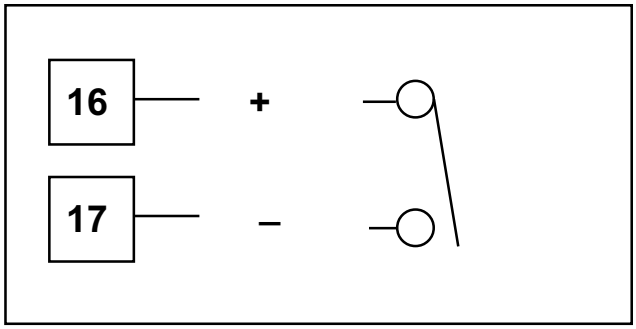
Option Slot A Connections - RS485 Serial Communications Module

If option slot A is fitted with the RS485 serial communication module, connections are as illustrated. Carefully observe the polarity of the A (Rx/Tx +ve) and B (Rx/Tx -ve) connections.



Option Slot A Connections - Digital Input Module

If a digital input module is fitted in option slot A, this may be connected to either voltage free contacts (e.g. switch or relay), or a TTL compatible voltage. Connections are shown below.



First-Time Power Up

WARNING:

ENSURE SAFE WIRING PRACTICES ARE FOLLOWED

The instrument must be powered from a supply according to the wiring label on the side of the unit. The supply will be either 100 to 240V AC, or 24/48V AC/DC powered. Check carefully the supply voltage and connections before applying power.

CAUTION:

When powering up for the first time, disconnect the output connections.

Powering Up Procedure

At power up, a self-test procedure is automatically started, during which all LED segments and indicators are lit. At the first ever power up, or if option modules are changed, `Goto ConF` will then be displayed, indicating configuration is required *(refer to section 6)*. At all other times, the instrument returns to operator mode once the self-test procedure is complete.

NOTES

Section 3
OPERATION

Displays and Indicators

Displays

The S428A features a single line display, which normally shows the process variable value, and status indicators LED's for mode and alarm indication.

LED Indicator Functions

LED	FUNCTION
	**SET** indicates the Setup Mode has been entered
	**SET - FLASHING** indicates the configuration mode has been entered
	**ALM - FLASHING** indicates that an alarm condition is present

Messages and Error Indications

The following displays are shown when an error occurs or a hardware change is detected.

Error/Faults Conditions	Main Display	Units Display
Configuration & Setup is required. Seen at first turn on or if hardware configuration changed. Press ↺ to enter Configuration Mode, next press △ or ▽ to enter the unlock code number, then press ↺ to proceed. Configuration must be completed before return to operator mode is allowed [1]	Goto Goto *for 1 second, then* ConF	C
Input more than 5% over-range[2]	[HH]	Normal Display
Input more than 5% under-range[3]	[LL]	Normal Display
Sensor Break. Break detected in the input sensor or wiring	OPEN	Normal Display
Option 1 module fault.	Err*	1
Option 2 module fault.	Err*	2
Option 3 module fault.	Err*	3
Option A module fault.	Err*	A

1 This feature does not guarantee correct configuration but only helps to ensure that the unit will be configured before use. Use of set-up mode is not enforced but may be essential for the users process.

2 If the PV display exceeds 9999 before 5% over-range is reached, an over-range indication is given.

3 Indicators will allow up to 10% under-range on non-zero based Linear ranges. If the PV display is less than -1999 before the % under-range is reached, an under-range indication is given.

Operation Modes

The S428A 4-digit display will show the Mode Description for approx 1 second before the Mode Setting value is shown. For more details, refer to the following table.

Select Mode

This mode is used to gain entry to each of the modes available in the instrument.

Entry into the Select Mode

Hold down ⟳ and press △ in any mode to force the unit to enter Select Mode.

Navigating in Select Mode

Once in Select Mode, press △ or ▽ to select the required mode, then press ⟳ to enter the chosen mode.

To prevent unauthorized entry to Configuration, and Setup modes, an unlock code is required. These are shown in the - Lock code values table

Mode	Description	Initial Display of Legend (1 Second)	Mode Setting Value	Units Display
Operator Mode	The Default Mode on power up used for normal operation.	SLct	OPtr	S
Set Up Mode	Used to tailor the instrument to the application, adjustment of alarm values, etc.	SLct	SEtP	S
Configuration Mode	Used to configure the instrument for first time use or on re-installation.	SLct	ConF	S
Product Information Mode	Used to check the hardware, firmware and manufacturing information of the instrument.	SLct	inFo	S

Operation Modes

Unlock Codes

The ULoc screen is seen before entry is allowed to Configuration & Setup modes. An unlock code must be correctly selected using the △ or ▽ keys to enter the required mode.

An incorrect entry results in a return to Select Mode. The value of the lock codes only can be changed from within the modes that they apply to.

Description	Initial Display of Legend (1 sec.)	Setting Value	Units Display
Default values are: Set-up mode = 10 Configuration Mode = 20.	ULoc	10	U

Unlock Codes Display & Entry

Lock Code View

In the event that a lock code is forgotten, the instrument lock code current values can be seen in the lock code view. In this view the codes are read only, the codes can be changed from the mode to which they apply.

Entry and Navigating in Lock Code View Mode

Press △ and ◯ together while the instrument is powering up until the CLoc display is shown.

Once this mode has been entered:

Press ◯ to step between lock codes.

Note:

If there is no key activity for 2 minutes the instrument returns to Operator Mode, or to forcefully exit this view, switch off the instrument.

Lock Code Name	Description	Setting Value	Legend Display (for 1sec.)	Units Display
Configuration Lock Code	Read only view of Configuration Lock Code.	Current Value	CLoc	C
Setup Lock Code	Read only view of Setup Mode Lock Code.	Current Value	SLoc	S

Product Information Mode

This is a read only mode describing the instrument and the options fitted to it.

Navigating the Product Information Mode

Press ◯ to view each parameter in turn.

Hold Down ◯ and press △ to return to Select Mode.

Note:

If there is no key activity for 2 minutes the controller automatically returns to operator mode

Parameter	Possible Values	Setting Value	Legend Shown for 1 Second	Units Display
Input type	Universal input	Un i	In_1	t
Option 1 module type	No option fitted	nonE	OPn1	1
	Relay	rLY		
	SSR drive	SSr		
	Triac	tri		
	Linear voltage / current output	Lin		
Option 2 module type	No option fitted.	nonE	OPn2	2
	Relay	rLY		
	SSR drive	SSr		
	Triac	tri		
	Linear voltage / current output	Lin		
Option 3 module type	No option fitted.	nonE	OPn3	3
	Relay	rLY		
	SSR drive	SSr		
	Linear voltage / current output	Lin		
	24V Transmitter power supply	dc24		
Auxiliary option A module type	No option fitted	nonE	OPnA	A
	RS485 comms	r485		
	Digital Input	diGi		
	Basic remote setpoint input	rSPi		
Firmware	Value displayed is firmware type number		FUU	F
Issue No.	Value displayed is firmware issue number		ISS	n
Product Rev Level	Value displayed is Product Revision Level.		PrL	r
Date of manufacture	Manufacturing date code (mmyy)		dOM	d
Serial number 1	First four digits of serial number		Sn1	A
Serial number 2	Second four digits of serial number		Sn2	b
Serial number 3	Last four digits of serial number		Sn3	c

Configuration Mode

This mode is normally used only when the indicator is configured for the first time or when a major change is made to the instruments characteristics. The Configuration Mode parameters must be set as required before adjusting parameters in Setup Mode, or attempting to use in an application.

Entry into the Configuration Mode

CAUTION:

Adjustments to these parameters should only be performed by personnel competent and authorised to do so.

Configuration is entered from Select Mode

Hold down ◯ and press △ to force the controller into the Select Mode.

The SLcE legend is shown for 1 second, followed by the legend for the current mode.

Press △ or ▽ to navigate to the Configuration Mode option, then press ◯ .

Note:

Entry into this mode is security-protected by the Configuration Mode Lock Code. Refer to the Unlock Code section for more details.

Note:

The Set LED indicator flashes in Configuration Mode.

Scrolling through Parameters and Values

Press ◯ to scroll through the parameters. While this key is pressed, and up to 1 second after, the parameter legend is shown, followed by the current parameter value.

Note:

Only parameters that are applicable to the hardware options chosen will be displayed.

Changing Parameter Values

Press ◯ to navigate to the required parameter, then press △ or ▽ to set the value as required.

Once the desired value is set, press ◯ to display YESP, press △ within 10 seconds, accept the change, otherwise parameter will revert to previous value.

Or

Press ◯ to reject the change and to move onto the next parameter.

Hold down ◯ and press △ to return to Select Mode.

Note:

If there is no key activity for 2 minutes the instrument returns to the operator mode.

Parameter	Legend *for 1 sec followed by* →	Set Value	Adjustment Range & Description	Default Value	When Visible	Units Display
Input type and Range	InPt	bC	B type: 100 to 1824 °C	JC for Europe JF for USA	Always	r
		bF	B type: 211 to 3315 °F			
		CC	C type: 0 to 2320 °C			
		CF	C type: 32 to 4208 °F			
		JC	J type: -200 to 1200 °C			
		JF	J type: -328 to 2192 °F			
		J.C	J type: -128.8 to 537.7 °C with decimal point			
		J.F	J type: -199.9 to 999.9 °F with decimal point			
		KC	K type: -240 to 1373 °C			
		KF	K type: -400 to 2503 °F			
		K.C	K type: -128.8 to 537.7 °C with decimal point			
		K.F	K type: -199.9 to 999.9 °F with decimal point			

Configuration Mode Parameters

Configuration Mode Parameters

Parameter	Legend *for 1 sec followed by* →	Set Value	Adjustment Range & Description	Default Value	When Visible	Units Display
		LC	L type: 0 to 762 °C			
		LF	L type: 32 to 1403 °F			
		L.C	L type: 0.0 to 537.7 °C with decimal point			
		L.F	L type: 32.0 to 999.9 °F with decimal point			
		nC	N type: 0 to 1399 °C			
		nF	N type: 32 to 2551 °F			
		rC	R type: 0 to 1759 °C			
		rF	R type: 32 to 3198 °F			
		SC	S type: 0 to 1762 °C			
		SF	S type: 32 to 3204 °F			
		tC	T type: -240 to 400 °C			
		tF	T type: -400 to 752 °F			
		t.C	T type: -128.8 to 400.0 °C with decimal point			
		t.F	T type: -199.9 to 752.0 °F with decimal point			
		P24C	PtRh20% vs PtRh40%: 0 to 1850 °C			
		P24F	PtRh20% vs PtRh40%: 32 to 3362 °F			
		PtC	Pt100: -199 to 800 °C			
		PtF	Pt100: -328 to 1472 °F			
		Pt.C	Pt100: -128.8 to 537.7 °C with decimal point			
		Pt.F	Pt100: -199.9 to 999.9 °F with decimal point			
		0_20	0 to 20mA DC			
		4_20	4 to 20mA DC			
		0_50	0 to 50mV DC			
		10.50	10 to 50mV DC			
		0_5	0 to 5V DC			
		1_5	1 to 5V DC			
		0_10	0 to 10V DC			
		2_10	2 to 10V DC			

Configuration Mode Parameters

Parameter	Legend *for 1 sec followed by →*	Set Value	Adjustment Range & Description	Default Value	When Visible	Units Display
Scale Range Upper Limit	rUL	Scale Range Lower Limit +100 to Range Max		Linear = 1000 °C/°F = max range	Always	U
Scale Range Lower Limit	rLL	Range Min. to Scale range Upper Limit - 100		Linear = 0 °C/°F = min range	Always	L
Decimal point position	dPoS	0	Decimal point position in non-temperature ranges. 0 = **XXXX** 1 = **XXX.X** 2 = **XX.XX** 3 = **X.XXX**	1	InPt = mV, V or mA	P
		1				
		2				
		3				
Linear Range Engineering Units Display	L inU	nonE	nonE (Blank), C = °C or F = °F For use where linear inputs represent temperature. *Available on 1/8 Din units only.*	nonE	1/8 Din only. InPt = mV, V or mA	
		C				°C
		F				°F
Multi-Point Scaling	MPS	EnAb	d iSA disabled or EnAb enabled	d iSA	Always	S
		d iSA				
Alarm 1Type	ALA 1	P_H i	Process High Alarm	P_H i	Always	1
		P_Lo	Process Low Alarm			
		nonE	No alarm			
Process High Alarm 1 value*	PhA 1	Range Min. to Range Max. *Parameter repeated in Setup Mode*		Range Max.	ALA 1 = P_H i	A if alarm 1 only or 1
Process Low Alarm 1 value*	PLA 1	Range Min. to Range Max *Parameter repeated in Setup Mode*		Range Min.	ALA 1 = P_Lo	
Alarm 1 Hysteresis*	AHY 1	1 LSD to 100% of span (in display units) on "safe" side of alarm point. *Parameter repeated in Setup Mode*		1	ALA 1 is not nonE	-
Alarm 2 Type	ALA2	As for alarm 1 type		nonE	Always	2
Process High Alarm 2 value*	PhA2	Range Min. to Range Max. *Parameter repeated in Setup Mode*		Range Max.	ALA2 = P_H i	2
Process Low Alarm 2 value*	PLA2	Range Min. to Range Max. *Parameter repeated in Setup Mode*		Range Min.	ALA2 = P_Lo	
Alarm 2 Hysteresis*	AHY2	1 LSD to 100% of span (in display units) on "safe" side of alarm point. *Parameter repeated in Setup Mode*		1	ALA2 is not nonE	=

Configuration Mode Parameters

Parameter	Legend *for 1 sec followed by →*	Set Value	Adjustment Range & Description	Default Value	When Visible	Units Display
Alarm 3 Type	ALA3	As for alarm 1 type		nonE	Always	3
Process High Alarm 3 value*	PhA3	Range Min. to Range Max. *Parameter repeated in Setup Mode*		Range Max.	ALA3 = P_H ,	3
Process Low Alarm 3 value*	PLA3	Range Min. to Range Max. *Parameter repeated in Setup Mode*		Range Min.	ALA3 = P_Lo	
Alarm 3 Hysteresis*	AHY3	1 LSD to 100% of span (in display units) on "safe" side of alarm point. *Parameter repeated in Setup Mode*		1	ALA3 is not nonE	3
Alarm 4 Type	ALA4	As for alarm 1 type		nonE	Always	4
Process High Alarm 4 value*	PhA4	Range Min. to Range Max. *Parameter repeated in Setup Mode*		Range Max.	ALA4 = P_H ,	4
Process Low Alarm 4 value*	PLA4	Range Min. to Range Max. *Parameter repeated in Setup Mode*		Range Min.	ALA4 = P_Lo	
Alarm 4 Hysteresis*	AHY4	1 LSD to 100% of span (in display units) on "safe" side of alarm point. *Parameter repeated in Setup Mode*		1	ALA4 is not nonE	4
Alarm 5 Type	ALA5	As for alarm 1 type		nonE	Always	5
Process High Alarm 5 value*	PhA5	Range Min. to Range Max. *Parameter repeated in Setup Mode*		Range Max.	ALA5 = P_H ,	5
Process Low Alarm 5 value*	PLA5	Range Min. to Range Max. *Parameter repeated in Setup Mode*		Range Min.	ALA5 = P_Lo	
Alarm 5 Hysteresis*	AHY5	1 LSD to 100% of span (in display units) on "safe" side of alarm point. *Parameter repeated in Setup Mode*		1	ALA5 is not nonE	5
Output 1 Usage	USE 1	A Ind	Alarm 1, direct, non-latching	A Ind when OPn 1 is not linear output type, rEtP if OPn 1 is linear output type	OPn 1 is not empty	1
		A Inr	Alarm 1, reverse, non-latching			
		A ILd	Alarm 1, direct, latching			
		A ILr	Alarm 1, reverse, latching			
		A2nd	Alarm 2, direct, non-latching			
		A2nr	Alarm 2, reverse, non-latching			
		A2Ld	Alarm 2, direct, latching			
		A2Lr	Alarm 2, reverse, latching			
		A3nd	Alarm 3, direct, non-latching			
		A3nr	Alarm 3, reverse, non-latching			
		A3Ld	Alarm 3, direct, latching			
		A3Lr	Alarm 3, reverse, latching			

Configuration Mode Parameters

Parameter	Legend *for 1 sec followed by →*	Set Value	Adjustment Range & Description	Default Value	When Visible	Units Display
		A4nd	Alarm 4, direct, non-latching			
		A4nr	Alarm 4, reverse, non-latching			
		A4Ld	Alarm 4, direct, latching			
		A4Lr	Alarm 4, reverse, latching			
		A5nd	Alarm 5, direct, non-latching			
		A5nr	Alarm 5, reverse, non-latching			
		A5Ld	Alarm 5, direct, latching			
		A5Lr	Alarm 5, reverse, latching			
		O 12d	Logical Alarm 1 OR 2, direct			
		O 12r	Logical Alarm 1 OR 2, reverse			
		O 13d	Logical Alarm 1 OR 3, direct			
		O 13r	Logical Alarm 1 OR 3, reverse			
		O23d	Logical Alarm 2 OR 3, direct			
		O23r	Logical Alarm 2 OR 3, reverse			
		AnYd	Any active alarm, direct			
		AnYr	Any active alarm, reverse			
		rEtP	Retransmit PV Output		OPn 1 is linear output type	
		dc 10	0 to 10VDC (adjustable) transmitter power supply*			
Output 1 PV Retransmit Type	tYP 1	0_5	0 to 5 V DC output 1	0_10	USE 1 = rEtP	1
		0_10	0 to 10 V DC output			
		2_10	2 to 10 V DC output			
		0_20	0 to 20 mA DC output			
		4_20	4 to 20 mA DC output			
Retransmit Output 1 Scale maximum	ro 1H	-1999 to 9999 Display value where output is maximum		Range max	USE 1 = rEtP	H
Retransmit Output 1 Scale minimum	ro 1L	-1999 to 9999 Display value where output is minimum		Range min	USE 1 = rEtP	L
Output 1 TxPSU voltage level	PSU 1	0 to 10VDC transmitter power supply output in 0.1V steps*		10.0	USE 1 = dc 10	1

Configuration Mode Parameters

Parameter	Legend *for 1 sec followed by →*	Set Value	Adjustment Range & Description	Default Value	When Visible	Units Display
Output 2 Usage	USE2	As for Output 1 usage		A2nd or rEtP	OPn2 is not empty	2
Output 2 PV Retransmit Type	tYP2	0_5	0 to 5 V DC output 1	0_10	USE2 = rEtP	2
		0_10	0 to 10 V DC output			
		2_10	2 to 10 V DC output			
		0_20	0 to 20 mA DC output			
		4_20	4 to 20 mA DC output			
Retransmit Output 2 Scale maximum	ro2H	-1999 to 9999 Display value where output is maximum		Range max	USE2 = rEtP	H
Retransmit Output 2 Scale minimum	ro2L	-1999 to 9999 Display value where output is minimum		Range min	USE2 = rEtP	L
Output 2 TxPSU voltage level	PSU2	0 to 10VDC transmitter power supply output in 0.1V steps*		10.0	USE2 = dc 10	2
Output 3 Usage	USE3	As for Output 1 usage		A3nd or rEtP	OPn3 is not empty	3
Output 3 PV Retransmit Type	tYP3	0_5	0 to 5 V DC output 1	0_10	USE3 = rEtP	3
		0_10	0 to 10 V DC output			
		2_10	2 to 10 V DC output			
		0_20	0 to 20 mA DC output			
		4_20	4 to 20 mA DC output			
Retransmit Output 3 Scale maximum	ro3H	-1999 to 9999 Display value where output is maximum		Range max	USE3 = rEtP	H
Retransmit Output 3 Scale minimum	ro3L	-1999 to 9999 Display value where output is minimum		Range min	USE3 = rEtP	L
Output 3 TxPSU voltage level	PSU3	0 to 10VDC transmitter power supply output in 0.1V steps*		10.0	USE3 = dc 10	3
Output 4 Usage	USE4	Alarm output options as for Output 1 usage *(Linear retransmit and PSU not possible)*		A4nd	OPn4 = drLY	4
Output 5 Usage	USE5	Alarm output options as for Output 1 usage *(Linear retransmit and PSU not possible)*		A5nd	OPn5 = drLY	5

Configuration Mode Parameters

Parameter	Legend *for 1 sec followed by →*	Set Value	Adjustment Range & Description	Default Value	When Visible	Units Display
Display Strategy	diSP	0, 1, 2, 3, 4 or 6 *(see Operator Mode for details)*		0	Always	d
Display Colour	CLor	rEd	Permanent Red	G-r	1/8 Din units if colour change display fitted	c
		Grn	Permanent Green			
		r-G	Red to Green if any alarm active			
		G-r	Green to Red if any alarm active			
Comms Protocol	Prot	ASCI	ASCII	rtbn	OPnA = r485	P
		rtbn	Modbus with no parity			
		rtbE	Modbus with Even Parity			
		rtbo	Modbus with Odd Parity			
Bit rate	bAud	1.2	1.2 kbps	4.8	OPnA = r485	b
		2.4	2.4 kbps			
		4.8	4.8 kbps			
		9.6	9.6 kbps			
		19.2	19.2 kbps			
Communications Address	Addr	1	A unique address for each instrument between 1 to 255 (Modbus), or 1 to 99 (Ascii)	1	OPnA = r485	A
Communications Write Enable	CoEn	r_o	Read only. Comms writes ignored	r_Wd	Always	E
		rWd	Read / Write. Writing via Comms is possible			
Digital Input Usage	diGi	rrLY	Reset latched relay(s)	rrLY	OPnA = diGi	i
		tArE	Initiate Tare (zero display)			
		rPu	Reset min/max PV values			
		rE	Reset Alarm 1 elapsed time			
		rPuE	Reset Alarm 1 elapsed time & min/max PV values			
Configuration Mode Lock Code	CLoc	0 to 9999		20	Always	C

Setup Mode

This mode is normally selected only after Configuration Mode has been completed, or is used when a change to the process set up is required. These parameters must be set as required before attempting to use the indicator in an application.

Entry into the Setup Mode

Setup Mode is entered from Select Mode

Hold down ⟳ and press △ to force the controller into the Select Mode.

The SLCt legend is shown for 1 second, followed by the legend for the current mode.

Press △ or ▽ to navigate to the Setup Mode option, then press ⟳.

Note:
Entry into Setup Mode is security-protected by the Setup Mode lock code. Refer to the Unlock Code section for more details.
Note:
The Set LED indicator is on in Setup Mode.

Scrolling through Parameters and Values

Press ⟳ to scroll through the parameters. While this key is pressed, and up to 1 second after, the parameter legend is shown, followed by the current parameter value.

Changing Parameter Values

Press ⟳ to select the required parameter, then press △ or ▽ to set the value as required.

Once the displayed value is changed, it is effective is immediately. No confirmation of the change is required.

Press ⟳ to move onto the next parameter.

Hold ⟳ down and press △ to return to Select Mode.

Note:
If there is no key activity for two minutes the instrument returns to the operator mode.

Setup Mode Parameters

Parameter	Legend *for 1 sec followed by →*	Set Value	Adjustment Range & Description	Default Value	When Visible	Units Display
Input Filter Time constant	F iLt	OFF, 0.5 to 100.0 seconds in 0.5 sec increments		2.0	Always	t
Process Variable Offset	OFFS	±Instrument Span		0	Always	o
Raw Process Variable value	S iG	The un-scaled value of the input signal in mV, V or mA DC as defined by the input range and type. Resolution to 1 decimal place (e.g. 4.0 to 20.0mA). *This parameter is Read Only*			InPt = mV, V or mA	***blank***
Process High Alarm 1 value*	PhA 1	Range Min. to Range Max. *Repeat of Configuration Mode parameter*		Range Max.	ALA 1 = P_H ,	A if alarm 1 only or 1
Process Low Alarm 1 value*	PLA 1	Range Min. to Range Max *Repeat of Configuration Mode parameter*		Range Min.	ALA 1 = P_Lo	
Alarm 1 Hysteresis*	AHY 1	1 LSD to 100% of span (in display units) on "safe" side of alarm point. *Repeat of Configuration Mode parameter*		1	ALA 1 is not nonE	-
Process High Alarm 2 value*	PhA2	Range Min. to Range Max. *Repeat of Configuration Mode parameter*		Range Max.	ALA2 = P_H ,	2
Process Low Alarm 2 value*	PLA2	Range Min. to Range Max. *Repeat of Configuration Mode parameter*		Range Min.	ALA2 = P_Lo	
Alarm 2 Hysteresis*	AHY2	1 LSD to 100% of span (in display units) on "safe" side of alarm point. *Repeat of Configuration Mode parameter*		1	ALA2 is not nonE	=
Process High Alarm 3 value*	PhA3	Range Min. to Range Max. *Repeat of Configuration Mode parameter*		Range Max.	ALA3 = P_H ,	3
Process Low Alarm 3 value*	PLA3	Range Min. to Range Max. *Repeat of Configuration Mode parameter*		Range Min.	ALA3 = P_Lo	
Alarm 3 Hysteresis*	AHY3	1 LSD to 100% of span (in display units) on "safe" side of alarm point. *Repeat of Configuration Mode parameter*		1	ALA3 is not nonE	=
Process High Alarm 4 value*	PhA4	Range Min. to Range Max. *Repeat of Configuration Mode parameter*		Range Max.	ALA4 = P_H ,	4
Process Low Alarm 4 value*	PLA4	Range Min. to Range Max. *Repeat of Configuration Mode parameter*		Range Min.	ALA4 = P_Lo	
Alarm 4 Hysteresis*	AHY4	1 LSD to 100% of span (in display units) on "safe" side of alarm point. *Repeat of Configuration Mode parameter*		1	ALA4 is not nonE	4

Note:
*Alarm parameters marked * are repeated in Configuration Mode.*
Note:
***Once the complete list of Set Up Mode parameters has been displayed, the Operator Mode displays are shown without exiting from Set Up Mode.*

Setup Mode Parameters

Parameter	Legend *for 1 sec followed by →*	Set Value	Adjustment Range & Description	Default Value	When Visible	Units Display
Process High Alarm 5 value*	PhA5		Range Min. to Range Max. *Repeat of Configuration Mode parameter*	Range Max.	ALA5 = P_H i	5
Process Low Alarm 5 value*	PLA5		Range Min. to Range Max. *Repeat of Configuration Mode parameter*	Range Min.	ALA5 = P_Lo	
Alarm 5 Hysteresis*	AHY5		1 LSD to 100% of span (in display units) on "safe" side of alarm point. *Repeat of Configuration Mode parameter*	1	ALA5 is not nonE	5
Scaling Breakpoint 1	ScA 1		Multi-point scaling breakpoint 1 value, adjustable from 0 to 100 in % of span	100	MPS = EnAb	1
Display Value 1	d iS 1		Value to be displayed at multi-point scaling breakpoint 1, in display units	Range Max.		
Scaling Breakpoint 2	ScA2		Multi-point scaling breakpoint 2, adjustable up to 100% of span. Must be >ScA 1 value		MPS = EnAb	2
Display Value 2	d iS2		Value to be displayed at Multi-point scaling breakpoint 2, in display units			
Scaling Breakpoint 3	ScA3		Multi-point scaling breakpoint 3, adjustable up to 100% of span. Must be >ScA2 value		MPS = EnAb	3
Display Value 3	d iS3		Value to be displayed at Multi-point scaling breakpoint 3, in display units			
Scaling Breakpoint 4	ScA4		Multi-point scaling breakpoint 4, adjustable up to 100% of span. Must be >ScA3 value		MPS = EnAb	4
Display Value 4	d iS4		Value to be displayed at Multi-point scaling breakpoint 4, in display units			
Scaling Breakpoint 5	ScA5		Multi-point scaling breakpoint 5, adjustable up to 100% of span. Must be >ScA4 value		MPS = EnAb	5
Display Value 5	d iS5		Value to be displayed at Multi-point scaling breakpoint 5, in display units			
Scaling Breakpoint 6	ScA6		Multi-point scaling breakpoint 6, adjustable up to 100% of span. Must be >ScA5 value		MPS = EnAb	6
Display Value 6	d iS6		Value to be displayed at Multi-point scaling breakpoint 6, in display units			
Scaling Breakpoint 7	ScA7		Multi-point scaling breakpoint 7, adjustable up to 100% of span. Must be >ScA6 value		MPS = EnAb	7
Display Value 7	d iS7		Value to be displayed at Multi-point scaling breakpoint 7, in display units			
Scaling Breakpoint 8	ScA8		Multi-point scaling breakpoint 8, adjustable up to 100% of span. Must be >ScA7 value		MPS = EnAb	8
Display Value 8	d iS8		Value to be displayed at Multi-point scaling breakpoint 8, in display units			

Note:
*Alarm parameters marked * are repeated in Configuration Mode.*
Note:
***Once the complete list of Set Up Mode parameters has been displayed, the Operator Mode displays are shown without exiting from Set Up Mode.*

Setup Mode Parameters

Parameter	Legend *for 1 sec followed by →*	Set Value	Adjustment Range & Description	Default Value	When Visible	Units Display
Scaling Breakpoint 9	ScA9	Multi-point scaling breakpoint 9, adjustable up to 100% of span. Must be >ScA8 value			MPS = EnAb	9
Display Value 9	d.S9	Value to be displayed at Multi-point scaling breakpoint 9, in display units				
Tare Function	tArE	EnAb	Enables or disables the input auto-zero Tare feature	d.SA	Always	r
		d.SA				
Set-up Lock Code	SLoc	0 to 9999		10	Always	5
**Operator mode displays follows.						

Note:
*Alarm parameters marked * are repeated in Configuration Mode.*
Note:
***Once the complete list of Set Up Mode parameters has been displayed, the Operator Mode displays are shown without exiting from Set Up Mode.*

Operator Mode

This is the mode used during normal operation of the instrument. It can be accessed from Select Mode, and is the usual mode entered at power-up. The available displays are dependent upon the setting of the Display Strategy parameter in Configuration Mode.

WARNING:

IN NORMAL OPERATION, THE OPERATOR MUST NOT REMOVE THE INSTRUMENT FROM ITS HOUSING OR HAVE UNRESTRICTED ACCESS TO THE REAR TERMINALS, AS THIS WOULD PROVIDE POTENTIAL CONTACT WITH HAZARDOUS LIVE PARTS.

CAUTION:

Set all Configuration Mode parameters and Set Up Mode parameters as required before starting normal operations.

Entry into Operator Mode

This is the normal operating mode of the instrument from power-up. It can also be accessed from any other mode via Select Mode as follows:

Hold down ◯ and press △ to force the controller into the Select Mode.

The SLCt legend is shown for 1 second, followed by the legend for the current mode.

Press △ or ▽ to navigate to the Operator Mode option, then press ◯.

Scrolling through Parameters and Values

Press ◯ to scroll through the parameters. While this key is pressed, and up to 1

second after, the parameter legend is shown, followed by the current parameter value.

Changing Parameter Values

Press ◯ to select the required parameter, then press △ or ▽ to set the value as required.

Once the displayed value is changed, it is effective is immediately. No confirmation of the change is required.

Press ◯ to move onto the next parameter.

Note:

The operator can freely view the parameters in this mode, but alteration depends on the Display strategy setting in Configuration Mode. All parameters in Display strategy 6 are read only, and can only be adjusted via Setup mode.

Operator Mode Parameters

Parameter	Legend *for 1 sec followed by →*	Set Value	Adjustment Range & Description	Display Strategy & When Visible	Units Display
Process Variable	Proc		Current Process Variable value *Read only, but latched relays can be reset (*see below)*	Always	°C, °F or *blank*
Maximum PV Value	mA		Maximum displayed value (inc [HH] or OPEn) since mA was last reset. Max LED ▲ is lit	Strategies 0, 1, 3, 4, & 6	°C, °F or *blank*
Minimum PV Value	m in		Minimum displayed value (inc [LL] or OPEn) since m in was last reset. Min LED ▼ is lit	Strategies 0, 1, 3, 4, & 6	°C, °F or *blank*
Alarm 1 Active Time	Et 1		Accumulated time alarm 1 has been active since Et 1 was last reset. Format *mm.ss to 99.59 then mmm.s (10 sec increments)* *Shows* [HH] if *>999.9*	Strategies 0, 4 & 6 if alarm 1 configured.	E
Process Alarm 1 value	AL 1		Alarm 1 value. *Adjustable except in Strategy 6*	Strategies 2, 3, 4 & 6 if alarm 1 configured	A if alarm 1 only or 1
Process Alarm 2 value	AL2		Alarm 2 value. *Adjustable except in Strategy 6*	Strategies 2, 3, 4 & 6 if alarm 2 configured	2
Process Alarm 3 value*	AL3		Alarm 3 value. *Adjustable except in Strategy 6*	Strategies 2, 3, 4 & 6 if alarm 3 configured	3
Process Alarm 4 value	AL4		Alarm 4 value. *Adjustable except in Strategy 6*	Strategies 2, 3, 4 & 6 if alarm 4 configured	4
Process Alarm 5 value*	AL5		Alarm 5 value. *Adjustable except in Strategy 6*	Strategies 2, 3, 4 & 6 if alarm 5 configured	5
Active Alarm Status	ALSt	The alarm status screen indicates any active alarms. ALM1 ALM2 ALM3 ALM4 In addition, when alarms 1, 2, 3, 4 or 5 are active, their associated Alarm LED flashes. **Latched relays can be reset (see below)*	Display(s) show active alarms. Inactive alarms are blank		
				Alarm 1 Active	1
			2	Alarm 2 Active	
			3	Alarm 3 Active	
			4	Alarm 4 Active	
			5	Alarm 5 Active	

The S428A Units Display

The single-digit Units Display is located directly to the right of the main display. In Operator Mode, this display shows C or F when a temperature input range is displayed, and is blank for linear inputs.

The units display is also used in other modes as a confirmation of the parameter type currently shown in the main display.

Alarm Indications

The alarm status screen indicates any active alarms, in addition, when alarms 1, 2, 3, 4 or 5 are active, their associated Alarm LED flashes. For latching alarm outputs, the LED **FLASHES** when the alarm condition exists, and goes to **ON** when the alarm condition is no longer present if the output has not yet been reset., to indicate that the relay is in the Latched on condition.

*Resetting Latched Alarm Outputs

Latched outputs can be reset while the Process variable or Alarm Status screens are displayed, via the Digital Input (if fitted), with a communications command via the RS485 module (if fitted) or from the front keypad as follows:

Press either △ or ▽ to reset the latched relay(s).

Note:

Outputs will only reset if their alarm condition is no longer present.

CAUTION:

A reset will affect ALL latched outputs.

Resetting Alarm 1 Active Time, Minimum PV or Maximum PV

The stored Maximum PV value, Minimum PV value or Alarm 1 active Elapsed Time value can be reset via the Digital Input (if fitted), with a communications command via the RS485 module (if fitted) or from the front keypad as follows:

Press ◯ to select the parameter to be reset.

Press either △ or ▽ for three seconds.

The display briefly shows ---- when the value is reset before the unit reverts to the requested display.

Multi-Point Scaling

When Multi-Point Scaling is enabled (mPS = EnAb in Configuration Mode), up to 9 breakpoints can be set to linearize the input signal. This only applies to mA, mV or Voltage input types.

For each breakpoint the input scale value (ScAn) is entered in % of input span, followed by

the value to be shown (d ISn) in display units. Each breakpoint's input scale value must be higher than the previous value, but the display values can be either higher or lower. Any scale value set to 100% becomes the last in the series.

Tare Feature

When Tare is enabled (tArE = EnAb in Configuration Mode), it can be used to set the displayed value to zero automatically, by making the PV Offset parameter equal, but opposite to, the current process variable value.

Tare can be initiated via the Digital Input (if fitted), with a communications command via the RS485 module (if fitted) or by using the following key press sequence:

Press ↻ until the process variable is displayed.

Hold down △ or ▽ together for three seconds until the display shows YESP.

Release both keys and press △ within 3 seconds to confirm the request.

Note:
The Tare request is aborted if this sequence is not followed exactly.

Section 4
COMMUNICATIONS

Serial Communications Parameters

The Modbus parameter addresses, and the possible ASCII message types and parameters are detailed below. RO indicates a parameter is read only,

WO indicates a parameter is write only and R/W indicates it can read from or written to.

Communications writes will not implemented if the Communications Write Parameter is disabled. Refer to the Modbus and ASCII Communications sections of this manual for details of the protocols used.

Bit Parameters

Bit parameters are not applicable to the ASCII protocol.

Parameter	Modbus Parameter No.		Notes
Alarm 1 Status	**1**	RO	1 = Active, 0 = Inactive
Alarm 2 Status	**2**	RO	1 = Active, 0 = Inactive
Alarm 3 Status	**3**	RO	1 = Active, 0 = Inactive
Alarm 1 Latched	**4**	RO	1 = Alarm 1 Latched, 0 = Not Latched*
PV Under Range	**5**	RO	1 = PV Under-range, 0 = PV within range
PV Over Range	**6**	RO	1 = PV Over-range, 0 = PV within range
Sensor Break	**7**	RO	1 = Sensor Break Active, 0 = Sensor Break Inactive
Latched Alarm Reset	**8**	WO	Writing any value resets all latched alarm relays. ***Note:*** **Outputs will only reset if their alarm condition is no longer present.**
Reset Maximum PV	**9**	WO	Writing any value resets the stored maximum displayed PV value
Reset Minimum PV	**10**	WO	Writing any value resets the stored minimum displayed PV value
Reset Elapsed Time	**11**	WO	Writing any value resets the stored alarm 1 active time value
Alarm 5 Status	**12**	RO	1 = Active, 0 = Inactive
Alarm 5 Status	**13**	RO	1 = Active, 0 = Inactive
Alarm 2 Latched	**14**	RO	1 = Alarm 2 Latched, 0 = Not Latched*
Alarm 3 Latched	**15**	RO	1 = Alarm 3 Latched, 0 = Not Latched*
Alarm 4 Latched	**16**	RO	1 = Alarm 4 Latched, 0 = Not Latched*
Alarm 5 Latched	**17**	RO	1 = Alarm 5 Latched, 0 = Not Latched*

To set the bit value to 1 write FF, to set the bit value to 0 write 00. Refer to Function Code 05 in the Modbus Communications section

Note:_Alarm Latched status requests always returns 0 if that alarm is not configured to be latching._

Setup Mode Parameters

Parameter	Modbus Parameter No.		ASCII Ident & Message Types		Notes	
Process Variable	1	RO	M *Type 2*	RO	Current value of PV.	
					If under-range = 62976 (<??>5 ASCII)	
					If over-range = 63232 (<??>0 ASCII)	
					Sensor break = 63488 (ASCII = n/a)	
Process Variable Maximum	2	RO	A *Type 2*	RO	Maximum displayed value since this was last reset. Shows under/over-range or break values if appropriate.	
Process Variable Minimum	3	RO	B *Type 2*	RO	Minimum displayed value since this was last reset. Shows under/over-range or break values if appropriate.	
Alarm 1 Elapsed Time	4	RO	T *Type 2*	RO	Accumulated alarm 1 active time since this was last reset. Returns the over-range value if the time exceeds 1000 minutes. Units = seconds in Modbus	
Instrument Status	5	RO	L *Type 2*	RO	**Bit**	**Meaning**
					0	Alarm 1 status. 0 = activated, 1 = safe
					1	Alarm 2 status. 0 = activated, 1 = safe
					2	Alarm 3 status. 0 = activated, 1 = safe
					3	Change Indicator. 1 = A parameter other than instrument status or PV has changed since the last time the status word was read.
					4	This bit always = 1
					5	Alarm 1 latched status. 0 = latched 1 = not latched or non-latching output type
					6	This bit always = 0
					7	This bit always = 0
Process Variable Offset	6	R/W	J *Type 2, 3/4*	R/W	Modified PV = Actual PV + PV Offset. Limited by Scale Range Maximum and Scale Range Minimum.	
Alarm 1 Value	7	R/W	C *Type 2, 3/4*	R/W	Alarm 1 active at this level	
Alarm 2 Value	8	R/W	E *Type 2, 3/4*	R/W	Alarm 2 active at this level	
Alarm 3 Value	9	R/W	N *Type 2, 3/4*	R/W	Alarm 3 active at this level	

Setup Mode Parameters

Parameter	Modbus Parameter No.		ASCII Ident & Message Types		Notes
Alarm 1 Hysteresis	**10**	R/W	**D** *Type 2, 3/4*	R/W	0 to 100% of span
Alarm 2 Hysteresis	**11**	R/W	**F** *Type 2, 3/4*	R/W	0 to 100% of span
Alarm 3 Hysteresis	**12**	R/W	**O** *Type 2, 3/4*	R/W	0 to 100% of span
Input Filter Time Constant	**13**	R/W	**m** *Type 2, 3/4*	R/W	0 to 100 seconds
Decimal Point Position	**14**	R/W	**Q** *Type 2* *Type 3/4*	RO R/W	0 = xxxx 1 = xxx.x 2 = xx.xx 3 = x.xxx Read only if not Linear Input.
Scale Range Lower Limit	**15**	R/W	**H** *Type 2* *Type 3/4*	RO R/W	Lower limit of scaled input range
Scale Range Upper Limit	**16**	R/W	**G** *Type 2* *Type 3/4*	RO R/W	Upper limit of scaled input range
Re-transmit Output Maximum	**18**	R/W	**[** *Type 2, 3/4*	R/W	Maximum scale value for retransmit output, 1999 to 9999. This parameter applies to the first re-transmit output fitted (see also Modbus parameters 2214, 2224 & 2234).
Re-transmit Output Minimum	**17**	R/W	**** *Type 2, 3/4*	R/W	Minimum scale value for retransmit output, 1999 to 9999. This parameter applies to the first re-transmit output fitted (see also Modbus parameters 2215, 2225 & 2235).
Scan Table			**]** *Type 2*	R	Reads back main process values. Response is: L{N}25aaaaabbbbb ccccdddddeeeeeA* where: aaaaa = Process Variable value bbbbb = Stored Maximum PV value ccccc = Stored Minimum PV value ddddd = Stored Alarm 1 Elapsed Time eeeee = Instrument Status (see above)
Instrument commands			**Z** *Type 3/4*	WO	Only Type 3 / 4 ASCII messages are allowed with this parameter. The {DATA} field must be one of four 5-digit numbers. The commands corresponding to the {DATA} field value are: 00150 = Unlatch Alarm 1 relay 00160 = Reset Stored Max PV 00170 = Reset Stored Min PV 00180 = Reset Alm1 Elapsed Time
Equipment ID	**122**	RO			The four digit model number 8010

Parameter	Modbus Parameter No.		ASCII Ident & Message Types		Notes	
Serial Number Low	123	RO			Digits aaaa	Unit serial number. Format aaaa bbbb cccc, (12 BCD digits).
Serial Number Mid	124	RO			Digits bbbb	
Serial Number High	125	RO			Digits cccc	
Date of manufacture	126	RO			Manufacturing date code as an encoded binary number. E.g. 0403 for April 2003 is returned as 193hex	
Product Revision Level	129	RO			Low Byte High Byte	Alpha part of PRL. E.g. A = 01hex Numeric part of PRL. E.g. 13 = 0Dhex
Firmware Version	130	RO			***Bits*** 0 - 4 5 - 9 10 - 15	***Meaning*** Revision number (1,2...) Alpha version (A=0, B=1...) Numeric version (starting from 121 = 0)
Input status	133	RO			Input status. Read Only. Bit 0: Sensor break flag Bit 1: Under-range flag Bit 2: Over-range flag	
Tare Enable	2111	R/W			0 = Disabled, 1 = Enabled	
Tare Activate	2112	RO			Write any value to activate.	
Option Slot 1 Re-transmit output Maximum	2214	R/W			Maximum scale value for retransmit output in slot 1, 1999 to 9999.	
Option Slot 1 Re-transmit output Minimum	2215	R/W			Minimum scale value for retransmit output in slot 1, 1999 to 9999.	
Option Slot 2 Re-transmit output Maximum	2224	R/W			Maximum scale value for retransmit output in slot 2, 1999 to 9999.	
Option Slot 2 Re-transmit output Minimum	2225	R/W			Minimum scale value for retransmit output in slot 2, 1999 to 9999.	
Option Slot 3 Re-transmit output Maximum	2234	R/W			Maximum scale value for retransmit output in slot 3, 1999 to 9999.	
Option Slot 3 Re-transmit output Minimum	2235	R/W			Minimum scale value for retransmit output in slot 3, 1999 to 9999.	

Note:

Some of the parameters that do not apply to a particular configuration will accept reads and writes (e.g. attempting to scale a Linear output which has not been fitted). Read only parameters will return an exception if an attempt is made to write values to them.

Modbus Serial Communications

All models support the Modbus RTU communication protocol. Some models also support an ASCII communication protocol. Where both Modbus and ASCII are supported, the protocol to be used is selected from Configuration Mode. The RS485 Communications Module must be fitted into Option Slot A in order to use serial communications.

Refer to the relevant Model Group Section for the ASCII and Modbus Application Layer (parameter address/ident information).

For a complete description of the Modbus protocol refer to the description provided at http://www.modicon.com/ or http: www.modbus.org/

Physical Layer

The Base address, bit rate and character format are configured via the front panel in

Configuration Mode or by using the PC Configurator software.

Physical layer configuration settings possible are:

Data rate: 1200, 2400, 4800 (default), 9600 and 19,200 bps

Parity: None (default), Even, Odd

Character format: Always 8 bits per character.

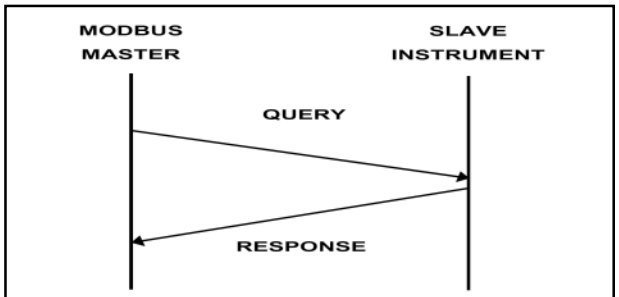
The transmitter must not start transmission until 3 character times have elapsed since reception of the last character in a message, and must release the transmission line within 3 character times of the last character in a message.

Note:

Three character times = 1.5ms at 19200, 3ms at 9600, 6ms at 4800, 12ms at 2400 and 24ms at 1200 bps.

Link Layer

A Query (or command) is transmitted from the Modbus Master to the Modbus Slave. The slave instrument assembles the reply to the master. All of the instruments covered by this manual are slave devices, and cannot act as a Modbus Master.



Modbus Link Layer

A message for either a QUERY or RESPONSE is made up of an inter-message gap followed by a sequence of data characters. The inter-message gap is at least 3.5 data character times.

Data is encoded for each character as binary data, transmitted LSB first.

For a QUERY the address field contains the address of the slave destination. The slave address is given together with the Function and Data fields by the Application layer. The CRC is generated from the given address, function and data characters.

For a RESPONSE the address field contains the address of the responding slave. The Function and Data fields are generated by the slave application. The CRC is generated from the address, function and data characters.

The standard MODBUS RTU CRC-16 calculation employing the polynomial 216+215+22+1 is used.

Inter-message gap	Address 1 character	Function 1 character	Data *n*characters	CRC Check 2 characters

Device Addressing

The instrument is assigned a unique device address by the user in the range 1 (default) to 255 using the 5DD9 parameter in Configuration Mode. This address is used to recognize Modbus Queries intended for this instrument. The instrument does not respond to Modbus Queries that do not match the address that has been assigned to it.

The instrument will also accept global Queries using device address 0 no matter what device address is assigned. No responses are returned for globally addressed Queries.

Supported Modbus Functions

Modbus defines several function types; these instruments support the types that are listed in the following table:

Function Code (decimal)	Modbus Meaning	Description
01 / 02	Read Coil/Input Status	Read output/input status bits at given address.
03 / 04	Read Holding/Input registers	Read current binary value of specified number of parameters at given address. Up to 64 parameters can be accessed with one Query.
05	Force single Coil	Writes a single binary bit to the Specified Slave Bit address.
06	Pre-set Single Register	Writes two bytes to a specified word address.
08	Diagnostics	Used for loopback test.
16	Pre-set Multiple Registers	Writes up to 1 word parameter values to the specified address range.

Supported Modbus Functions

Function Descriptions

The following is interpreted from the Modbus Protocol Description obtainable from http://www.modicon.com/ or http://www.modbus.org/. Refer to that document if clarification is required.

In the function descriptions that follow, the preceding device address value is assumed, as is the correctly formed two-byte CRC value at the end of the QUERY and RESPONSE frames.

Read Coil/Input Status (Function 01 / 02)

Reads the content of instruments output/input status bits at the specified bit address.

QUERY - Read Coil/Input Status (Modbus Function 01/02)				
Function	**Address of 1st Bit**		**Number of Bits**	
01 / 02	HI	LO	HI	LO

RESPONSE			
Function	**Number of Bytes**	**1st 8 Bytes**	**2nd 8 Bytes**
01 / 02			

In the response the .Number of Bytes. indicates the number of data bytes read from the instrument. E.g. if 16 bits of data are returned then the count will be 2. The maximum number of bits that can be read is 16 in one transaction. The first bit read is returned in the least significant bit of the first 8 bits returned.

Read Holding/Input Registers (Function 03 / 04)

Reads current binary value of data at the specified word addresses.

QUERY - Read Holding/Input Registers (Modbus Function 03/04)				
Function	**Address of 1st Word**		**Number of Words**	
03 / 04	HI	LO	HI	LO

RESPONSE					
Function	**Number of Bytes**	**First Word**		**Last Word**	
03 / 04		HI	LO	HI	LO

In the response the .Number of Bytes. indicates the number of data bytes read from the instrument. E.g. if 5 words are read, the count will be 10 (A hex). The maximum number of words that can be read is 64. If a parameter does not exist at one of the addresses read, then a value of 0000h is returned for that word.

Force Single Coil (Function 05)

Writes a single binary value to the Specified Instrument Bit address.

QUERY - Force Single Coil (Modbus Function 05)				
Function	**Address of Bit**		**State to write**	
05	HI	LO	FF/00	00

RESPONSE				
Function	**Address of Bit**		**State written**	
05	HI	LO	FF/00	00

The address specifies the address of the bit to be written to. The State to write is FF when the bit is to be SET and 00 if the bit is to be RESET.

Note: *The Response normally returns the same data as the Query.*

Pre-Set Single Register (Function 06)

Writes two bytes to a specified word address.

QUERY - Pre-Set Single Register (Modbus Function 06)				
Function	**Address of Word**		**Value to write**	
06	HI	LO	HI	LO

RESPONSE				
Function	**Address of Word**		**Value written**	
06	HI	LO	HI	LO

Note: *The Response normally returns the same data as the Query.*

Loopback Diagnostic Test (Function 08)

QUERY - Loopback Diagnostic Test (Modbus Function 08)				
Function	**Diagnostic Code**		**Value**	
08	HI= 00	LO= 00	HI	LO

RESPONSE				
Function	**Sub-function**		**Value**	
08	HI= 00	LO= 00	HI	LO

Note: *The Response normally returns the same data as the Query.*

Pre-Set Multiple Registers (Function 10 Hex)

Writes a consecutive word (two-byte) value to the specified address range.

QUERY - Pre-Set Multiple Registers (Modbus Function 10 Hex)								
Function	**1st Word Address**		**Number of Words**		**Number of Query Bytes**	**First value to write**	
10	HI	LO	HI	LO		HI	LO

RESPONSE				
Function	**1st Word Address**		**Number of Words**	
10	**HI**	**LO**	**HI**	**LO**

Note: *The number of consecutive words that can be written is limited to 1.*

Exception Responses

When a QUERY is sent that the instrument cannot interpret then an Exception RESPONSE is returned. Possible exception responses are:

MODBUS EXCEPTION RESPONSES		
Exception Code	**Error Condition**	**Interpretation**
00	Unused	None.
01	Illegal function	Function number out of range.
02	Illegal Data Address	Write functions: Parameter number out of range or not supported. (for write functions only). Read Functions: Start parameter does not exist or end parameter greater than 65536
03	Illegal Data Value	Attempt to write invalid data / required action not executed.

The format of an exception response is:

RESPONSE	
Function	**Exception Code**
Original Function code with ms bit set.	as detailed above

Note: *In the case of multiple exception codes for a single QUERY the Exception code returned is the one corresponding to the first parameter in error.*

ASCII Communications

This is a simple ASCII protocol that provides backwards compatibility with previous generations of products. ASCII is not available in all models in the range. The Modbus protocol is recommended for future use. Refer to the relevant Model Group Section for the ASCII and Modbus Application Layer (parameter address/ident information).

Physical Layer

The Base address, bit rate and character format are configured via the front panel in Configuration Mode or by using the PC Configurator software.

Physical layer configuration settings possible are:

Data rate: 1200, 2400, 4800 (default), 9600 and 19,200 bps

Parity: Even

Character format: 7 bits per character. + 1 stop bit.

The transmitter must not start transmission until 3 character times have elapsed since reception of the last character in a message, and must release the transmission line within 3 character times of the last character in a message.

Note: *Three character times = 1.5ms at 19200, 3ms at 9600, 6ms at 4800, 12ms at 2400 and 24ms at 1200 bps.*

Device Addressing

The instrument is assigned a device address by the user using the 5DD9 parameter in Configuration Mode. The address may be set to any unique value from 1 (default) to 99. This address is used to recognize ASCII messages intended for this instrument. The instrument does not respond to messages that do not match the address that has been assigned to it.

Session Layer

The ASCII protocol assumes half duplex communications. The master device initiates all communication. The master sends a command or query to the addressed slave instrument and the slave replies with an acknowledgement of the command or the reply to the query.

Messages from the master device may be one of five types:

Type 1: {S}{N}??*
Type 2: {S}{N}{P}{C}* or R{N}{P}{C}*
Type 3: {S}{N}{P}#{DATA}* or R{N}{P}#{DATA}*
Type 4: {S}{N}{P}I* or R{N}{P}I*
Type 5: {S} {N} \ P S S ? *

All characters are in ASCII code. See the following Parameter Key table for details of the parameters in brackets **{ }**.

{S}	is the Start of Message character L (Hex 4C) or R (Hex 52). L is used for Controllers; R is used for Profilers.
{N}	is the slave device address (in the range 1 - 99); addresses 1 - 9 may be represented by a single digit (e.g. 7) or in two-digit form, the first digit being zero (e.g. 07).
{P }	is a character which identifies the parameter to be interrogated/modified.
{C}	is the command (Refer to the Serial Communications Application Layer information for each Model Group)
#	indicates that {DATA} is to follow (Hex 23)
{DATA}	is a string of numerical data in ASCII code (refer to the Data Element table below)
P	is the Program Number
S S	is the Segment Number (01 to 16)
*	is the End of Message Character (Hex 2A)

No space characters are permitted in messages. Any syntax errors in a received message will cause the slave instrument to issue no reply and await the Start of Message character.

ASCII Communications

ASCII Data Element . Sign/Decimal Point Position

{DATA} Content	Data Format	Description
abcd0	+abcd	Positive value, no decimal place
abcd1	+abc.d	Positive value, one decimal place
abcd2	+ab.cd	Positive value, two decimal places
abcd3	+a.bcd	Positive value, three decimal places
Abcd5	-abcd	Negative value, no decimal place
Abcd6	-abc.d	Negative value, one decimal place
Abcd7	-ab.cd	Negative value, two decimal places
Abcd8	-a.bcd	Negative value, three decimal places

(in the Data Content, abcd represents the data value, the last digit indicates data format)

Type 1 Message

L {N} ? ? *

This message is used by the master device to determine whether the addressed slave device is active.

The reply from an active slave is

L {N} ? A *

An inactive device will give no reply.

Type 2 Message

L {N} {P} {C} * or R {N} {P} {C} *

This type of message is used by the master device, to interrogate or modify a parameter in the addressed slave device. **{P}** identifies the parameter and **{C}** represents the command to be executed, which may be one of the following:

+ (Hex 2B) = Increment the value of the parameter defined by **{P}**

. (Hex 2D) = Decrement the value of the parameter defined by **{P}**

? (Hex 3F) = Determine the current value of the parameter defined by **{P}**

The reply from the addressed slave device is of the form:

L {N} {P} {DATA} A * or R {N} {P} {DATA} A *

where **{DATA}** comprises five ASCII-coded digits whose format is shown in the Data Element table above. The data is the value requested in a query message or the new value of the parameter after modification. If the action requested by the message from the master device would result in an invalid value for that parameter (either because the requested new value would be outside the permitted range for that parameter or because the parameter is not modifiable), the slave device replies with a negative acknowledgement:

L {N} {P} {DATA} N * or R {N} {P} {DATA} N *

The **{DATA}** string in the negative acknowledgement reply will be indeterminate. If the process variable or the deviation is interrogated whilst the process variable is outside the range of the slave device, the reply is:

L {N} {P} < ? ? > 0 A *

if the process variable is over-range, or

L {N} {P} < ? ? > 5 A *

if the process variable is under-range.

ASCII Communications

Type 3 Message

L {N} {P} # {DATA} * or R {N} {P} # {DATA} *

This message type is used by the master device to set a parameter to the value specified in **{DATA}**. The command is not implemented immediately by the slave device; the slave will receive this command and will then wait for a Type 4 message (see below). Upon receipt of a Type 3 message, if the **{DATA}** content and the specified parameter are valid, the slave device reply is of the form:

L {N} {P} {DATA} I * or R {N} {P} {DATA} I *

(where **I** = Hex 49) indicating that the slave device is ready to implement the command. If the parameter specified is invalid or is not modifiable or if the desired value is outside the permitted range for that parameter, the slave device replies with a negative acknowledgement in the form:

L {N} {P} {DATA} N * or R {N} {P} {DATA} N *

Type 4 Message

L {N} {P} I * or R {N} {P} I *

This type of message is sent by the master device to the addressed slave device, following a successful Type 3 transaction with the same slave device. Provided that the **{DATA}** content and the parameter specified in the preceding Type 3 message are still valid, the slave device will then set the parameter to the desired value and will reply in the form:

L {N} {P} {DATA} A *

where **{DATA}** is the new value of the parameter. If the new value or parameter specified is invalid, the slave device will reply with a negative acknowledgement in the form:

L {N} {P} {DATA} N *

where **{DATA}** is indeterminate. If the immediately preceding message received by the slave device was not a Type 3 message, the Type 4 message is ignored.

Error Response

The circumstances under which a message received from the master device is ignored are:

Parity error detected

Syntax error detected

Timeout elapsed

Receipt of a Type 4 message without a preceding Type 3 command message.

Negative acknowledgements will be returned if, in spite of the received message being notionally correct, the slave device cannot supply the requested information or perform the requested operation. The **{DATA}** element of a negative acknowledgement will be indeterminate.

NOTES

Section 5
CALIBRATION

Calibration

WARNING:

CALIBRATION IS ONLY REQUIRED FOR INSTRUMENTS IN WHICH CALIBRATION ERRORS HAVE BEEN ENCOUNTERED. REFER TO CALIBRATION CHECK BELOW.

CAUTION:

Calibration must be performed by personnel who are technically competent and authorized to do so.

Calibration is carried out during manufacture and is not normally required again during the lifetime of the instrument.

Equipment Required For Checking or Calibrating the Universal Input

A suitable calibration signal source is required for each input type. To verify the accuracy of the instrument or carry out recalibration, the listed input sources are required, with better than ±0.05% of the reading accuracy:

1. DC linear inputs: 0 to 50mV, 0 to 10VDC and 0 to 20mADC.

2. Thermocouple inputs - complete with 0ºC reference facility, appropriate thermocouple

functions and compensating leads (or equivalent).

3. RTD inputs: decade resistance box with connections for three-wire input (or equivalent).

Calibration Check

1. Set the instrument to the required input type.

2. Power up the instrument and connect the correct input leads.

Leave powered up for at least five minutes for RTD and DC linear inputs, or at least 30 minutes for thermocouple inputs.

3. After the appropriate delay for stabilization has elapsed, check the calibration by connecting the appropriate input source and checking a number of cardinal points.

4. Repeat the test for all required input types.

Recalibration Procedure

Recalibration is carried out in five phases as shown in the table below, each phase

corresponds to an input range of the instrument.

CAUTION:

The 50mV phase MUST be calibrated before the thermocouple range.

INPUT CALIBRATION PHASES	
ıP_1	50 mV
ıP_2	10 V
ıP_3	20 mA
ıP_4	RTD input (200 ohm)
ıP_5	Thermocouple (K type source at 0ºC required)

To start calibration, apply the required calibration input from the source type list above, using the correct connections,

1. While the instrument is powering up, press ↻ and ▽ together until ıP_1 is displayed.

Note:
If a phase has not been previously calibrated the display will flash.

2. Press △ and ▽ together to initiate calibration on Indicators.

3. During calibration the display changes to - - - - for a few seconds.

4. If the input is misconnected or an incorrect signal is applied the calibration will be aborted and the display will show FAIL. The previous calibration value will be retained.

5. If the calibration has succeeded, the pass display is shown as ıP_1 (non-flashing).

6. Press ↻ to step to the next phase.

7. Repeat this process for each input type until all the phases are calibrated.

Note:
Switch off the instrument to exit the Calibration Mode or Calibration Mode will be automatically exited if there is no button activity for five minutes.

NOTES

Appendix 1

PLUG-IN OPTIONS
&
PART NUMBERS

Appendix 2

GLOSSARY

Appendix 3
COMPLETE SPECIFICATION

Appendix 1 Plug-In Options & Part Numbers

Options Modules and Functions

A range of plug-in option modules is available to add additional input, output and communication functions to the instruments in the range. These modules can be either preinstalled at the time of manufacture, or retrofitted to a Base Model in the field, see table below.

The modules are installed between the instruments main circuit boards into the four option slots. These are designated as Slots 1, 2, 3, & A. Installation is detailed below.

Auto Detection of Option Modules

The instrument automatically detects which option modules have been fitted into each slot. In Configuration Mode, the menus will change to reflect the options compatible with the hardware fitted. The modules fitted can be viewed in the Product Information Mode.

Note:

Slot 1 modules cannot be fitted into Slot 2 or 3. Slot 2 & 3 modules cannot be fitted into Slot 1. Some Slot 2 &3 modules should only be fitted into one of the two slots. This is detailed in the - Allowed Functions in Options Slots table, next page.

The following table shows available standard model configurations that may be provided in the Series S428A when ordered from the factory. Alternatively, Base Models may be ordered and fitted with option models in the field. Part Numbers for and placement of Option Modules is detailed in the - Allowed Functions in Options Slots table, next page.

Input Type must be specified in Base Model.		The functions in Option Slots below may be outfitted at any time by ordering Option Modules, then installing per the procedure in this section.				Power Supply and Display color/ must be specified in Base Model.	
Code 1: Model #	**Code 2: Input Type**	**Code 3: Option Slot 1**	**Code 4: Option Slot 2**	**Code 5: Option Slot 3**	**Code 6: Option Slot A**	**Code 7: Power Supply**	**Code 8: Display Color**
S428A	☐	☐	☐	☐	☐	☐	☐
I/8 DIN Indicator with Alarm Function	**1** 3 Wire RTD or DC mV **2** Thermo-couple **3** DC mA **4** DC Voltage	**0** Not Fitted **1** Relay **2** DC for SSR **3** DC 0-10V **4** DC 0-20mA **5** DC 0-5V **6** DC 2-10V **7** DC 4-20mA **8** Triac*	**0** Not Fitted **1** Relay **2** DC for SSR **3** DC 0-10V **4** DC 0-20mA **5** DC 0-5V **6** DC 2-10V **7** DC 4-20mA **8** Triac* **9** Dual Relay	**0** Not Fitted **1** Relay **2** DC for SSR **3** DC 0-10V **4** DC 0-20mA **5** DC 0-5V **6** DC 2-10V **7** DC 4-20mA **8** Transmitter Power Supply **9** Dual Relay	**0** Not fitted **1** RS-485 Serial Communication **3** Remote Setpoint Input (digital)	**0** 100-240 AC **2** 24-48 AC or DC	**0** Red Display **1** Green Display **4** Color Change Display (Red/Green)

* Maximum of two Triac outputs per unit

Appendix 1 Plug-In Options & Part Numbers

Allowed Functions in Option Slots

OPTION SLOT 1		OPTION SLOT 2	
P/N	**Function**	**P/N**	**Function**
PO1-C10F	Relay	**PO2-C10F**	Relay
PO1-C50F	SSR Driver	**PO2-C50F**	SSR Driver
PO1-C80F	Triac	**PO2-C80F**	Triac
PO1-C21F	Linear mA/V DC	**PO2-C21F**	Linear mA/V DC
		PO2-W09F	Dual Relay
OPTION SLOT 3		**OPTION SLOT A**	
P/N	**Function**	**P/N**	**Function**
PO2-C10F	Relay	**PA1-W06F**	RS485 Comms
PO2-C50F	SSR Driver	**PA1-W03F**	Digital Input
PO2-C21F	Linear mA/V DC		
PO2-W08F	TransmitterPSU		
PO2-W09F	Dual Relay		

Table shows part number and function of boards that my be used in option slots 1, 2, 3 and A

Preparing to Install or Remove Options Modules

CAUTION:

Before removing the instrument from it's housing, ensure that all power has been removed from the rear terminals.

1. Remove the instrument from its housing by gripping the side edges of the front panel (there is a finger grip on each edge) then pulling the instrument forward while pressing down on the two latching tabs located on the top and bottom of the case directly behind the front panel. This will release the instrument from the rear connectors in the housing and will give access to the PCBs.

2. Take note of the orientation of the instrument for subsequent replacement into the housing. The positions of the main and option PCBs in the instrument are shown in the figure that follows.

Removing/Installing Option Modules

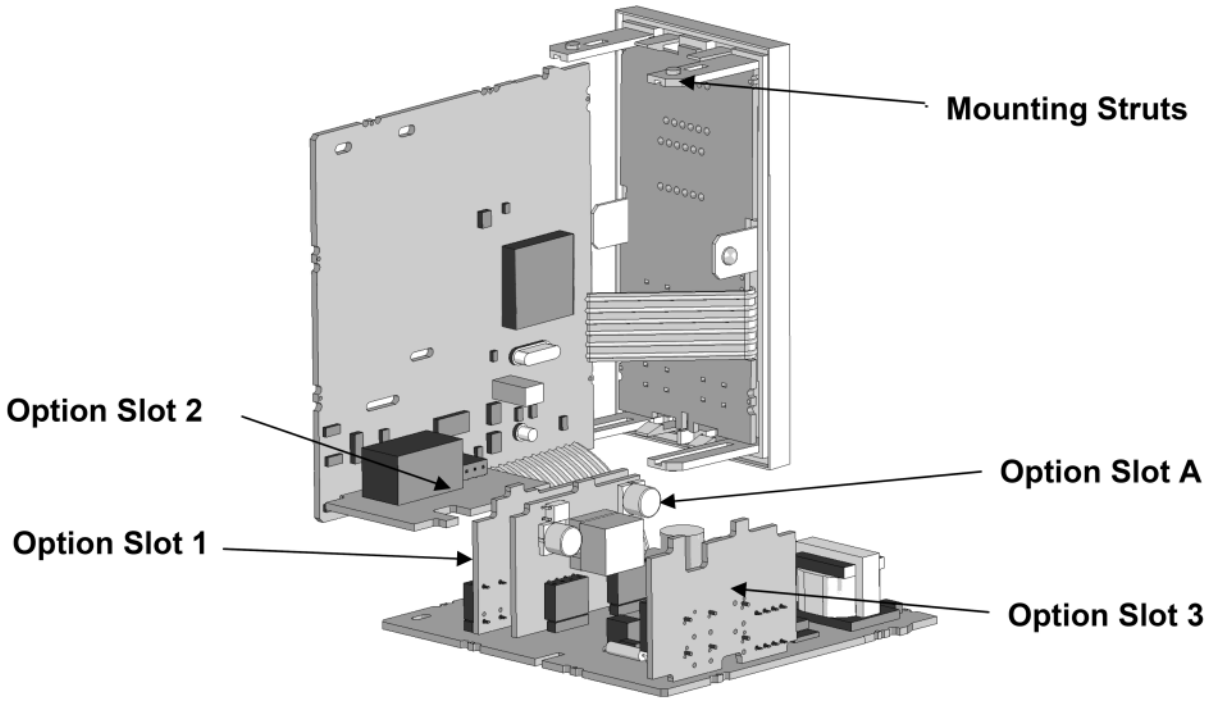
With the instrument removed from its housing:

1. To remove, install or replace modules into Option Slots 1, 2, 3 or A, it is necessary to gently separate the CPU and PSU PCBs. This is achieved by detaching the main boards (PSU and CPU) from the front moulding by lifting first the upper and then lower mounting struts as shown. This frees the boards from the front.

CAUTION:

Take care not to put undue stress on the ribbon cable attaching the display and CPU boards.

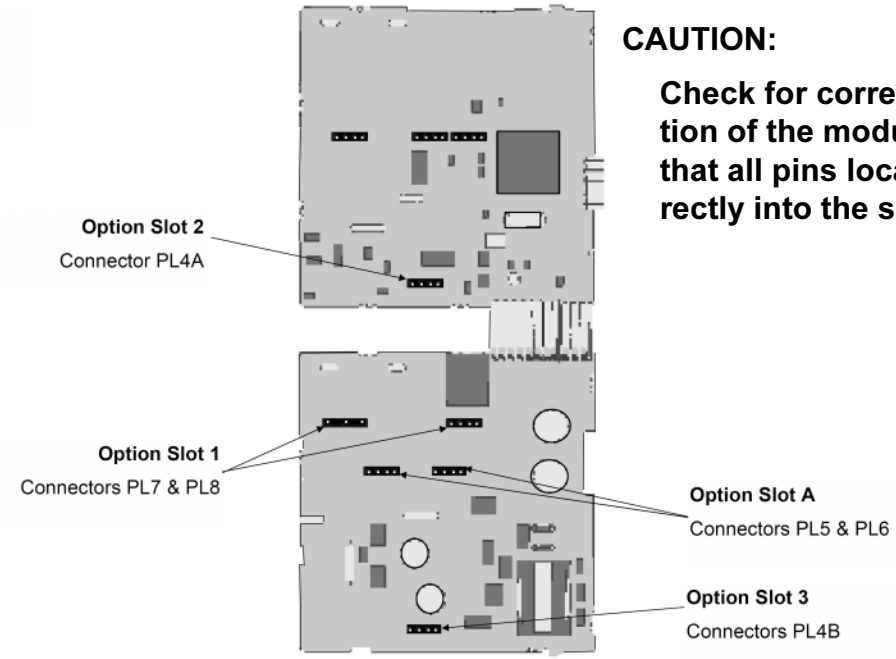
Appendix 1 Plug-In Options & Part Numbers



Location of Option Modules

2. Remove or fit the modules into the Option slots as required. The location of the connectors is shown below.

Tabs on each option module engage slots in the main boards, opposite each of the connectors, in order to stabilize the assembly.



CAUTION:

Check for correct orientation of the modules and that all pins locate correctly into the socket

Option Module Connections

Appendix 1 Plug-In Options & Part Numbers

Replacing the Instrument in its Housing

With the required option modules correctly located into their respective positions the instrument can be replaced into its housing as follows:

1. Move the CPU and PSU boards back together, taking care to locate the option module tabs into the slots in the board opposite. Hold the main boards together while relocating them back into the mounting struts on the front panel.

2. Align the CPU and PSU PCBs with their guides and connectors in the housing.

3. Slowly and firmly, push the instrument in position.

CAUTION:

Be sure that the instrument is correctly orientated. A mechanical stop will attempt to prevent insertion of the PCBs in the wrong orientation, this stop MUST NOT be over-ridden.

Appendix 2 . Glossary

This Glossary explains the technical terms and parameters used in this manual. The entry type is also shown:

General Definition: Terms applicable to the entire model range.

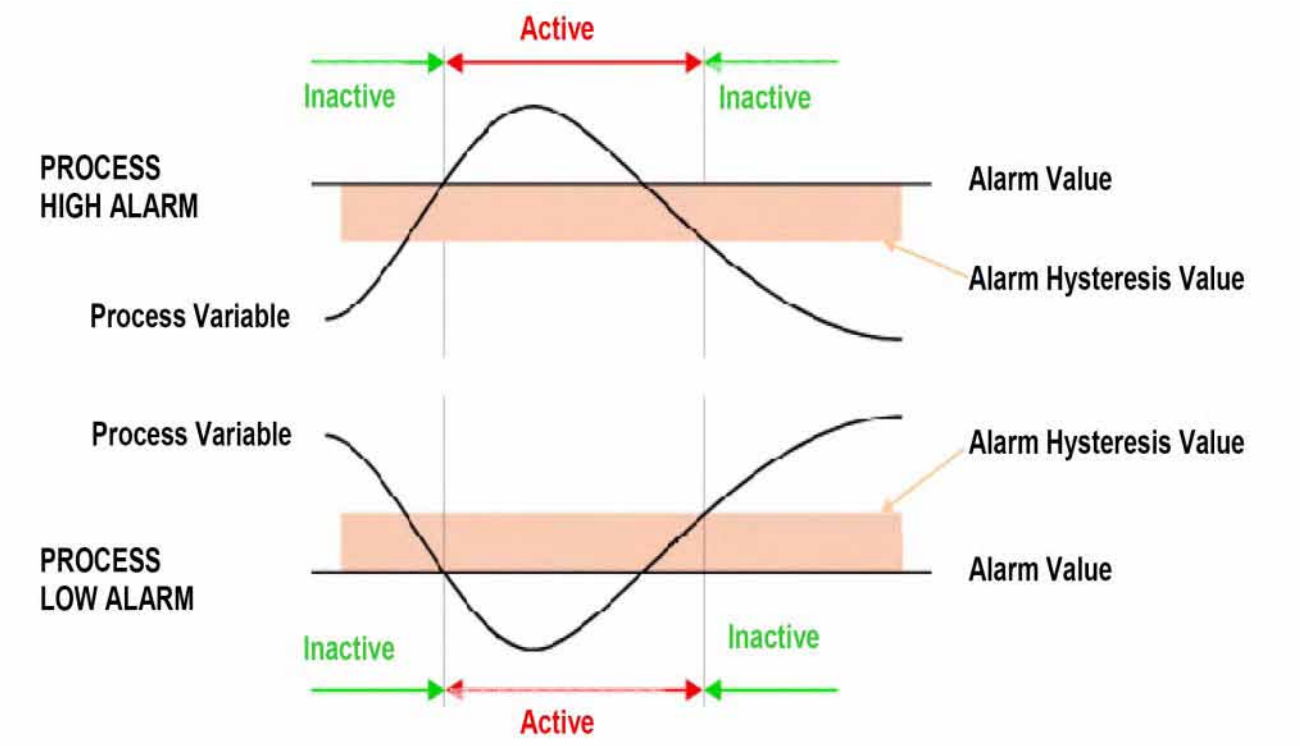
Indicator Definition: Terms applicable to S428A indicator models.

General Parameter: Parameters applicable to the entire model range.

Indicator Parameter: Parameters applicable to indicator S428A models.

Alarm Hysteresis Type: *General Parameter*

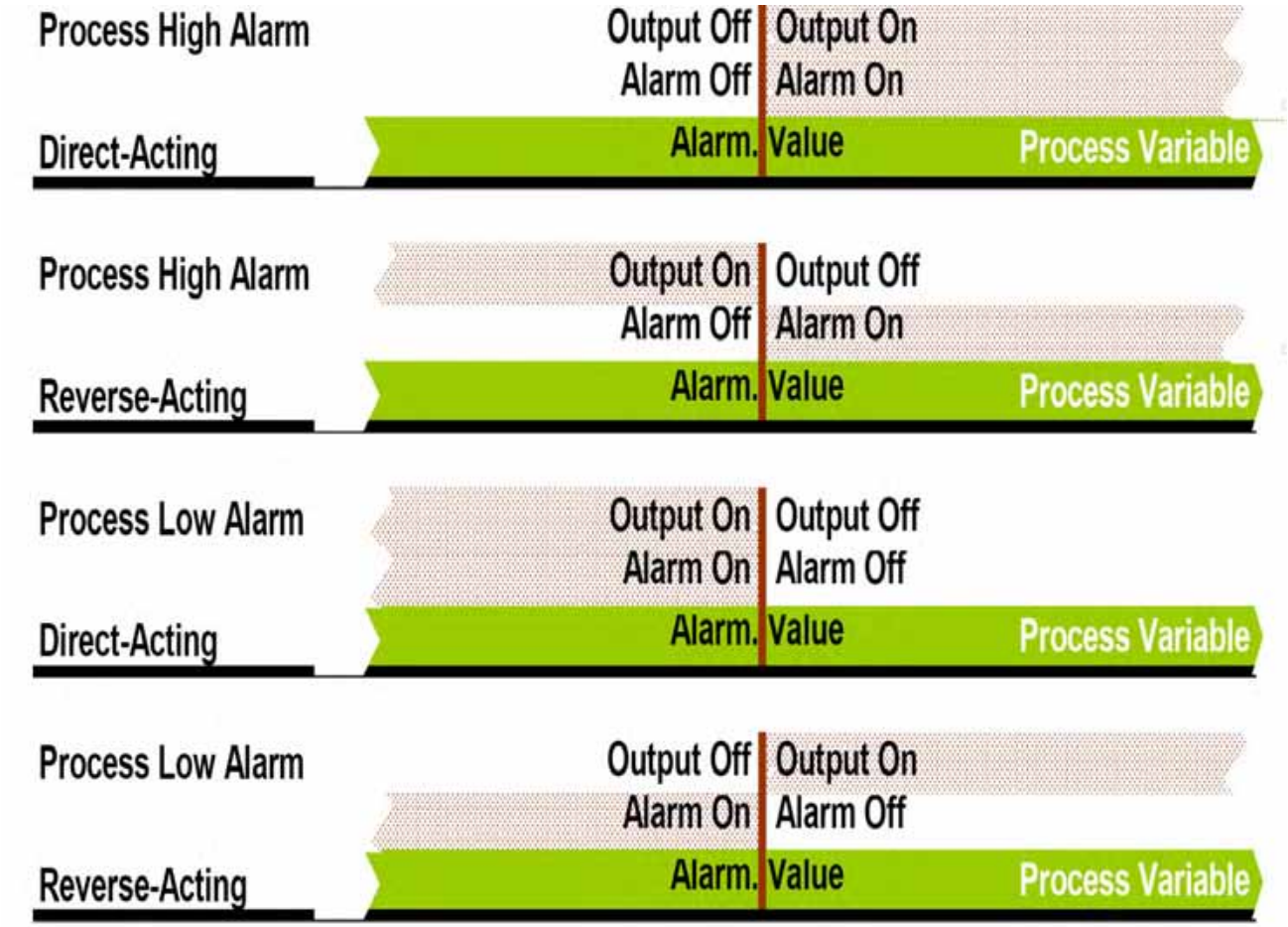
An adjustable band on the .safe. side of an alarm point, through which the process variable must pass before the alarm will change state, as shown in the diagram below. E.g. a high alarm's hysteresis band is below the high alarm value, and a low alarm's hysteresis is above the low alarm value. Also refer to *Alarm Operation*.



Appendix 2 . Glossary

Alarm Operation Type: *General Definition*

The different alarm types are shown below, together with the action of any outputs. Also refer to Alarm Hysteresis, Latching Relay, *Logical Alarm Combinations, Process High Alarm and Process Low Alarm.*



Appendix 2 . Glossary

Communications Write Enable Type: *General Definition*

Enables/disables the changing of parameter values via the RS485 communications link, if the communications option is installed. Possible settings are read only or read/write. Display code = CoEn, default setting = r-W (read/write).

Display Strategy Type: *General Parameter*

Alters the parameters displayed in normal operator mode. For example an indicator could display PV + AL 1, 2, 3, 4, 5, PV or SP only. Display strategy 6 will allow read only access to the setpoint values in Operator Mode, Setup Mode must then be entered to change the setpoint. Display code = d ISP Also refer to Process Variable.

Elapsed Time Type: *Indicator Definition*
The total accumulated time that Alarm 1 has been active on an Indicator since this parameter was last reset. This does not include the time when the alarm condition has cleared. The Elapsed Time is not affected by the Alarm 2 and Alarm 3 status. *Also refer to Alarm Operation, and Indicator.*

Indicator Type: *Indicator Definition*
An instrument that can display a Process Variable. Alarm outputs are available that will activate at preset PV values. Relay outputs can be selected to have a Latching function similar to a Limit Controller output, but indicators do not have the necessary approvals for safety critical applications. Other options are PV retransmission and Serial Communications. Process control functions are not available. Also refer to Alarm Operation, Elapsed Time, Latching Relay, Process Variable, Retransmit Output, Serial Communications, Tare.

Input Filter Time Constant Type: *General Parameter*
This parameter is used to filter out extraneous impulses on the process variable. The filtered PV is used for all PV-dependent functions (display control, alarm etc). The time constant is adjustable from 0.0 seconds (off) to 100.0 seconds in 0.5 second increments. Display code = FILt, Default value = 2.0 seconds. Also refer to Process Variable.

Input Range Type: *General Definition*
This is the overall process variable input range and type as selected by the Set Value parameter in Configuration Mode. Also refer to Input Span.

Input Span Type: *General Definition*
The measuring limits, as defined by the Scale Range Lower and Scale Range Upper Limits.

Also refer to Input Range, Scale Range Lower Limit and Scale Range Upper Limit.

Appendix 2 . Glossary

Latching Relay Type: *General Definition*

A type of relay that, once it becomes active, requires a reset signal before it will deactivate.

This output is available on indicator alarms. To successfully deactivate a latched relay, the alarm or alarm condition that caused the relay to become active must first be removed, then a reset signal can be applied. This signal may be applied from the instrument keypad, Digital Input or command via Serial Communication. Also refer to Alarm Operation, Indicator, Alarm Hysteresis, Serial Communications.

LED Type: *General Definition*

Light Emitting Diode. LED's are used as indicator lights (e.g. for the alarm indication). The 7-segment display is also LED.s.

Lock Codes Type: *General Parameter*

Defines the codes required to enter Configuration (20) & Set-Up (10).
Display codes = cLoc & SLoc, default values shown above in brackets.

Logical Combination of Alarms Type: *General Definition*

Two alarms may be combined logically to create an OR situation. Any suitable output may be assigned as a Logical Alarm Output, configured for Reverse-acting or Direct action. Also refer to Alarm Operation.

Logical Alarm Outputs

Logical OR: Alarm 1 OR Alarm 2					
Direct Acting					
ALARM 1	ALARM 2		OUTPUT		
OFF	OFF		OFF		
ON	OFF		ON		
OFF	ON		ON		
ON	ON		ON		
Reverse-Acting					
ALARM 1	ALARM 2		OUTPUT		
OFF	OFF		ON		
ON	OFF		OFF		
OFF	ON		OFF		
ON	ON		OFF		

mADC Type: General Definition

This stands for milliamp DC. It is used in reference to the DC milliamp input ranges and the linear DC milliamp outputs. Typically, these will be 0 to 20mA or 4 to 20mA.

Multi-Point Scaling Enable Type: *Indicator Parameter*

When an Indicators Multi-Point Scaling function is enabled by setting MPS to EnAb in Configuration Mode, up to 9 breakpoints can be defined to linearize the input signal. This only applies to mA, mV or Voltage input types. For each breakpoint, an input scale value is entered, followed by the value to be shown at the breakpoint.

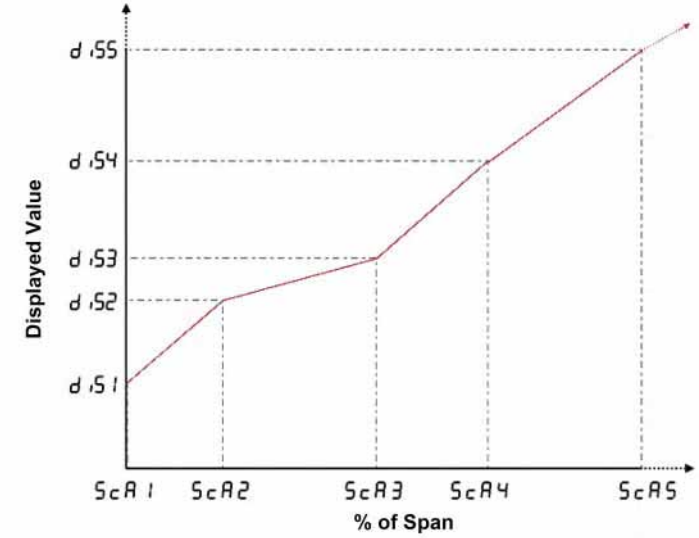
Display code = MPS default setting = d ISA

Also refer to Indicator, Multipoint Scaling Set Up and Process Variable.

Appendix 2 . Glossary

Multi-Point Scaling Set Up Type: *Indicator Parameter*

For each breakpoint, the input scale value (ScAn) is entered as a percentage of the input span, followed by the value to be shown (d.5n) in display units, for this input value. Each breakpoint's input scale value must be higher than the previous value, but the display values can be either higher or lower. This procedure is repeated for up to nine breakpoints, but if any scale value is set to 100% if automatically becomes the last in the series.



Also refer to Indicator, *Multipoint Scaling Enable* and *Process Variable*.

PLC Type: *General Definition*

This stands for Programmable Logic Controller. A microprocessor based device used in machine control. It is particularly suited to sequential control applications, and uses Ladder Logic programming techniques. Some PLC's are capable of basic PID control, but tend to be expensive and often give inferior levels of control.

Process High Alarm 1 Value Type: *General Parameter*

This parameter, applicable only when Alarm 1 is selected to be a Process High alarm, defines the process variable value above which Alarm 1 will be active. Its value may be adjusted between Scale Range Upper Limit and Scale Range Lower Limit.
Display code = PHA1, Default value = Scale Range Upper Limit.
Also refer to Alarm Operation, Process High Alarm 2 Value, Process Variable, Scale Range *Lower Limit and Scale Range Upper Limit.*

Process High Alarm 2 Value Type: *General Parameter*

This parameter, applicable only when Alarm 2 is selected to be a Process High alarm. It is similar to the Process High Alarm 1 Value. Display code = PHA2, Default value = Scale Range Upper Limit. Also refer to Alarm Operation, Process High Alarm 1 Value, Process Variable, Scale Range Lower Limit and Scale Range Upper Limit.

Appendix 2 . Glossary

Process Low Alarm 1 Value Type: *General Parameter*
This parameter, applicable only when Alarm 1 is selected to be a Process low alarm, defines the process variable value below which Alarm 1 will be active. Its value may be adjusted between Scale Range Upper Limit and Scale Range Lower Limit.
Display code = PLA 1, Default value = Scale Range Lower Limit. Also refer to Alarm Operation, Process Low Alarm 2 Value, Process Variable, Scale Range Lower Limit and Scale Range Upper Limit.

Process Low Alarm 2 Value Type: *General Parameter*
This parameter, applicable only when Alarm 2 is selected to be a Process low alarm. It is similar to the Process Low Alarm 1 Value. Display code = PLA2, default value = Scale Range Lower Limit.
Also refer to Alarm Operation, Process Low Alarm 1 Value, Process Variable, Scale Range Lower Limit and Scale Range Upper Limit.

Process Variable (PV) Type: *General Definition*
Process Variable is the variable to be measured by the primary input of the instrument. The PV can be any parameter that can be converted into a electronic signal suitable for the input. Common types are Thermocouple or PT100 temperature probes, or pressure, level, flow etc from transducers which convert these parameters into linear DC signals (e.g. 4 to 20mA). Linear signals can be scaled into engineering units using the Scale Range Lower Limit and Scale Range Upper Limit parameters.
Also refer to Input Span, Scale Range Lower Limit and Scale Range Upper Limit.

Retransmit Output Type: *General Definition*
A linear DC voltage or mA output signal, proportional to the Process Variable for use by slave controllers or external devices, such as a Data Recorder or PLC. The output can be scaled to transmit any portion of the input span.
Also refer to Input Span and Process Variable.

Retransmit Output 1 Scale Maximum Type: *General Parameter*
Scales a linear output module in slot 1 that has been set up to retransmit PV. Retransmit Scale Maximum defines the value of the process variable at which the output will be at its maximum value. E.g. for a 0 to 5V output, the value corresponds to 5V. It may be adjusted within the range -1999 to 9999; the decimal position is always the same as that for the process variable input. If this parameter is set to a value less than that for Retransmit Output 1 Scale Minimum, the relationship between the process variable and the retransmission output is reversed. Display code = ro 1H, default value = Scale Range Upper Limit.
Also refer to Process Variable, Retransmit Output, Retransmit Output 1 Scale Minimum and Scale Range Upper Limit.

Appendix 2 . Glossary

Retransmit Output 1 Scale Minimum Type: *General Parameter*
Scales a linear output module in slot 1 that has been set up to retransmit PV. Retransmit Scale Minimum defines the value of the process variable at which the output will be at its minimum value. E.g. for a 0 to 5V output, the value corresponds to 0V. It may be adjusted within the range -1999 to 9999; the decimal position is always the same as that for the process variable input. If this parameter is set to a value greater than that for Retransmit Output Scale Maximum, the relationship between the process variables and the retransmission output is reversed. Display code = rolL, default value = Scale Range Lower Limit.
Also refer to Process Variable, Retransmit Output, Retransmit Output 1 Scale Maximum and Scale Range Lower Limit.

Retransmit Output 2 Scale Maximum Type: *General Parameter*
Defines the value of the process variable at which Retransmit Output 2 will be at its maximum value. It is similar to Retransmit Output 1 Scale Maximum.
Display code = ro2H, default value = Scale Range Upper Limit.
Also refer to Process Variable, Retransmit Output, Retransmit Output 2 Scale Minimum and Scale Range Upper Limit.

Retransmit Output 2 Scale Minimum Type: *General Parameter*
Defines the value of the process variable at which Retransmit Output 2 will be at its minimum value. It is similar to Retransmit Output 1 Scale Minimum.
Display code = roIL, default value = Scale Range Lower Limit.
Also refer to Process Variable, Retransmit Output, Retransmit Output 2 Scale Maximum, and Scale Range Lower Limit.

Retransmit Output 3 Scale Maximum Type: *General Parameter*
Defines the value of the process variable at which Retransmit Output 3 will be at its maximum value. It is similar to Retransmit Output 1 Scale Maximum.
Display code = ro3H, default value = Scale Range Upper Limit.
Also refer to Process Variable, Retransmit Output, Retransmit Output 3 Scale Minimum and *Scale Range Upper Limit.*

Retransmit Output 3 Scale Minimum Type: *General Parameter*
Defines the value of the process variable at which Retransmit Output 3 will be at its minimum value. It is similar to Retransmit Output 1 Scale Minimum.
Display code = ro3L, default value = Scale Range Lower Limit.
Also refer to Process Variable, Retransmit Output, Retransmit Output 3 Scale Maximum

Appendix 2 . Glossary

and Scale Range Lower Limit.

Scale Range Upper Limit Type: *General Parameter*
For linear inputs, this parameter is used to scale the process variable into engineering units. It defines the displayed value when the process variable input is at its maximum value. It is adjustable from -1999 to 9999 and can be set to a value less than (but not within 100 units of) the Scale Range Lower Limit, in which case the sense of the input is reversed. For thermocouple and RTD inputs, this parameter is used to reduce the effective range of the input. All span related functions work from the trimmed input span. The parameter can be adjusted within the limits of the range selected by Configuration Mode parameter inPt. It is adjustable to within 100 degrees of the Scale Range Lower Limit.
Display code rUL, default value = 1000 for linear inputs or range maximum for temperature inputs.
Also refer to Input Span, Process Variable and Scale Range Lower Limit.

Scale Range Lower Limit Type: *General Parameter*
For linear inputs, this parameter can be used to display the process variable in engineering units. It defines the displayed value when the process variable input is at its minimum value. It is adjustable from -1999 to 9999 and can be set to a value more than (but not within 100 units of) the Scale Range Upper Limit, in which case the sense of the input is reversed. For thermocouple and RTD inputs, this parameter is used to reduce the effective range of the input. All span related functions, work from the trimmed span. The parameter can be adjusted within the limits of the range selected by Configuration Mode parameter inPt. It is adjustable to within 100 degrees of the Scale Range Upper Limit.
Display code = rUL, default value = 0 for linear inputs, or range minimum for temperature inputs.
Also refer to Input Span, Process Variable and Scale Range Upper Limit.

Serial Communications Option Type: *General Definition*
A feature that allows other devices such as PC's, PLC's or a master controller to read or change an instruments parameters via an RS485 Serial link. Full details can be found in the Serial Communications sections of this manual.
Also refer to Indicator and PLC

Solid State Relay (SSR) Type: *General Definition*
An external device manufactured using two silicone controlled rectifiers, which can be used to replace mechanical relays in most AC power applications. As a solid state device, an SSR does not suffer from contact degradation when switching electrical current. Much faster switching cycle times are also possible, leading to superior control. The instrument.s SSR Driver output is a 10VDC pulse which causes conduction of current to the load when the pulse is on.
Also refer to Triac.

Appendix 2 . Glossary

Tare Type: *Indicator Parameter*

When an Indicator's Tare function has been enabled, the operator can set the current Process Variable input value to be displayed as zero. This function may be used to easily eliminate any offset on the input signal, e.g. when a transducer output is not giving a true zero value. It may also be used in applications displaying the weight of a product, to remove the weight of a container before starting. When Tare is activated, the instrument automatically sets the PV Offset to an equal, but opposite value to the current measured value.

Display code = tArE, default setting = diSA (disabled).

Also refer to Indicator and Process Variable.

Triac Type: *General Definition*

A small internal solid state device, which can be used in place of a mechanical relay in applications switching low power AC, up to 1 amp. As a solid-state device, a Triac does not suffer from contact degradation when switching electrical currents. A triac cannot be used to switch DC power.

Also refer to SSR.

NOTES

Appendix 3. Complete Specification

Universal Input

General Input Specification

Input Sample Rate:	Four samples/second.
Digital Input Filter time constant	0.0 (OFF), 0.5 to 100.0 seconds in 0.5 second increments.
Input Resolution:	14 bits approximately. Always four times better than display resolution.
Input Impedance:	10V DC 47K-Ohm 20mA DC: 5 Ohm Other ranges: Greater than 10M-Ohm resistive
Isolation:	Isolated from all outputs (except SSR driver). If single relay outputs are connected to a hazardous voltage source, and the universal input is connected to operator accessible circuits, supplementary insulation or input grounding is required.
PV Offset:	Adjustable ±input span.
PV Display:	Displays process variable up to 5% over and 5% under span.

Thermocouple

Thermocouple Ranges Available

Sensor Type	Range Min. in °C	Range Max. in °C	Range Min. in °F	Range Max. in °F	Resolution
J (default)	-200	1200	-328	2192	1°
J	-128.8	537.7	-199.9	999.9	0.1°
T	-240	400	-400	752	1°
T	-128.8	400.0	-199.9	752.0	0.1°
K	-240	1373	-400	2503	1°
K	-128.8	537.7	-199.9	999.9	0.1°
L	0	762	32	1403	1°
L	0.0	537.7	32.0	999.9	0.1°
N	0	1399	32	2551	0.1°
B	100	1824	211	3315	1°
R	0	1759	32	3198	1°
S	0	1762	32	3204	1°
C	0	2320	32	4208	1°
PtRh20%: PtRh40%	0	1850	32	3362	1°

Note:
Defaults to °F for USA units. The Configuration Mode parameters, Scale Range Upper Limit and Scale Range Lower Limit, can be used to restrict range.

Appendix 3. Complete Specification

Thermocouple Performance

Calibration:	Complies with BS4937, NBS125 and IEC584.
Measurement Accuracy:	±0.1% of full range span ±1LSD. NOTE: Reduced performance for B Thermocouple from 100 to 600°C. NOTE: PtRh 20% vs PtRh 40% Thermocouple accuracy is 0.25% and has reduced performance below 800°C.
Linearisation Accuracy:	Better than ±0.2°C any point, for 0.1° resolution ranges (±0.05°C typical). Better than ±0.5°C any point, for 1° resolution ranges.
Cold Junction Compensation:	Better than ±0.7°C under reference conditions. Better than ±1°C under operating conditions.
Temperature Stability:	0.01% of span/°C change in ambient temperature.
Supply Voltage Influence:	Negligible.
Relative Humidity Influence:	Negligible.
Sensor Resistance Influence:	Thermocouple 100 Ohms: <0.1% of span error. Thermocouple 1000 Ohms: <0.5% of span error.
Sensor Break Protection:	Break detected within two seconds. Alarms operate as if the process variable is over-range.

Resistance Temperature Detection (RTD)

RTD Ranges Available

Range Min in °C	Range Max in °C	Range Min in °F	Range Max in °F	Resolution
-128.8	537.7	-199.9	999.9	0.1°
-199	800	-328	1472	1° (default)

Note:
Scale Range Upper Limit and Scale Range Lower Limit Configuration Mode parameters can be used to restrict range.

Appendix 3. Complete Specification

RTD Performance

Type:	Three-wire Pt100.
Calibration:	Complies with BS1904 and DIN43760 *(0.00385././°C).*
Measurement Accuracy:	±0.1% of span ±1LSD.
Linearization Accuracy:	Better than ±0.2°C any point, any 0.1°C range (±0.05°C typical). Better than ±0.5°C any point, any 1°C range.
Temperature Stability:	
Supply Voltage Influence:	Negligible.
Relative Humidity Influence:	Negligible.
Sensor Resistance Influence:	Pt100 50 Ohm/lead: <0.5% of span error.
Lead Compensation:	Automatic scheme.
RTD Sensor Current:	150µA (approximately).
Sensor Break Protection:	Break detected within two seconds. Alarms operate as if the process variable has gone over-range.

DC Linear

DC Linear Ranges Available

0 to 20mA	0 to 50mV	0 to 5V
4 to 20mA (default)	10 to 50mV	1 to 5V
		0 to 10V
		2 to 10V

DC Linear Performance

Scale Range Upper Limit:	–1999 to 9999. Decimal point as required.
Scale Range Lower Limit:	–1999 to 9999. Decimal point as for Scale Range Upper Limit.
Minimum Span:	1 display LSD.
Measurement Accuracy	±0.1% of span ±1LSD.
Temperature stability:	0.01% of span/°C change in ambient temperature.
Supply Voltage Influence:	Negligible.
Relative Humidity Influence:	Negligible.
Input Protection:	Up to 10 times maximum span of selected input connection.
Sensor Break Protection	Applicable for 4 to 20mA, 1 to 5V and 2 to 10V ranges only. Alarms operate as if process variable is under-range.

Appendix 3. Complete Specification

Digital Inputs

Type:	Voltage-free or TTL-compatible
Voltage-Free Operation: *functions depend on model and how configured*	Connection to contacts of external switch or relay: **Open**= No Action **Closed**= Latching Relay, Stored Min/Max/Time reset (edge trig gered) or Tare activate (edge triggered). *Maximum contact resis tance = 50 Ohm*.
TTL levels: *functions depend on model and how configured*	**2.0 to 24VDC** = No Action **0.6 to 0.8VDC**= Latching Relay, Stored Min/Max/Time reset (edge triggered) or Tare activate (edge triggered).
Maximum Input Delay (OFF-ON):	0.25 second.
Maximum Input Delay (ON-OFF):	0.25 second.
Isolation:	Reinforced safety isolation from any source of hazardous voltages.

Appendix 3. Complete Specification

Output Specifications

Output Module Types

Option Slot 1 Module Options:	Relay, SSR drive, Triac or DC linear.
Option Slot 2 Module Options:	Relay, Dual Relay, SSR drive, Triac or DC linear.
Option Slot 3 Module Options:	Relay, Dual Relay, SSR drive, DC Linear or Transmitter PSU.

Specifications of Output Types

Single Relay:	Contact Type:	Single pole double throw (SPDT).
	Alarm Rating:	2A resistive at 240V AC
	Control/Alarm Lifetime:	>500,000 operations at rated voltage/current.
	Isolation:	Basic Isolation from universal input and SSR outputs.
Dual Relay:	Contact Type:	2 x Single pole single throw (SPST) with shared common.
	Alarm Rating:	2A resistive at 240VA.
	Control/Alarm Lifetime:	>200,000 operations at rated voltage/current.
	Isolation:	Reinforced safety isolation from inputs and other outputs.
SSR Driver:	Drive Capability:	10V minimum at up to 20mA load.
	Isolation:	Not isolated from universal input or other SSR driver outputs.

Appendix 3. Complete Specification

Triac:	Operating Voltage Range:	20 to 280Vrms @47 to 63Hz.
	Current Rating:	0.01 to 1A (full cycle rms on-state @ 25°C); derates linearly above 40°C to 0.5A @ 80°C.
	Max. Non-repetitive Surge Current (16.6ms):	25A peak.
	Min. OFF-State dv/dt @ Rated Voltage:	500V/µs.
	Max. OFF-State leakage @ Rated Voltage:	1mA rms.
	Max. ON-State Voltage Drop @ Rated Current:	1.5V peak.
	Repetitive Peak OFF-state Voltage, Vdrm:	600V minimum.
	Isolation:	Reinforced safety isolation from inputs and other outputs.
Linear DC:	Resolution:	Eight bits in 250mS (10 bits in 1 second typical, >10 bits in >1 second typical).
	Update Rate:	Every control algorithm execution
	Ranges:	0 to 10V, 0 to 20mA 0 to 5V, 4 to 20mA 2 to 10V (default)
	Load Impedance:	0 to 20mA & 4 to 20mA: 500 Ohm maximum. 0 to 5V, 0 to 10V & 2 to 10V: 500 Ohm minimum. Short circuit protected
	Accuracy:	±0.25% (mA @ 250 Ohms, V @ 2k Ohm). Degrades linearly to ±0.5% for increasing burden (to specification limits).
	Isolation:	Reinforced safety isolation from inputs and other outputs.
	Use as 0 to 10VDC transmitter power supply*	Adjustable, 0.0 to 10.0V (regulated) output into 500 Ohm minimum.
Transmitter Power Supply: **see Linear output spec for 0-10V PSU*	Power Rating	19 to 28VDC (24V nominal) into 910 Ohm minimum resistance.
	Isolation:	Reinforced safety isolation from inputs and other outputs.

Appendix 3. Complete Specification

Process Alarms

Maximum Number of Alarms:	Five “soft” alarms (process high or low)
Combinatorial Alarms:	Logical OR of alarms to any suitable output.

Digital Communications

Type:	Asynchronous Serial.
Protocols Supported:	Modbus RTU (all models) and ASCII (some models).
Physical Layer:	RS485.
Zone address range:	1 to 99 (ASCII), 1 to 255 (Modbus).
Bit Rate:	1200, 2400, 4800, 9600 and 19200 bps.
Bits per character:	ASCII: 10 Modbus: 10 or 11 (depending on parity setting)
Stop Bits:	1
Parity:	ASCII: Even (fixed). Modbus: None, even or odd (selectable).
Isolation:	Reinforced safety isolation from inputs and outputs.

Reference Conditions

Ambient Temperature:	20°C ±2°C.
Relative Humidity:	60 to 70%.
Supply Voltage:	100 to 240V AC 50Hz ±1%.
Source Resistance:	<10 Ohm for thermocouple input.
Lead Resistance:	<0.1 Ohm /lead balanced (Pt100).

Appendix 3. Complete Specification

Operating Conditions

Ambient Temperature (operating):	0°C to 55°C.
Ambient Temperature (storage):	-20°C to 80°C.
Relative Humidity:	20% to 95% non-condensing.
Altitude:	Up to 2000m above sea level.
Supply Voltage:	Either 100 to 240V ±10% AC 50/60Hz or 20 to 48V AC 50/60Hz & 22 to 55V DC
Power Consumption:	5W / 7.5 VA maximum.
Source Resistance:	1000 Ohm maximum (thermocouple).
PT100 Input Lead Resistance:	50 Ohm per lead maximum, balanced

Standards

Conformance Norms:	CE, UL, ULC.
EMC standards:	EN61326*
Safety Standards:	EN61010 and UL3121. Pollution Degree 2, Installation Category II.
Front Panel Sealing:	IP66

Note:

**For disturbances induced by RF fields of 10V/m 80% AM at 1kHz the input accuracy specification is changed to 0.25% in the frequency bands 465 to 575 MHz and 630 to 660 MHz.*

Physical Specifications

Depth behind panel:	100mm
Front bezel size (*w x h*):	96 x 48mm
Mounting:	Plug-in with panel mounting fixing strap.
Panel cut-out size (*w x h*):	92 x 45mm
Terminals:	Screw type (combination head).
Weight:	0.21kg maximum.

NOTES

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3 Year Warranty and Return Statement

These products are sold by Danaher Idustrial Controls under the warranties set forth in the following paragraphs. Such warranties are extended only with respect to a purchase of these products, as new merchandise, directly from Danaher Industrial Controls or from an authorized product distributor, representative or reseller, and are extended only to the first buyer thereof who purchases them other than for the purpose of resale.

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These products are warranted to be free from functional defects in materials and workmanship at the time the products leave the factory and to conform at that time to the specifications set forth in the relevant instruction manual or manuals, sheet or sheets, for such products for a period of three years.

THERE ARE NO EXPRESSED OR IMPLIED WARRANTIES WHICH EXTEND BEYOND THE WARRANTIES HEREIN AND ABOVE SET FORTH. DANAHER INDUSTRIAL CONTROLS MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE PRODUCTS.

Limitations
Danaher Industrial Controls shall not be liable for any incidental damages, consequential damages, special damages, or any other damages, costs or expenses excepting only the cost or expense of repair or replacement as described above.

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This warranty is void if the purchaser uses non-factory approved replacement parts and supplies or if the purchaser attempts to repair the product themselves or through a third party without Danaher Industrial Controls authorization.

Returns
Danaher Industrial Controls' sole and exclusive obligation and buyer's sole and exclusive remedy under the above warranty is limited to repairing or replacing (at Danaher Industrial Controls' option), free of charge, the products which are reported in writing to Danaher Industrial Controls at its main office indicated below.

Danaher Industrial Controls is to be advised of return requests during normal business hours and the technical support department will issue a return authorization number and shipping location at that time. Such returns are to include a statement of the observed deficiency. The buyer shall prepay shipping charges for products returned and Danaher Industrial Controls or its representative shall pay for the return of the products to the buyer.

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