Algas-SDI™

...Innovative liquid vaporizing and gas mixing solutions

ISO 9001 Certified

GA 500 GAS ANALYZER

Operations & Maintenance Manual

1140 NW 46 Street, Seattle, Washington, USA 98107
Tel: 206-789-5410 Fax: 206-789-5414 Web: www.algas-sdi.com

MANUAL PN 52667 REV 10-06-03 GA500.DOC

ECLIPSE Innovative Thermal Solutions

WARNING

Read the OPERATION MANUAL before operating this equipment.

- **NOTE: Algas-SDI reserves the right to use alternate manufacturers' components as vendor delivery applicability dictates. Vendors have supplied literature contained in the Operation Manual. Please check to be sure supplied data matches your configuration. Contact Algas-SDI if any questions exist.**
- **This equipment uses LPG-a flammable fuel, or NH3-a toxic gas, (depending on the model), handled under pressure. Inherent hazards exist and a thorough understanding of the equipment is required to allow safe operation and maintenance.**
- **Allow only a TRAINED and FULLY QUALIFIED PERSON to service this equipment.**
- **Any time a component must be replaced, use the same type, model, etc. DO NOT SUBSTITUTE! The consequence from such actions are unpredictable and may lead to dire consequences. When components are replaced with components not approved for use in our FM/CSA listed equipment, the FM/CSA listing becomes void for that unit.**

GA500-W INSTRUMENT SPECIFICATIONS - Wobbe Index Thermal Analyzer

Units: Kcal/Nm^3 or Btu/scf

Standard Measuring Range: 7500 – 18800 Kcal/Nm^3 or 800 – 2000 Btu/scf

Accuracy: ± 1.5%

Repeatability: ± 0.3%

Linearity: ± 0.2%

Fuel Consumption: 85 liters/hr or 3 scfh
(based on a fuel gas with a specific gravity of 0.6)

Gas Pressure: 2.5 kpa or 15" W.C. minimum
6.9 kpa or 27.7" W.C. maximum

Air Consumption: 4250 liters/hr or 152 scfh

Air Pressure: 275 kpa or 75 PSIG minimum
1034 kpa or 150 PSIG maximum

Electrical Requirements:

115 VAC/ 1ph / 50-60 hz @ 1 Amp

Or

230 VAC / 1ph / 50-60 hz @ 0.5 Amp

Fuse: F1 - 1 Amp Slo-Blo
Fuse: F2 - 1 Amp Slo-Blo

Electrical Area Classification: General Purpose

Output: 4 – 20 mA 600 Ohms impedance isolated
Alarm Output Relay 2 Amp 264 VAC

Dimensions: 635 mm W x 889 mm D x 2235 mm H

Or

25 in W x 35 in D x 88 in H

Weight: 113 kg or 250 lbs

Response: Less than one second after deviation of gas sample at the instrument.50% of deviation within 30 seconds and 90% in one minute. Full scale stability in less than 3 minutes.

GA500-W INSTRUMENT SPECIFICATIONS - Wobbe Index Thermal Analyzer

Transformer wired for: **115 VAC** ☐ **230 VAC** ☐

Regulator & Flow Meter Settings

Regulators:	**Setting:**
1st stage Air regulator	**60** psig
2nd stage Burner Air regulator	**25** psig
1st stage Calibration Gas regulator	**4"** W.C.
1st stage Sample Gas regulator	**4"** W.C.
2nd stage Gas regulator	**2"** W.C.
Flow Meters:	**Setting:**
Thermal Analyzer - Measurement Air	**100** scfh

Burner Air pressure switch set to open at: **20** PSIG on decreasing pressure.

OPERATOR DISPLAY SETUP

2408i Indicator Home level Settings

LEVEL	ITEM	ASDI DEFAULT SETTING
dSP.F - Home Display Front	**PU** - Process Value	**Not Adjustable**
dSP.F - Home Display Front	**PU** - Process Value	**Not Adjustable**

2408i Indicator Home Level Settings: Low Alarm Setpoint

LEVEL	ITEM	ASDI DEFAULT SETTING
AL - Alarm Setpoint ** NOTE	**1FSL** - Alarm Setpoint Low	**7500**
	Below Setpoint Alarm Relay is on.	

**** NOTE: The GA500-W operator should determine if Low Wobbe Index Alarm is needed. Factory Default setting for Low Wobbe Index Alarm ("FSL") is set to "OFF" in the configuration menu under "AL" then "AL 1". The Low Wobbe Index Alarm value can only be adjusted when "AL" then "AL 1" is set to "FSL" in the configuration menu.**

2408i Indicator Home Level Settings: Alarm Setpoint Range

LEVEL	ITEM	ASDI DEFAULT SETTING
SP L - Minimum Alarm Setpoint	**1FSL** - Alarm Setpoint Low	**0**
SP H - Maximum Alarm Setpoint	**1FSL** - Alarm Setpoint High	**25,000 *****

***** NOTE: This Value may vary with each calibration. Maximum is Set by ",P", "VAL.H".**

2408i Indicator Home Level Settings: Input Filtering

LEVEL	ITEM	ASDI DEFAULT SETTING
,P - Input Filtering	**int.t** - Input Filtering Time	**5**
	Stabilizes last digit on display	

GA500-W INSTRUMENT SPECIFICATIONS - Wobbe Index Thermal Analyzer

OPERATOR DISPLAY SETUP

To enter Configuration Setup:

ACCS → "CODE" → Select "1"

GOTO → Select → "conF" → "CONF" → Select "2"

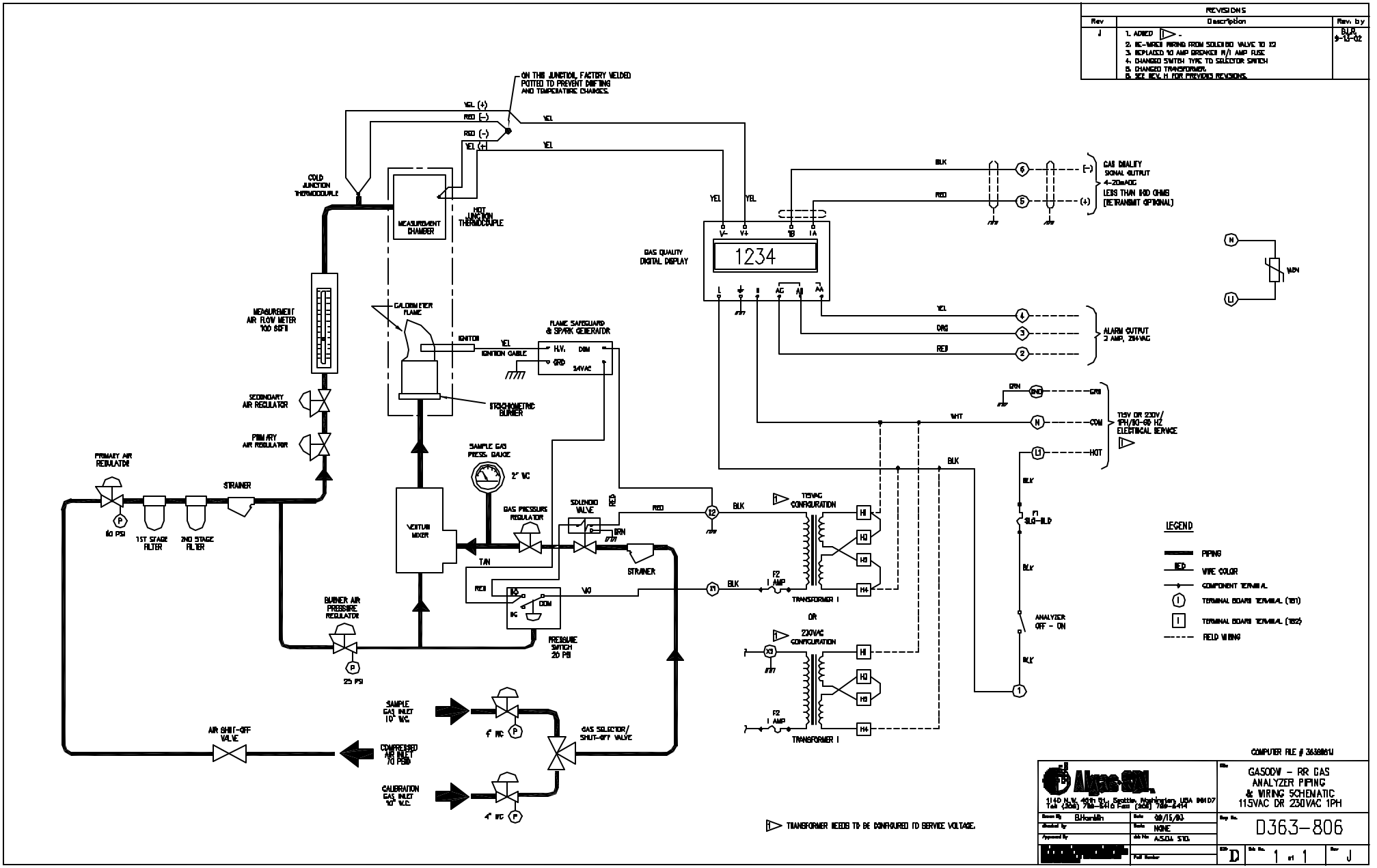
2408i Indicator Configuration Level Settings

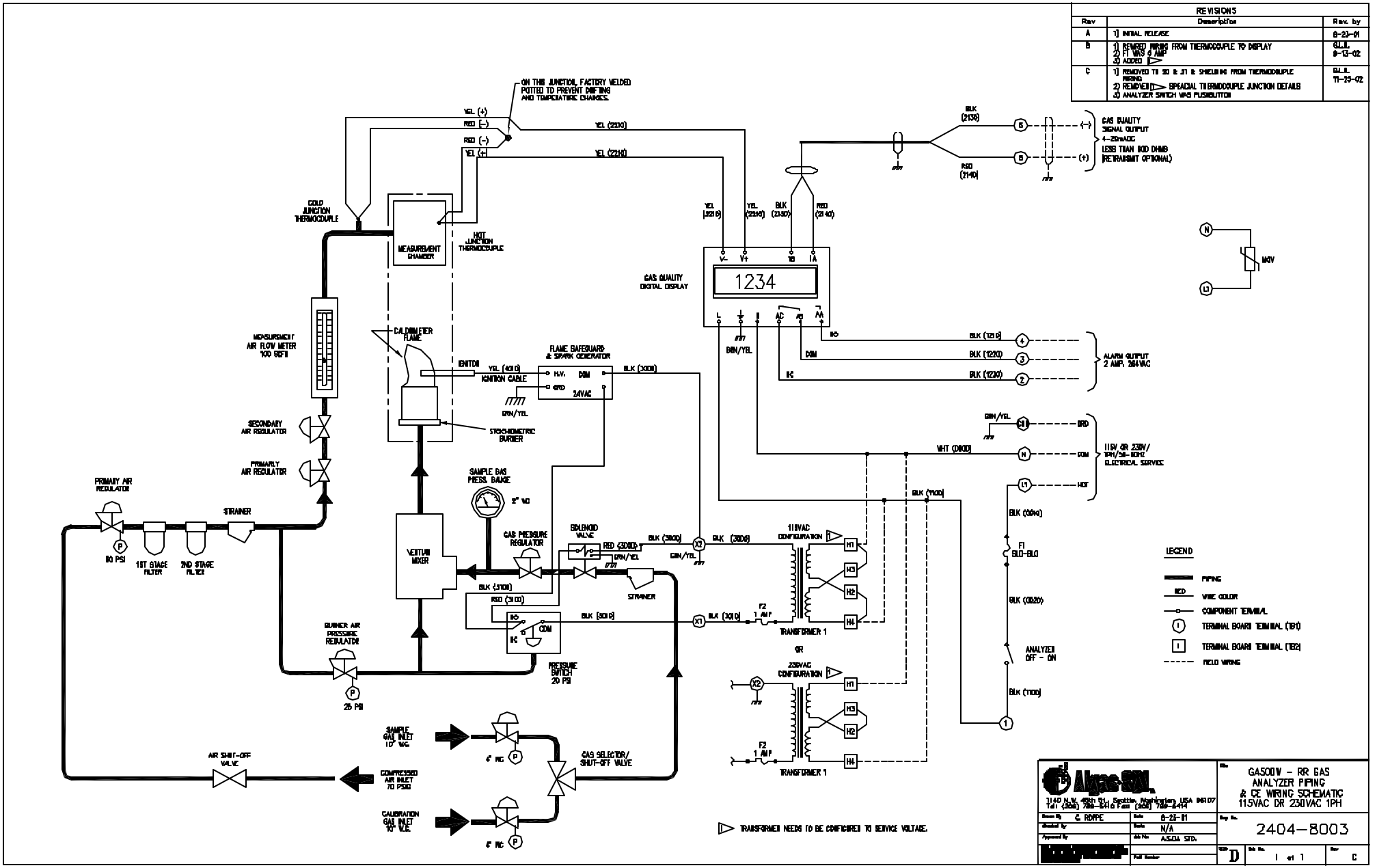
LEVEL	ITEM	ASDI DEFAULT SETTING
InST - Instrument Configuration	unit - Units	**None**
	deCP - Decimal Places	**None**
	Acbu - Front Panel Ack/Reset Button	**Disabled**
,P - Sensor Input Configuration	**,nPt** - Input Type	**mV - Linear Millivolts**
	ImP - Input Impedance	**AUTO - DETECT SENSOR BREAK**
	InP.L - Electrical Input Low	
	InP.H - Electrical Input High	**40.00**
	VAL.L - Displayed Value Low	
	VAL.H - Displayed Value High SPAN - Value Changes with each calibration	
	tYPE - Type of Calibration	**OFF**
AL - Alarm Configuration	**AL 1** - Alarm 1 Type	**FSL - Full Scale, Low Alarm**
	Ltch - Alarm 1 Latching	**NO**
	bLoc - Alarm 1 Blocking	**NO**
	AL 2 - Alarm 1 Type	**OFF**
	Ltch - Alarm 1 Latching	**NO**
	bLoc - Alarm 1 Blocking	**NO**
	AL 3 - Alarm 1 Type	**OFF**
	Ltch - Alarm 1 Latching	**NO**
	bLoc - Alarm 1 Blocking	**NO**
	AL 4 - Alarm 1 Type	**OFF**
	Ltch - Alarm 1 Latching	**NO**
	bLoc - Alarm 1 Blocking	**NO**
	Sbrt - Sensor break	**EnAb**
LA - Digital Input Config.	**N/A** - Skip over, use Factory Default	
Lb - Digital Input Config.	**N/A** - Skip over, use Factory Default	

OPERATOR DISPLAY SETUP CONTINUED

2408i Indicator Configuration Level Settings

LEVEL	ITEM	ASDI DEFAULT SETTING
AA - Relay 1 Output Config.*	**,d** - Identity of Output	**rELY - Relay**
	Func - Function of Output	**diG - Output Enabled**
	SEnS - Sense of the Output	**Inu - Inverted**
NOTE: 1FSL changes to AL 1	**1FSL** - Alarm 1, Full Scale - Low (NOTE)	**YES**
when "AL" - "AL 1" is set to	**AL 2** - Alarm 2	**NO**
"Off", set value stays "YES".	**AL 3** - Alarm 3	**NO**
	AL 4 - Alarm 4	**NO**
	Sbr - Sensor Break	**YES**
	SPAn - Process Span Exceeds Limits	**YES**
	rmt.F - Remote Failure	**NO**
	iP1.F - Input 1 Fail	**YES**
	nw.AL - New Alarm	**NO**
HA - Communication Module	**N/A** - Skip over, use Factory Default	
JA - PDSIO MODULE	**N/A** - Skip over, use Factory Default	
1A - Output Module 1Config.**	**,d** - Identity of Module	**dc.Re - DC Retransmission**
	Func - Function	**PU - Process value retransmission**
	VAL.L - Retransmission Value Low	**7,500**
	VAL.H - Retransmission Value High (span)***	**18,800**
	Unit - Electrical Output units	**mA - Milliamps**
	Out.L - Min. Electrical Output	**4.0**
	Out.H - Max. electrical Output	**20.0**
2A - Module 2 Config.	**N/A** - Skip over, use Factory Default	
3A - Module 3 Config.	**N/A** - Skip over, use Factory Default	
CAL - Calibration	**N/A** - Skip over, use Factory Default	
PASS - Passwords	**N/A** - Skip over, use Factory Default	
EXIT - Leaving Configuration	**YES** - Select Yes to Exit	


REVISIONS
Rev
Description
Rev. by
J
1. ADDED ▷ .
2. RE-WIRED WIRING FROM SOLENOID VALVE TO X2
3. REPLACED 10 AMP BREAKER W/1 AMP FUSE
4. CHANGED SWITCH TYPE TO SELECTOR SWITCH
5. CHANGED TRANSFORMER.
6. SEE REV. H FOR PREVIOUS REVISIONS.
BJH 9-13-02
ON THIS JUNCTION, FACTORY WELDED POTTED TO PREVENT DRIFTING AND TEMPERATURE CHANGES.
YEL (+)
RED (-)
RED (-)
YEL (+)
YEL
COLD JUNCTION THERMOCOUPLE
MEASUREMENT CHAMBER
HOT JUNCTION THERMOCOUPLE
YEL
YEL
BLK
RED
GAS QUALITY SIGNAL OUTPUT 4-20mADC LESS THAN 800 OHMS (RETRANSMIT OPTIONAL)
GAS QUALITY DIGITAL DISPLAY
1234
V-
V+
1B
1A
L
+
-
AC
AB
AA
YEL
ORG
RED
ALARM OUTPUT 3 AMP, 28VAC
MEASUREMENT AIR FLOW METER 100 SCFH
CALORIMETER FLAME
IGNITOR
YEL
IGNITION CABLE
FLAME SAFEGUARD & SPARK GENERATOR
H.V.
GRD
DSM
24VAC
STOICHIOMETRIC BURNER
SECONDARY AIR REGULATOR
PRIMARY AIR REGULATOR
PRIMARY AIR REGULATOR
60 PSI
1ST STAGE FILTER
2ND STAGE FILTER
STRAINER
SAMPLE GAS PRESS. GAUGE
2" WC
VENTURI MIXER
GAS PRESSURE REGULATOR
SOLENOID VALVE
RED
GRN
STRAINER
TAN
RED
M2
DSM
M1
WHT
BURNER AIR PRESSURE REGULATOR
25 PSI
PRESSURE SWITCH 20 PSI
SAMPLE GAS INLET 10" WC.
4" WC
GAS SELECTOR/ SHUT-OFF VALVE
AIR SHUT-OFF VALVE
COMPRESSED AIR INLET 70 PSIG
CALIBRATION GAS INLET 40" W.C.
4" WC
GRN
GND
WHT
N
BLK
L1
115V OR 230V/ 1PH/60-68 HZ ELECTRICAL SERVICE
HOT
BLK
F1 SLO-BLO
BLK
ANALYZER OFF - ON
BLK
1
RED
X2
BLK
TRANSFORMER CONFIGURATION
H1
H3
H5
H4
F2 1 AMP
TRANSFORMER 1
OR
230VAC CONFIGURATION
X3
H1
H3
H5
H4
F2 1 AMP
TRANSFORMER 1
X1
BLK
LEGEND
PIPING
RED
WIRE COLOR
COMPONENT TERMINAL
1
TERMINAL BOARD TERMINAL (TB1)
1
TERMINAL BOARD TERMINAL (TB2)
FIELD WIRING
▷ TRANSFORMER NEEDS TO BE CONFIGURED TO SERVICE VOLTAGE.
COMPUTER FILE # 3638861J
Alpha-SEM
1140 N.W. 46th St., Seattle, Washington, USA 98107
Tel (206) 782-8410 Fax (206) 782-8414
GASODW - RR GAS ANALYZER PIPING & WIRING SCHEMATIC 115VAC OR 230VAC 1PH
Drawn By BJHamblin
Date 09/15/03
Checked by
Date NONE
Approved By
Job No. ASCII STD
Part Number
Dwg No. D363-806
Size D
Job No.
Sheet 1 of 1
Rev J


REVISIONS
Rev | Description | Rev. by
A | 1) INITIAL RELEASE | 6-23-01
B | 1) REMOVED WIRING FROM THERMOCOUPLE TO DISPLAY 2) F1 WAS 6 AMP 3) ADDED ▷ | G.L.L. 9-13-02
C | 1) REMOVED T1 (C) & J1 & SHIELDING FROM THERMOCOUPLE WIRING 2) REINDEX (▷ SPECIAL THERMOCOUPLE JUNCTION DETAILS 3) ANALYZER SWITCH WAS PUSHBUTTON | G.L.L. 11-29-02
ON THIS JUNCTION, FACTORY WELDED POTTED TO PREVENT DRIFTING AND TEMPERATURE CHANGES.
YEL (+)
RED (-)
YEL (2230)
RED (-)
YEL (+)
YEL (2210)
BLK (2138)
RED (2140)
GAS QUALITY SIGNAL OUTPUT 4-20mADC LESS THAN 800 OHMS (RETRANSMIT OPTIONAL)
COLD JUNCTION THERMOCOUPLE
MEASUREMENT CHAMBER
HOT JUNCTION THERMOCOUPLE
YEL (2210)
YEL (2230)
BLK (2330)
RED (2140)
V-
V+
TB
TA
GAS QUALITY DIGITAL DISPLAY
1234
MOV
L1
MEASUREMENT AIR FLOW METER 100 SCFH
CALIBRATED FLAME
IGNITION
YEL (4010)
IGNITION CABLE
FLAME SAFEGUARD & SPARK GENERATOR
H.V.
GRD
COM
24VAC
BLK (3008)
GRN/YEL
STOICHIOMETRIC BURNER
L
AC
AA
NO
COM
NC
BLK (1210)
BLK (1220)
BLK (1230)
ALARM OUTPUT 2 AMP, 264VAC
GRN/YEL
WHT (0800)
GRD
COM
HOT
115V OR 230V/ 1PH/50-60Hz ELECTRICAL SERVICE
SECONDARY AIR REGULATOR
PRIMARY AIR REGULATOR
PRIMARY AIR REGULATOR
80 PSI
1ST STAGE FILTER
2ND STAGE FILTER
STRAINER
SAMPLE GAS PRESS. GAUGE
2" WC
VENTURI MIXER
GAS PRESSURE REGULATOR
SOLENOID VALVE
RED (3000)
GRN/YEL
BLK (3800)
BLK (3808)
X2
STRAINER
BLK (3108)
RED (3100)
BLK (3010)
X1
F2 1 AMP
115VAC CONFIGURATION
H1
H3
H2
H4
TRANSFORMER 1
OR
230VAC CONFIGURATION
BLK (1000)
F1 6LO-BLO
BLK (0804)
BLK (0820)
ANALYZER OFF - ON
BLK (1100)
1
BURNER AIR PRESSURE REGULATOR
25 PSI
PRESSURE SWITCH 20 PSI
NO
COM
NC
AIR SHUT-OFF VALVE
COMPRESSED AIR INLET 70 PSIG
SAMPLE GAS INLET 10" WC
4" WC
CALIBRATION GAS INLET 10" W.C.
4" WC
GAS SELECTOR/ SHUT-OFF VALVE
▷ TRANSFORMER NEEDS TO BE CONFIGURED TO SERVICE VOLTAGE.
LEGEND
PIPING
WIRE COLOR
COMPONENT TERMINAL
TERMINAL BOARD TERMINAL (TB1)
TERMINAL BOARD TERMINAL (TB2)
FIELD WIRING
Alpac-SSI
1140 N.W. 45th St. Seattle, Washington USA 98107
tel (206) 782-5410 Fax (206) 782-5414
C. RIPPE
6-23-01
N/A
A.S.C.U. STD.
GAS00W - RR GAS ANALYZER PIPING & CE WIRING SCHEMATIC 115VAC OR 230VAC 1PH
2404-8003
D
1 of 1
C

GA500-WC INSTRUMENT SPECIFICATIONS - Wobbe Index Thermal Analyzer / Calorific Value / Specific Gravity

Calorific Value: Units Kcal/Nm^3 or Btu/scf

Wobbe Index: Units Kcal/Nm^3 or Btu/scf

Specific Gravity: Unity

Wobbe Index Measuring Range: 7500 – 18800 Kcal/Nm^3 or 800 – 2000 Btu/scf

Calorific Value Measuring Range: 7500 – 18800 Kcal/Nm^3 or 800 – 2000 Btu/scf

Specific Gravity Measuring Range: 0.50 – 1.60

Accuracy: +/- 1.5%

Repeatability: +/- 0.3%

Linearity: +/- 0.2%

Fuel Consumption: 55.0 liters/hr or 1.94 scfh on a fuel gas with a specific gravity of 1.43

57.7 liters/hr or 2.04 scfh on a fuel gas with a specific gravity of 1.30

Gas Pressure: 2.5 Kpa or 15" W.C. minimum
6.9 Kpa or 27.7" W.C. maximum

Air Consumption: 4250 liters/hr or 152 scfh

Air Pressure: 275 Kpa or 75 PSIG minimum
1034 Kpa or 150 PSIG maximum

Electrical Requirements:

115VAC / 1ph / 50-60hz @ 1 amp

Or

230VAC / 1ph / 50-60hz @ 0.5 amp

Fuse: F1 - 1 Amp Slo-Blo
Fuse: F2 - 3/4 Amp Slo-Blo
Fuse: F3 - 1/2 Amp Slo-Blo
Fuse: F4 - 1 Amp Slo-Blo

Electrical Area Classification: General Purpose

Output: 4 – 20 mA 900 Ohms impedance isolated

Dimensions: 635 mm W x 889 mm D x 2235 mm H
Or
25in W x 35 in D x 88 in H

Weight: 113 kg or 250 lbs

Response: Less than one second after deviation of gas sample at the instrument. 50% of deviation within 30 seconds and 90% in one minute. Full scale stability in less than 3 minutes.

GA500-WC INSTRUMENT SPECIFICATIONS - Wobbe Index Thermal Analyzer / Calorific Value / Specific Gravity

Transformer wired for: ☐ 115V ☐ 230V

SETTINGS:

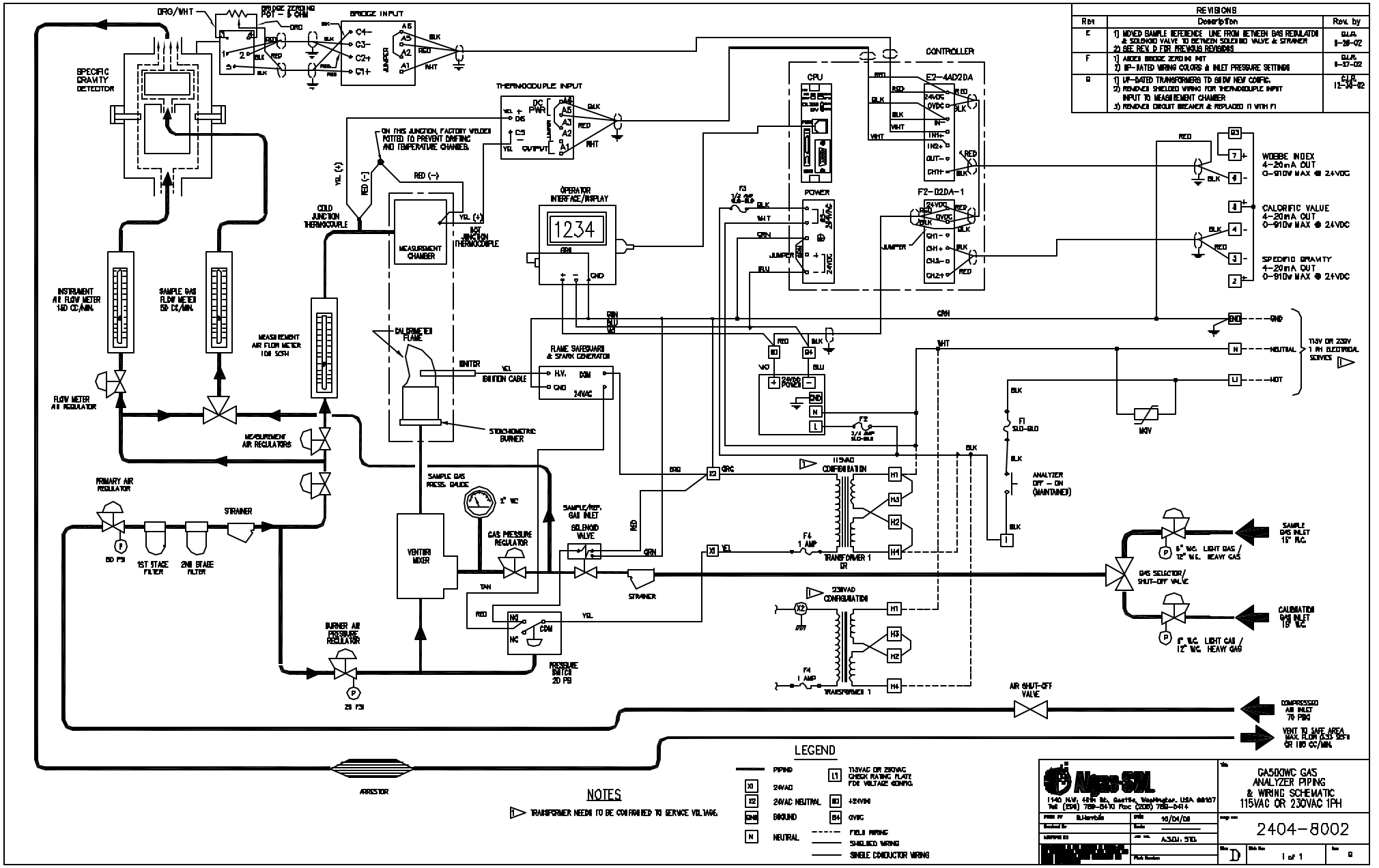
Regulator	***Setting***
1st stage Air regulator	60 PSIG
2nd stage Burner Air regulator	25 PSIG
1st stage Calibration gas regulator, Light Gas / Heavy Gas	6" / 12" W.C.
1st stage Sample gas regulator, Light Gas / Heavy Gas	6" / 12" W.C.
2nd stage Gas regulator	2" W.C.
Flow Meter	***Setting***
Measurement Air - Thermal Analyzer	100 scfh
Sample Gas - Specific Gravity	50 cc/min
Instrument Air - Specific Gravity	150 cc/min

Recorder Output Factory Default Values	***Setting***
WI - Wobbe Index Low - 4.00 mA @	7,500 Kcal/Nm^3
WI - Wobbe Index High - 20.00 mA @	18,800Kcal/Nm^3
CV - Calorific Value Low - 4.00 mA @	7,500 Kcal/Nm^3
CV - Calorific Value High - 20.00 mA @	18,800Kcal/Nm^3
SG - Specific Gravity Low - 4.00 mA @	0.50
SG - Specific Gravity High - 20.00 mA @	1.60

Burner Air Pressure switch set to open at: 20 PSIG on decreasing pressure.

	Display Configuration	**PLC Current Output milliamps**	**BRIDGE OUTPUT mV DC Output**
WI - ZERO - Water Bath			
CV - ZERO - Water			
SG - AIR			
SG - Calibration Gas	0	N / A	
WI - Calibration Gas			
CV - Calibration Gas			
WI - Sample Gas			
SG - Sample Gas			
CV - Sample Gas			

Bridge Excitation Voltage:


REVISIONS
Rev | Description | Rev. by
E | 1) MOVED SAMPLE REFERENCE LINE FROM BETWEEN GAS REGULATOR & SOLENOID VALVE TO BETWEEN SOLENOID VALVE & STRAINER 2) SEE REV. D FOR PREVIOUS REVISIONS | G.L.R. 11-28-02
F | 1) ADDED BRIDGE ZEROING POT 2) UP-DATED WIRING COLORS & INLET PRESSURE SETTINGS | G.L.R. 11-27-02
G | 1) UP-DATED TRANSFORMERS TO SHOW NEW CONFIG. 2) REVISED SHIELDED WIRING FOR THERMOCOUPLE INPUT INPUT TO MEASUREMENT CHAMBER 3) REVISED CIRCUIT BREAKER & REPLACED IT WITH F1 | G.L.R. 12-30-02
ORG/WHT
BRIDGE ZEROING POT - 5 OHM
BRIDGE INPUT
THERMOCOUPLE INPUT
CONTROLLER
CPU
E2-4AD2DA
POWER
E2-D2DA-1
OPERATOR INTERFACE/DISPLAY
1234
SPECIFIC GRAVITY DETECTOR
ON THIS JUNCTION, FACTORY WELDED POTTED TO PREVENT DRAFTING AND TEMPERATURE CHANGES.
COLD JUNCTION THERMOCOUPLE
MEASUREMENT CHAMBER
HOT JUNCTION THERMOCOUPLE
INSTRUMENT AIR FLOW METER 150 CC/MIN.
SAMPLE GAS FLOW METER 50 CC/MIN.
MEASUREMENT AIR FLOW METER 100 SCFH
FLOW METER AIR REGULATOR
MEASUREMENT AIR REGULATORS
PRIMARY AIR REGULATOR
60 PSI
STRAINER
1ST STAGE FILTER
2ND STAGE FILTER
SAMPLE GAS PRESS. GAUGE
0-5" WC
VENTURI MIXER
GAS PRESSURE REGULATOR
SAMPLE/REF. GAS INLET SOLENOID VALVE
BURNER AIR PRESSURE REGULATOR
25 PSI
PRESSURE SWITCH 20 PSI
IGNITOR
IGNITION CABLE
FLAME SAFEGUARD & SPARK GENERATOR
H.V.
GND
24VAC
ENERGIZED FLAME
STOICHIOMETRIC BURNER
F3 1/2 AMP SLO-BLO
F2 3/4 AMP SLO-BLO
F1 SLO-BLO
24VDC POWER
115VAC CONFIGURATION
230VAC CONFIGURATION
TRANSFORMER 1
F4 1 AMP
ANALYZER OFF - ON (MAINTAINED)
MOV
AIR SHUT-OFF VALVE
GAS SELECTOR/ SHUT-OFF VALVE
SAMPLE GAS INLET 15" W.C.
CALIBRATION GAS INLET 15" W.C.
8" W.C. LIGHT GAS / 12" W.C. HEAVY GAS
COMPRESSED AIR INLET 70 PSIG
VENT TO SAFE AREA MAX FLOW 0.50 SCFH OR 180 CC/MIN.
ARRESTOR
WOBBE INDEX 4-20mA OUT 0-910Btu MAX @ 24VDC
CALORIFIC VALUE 4-20mA OUT 0-910Btu MAX @ 24VDC
SPECIFIC GRAVITY 4-20mA OUT 0-910Btu MAX @ 24VDC
115V OR 230V 1 PH ELECTRICAL SERVICE
GND
NEUTRAL
HOT
LEGEND
PIPING
X1 24VAC
X2 24VAC NEUTRAL
GND GROUND
N NEUTRAL
L1 115VAC OR 230VAC CHECK RATING PLATE FOR VOLTAGE CONFIG.
B3 +24VDC
B4 0VDC
FIELD WIRING
SHIELDED WIRING
SINGLE CONDUCTOR WIRING
NOTES
1) TRANSFORMER NEEDS TO BE CONFIGURED TO SERVICE VOLTAGE.
Nova-Sil
1140 NW, 49th St. Seattle, Washington, USA 98107
Tel (206) 789-5470 Fax (206) 789-5494
GA500WC GAS ANALYZER PIPING & WIRING SCHEMATIC 115VAC OR 230VAC 1PH
2404-8002
D
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G

	GA500 Gas Analyzer Spare Parts and Accessories	Recommended Spares	Quantity	Model		
				GA500-W 363-203-02	GA500-W 363-203-03	GA500-WC 2404-2001-01
	DESCRIPTION			A.S.D.I. P/N:		
	EQUIPMENT DRAWING			D363-603	D363-603	2404-6001
	PIPING DIAGRAM			D363-806	2404-8003	2404-8002
	ELECTRICAL DRAWING					2404-7001
	PRESS SNUBBER #25B 1/4" NPT BRASS		2	30499		
	GAU 0-100 PSI BKMT LIQ DUAL SCALE		1	30637		
	SPARK IGNITER, SELF GROUNDING		1	34120		
	GAU 0-60 PSI BKMT LIQ DUAL SCALE		1	35337		
	F1 - FUSE SLO-BLO 1 AMP 250V	*	1	F1 - 52514		
	FUSE FNM 1 AMP 250V	*	1	F2 - 50059		F4 - 50059
	MOV 250V 72 JOULES 4500AMPS		1	50544		
	MANUAL FOR GA500W & GA500-WC		2	52667		
	XFMR PRI 120V/240V SEC 24VAC 75 VA		1	52907		
	GA500-W PROCESS INDICATOR/ALARM		1	53134		
	DIVERTER, DRAFT		1	363-505-03		
	BURNER BAFFLE, GA500		3	363-511-01		
	VALVE SLND 1/4"NPT 24VAC / 6.1W		1	8053-101		
	RPR KIT 1/4" SLND VALVE, 24VAC / 6.1W	*		40377		
	REGULATOR, 1/4"NPT, 35-100 PSIG		1	8122-111		
	GAU PRESSURE 0-4" W.C.		1	8144-102		
	ELECTRONIC IGNITER 117VAC / 24VAC		1	8146-103		
	REGULATOR, 1/4"NPT, 0-60 PSI		1	8151-106		
	REGULATOR, 1/4"NPT, O-2 PSI		3	8151-112		
	PRV R400S 1/2" 1-3.5 W.C. BRN SPR		1	8159-104		
	PRV R500S 3/4" 4-12"W.C VIO SPR		1	8159-105		
	ELEMENT, FILTER, 1 X 2-1/2		2	8161-202		
	SWITCH, PRESSURE, 0-50 PSI		1	8169-106		
	TC DIFFERENTIAL 'K' TYPE		1	8174-105		
	ARRESTOR/SNUBBER 1/4"NPT BRASS		1			33558
	F2 - FUSE SLO-BLO 3/4 AMP 250V	*	1			F2 - 50279
	F3 - FUSE SLO-BLO 1/2 AMP 250V	*	1			F3 - 50034
	MINIATURE POT-TRIMMER SCREWDRIVER		1			51331
	PLC 4-SLOT BASE 110V / 220V		1			52400
	DL205 DL250 CPU Module		1			52441
	D2-250 PLC CPU BATTERY		1			52442
	POWER SUPPLY 24VDC @ 1.2 AMPS		1			52449
	4 CH IN, 2 CH OUT ANALOG CURR. CARD		1			52461
	2 CH OUTPUT ANALOG CURRENT CARD		1			52462
	CPU PROGRAMMED PLC CARD		1			52464
	OPERATOR DISPLAY INTERFACE		1			52465
	COMPLETE PLC ASSY		1			52466
	BRIDGE SIGNAL ISOLATOR		1			51801-1
	THERMOCOUPLE SIGNAL ISOLOATER		1			51802-1

Spare Parts Used prior to SN: 02130016

Notes	*GA500 Gas Analyzer Spare Parts and Accessories*	Recommended Spares	Quantity	Model			
				GA500-W 363-203-01	GA500-W 363-203-02	GA500-WC 2404-2001-01	GA500-W 363-203-03
	DESCRIPTION			A.S.D.I. P/N:			
1	GA500-W PROCESS INDICATOR/ALARM		1	8180-105F			
2	XFMR PRI 115V/230V SEC 24VAC		1	9013-109 (Replaced by PN: 52907)			
3	CIRCUIT BREAKER, 10 Amp		1	9051-101A (Replaced by PN: 52514 Fuse)			
4	POWER SUPPLY 24VDC @ 1.2 AMPS		1	50288 (Replaced by PN: 52449)			
5	REGULATOR, 1/4"NPT, 0.5-10 PSI		2	8151-125 (Replaced by PN: 8151-112)			

Notes:

1. PN: 8180-105F is still availble for replacement, ASDI PN: 53134 can be used as substitue. Part number 53134 is equiped with a relay and 4-20 mA retransmission.
2. Replacing the transformer with ASDI PN: 52907 requires new mounting holes and slight wiring change.
3. Circuit breaker is not in stock and requres ordering. Circuit Breaker can be replaced by a fuse, will require re-wiring and installing a fuse holder.
4. Replacing the Power Supply with ASDI PN: 52449 requires new mounting holes. New Power Supply operates on 85 - 265 VAC, no jumper required. When installing ASDI PN: 50288, copy the jumper configuration of the previous power supply.
5. The Replacement Regulator ASDI PN: 8151-112 is rated for 0-2 PSI. This range improves the resolution when setting the pressure.

Warranty Registration

To Register your new equipment: Visit Algas-SDI's web site at: algas-sdi.com, then click on the "Tech Support" button. Select online Registration or print out the Acrobat Warranty Registration.

OR

Fill out the Warranty Registration information on the last page of this manual. Then make a photocopy and mail to the address shown at the bottom.

Warranty and Copyrights

WARRANTY

Algas-SDI International, LLC (ASDI) warrants that the equipment is free of defects in materials and workmanship under normal use and service. ASDI agrees to repair or replace, at our option, without charge f.o.b. factory, any part which has proven defective to the satisfaction of Algas-SDI International, LLC within one (1) year from the date of the original installation or within 18 months from the date of shipment, whichever is earlier. Equipment, which in the opinion of ASDI, has been damaged by improper installation or operation, or has been abused or tampered with in any way, will not be accepted for return under warranty.

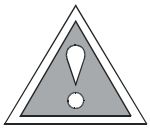
Algas-SDI International, LLC will not accept back charges for work performed by others upon or in conjunction with ASDI equipment, unless prior authorization is given by means of an Algas-SDI International, LLC purchase order. Algas-SDI International, LLC will not be liable by reason of shutdown, non-operation or increased expense of operation of other equipment, or any other loss or damage of any nature, whether direct or consequential, arising from any cause whatsoever.

Algas-SDI International, LLC makes NO other warranty of any kind, whatsoever expressed or implied; and all warranties of merchantability and fitness for a particular purpose are hereby disclaimed by Algas-SDI International, LLC and excluded from these terms of sale. No person has any authority to bind Algas-SDI International, LLC to any representation or warranty other than this warranty.

COPYRIGHT

Symbols and Conventions

Special symbols are used to denote hazardous or important information. You should familiarize yourself with their meaning and take special notice of the indicated information.
Please read the following explanations thoroughly.



GENERAL WARNING OR CAUTION

Indicates hazards or unsafe practices, which can result in damage to the equipment or cause personal injury. Use care and follow the instructions given.

FLAMMABLE GAS HAZARD

Indicates a potential hazard, which can result in severe personal injury or death. Use extreme care and follow the instructions given.

ELECTRICAL DISCONNECT REQUIRED

Indicates a potentially dangerous situation, which can result in severe personal injury or death or damage to equipment. Use great care and follow the instruction given.

ASDI CONTACT NUMBERS

If you have questions, need help with your equipment, or want information on other products, contact Algas-SDI at:

Telephone: 206.789.5410

Facsimile: 206.789.5414

E-mail: sales@algas-sdi.com

Internet: http://www.algas-sdi.com

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Appendix A: Component Information

Warranty Registration - Refer to the nameplate on the unit to fill out the product registration. Then Photo copy and mail to address shown. Or register on line by visiting Algas-SDI web site under "Tech Support".

Introduction 1

DESCRIPTION

The Algas-SDI GA500 is a fuel gas analyzing device which burns a sample of fuel gas, under highly controlled conditions and produces an electronic output to provide information, in the form of an indicator or recorder, concerning the combustion characteristics of the fuel gas. The output can also be used in a controlling instrument, which in turn can control a device used to add air or an inert gas to the fuel gas for purposes of stabilizing the gas. The GA500-W version of this analyzer is designed to detect changes in the heating index of the fuel gas being analyzed; and provides a function referred to as "Wobbe Index". The GA500-WC version of this analyzer is designed to detect changes in both the heating index and specific gravity of the fuel gas being analyzed; and provides the function referred to as “Wobbe Index”, “Calorific Value”, and “Specific Gravity”.

The instrument receives a fuel gas sample and uses compressed air to provide the required flame geometry in a precision burner. A larger volume of compressed air, under highly controlled conditions, passes through a measurement chamber where the amount of heat added by the burner is measured in an accurate and precise thermally isolated atmosphere.

A change in heating value of the gas will change the amount of heat added to the measurement chamber. Likewise, a change in specific gravity will cause flow rate changes in the burner gas mixing system providing the sample to the burner, also changing the amount of heat added to the measurement chamber. Since the flow rate change (due to a change in specific gravity) is a square root function, the interaction of changes in heating value and changes in specific gravity results in a Wobbe Index output.

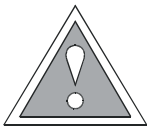
UNIVERSAL MODEL

Since all applications, other than laboratory analyses, are only interested in values of Calorific Value (CV) or Wobbe Index (WI) at a given specific set point; the Algas-SDI GA500-W is the standard unit for these applications. This unit provides a signal from the analyzer to one or more electronic displays, which may be calibrated, to a specific value required by the process. The displays will then indicate any deviation from the desired CV - (Calorific Value) or WI - (Wobbe Index).

NOTE:

All discussions in this manual refer to the Universal Model

CAUTION



Natural gas, propane, butane, and various other hydrocarbons are combustible gases, transmitted under pressure, which, when mixed with the proper amount of air, or released free into the atmosphere, can be ignited from a source of ignition. Natural gas is lighter than air but the others are heavier than air. In any case, adequate ventilation is necessary in enclosed areas where equipment and distribution lines are installed, to prevent accumulation of gas from a possible leak in the system. It is most important that any system of piping, vessels or equipment handling fuel gas be carefully checked for leaks and repaired when necessary. Fuel gas contains an odorant in order to make its presence detectable. The presence of this odor indicates a leak that should be repaired at once. It is most important that you read the following instruction book carefully before attempting to operate your equipment.

WARNING

All electrical equipment and controls furnished with this system are enclosed in standard industrial enclosures appropriate for the environment in which the equipment is intended to be installed. The equipment as furnished is intended for indoor operation in a dry environment. As necessary wiring and terminal strips are enclosed in approved enclosures. For the safety of the operator and the equipment, do not operate this equipment with terminal strips and wiring exposed. When making changes to, or removal of wiring, necessitating removing covers from junction boxes and other components of the equipment, make certain all power is disconnected first. In the event it is necessary (for calibration and troubleshooting procedures) to open covers on electrical enclosures with power on, trained personnel should accomplish this only. The equipment furnished includes enclosures, which are not to be exposed to moisture. Water impinging on open terminal strips which have power applied to them can cause a potential hazard for the operator from electric shock and destroy control equipment. Algas-SDI International will not honor its warranty on equipment which is destroyed by failure on the part of the operator or other personnel to take precautions to keep electrical equipment dry and further, will not be held responsible for injury to personnel due to negligence or any other action or cause beyond its control.

DESCRIPTION OF OPERATION

Please refer to the piping and wiring diagram located at the beginning of the manual (D363-806) when reading the following description. The operation of the Thermal Analyzer on the GA500-W and GA500-WC are identical.

1. 115 volt AC or 230 volt AC electric power enters the unit at terminal "L1" & "N" and powers the digital display and electronic network directly, since each has its own supply and also provides power to the primary side of a transformer with a 24 volt AC secondary, which powers the safety and ignition system. If a different service voltage required, refer to electrical drawing and reconfigure transformer to the desired voltage. On some older units (prior to S/N: 03130018), the 24 VDC power supply needs to be configured to the new desired voltage selection. Units built after S/N: 03130018 are equipped with a 24 VDC power supply, PLC or meter that operates on 115 VAC or 230 VAC.

2. The gas to be analyzed enters the gas inlet through a 100 mesh strainer and proceeds to a solenoid valve where flow is stopped until the safety system is energized.

3. Air enters the air inlet of the system passing through two air filters, piped in tandem, through a 100 mesh strainer to a tee connection where air is divided into measurement air and burner air.

4. Burner air proceeds through a burner air pressure regulator with a pressure gauge on the downstream side and then enters the gas-air venturi mixer and at the same time establishes air to an air pressure switch.

5. With the proper burner air pressure registering on the pressure switch, electric power is provided to the gas solenoid valve and the automatic ignition system.

6. The automatic ignition system begins sparking to ignite a flame at the burner.

7. With the gas solenoid activated, gas proceeds through the gas pressure regulator to the venturi mixer and also registers on the gas pressure gauge.

8. As gas is delivered to the burner head, ignition takes place and the automatic ignition system discontinues sparking.

9. Measurement air passes through a primary regulator, which reduces the air pressure to an acceptable level for the secondary measurement air regulator. This regulator is used to regulate the measurement air flow as registered on the meter.

10. Air passing through the Air flow measurement meter passes over a thermocouple measuring the temperature of the incoming air and then proceeds to the measurement chamber. The measurement chamber contains a second thermocouple measuring the temperature of the products of combustion in the measurement chamber.

11. The outputs of the thermocouples enter the electronic network, which provides an output, which translates into Wobbe Index Units.

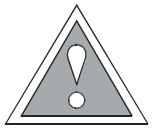
12. Wobbe Index is indicated in the Wobbe Index Digital Display and this signal also provides output to a remote recorder. The display and/or recorder can be calibrated to display and/or record Wobbe Index.

13. A Calibration Gas with a known heating value and specific gravity must be supplied by the purchaser and connected to the unit to use as calibrating gas. High-pressure cylinders of gas are available at some gas utilities and at most industrial gas supply companies.

14. On the GA500-WC model a specific gravity sensor is included. The specific gravity is measured by comparing Instrument Air with the Sample Gas being measured. The specific gravity sensor uses a bridge circuit to measure the difference between the 2 gases. The signal is the processed and in the PLC. A 3-way valve allows for the use of air to calibrate the sensor. The Specific gravity and a calculated Calorific Value are displayed on the Operator Interface Panel. Three 4-20mA outputs are provided for Wobbe Index, Calorific Value, and Specific Gravity. The ranges for the outputs are user definable.

15. The GA500-W models feature an Alarm Relay that can be configured by the customer as desired. Factory default for this relay is set to not used. The GA500-WC does not have an Alarm Relay. If alarm is required the recorder output can be used with another device provided by the customer.

Installation 2



1. Place cabinet in a location where access is available to both the front and rear of the cabinet since it is necessary to perform some calibration procedures through the rear door of the cabinet. The unit must not be installed in rooms where the ceiling is lower than 9 feet unless all construction in the ceiling and above is fireproof. Ambient Temperature should be maintained at 25^{O}C +/-3^{O}C (77^{O}F +/-5.4^{O}F). Analyzer should be shielded from drafts.

2. If the unit is supplied with casters for mobility, it will be necessary to provide some kind of detent in the floor, or some method of blocking to keep the unit from moving after service connections are made. If service connections are made with flexible tubing, the unit may be installed with the back against the wall provided there is sufficient room to roll the cabinet forward for access through the rear door. In any case, provisions must be made to prevent movement of the cabinet from breaking service connections.

3. Connect electrical service by cutting a hole for conduit (or for a grommet for portable units) at the most convenient location on either side, top or the back. If the unit is to be mounted permanently in position, it is suggested that the electrical service be brought down through the top panel. In such a case, the access must be near the rear of the cabinet, well away from the flue gas outlet, which is under the draft diverter panel, ***Figure 1A - Item #7,*** GA500-W.

4. Connecting gas, air and vent line: If the unit is to be installed permanently, these connections should be made with copper or stainless steel tubing. If the unit is installed on casters, it is suggested that rigid piping terminate at the wall or ceiling, near the unit, with the final connections from the permanent piping to the unit being made by the use of nylon or teflon instrument tubing, or equal.

5. Instrument air enters is Connected to Item #8 found on the side of the cabinet on ***Figure 1B & 3B*** and must be supplied at a pressure not less than 75 PSIG or more than 150 PSIG (75 PSIG recommended).

6. The Calibration Gas from the Calibration gas cylinder regulation station is connected to Item #9 found on the side of the cabinet on ***Figure 1B & 3B***. When procuring the Calibration Gas cylinder it is necessary to have the cylinder equipped with a regulator which will provide gas pressure at 15 inches Water Column.

7. The Sample Gas to be analyzed is Connected Item #10 found on the side of the cabinet on ***Figure 1B & 3B***. The Sample Gas needs to be equipped with a regulator, which will provide gas pressure at 15 inches Water Column.

8. On the GA500-WC models an additional connection at Item #23 found on the side of the cabinet on ***Figure 3B***, is required to vent the gas from the specific gravity sensor to a safe location.

NOTE

The sample gas line must be as short as possible, a minimum size, and operated at the reduced pressure, to minimize the time delay in delivering the sample to the analyzer.

9. A regulator must be installed **AT THE GAS LINE SAMPLE CONNECTION** to minimize the amount of gas in the line. Use of a ¼" tube is suggested for the sample line.

Figure 1A – GA500-W – Gas Analyzer Equipment Drawing

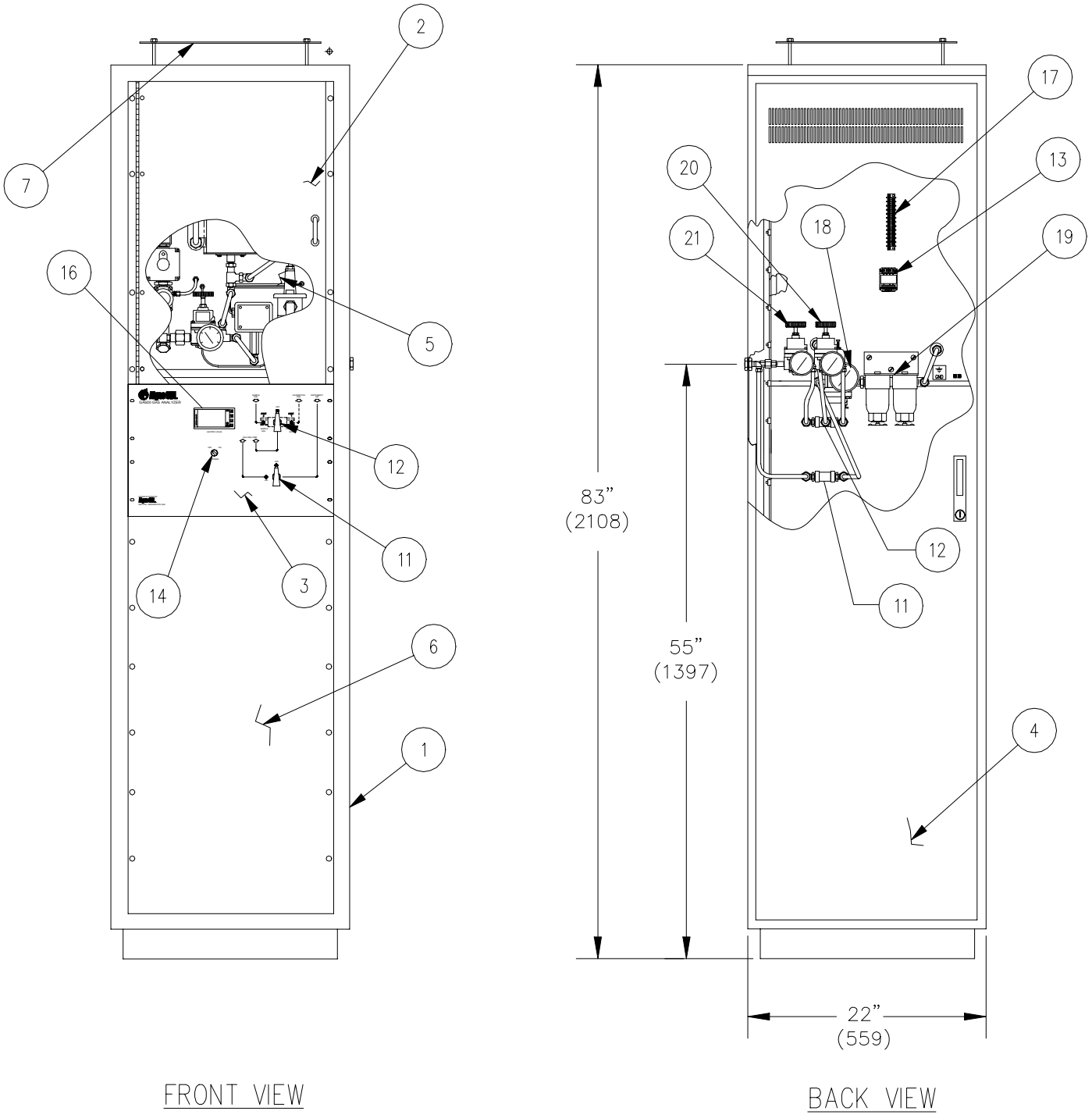
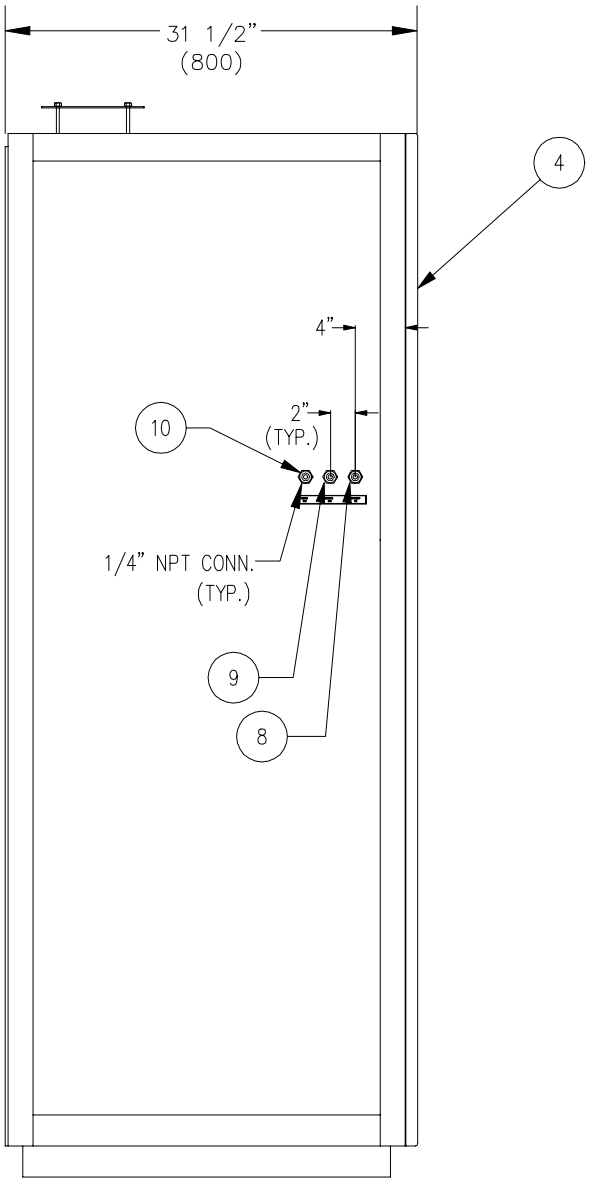


Figure 1B – GA500-W – Gas Analyzer Equipment Drawing



RIGHT SIDE VIEW

LIST OF COMPONENTS

1. GA500W–RR CABINET
2. GA500W–RR ANALYZER ACCESS DOOR
3. GA500W–RR SWITCH, VALVE, DISPLAY PANEL
4. REAR DOOR
5. GA500W–RR BURNER ASSEMBLY
6. LOWER FRONT PANEL
7. DRAFT DIVERTER PANEL
8. INSTRUMENT AIR INLET
9. CALIBRATION GAS INLET
10. SAMPLE GAS INLET
11. AIR VALVE
12. GAS VALVE
13. TRANSFORMER, 230 OR 115V PRIMARY, 24V SECONDARY
14. ANALYZER POWER SWITCH
15. NOT USED
16. DISPLAY W/SIGNAL PROCESSOR
17. TERMINAL STRIP
18. PRIMARY AIR REGULATOR & PRESSURE GAUGE
19. AIR FILTER
20. SAMPLE GAS REGULATOR
21. REFERENCE GAS REGULATOR

Figure 2 – GA500-W Control Panel Detail

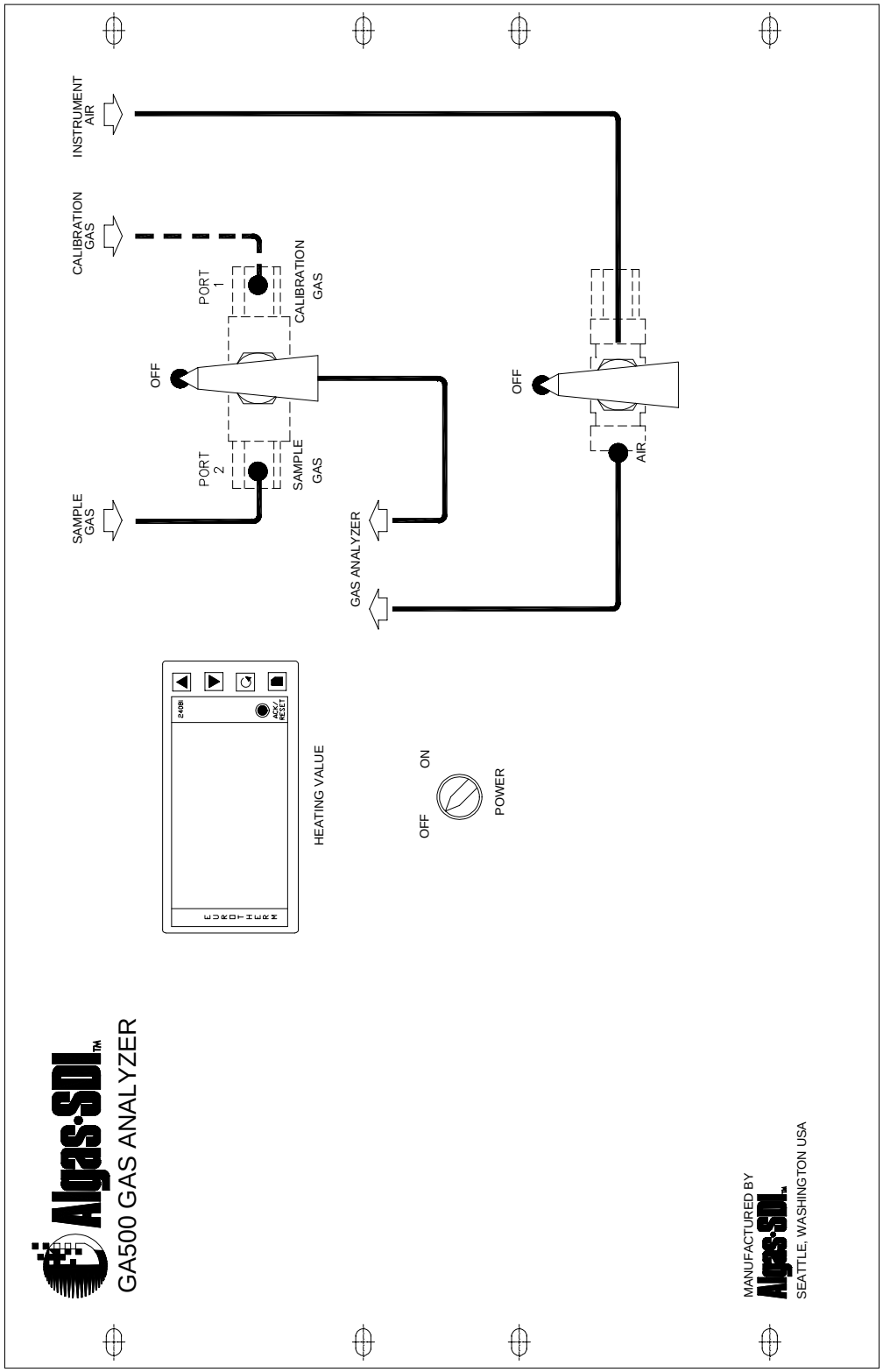


Figure 3A – GA500-WC – Gas Analyzer Equipment Drawing

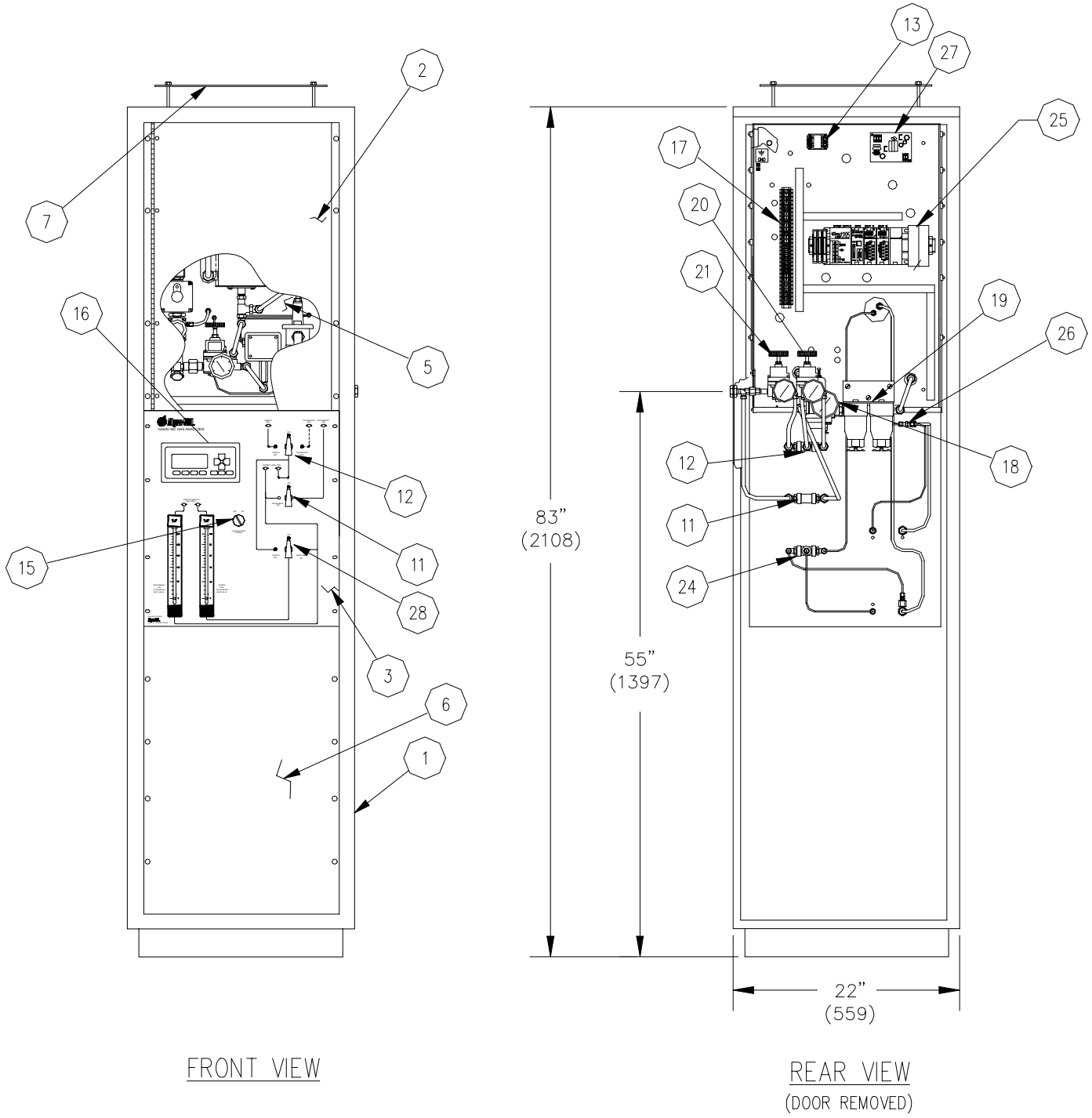
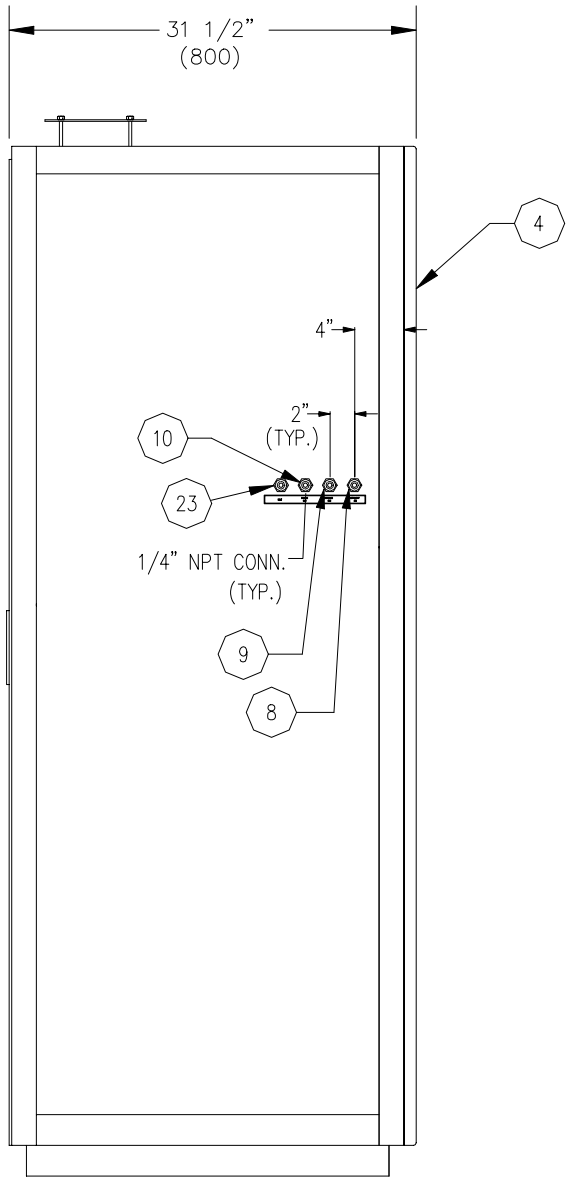


Figure 3B – GA500 – Gas Analyzer Equipment Drawing

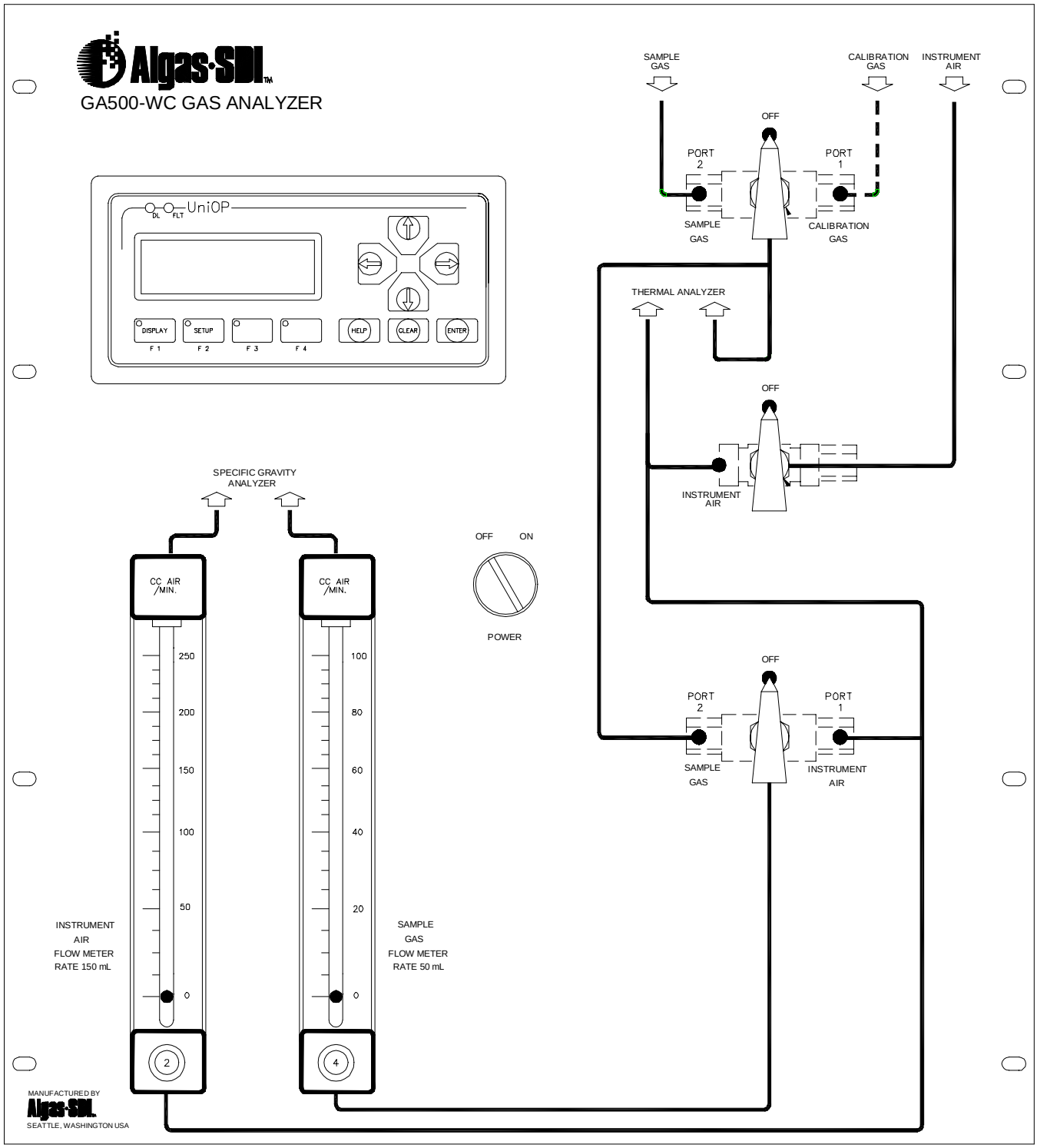


RIGHT SIDE VIEW

LIST OF COMPONENTS

1. GA500WC CABINET
2. GA500WC ANALYZER ACCESS DOOR
3. GA500WC SWITCH, VALVE, DISPLAY PANEL
4. S.G. ANALYZER FLOW METERS
5. GA500W BURNER ASSEMBLY
6. LOWER FRONT PANEL
7. DRAFT DIVERTER PANEL
8. INSTRUMENT AIR INLET
9. CALIBRATION GAS INLET
10. SAMPLE GAS INLET
11. AIR VALVE
12. GAS VALVE
13. TRANSFORMER, 230 OR 115V PRIMARY, 24V SECONDARY
14. (NOT USED)
15. POWER SWITCH
16. INTERFACE PANEL
17. TERMINAL STRIP
18. PRIMARY AIR REGULATOR & PRESSURE GAUGE
19. AIR FILTER
20. SAMPLE GAS REGULATOR
21. REFERENCE GAS REGULATOR
22. (NOT USED)
23. ATMOSPHERIC VENT
    (VENT TO SAFE LOCATION)
24. SPECIFIC GRAVITY (S.G.) ANALYZER VALVE
25. PLC PANEL
26. SPECIFIC GRAVITY (S.G.) ANALYZER
27. POWER SUPPLY
28. SPECIFIC GRAVITY (S.G.) ANALYZER VALVE

Figure 4 – GA500-WC Control Panel Detail



Operation 3

INITIAL START-UP

Item numbers referenced in the following description, refer to ***Figure 5***. The burner chamber is identical on the GA500-W & GA500-WC, with the one exception, on the GA500-WC. The GA500-WC has an extra connection before the gas pressure regulator Item #13 for the Specific Gravity measurement. Before start-up, check the following items:

1. Check to see that air, gas and electric power supplies are within acceptable limits. Air should be 75 PSIG and should be dry instrument quality air. Gas pressure to the unit should be 15 inches water column. If pressure is higher, an external gas regulator must be used to lower the pressure.

2. Electrical power is 115 volts AC, plus or minus 10% or 230 volts AC plus or minus 10%. This means that voltage could drop as low as 104 (207) volts or go as high as 126 (253) volts without affecting the operation.

NOTE:

Circuit Breaker/Power ON: On some older units (prior to S/N: 03130018), the main power switch is a combination power switch and circuit breaker which will move toward the center if the breaker is tripped by short circuiting or overloading. In this event, the circuit breaker may be reset by placing in the "OFF" position and then back in the "ON" position. Newer versions will use a fuse in place of the breaker and an "ON" / "OFF" selector switch operator in place of the breaker.

Starting the Gas Analyzer, "ON" / "OFF": On some older units (prior to S/N: 03130018) to start the Gas Analyzer, switch in the "ON" position by depressing the switch. Depressing it a second time will place the switch back in the "OFF" position. Newer versions will have an "ON" / "OFF" selector switch operator.

3. Make certain that gas and air lines are connected to the proper places. The gas line must enter through strainer Item #17 to solenoid valve Item #15. The air line is on the opposite side connecting to air strainer Item #16, which delivers air to regulator Item #10, and also to primary air measurement regulator Item #11.

4. Valves are provided on both air supply line and gas supply line. The gas supply line valves is a 3-way valves marked as "SAMPLE GAS" / "OFF" / "CALIBRATION GAS". The gas valve is arranged to supply a gas sample from a cylinder of standard calibration gas for calibration purposes or from the plant gas supply (SAMPLE GAS) which is to be analyzed. The air line supply valve is a 2-way valve marked as "INSTRUMENT AIR" / "OFF".

5. It is necessary that a bottle of standard calibration gas be supplied for calibration purposes. The GA500-W requires a chemically pure methane. The GA500-WC requires a gas blend for calibration that has identical Wobbe Index and Specific gravity to the desired mix.

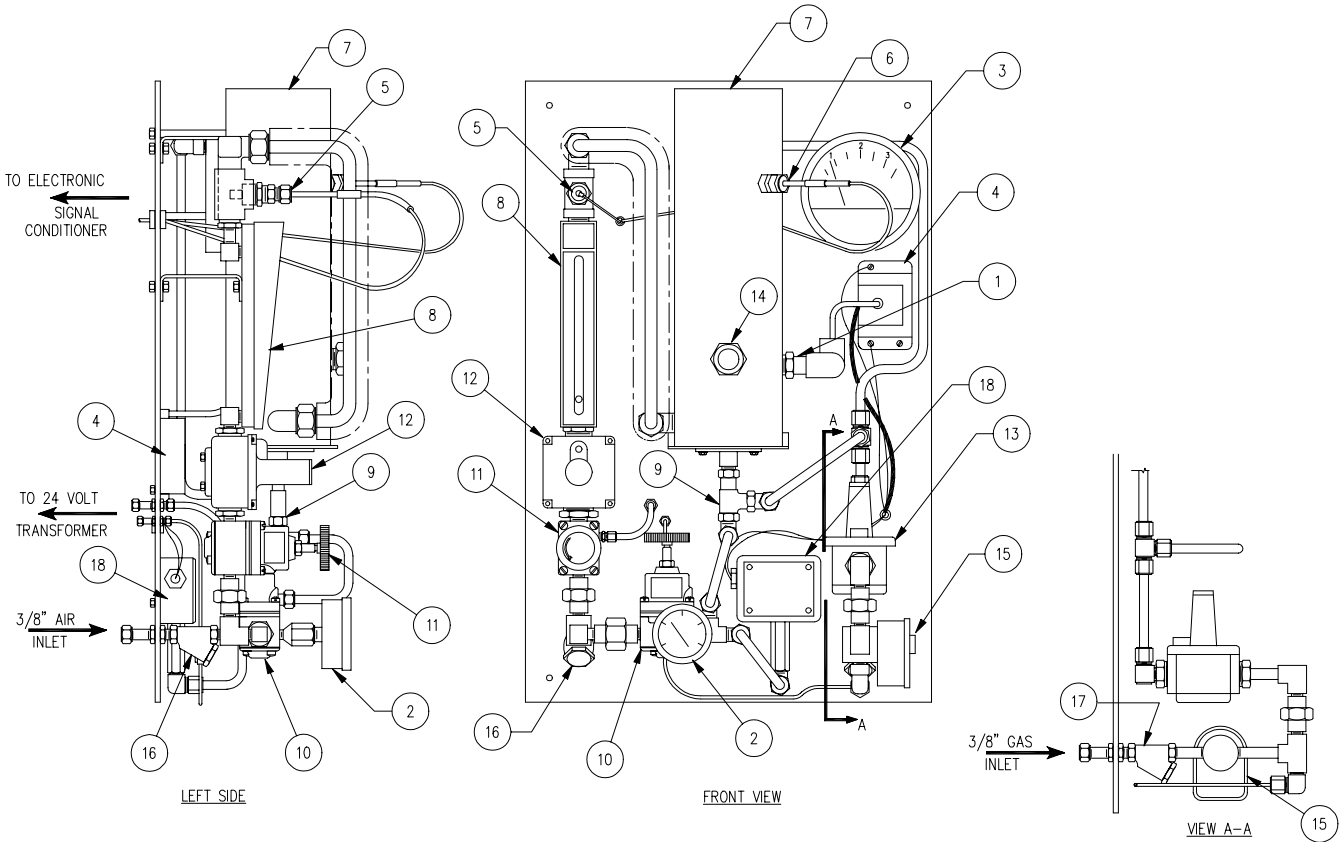
6. Check to see that the air filters have clean elements, properly in place, and that the polycarbonate bowls are clean and dry. Note: Some filters may be furnished with metal bowls. Opening the drain cock at the bottom of the polycarbonate bowls can drain any moisture that has been collected.

NOTE:

Terminology change: On some older units (prior to S/N: 03130018), Reference Gas and Calibration Gas have been used to describe the same function in the manual and on the labeling on the unit. Units built after S/N: 03130018 will use Calibration Gas only to describe the Calibration Gas processes.

Terminology change: On some older units (prior to S/N: 03130018), Instrument Air and Reference Air have been used to describe the same function in the manual and on the labeling on the unit. Units built after S/N: 03130018 will use Instrument Air only.

Figure 5 – GA500 Equipment for Burner Chamber, Regulators Drawing



1. **Flame rod**
2. **Burner air pressure gauge**
3. **Gas pressure gauge**
4. **Automatic ignition system**
5. **Cold junction thermocouple**
6. **Hot junction thermocouple**
7. **Measurement chamber and burner housing assembly**
8. **Air flow measurement meter**
9. **Venturi mixer**
10. **Burner air pressure regulator**
11. **Primary air measurement regulator**
12. **Secondary air measurement regulator**
13. **Gas pressure regulator**
14. **Sight glass**
15. **Gas solenoid valve**
16. **Air strainer**
17. **Gas strainer**
18. **Air pressure switch**

START-UP

After checking all of the above items, start the unit as follows:

1. Establish electric power to the analyzer. The digital display will show a meaningless value since the measurement chamber is below the minimum Wobbe Index.

2. Operate gas supply valve to introduce calibration gas to the unit. No gas will flow beyond solenoid valve Item #15 since air pressure switch Item #18 is not activated (Open) until air is present.

3. Open air inlet valve establishing air to the analyzer. Burner air pressure gauge Item #2 should read approximately 25 PSIG. If setting is not 25 PSIG, adjust burner air pressure regulator Item #10 to show 25 PSIG on pressure gauge Item #2.

   The low air pressure switch is set at approximately 20 PSIG so with 25 PSIG shown on gauge Item #2, solenoid valve Item #15 and automatic ignition system Item #4, are now energized and gas will be drawn into the unit.

4. The burner will be ignited by ignition rod Item #1. Note: The ignition rod and the flame rod are a single combination rod.

5. When flame rod Item #1 senses the burner has been ignited, sparking ceases. The flame is visible through site glass Item #14. If flame rod Item #1 senses a loss of flame, sparking again commences until flame is reestablished.

6. Gas pressure on gas pressure gauge Item #3 should read 2" W.C. If it does not read correctly, adjust gas pressure regulator Item #13 to show 2" W.C. on gauge Item #3.

7. Air flow rate on gauge Item #8 should be 100 SCFH. If the reading on flow gauge Item #8 is incorrect, adjust primary air measurement regulator Item #11 to produce the proper flow rate. Do not adjust Secondary regulator Item #12 unless proper control cannot be established by Primary regulator Item #11. Primary regulator Item #11 reduces air pressure to approximately 1 PSIG to the inlet of secondary regulator Item #12.

8. Observe Wobbe Index digital display. As the measurement chamber warms up, the display will begin showing an increasing number. After approximately 30 minutes warm-up time, the display will stabilize with only the unit digit (last digit on the right) changing to a point higher or lower. It is normal for the unit digit to change slightly during operation.

9. If the unit is also connected to a recorder, the recorder will show when stabilization has been achieved.

10. At this point, the digital display should show the Wobbe Index of the calibration gas. Using the usual natural gas, this will be a value of approximately 1360 Btu/scf or 12,758 Kcal/Nm^3, or use the Wobbe Index of the calibration gas. If the display is off set the span using the following equation. ((desired display)x(current span))/(current display)=(new span).

11. After the unit has been calibrated, switch the gas valve from Calibration Gas to Sample Gas to introduce the plant gas to be analyzed into the system.

12. If the analyzer is being used to control a blender and a deviation from the calibration point occurs (when analyzing the plant gas) the blender will be adjusted to provide the proper amount of air (or other gas) into the gas stream to bring it back to a proper Wobbe Index.

13. Note that if a momentary failure of gas occurs, the flame rod will automatically re-ignite the burner when gas is restored.

14. A short term loss of air, causing pressure to drop below the setting of the air pressure switch Item #18, will shut off the gas supply and the ignition system as well. When air is reestablished, above the setting of the air pressure switch, gas will automatically be reestablished by the activation of gas solenoid valve Item #15 and the ignition system Item #4 will automatically ignite the burner.

15. Since turning off the air will deactivate the unit, the gas supply valves can be left in the "ON" position, for short term shut down. Then by simply reestablishing air and electric power, the system is again operative.

16. It is advisable to calibrate the unit at least once each day while it is being used.

NORMAL START-UP

1. Observe air filter for proper operation.

2. Establish electric power.

3. Turn "ON" gas valve.

NOTE:

Gas can be left on at all times if desired as described under initial start-up and calibration.

4. Establish air supply.

5. Check gauges for proper readings:

   Gas pressure should be 2" W.C.
   Burner Air pressure 25 PSIG
   Measurement Air flow rate approximately 100 SCFH (or flow rate established during calibration)
   On GA500-WC models set the Instrument Air flow meter to 150 cc/min and Sample Gas flow meter to 50 cc/min.

6. After display and/or recorder shows stability, check calibration and adjust as necessary.

SHUT DOWN PROCEDURE

1. Turn off air supply. This will shut down entire system but leave display and electronic signal conditioning network active.
2. If system is going to be shut down for a long period of time, also discontinue electric power and close manual valve/s on the gas supply.

GA500-WC Operator Panel

General Description

This document will outline the operator screens and procedures for modifying the configuration of the GA500-WC gas analyzer manufactured by Algas-SDI International.

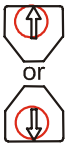
The GA500-WC operator panel displays three different gas quality characteristics. The gas characteristics are as follows; Wobbe Index (units of Btu/scf and Kcal/Nm^3), Calorific Value (units of Btu/scf and Kcal/Nm^3) and Specific Gravity (unity).

The operator can also calibrate the gas analyzer through the panel and scale the ranges for the three independent analog outputs. The three analog outputs provide a signal for the following perimeters; Wobbe Index, Calorific Value and Specific Gravity.

OPERATOR PANEL MENU LEVELS

F 1

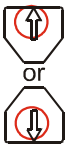
Display page menu button (shows present display of all parameters)



Parameter scroll arrows.

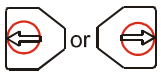
F 2

Setup page menu button (shows setpoints and allows adjustments of parameters)



Parameter scroll arrows.

Parameter modifications.



Shift cursor right or shift cursor left.

Increment Value / Up.

or

Decrement Value / Down.

Save parameter modification.

or

Reverts to previous entry.

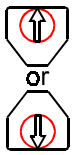
Display, F1

F 1

To view the displays for Wobbe Index, Calorific Value and Specific Gravity press the Display button (F1).

The operator can scroll through the following data items using the up or down arrow keys.

DATA DISPLAY



WI - (WOBBE INDEX)	**#### BTU / SCF** **##### Kcal / Nm^3**
CV - (CALORIFIC VALUE)	**#### BTU / SCF** **##### Kcal / Nm^3**
SG - (SPECIFIC GRAVITY)	**#.##**

Setup, F2

F 2

To view or change calibration of the gas analyzer press the Setup button (F2).

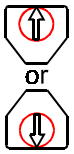
The operator can scroll through the following data items using the up and down arrow keys.

DATA SETUP

WI INPUT
ZERO ###

WI INPUT
SPAN #####

SG CORRECTION
####



WI OUTPUT
LOW #####Kcal/Nm^3

WI OUTPUT
HIGH #####Kcal/Nm^3

CV OUTPUT
LOW #####Kcal/Nm^3

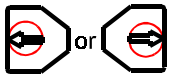
CV OUTPUT
HIGH #####Kcal/Nm^3

To convert from Btu/scf to Kcal/Nm^3 use the following equation;
[## (Btu/scf) x 9.381 = ## (Kcal/Nm^3)]

SG OUTPUT
LOW #.##

SG OUTPUT
HIGH #.##

Screen Brightness



The right arrow key brightens the display and the left arrow key dims the display.

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Calibration 4

GA500-WC FIELD CALIBRATION INSTRUCTIONS

Run vent line to safe area.

Connect Air and Gas to there appropriate inlet ports to set regulators.

Maximum Inlet Pressures: Air: 150 PSIG, Calibration Gas & Sample Gas: 20" W.C.

Turn on power.

Turn on fuel with gas selected and let burner ignite, check for proper flame.

Initial Setup Values

Pressure & Flow Settings

Regulators:	**Setting:**
• 1st stage Air regulator:	60 PSIG
• 2nd stage Burner Air regulator:	25 PSIG
• 1st stage Calibration Gas regulator:	6" W.C. Light Gas / 12" W.C. Heavy Gas
• 1st stage Sample Gas regulator:	6" W.C. Light Gas / 12" W.C. Heavy Gas
• 2nd stage Gas regulator:	2" W.C.

Flow Meters:	**Setting**
• Thermal Analyzer - Measurement Air:	100 scfh
• Specific Gravity - Sample Gas:	*50 cc/min

*NOTE: Flow needs to be adjusted when there are dramatic variations in gas quality.

• Specific Gravity - Instrument Air:	150 cc/min
• Burner Air Pressure Switch drops out at:	20 PSIG

Recorder Output factory default values for reference

• WI - Wobbe Index Low - 4.00mA @	7500	Kcal/Nm^3
• WI - Wobbe Index High - 20.00mA @	18,800	Kcal/Nm^3
• CV - Calorific Value Low - 4.00mA @	7,500	Kcal/Nm^3
• CV - Calorific Value High - 20.00mA @	18,800	Kcal/Nm^3

- SG - Specific Gravity Low - 4.00mA @ 0.50 SG
- SG - Specific Gravity High - 20.00mA @ 1.60 SG

WI - WOBBE INDEX SETUP & TESTING

Wobbe Index Zero

Reference Operator Display functions in Chapter 3 as needed.

Wobbe Index Zero should be performed when the thermocouple is changed or if the thermocouple is suspected as being defective. Otherwise under normal conditions this procedure is not required. Before starting record Wobbe Index Zero Value in case you need to return to this value again. Push the "SETUP" BUTTON, scroll to WI Zero and record value below.

Record Wobbe Index – Zero:_____

Before removing the thermocouples, place a circular mark using a black permanent marking pen on the thermocouple as close to the nut as possible for re-installation. Loosen the nut that holds the hot and cold junction thermocouples in place. Remove thermocouples and place in a container of water. Allow temperature to stabilize. If the Operator Display does not display 0, push the "Setup" button to enter setup mode. Scroll to Wobbe Index Zero, adjust to a new value using the arrow keys. If the display value is very high, may also indicate that the thermocouple needs to be replaced. The Wobbe Index Zero Range can be set between 0 and 999. Push the "Display" button, if the display does not read zero select another value. These steps may be repeated until the Operator Display Reads Zero. If the display should read "****", the Wobbe Index Zero value is set to high, decrement as necessary. Record new Wobbe Index Zero Setpoint for future reference:

Record New Wobbe Index – Zero:_____

Install thermocouples into there original locations at the Cold Junction and Hot Junction positions. Using the mark that you made to position the thermocouple to there original location. For reference the Cold Junction thermocouple is insert all the way in, then pull out the thermocouple about a 1/2" inch. This should center the Cold Junction thermocouple in the tube. The Hot Junction thermocouple is centered in the burner chamber. If you can not determine the center you may have to remove the top and visually center the thermocouple.

Wobbe Index Span

Wobbe Index Span should be performed at least once a month to ensure the accuracy of the unit. It is recommended that the Calibration Gas should have the same Wobbe Index & Specific Gravity characteristic as the gas that will be tested. Turn "SAMPLE GAS"/"OFF"/"CALIBRATION GAS" valve to CALIBRATION GAS position. Turn the "INSTRUMENT AIR"/"OFF" valve to INSTRUMENT AIR position. The Specific Gravity Analyzer valve "SAMPLE GAS"/"OFF"/"INSTRUMENT AIR" is not required for the Thermal Analyzer.

Verify that the Burner Air Pressure Regulator is set to 25 PSIG and Gas Pressure Regulator is set to 2" W.C. Also verify the Air Flow Measurement Meter has a flow rate of 100 SCFH. If the Air Flow Measurement is not 100 SCFH, adjust the Primary Air Regulator such that the Air Flow Meter reads 100 SCFH. The Secondary Air Regulator under normal conditions does not require adjusting. If

the Secondary Air Regulator should require adjusting, it is typically set at mid range. Allow unit to run a minimum of 120 minutes making sure reading is stable. For purposes of explaining the procedure we will use a Wobbe Index of 12,758 and a current display of 8500. Before starting record current Wobbe Index Span Value in case you need to return to this value again and for calculating the new span value. Push the "SETUP" BUTTON", scroll to WI Span and record value below. If the Wobbe Index Span is "0", using the arrow keys to enter 25,000. The Wobbe Index Span Range can be set between 0 and 99999.

Record Wobbe Index - span:_____Kcal/Nm^3

Use the following equation to provide the proper Wobbe Index Span number to insert:

Desired display x Current Span / Current display = New Span Setting

Desired display is the Wobbe Index value of the calibration gas.

Current span is the Wobbe Index Span reading on the display as recorded above from setup mode.

Current display is the Wobbe Index reading on the display in normal mode.

Example: Desired display x Current Span / Current display = New Span Setting

12,758 x 25,000 / 8,500 = 37,523

Push the "SETUP" BUTTON, scroll to WI span and enter 37,523 as a new span for this example. Exit the setup mode, your Wobbe Index should now read 12,758.

Wobbe Index Recorder Output

The Wobbe Index Recorder Output is an analog signal that can be scaled. The end user may change the Factory Default range on for the Wobbe Index Recorder Output as desired. Setting the Wobbe Index Low Output to the highest value possible could increase resolution and setting the Wobbe Index High Output the lowest value possible.

NOTE:

Before using the analog outputs (4-20 mA), be sure to read the manual of all the units that will be connected. In some cases an analog signal isolator is required to properly connect dissimilar instruments together. Also, if there is no instrument connected to the Recorder Output a load resistor is required to measure the Recorder Output. Use a 500 - 900 ohm resistor in series with the measuring device.

Calculating Recorder Output resolution using the factory default values.

Wobbe Index High - Wobbe Index Low = Wobbe Index Difference

18,800 - 7,500 = 11,300 Kcal/Nm^3

milliamp Out High - milliamp Out Low = milliamp Output Difference

20.00 - 4.00 = 16.00 mA

milliamp Output Difference / Wobbe Index Difference = mA/Kcal/Nm^3 Resolution

16.00 / 11,300 = 0.001416 mA/Kcal/Nm^3

Operator Display - Wobbe Index Low = Wobbe Index Delta

12,758 - 7,500 = 5,258 Kcal/Nm^3

Wobbe Index Delta x mA/Kcal/Nm^3 Resolution + milliamp Out Low = Recorder Output

5,258 x 0.001416 mA/Kcal/Nm^3 + 4.00 mA = 11.45 mA

The calculated Recorder Output values is 11.45 milliamps for the Operator Display value of 12,758 Kcal/Nm^3. The Resolution would be 0.001416 mA/Kcal/Nm^3.

Enter Display Setup Values by pushing the "Setup" button on the Operator Panel. Reference Operator Display functions in Chapter 3 as needed. The Wobbe Index Recorder output Range can be set between 0 and 99999.

WI - Wobbe Index Low - Factory Default Value, 4.00mA @ 7500 Kcal/Nm^3

WI - Wobbe Index High - Factory Default Value, 20.00mA @ 18,800 Kcal/Nm^3

NOTE: If Wobbe Index drops below 7,500 Kcal/Nm^3 the PLC current output will remain at 4.00 mA until the measurement increases above 7,500 Kcal/Nm^3 setpoint.

If Wobbe Index increases above 18,800 Kcal/Nm^3 the PLC current output will remain at 20.00 mA until the measurement decreases below 18,800 Kcal/Nm^3 setpoint.

SG - SPECIFIC GRAVITY SETUP & TESTING

Specific Gravity Zero

Reference Operator Display functions in Chapter 3 as needed.

Specific Gravity Zero should be performed annually to ensure the accuracy of the unit.

Otherwise under normal operating conditions this procedure is not required.

Turn the "INSTRUMENT AIR"/"OFF" valve to INSTRUMENT AIR position.

Turn the Specific Gravity Analyzer "SAMPLE GAS"/"OFF"/"INSTRUMENT AIR" valve to INSTRUMENT AIR position, allow unit to stabilize.

Continuously monitor and maintain Instrument Air at 150 mL and Sample Gas (AIR) at 50 mL.

Verify and set Specific Gravity Bridge Excitation voltage to 5.00 VDC at the Bridge Input Isolation card.

The Specific Gravity Zero potentiometer is located very close the Specific Gravity terminal board.

Using a multimeter set to millivolts, adjust Specific Gravity Zero potentiometer

such that the bridge output is 0mV, +/- 1mV at Terminal Pins 1 & 2.

Allow unit to run for 120 minutes making sure reading is stable, re-adjust bridge output to Zero.

After the Specific Gravity is Zeroed, a dab of silicone is placed on the zeroing potentiometer for shipping.

Specific Gravity Span

Specific Gravity Span should be performed annually to ensure the accuracy of the unit.

Otherwise under normal operating conditions this procedure is not required.

It is recommended that the Calibration Gas should have the same

Wobbe Index & Specific Gravity characteristic as the gas that will be tested.

Turn "SAMPLE GAS"/"OFF"/"CALIBRATION GAS" valve to CALIBRATION GAS.

Turn the "INSTRUMENT AIR"/"OFF" valve to INSTRUMENT AIR. Turn the Specific Gravity Analyzer valve to "SAMPLE GAS"/"OFF"/"INSTRUMENT AIR" valve to SAMPLE GAS POSITION, allow unit to stabilize. Continuously monitor and maintain Instrument Air flow meter rate at 150 mL & Sample Gas flow rate at 50 mL. For purposes of explaining the procedure we will use a Gas with a Specific Gravity of 1.35.

Test Gas: CP Propane / Air with a Specific Gravity of: 1.35

Once the display is stabilized, adjust the bridge excitation voltage such that the Operator Display will read the SG - Specific Gravity of the Calibration Gas being sampled, 1.35 from our example. The excitation voltage source can be found on the Bridge Input Isolation Din card. The lower hole is an adjustment potentiometer.

Repeat the Zeroing process, allow unit to stabilize with the Sample Gas flow meter set to Instrument Air. Verify and re-zero bridge output as necessary to 0mV, +/-1mV on Specific Gravity terminal board Pins 1 & 2.

Repeat the calibration process, allow unit to stabilize with the known Calibration Gas. Verify Operator Display reads the same value as the Calibration Gas specific gravity It may need to be adjusted if the Specific Gravity Zero potentiometer was adjusted. Once the display is stabilized, adjust the bridge excitation voltage such that the display will read the SG - Specific Gravity of the Calibration Gas being sampled, 1.35 from our example.

Specific Gravity Correction

The Specific Gravity Correction is used to shift the entire calibration curve up or down. Typical the Specific Gravity Correction is not used and set to a default value of Zero.

Specific Gravity Recorder Output

The Specific Gravity Recorder Output is an analog signal scaled by the PLC Controller based on the Specific Gravity measurements. The end user may change the Factory Default range on for the Specific Gravity Recorder Output as desired. Resolution can be increased by setting the Specific Gravity Low Output to the highest value possible and setting the Specific Gravity High Output the lowest value possible.

NOTE:

Before using the analog outputs (4-20 mA), be sure to read the manual of all the units that will be connected. In some cases an analog signal isolator is required to properly connect dissimilar instruments together. Also, if there is no instrument connected to the Recorder Output a load resistor is required to measure the Recorder Output. Use a 500 - 900 ohm resistor in series with the measuring device.

Calculating Recorder Output resolution using the factory default values.

Specific Gravity High	-	Specific Gravity Low	=	Specific Gravity Difference
1.60	-	0.50	=	1.10
milliamp Out High	-	milliamp Out Low	=	milliamp Output Difference
20.00	-	4.00	=	16.00 mA
milliamp Output Difference	/	Specific Gravity Difference	=	mA / Kcal/Nm^3 Resolution
16.00	/	1.10	=	14.55 mA / SG
Operator Display	-	Specific Gravity Low	=	Specific Gravity Delta
.35	-	0.50	=	0.85

Specific Gravity Delta	x	mA / SG Resolution	+	milliamp Out Low	=	Recorder Output
0.85	x	14.55	+	4.00	=	16.36 mA

The calculated Recorder Output values is 16.36 milliamps for the Operator Display value of 1.35. The Resolution would be 14.55 mA / SG.

Enter Display Setup Values by pushing the "Setup" button on the Operator Panel.

Reference Operator Display functions in Chapter 3 as needed. The Specific Gravity Recorder output Range can be set between 0 and 99999.

SG - Specific Gravity Low - Factory Default Value, 4.00mA @ 0.50

SG - Specific Gravity High - Factory Default Value, 20.00mA @ 1.60

NOTE: If Specific Gravity drops below 0.50 the PLC current output will remain at 4.00 mA until the measurement increases above 0.50 setpoint.

If Specific Gravity increases above 1.60 the PLC current output will remain at 20.00 mA until the measurement decreases below 1.60 setpoint.

CV - Calorific Value SETUP & TESTING

The Calorific Value requires no calibration since it is a calculated value based on the Wobbe Index and Specific Gravity measurements. However, it does have a Recorder Output Range that can be scaled.

Calorific Value Recorder Output

Reference Operator Display functions in Chapter 3 as needed.

The Calorific Value Recorder Output is an analog signal calculated by the PLC Controller using Wobbe Index and Specific Gravity measurements. The end user may change the Factory Default range on for the Calorific Value Recorder Output as desired. Resolution can be increased by setting the Calorific Value Low Output to the highest value possible and setting the Calorific Value High Output the lowest value possible.

NOTE:

Before using the analog outputs (4-20 mA), be sure to read the manual of all the units that will be connected. In some cases an analog signal isolator is required to properly connect dissimilar instruments together. Also, if there is no instrument connected to the Recorder Output a load resistor is required to measure the Recorder Output. Use a 500 - 900 ohm resistor in series with the measuring device.

Calculating Recorder Output resolution using the factory default values.

Calorific Value High - Calorific Value Low = Calorific Value Difference

18,800 - 7,500 = 11,300 Kcal/Nm^3

milliamp Out High - milliamp Out Low = milliamp Output Difference

20.00 - 4.00 = 16.00

milliamp Output Difference / Calorific Value Difference = mA / Kcal/Nm^3 Resolution

16.00 / 11,300 = 0.001416 mA/Kcal/Nm^3

Operator Display - Calorific Value Low = Calorific Value Delta

16,308 - 7,500 = 8,808 Kcal/Nm^3

Calorific Value Delta x mA/Kcal/Nm^3 Resolution + milliamp Out Low = Recorder Output

8,808 x 0.001416mA / Kcal/Nm^3 + 4.00 = 16.47 mA

The calculated Recorder Output values is 16.47 milliamps for the Operator Display value of 16,308 Kcal/Nm^3. The Resolution would be 0.001416 mA/Kcal/Nm^3.

Enter Display Setup Values by pushing the "Setup" button on the Operator Panel.

Reference Operator Display functions in Chapter 3 as needed.

The Calorific Value Recorder output Range can be set between 0 and 99999.

CV - Calorific Value Low - Factory Default Value, 4.00mA @ 7,500 Kcal/Nm^3

CV - Calorific Value High - Factory Default Value, 20.00mA @ 18,800 Kcal/Nm^3

NOTE: If Calorific Value drops below 7,500 Kcal/Nm^3 the PLC current output will remain at 4.00 mA until the measurement increases above 7,500 Kcal/Nm^3 setpoint.

If Calorific Value increases above 18,800 Kcal/Nm^3 the PLC current output will remain at 20.00 mA until the measurement decreases below 18,800 Kcal/Nm^3 setpoint.

Record Final Setpoints for Your Records

For your Records Record the setpoint ranges you have selected.

- WI INPUT ZERO _____
- WI INPUT SPAN _____
- SG CORRECTION _____
- WI OUTPUT LOW _____
- WI OUTPUT HIGH _____
- CV OUTPUT LOW _____
- CV OUTPUT HIGH _____
- SG OUTPUT LOW _____
- SG OUTPUT HIGH _____

GA500-W FIELD CALIBRATION INSTRUCTIONS

Run vent line to safe area.

Connect air and gas to there appropriate inlet ports to set regulators.

Maximum Inlet Pressures: Air: 150 PSIG, Calibration & Sample Gas: 20" W.C.

Turn on power.

Turn on fuel with gas selected and let burner ignite, check for proper flame.

Initial Setup Values

Pressure & Flow Settings

Regulators:	**Setting:**
• 1st stage air regulator:	60 PSIG
• 2nd stage burner air regulator:	25 PSIG
• 1st stage Calibration Gas regulator:	4" W.C.
• 1st stage Sample Gas regulator:	4" W.C.
• 2nd stage gas regulator:	2" W.C.
Flow Meters:	**Setting**
• Thermal Analyzer - Measurement Air:	100 SCFH

Initial Recorder Output factory default values for reference

• WI - Wobbe Index Low - 4.00mA @	7,500 Kcal/Nm^3
• WI - Wobbe Index High - 20.00mA @	18,800 Kcal/Nm^3

WOBBE INDEX SETUP & TESTING

Wobbe Index Zero

Set the minimum Wobbe Index Low Display value by selecting **",P"**-Sensor Input Configuration, then select **"VAL.L"**-Span, display value Low, enter "0". Wobbe Index Zero should be performed when the thermocouple is changed or if the thermocouple is suspected as being defective. Otherwise under normal conditions this procedure is not required.

Before removing the thermocouples, place a circular mark using a black permanent-marking pen on the thermocouple as close to the nut as possible for re-installation. Loosen the nut that holds the hot and cold thermocouples in place. Remove thermocouples and place in a container of water. Allow temperature to stabilize. The display should read +/-5 Kcal/Nm^3. If the display value is very high it may indicate that the thermocouple needs to be replaced.

Install thermocouples into there original locations at the Cold Junction and Hot Junction positions. Using the mark that you made to position the thermocouple

to there original location. For reference the Cold Junction thermocouple is insert all the way in, then pull out the thermocouple about a 1/2" inch. This should center the Cold Junction thermocouple in the tube. The Hot Junction thermocouple is centered in the burner chamber. If you can not determine the center you may have to remove the top and visually center the thermocouple.

Wobbe Index Span

Wobbe Index Span should be performed at least once a month to ensure the accuracy of the unit. It is recommended that the Calibration Gas should have the same Wobbe Index characteristic as the gas that will be tested. Turn "SAMPLE GAS"/"OFF"/"CALIBRATION GAS" valve to CALIBRATION GAS. Turn the "INSTRUMENT AIR"/"OFF" valve to INSTRUMENT AIR. Verify that the Burner Air Pressure Regulator is set to 25 PSIG and Gas Pressure Regulator is set to 2" W.C. Also verify the Air Flow Measurement Meter has a flow rate of 100 SCFH. If the Air Flow Measurement is not 100 SCFH, adjust the Primary Air Regulator such that the Air Flow Meter reads 100 SCFH. The Secondary Air Regulator under normal conditions does not require adjusting. If the Secondary Air Regulator should require adjusting, it is typically set at mid range. Allow unit to run for 120 minutes making sure reading is stable. For purposes of explaining the procedure we will use a Wobbe Index of 11,947 and a current display of 8500. Before starting, record current Wobbe Index Span Value in case you need to return to this value again and for calculating the new span value. Select **",P"**-Sensor Input Configuration, then select **"VAL.H"**-Span, display value high, and record value below. If the Wobbe Index Span is "0", using the arrow keys to enter 25,000. The Wobbe Index Span Range can be set between 0 and 99999.

Record Wobbe Index - span:_____Kcal/Nm^3

Use the following equation to provide the proper Wobbe Index Span number to insert:

Desired display x Current Span / Current display = New Span Setting

Desired display is the Wobbe Index value of the calibration gas.

Current span is the Wobbe Index Span reading on the display as recorded above from setup mode.

Current display is the Wobbe Index reading on the display in normal mode.

Example: Desired display x Current Span / Current display = New Span Setting

12,758 x 25,000 / 8,500 = 37,524

Select **",P"**-Sensor Input Configuration, then select **"VAL.H"**-Span, display value high and enter 35,138 as a new span for this example. Exit the setup mode, your Wobbe Index should now read 12,758.

Wobbe Index Recorder Output

The Wobbe Index Recorder Output (Retransmission) is an analog signal scaled by the Operator Display based on the Wobbe Index measurements. The end user may change the Factory Default range on for the Wobbe Index Recorder Output as desired. Setting the Wobbe Index Low Output to the highest value possible can increase resolution and setting the Wobbe Index High Output the lowest value possible.

NOTE:

Before using the analog outputs (4-20 mA), be sure to read the manual of all the units that will be connected. In some cases an analog signal isolator is required to properly connect dissimilar instruments together. Also, if there is no instrument connected to the Recorder Output a load resistor is required to measure the Recorder Output. Use a 500 - 900 ohm resistor in series with the measuring device.

Calculating Recorder Output resolution using the factory default values.

Wobbe Index High - Wobbe Index Low = Wobbe Index Difference

18,800 - 7,500 = 11,300 Kcal/Nm^3

milliamp Out High - milliamp Out Low = milliamp Output Difference

20.00 - 4.00 = 16.00

milliamp Output Difference / Wobbe Index Difference = mA/Kcal/Nm^3 Resolution

16.00 / 11,300 = 0.001416 mA/Kcal/Nm^3

Operator Display - Wobbe Index Low = Wobbe Index Delta

12,758 - 7,500 = 5,258 Kcal/Nm^3

Wobbe Index Delta x mA/Kcal/Nm^3 Resolution + milliamp Out Low = Recorder Output

5,258 x 0.001416 mA/Kcal/Nm^3 + 4.00 mA = 11.45 mA

The calculated Recorder Output values is 11.45 milliamps for the Operator Display value of 12,758 Kcal/Nm^3. The Resolution would be 0.001416 mA/Kcal/Nm^3.

To change or reset to the default values, select **"1A"**-Output Module 1Configuration, then select **"VAL.L"**-Retransmission Low or **"VAL.H"**-Retransmission High and enter the desired values. The Wobbe Index Recorder output Range can be set between 0 and 99999.

WI - Wobbe Index Low - Factory Default Value, 4.00mA @ 7,500 Kcal/Nm^3

WI - Wobbe Index High - Factory Default Value, 20.00mA @ 18,800 Kcal/Nm^3

NOTE: If Wobbe Index drops below 7,500 Kcal/Nm^3 the Recorder Retransmission current output will remain at 4.00 mA until the measurement increases above 7,500 Kcal/Nm^3 setpoint.

If Wobbe Index increases above 18,800 Kcal/Nm^3 the Recorder Retransmission current output will remain at 20.00 mA until the measurement decreases below 18,800 Kcal/Nm^3 setpoint.

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Maintenance 5

Virtually no maintenance is required on the unit except for checking air filters and strainer and gas strainer, periodically. Internal parts of gas solenoid valve and all four regulators should be replaced as required. If the unit is used often, these items should be checked and replaced, if necessary, at lease once a year. Under any circumstances, all components should be completely serviced, with a repair kit, at least once every 5 years.

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SYMPTOM	POSSIBLE CAUSE	CORRECTION NOTE NUMBER
Incorrect Burner Air Pressure	1. Air supply malfunction	1
	2. Filters or strainer plugged	2
	3. Regulator adjustment	3
	4. Defective regulator	4
	5. Defective gauge	5
Incorrect Measurement Air Flow	1-4 above	1-4
	6. Defective flow meter	6
Incorrect Gas Pressure	7. Gas supply pressure failure	1
	8. Strainer plugged	2
	9. Regulators adjustment	3
	10. Defective regulator	4
	11. Defective gauge	5
Incorrect Reading on Wobbe Index Display	Items 1-11 above	1-6
	If 1-11 are correct and condition still exist, one or more of the following:	
	A. Cold junction thermocouple	7
	B. Hot junction thermocouple	7
	C. Electronic network	8
	D. Display	9

CORRECTION NOTES (see 'correction note number' in chart):

1. **Correct supply**
2. **Replace filter elements and/or clean strainer**
3. **Adjust regulator**
4. **Replace regulator**
5. **Replace gauge**
6. **Replace flow meter**
7. **Replace thermocouple**
8. **Replace electronic network**
9. **Replace display**

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APPENDIX A

GA500-W & GA500-WC
Common Component Information

INSTALLATION AND MAINTENANCE INSTRUCTIONS

2-WAY DIRECT ACTING SOLENOID VALVES NORMALLY CLOSED OPERATION — 1/4 N.P.T.

BULLETIN 8262

ASCO

FORM NO. V-5927

DESCRIPTION

Bulletin 8262's are 2-way normally closed, direct acting solenoid valves having bodies of brass construction. Standard valves have a General Purpose NEMA Type 1 Solenoid Enclosure. Valves may also be equipped with a solenoid enclosure which is designed to meet NEMA Type 4 - Watertight, NEMA Type 7 (C or D) Hazardous Locations - Class I, Groups C or D and NEMA Type 9 (E, F or G) Hazardous Locations - Class II, Groups E, F or G. Installation and Maintenance Instructions for Explosion-Proof/Watertight Solenoid Enclosures are shown on Form Nos. V-5391 or V-5380.

OPERATION

Normally Closed: Valve is closed when solenoid is de-energized. Valve opens when solenoid is energized.

NOTE: Inlet port will either be marked "I" or "IN." Outlet port will be marked "2."

IMPORTANT: No minimum operating pressure required.

INSTALLATION

Check nameplate for correct catalog number, pressure, voltage and service.

TEMPERATURE LIMITATIONS

For maximum valve ambient and fluid temperatures, refer to chart below. For higher ambient and fluid temperatures, consult factory. Check catalog number and watt rating on nameplate to determine the maximum temperatures.

WATTAGE	CATALOG NUMBER PREFIX	COIL CLASS	MAXIMUM AMBIENT TEMP. °F	MAXIMUM FLUID TEMP. °F
6	NONE	A	77	180
	FT	F	122	200
	HT	H	140	200
9	NONE	F	77	180
9.7	NONE, FT OR HT	A, F OR H	77	120
11.2*	NONE, FT OR HT	A, F OR H	77	150
16.7*	NONE	F	77	200

*Catalog Nos. 8262C200 and 8262B200 and valves with suffix "W" in the catalog number are limited to 140°F fluid temperature.

POSITIONING

Valve is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertical and upright so as to reduce the possibility of foreign matter accumulating in the core tube area.

MOUNTING

For valve body and mounting bracket mounting dimensions, refer to Figures 1 and 2.

PIPING

Connect piping according to markings on valve body. Apply pipe compound sparingly to male pipe threads only; if applied to valve threads, it may enter valve and cause operational difficulty. Pipe strain should be avoided by proper support and alignment of piping. When tightening the pipe, do not use valve as a lever. Wrenches applied to valve body or piping are to be located as close as possible to connection point.

IMPORTANT: For the protection of the solenoid valve, install a strainer or filter suitable for the service involved in the inlet side as close to the valve as possible. Periodic cleaning is required depending upon service conditions. See Bulletins 8600, 8601 and 8602 for strainers.

WIRING

Wiring must comply with Local and National Electrical Codes. Solenoid housings are provided with a 7/8 diameter hole for 1/2 inch conduit. The general purpose solenoid enclosure may be rotated to facilitate wiring by removing the retaining cap or clip. CAUTION: When metal retaining clip disengages, it will spring upward. Rotate enclosure to desired position. Replace retaining cap or clip before operating.

NOTE: Alternating Current (A-C) and Direct Current (D-C) solenoids are built differently. To convert from one to the other, it is necessary to change the complete solenoid including the core assembly and solenoid base sub-assembly.

SOLENOID TEMPERATURE

Standard catalog valves are supplied with coils designed for continuous duty service. When the solenoid is energized for a long period, the solenoid enclosure becomes hot and can be touched with the hand only for an instant. This is a safe operating temperature. Any excessive heating will be indicated by the smoke and odor of burning coil insulation.

MAINTENANCE

WARNING: Turn off electrical power supply and depressurize valve before making repairs. It is not necessary to remove the valve from the pipe line for repairs.

CLEANING

A periodic cleaning of all solenoid valves is desirable. The time between cleanings will vary depending upon media and service conditions. In general, if the voltage to the coil is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. Clean valve strainer or filter when cleaning solenoid valve.

PREVENTIVE MAINTENANCE

1. Keep the medium flowing through the valve as free from dirt and foreign material as possible.
2. While in service, operate the valve at least once a month to insure proper opening and closing.
3. Periodic inspection (depending on media and service conditions) of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. Replace any parts that are worn or damaged.

IMPROPER OPERATION

1. **Faulty Control Circuit:** Check the electrical system by energizing the solenoid. A metallic click signifies the solenoid is operating. Absence of the click indicates loss of power supply. Check for loose or blown-out fuses, open-circuited or grounded coil, broken lead wires or splice connections.
2. **Burned-Out Coil:** Check for open-circuited coil. Replace coil if necessary.
3. **Low Voltage:** Check voltage across the coil leads. Voltage must be at least 85% of nameplate rating.
4. **Incorrect Pressure:** Check valve pressure. Pressure to valve must be within range specified on nameplate.
5. **Excessive Leakage:** Disassemble valve and clean all parts. Replace worn or damaged parts with a complete Spare Parts Kit for best results.

COIL REPLACEMENT

Turn off electrical power supply and disconnect coil lead wires. Refer to watt rating stamped on nameplate for identification of solenoid construction. When you have determined the watt rating of solenoid, select the correct paragraph below.

FIGURE 3 SHOWS A SOLENOID WITH A WATT RATING OF 6 A-C, 9.7 D-C OR 9 A-C.

1. Remove retaining cap or clip, nameplate and cover. CAUTION: When metal retaining clip disengages, it will spring upward.
2. Slip the yoke containing a coil, sleeves and insulating washers off the the solenoid base sub-assembly. Insulating washers are omitted when a molded coil is used.
3. Slip coil, sleeves and insulating washers from yoke.
4. Reassemble in reverse order of disassembly paying careful attention to exploded view provided for identification and placement of parts.

ASCO Valves

ASCO

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FIGURE 4 SHOWS A SOLENOID WITH A WATT RATING OF 10.5 A-C, 11.2 D-C OR 16.7 A-C

1. Remove retaining cap or clip, nameplate and housing. CAUTION: When metal retaining clip disengages, it will spring upward.
2. Slip spring washer, insulating washer and coil off the solenoid base sub-assembly. Insulating washers are omitted when a molded coil is used.
3. Reassemble in reverse order of disassembly paying careful attention to exploded views provided for identification and placement of parts.

CAUTION: Solenoid must be fully reassembled as the housing and internal parts are part of and complete the magnetic circuit. Place an insulating washer at each end of coil, if required.

VALVE DISASSEMBLY AND REASSEMBLY

Depressurize valve and turn off electrical power supply. For valves with a watt rating of 6 A-C, 9.7 D-C or 9 A-C, refer to Figure 3. For valves with a watt rating of 10.5 A-C, 11.2 D-C or 16.7 A-C, refer to Figure 4. Proceed in the following manner:

1. Remove retaining cap or clip and slip the entire solenoid enclosure off the solenoid base sub-assembly. CAUTION: When metal retaining clip disengages, it will spring upward.
2. Unscrew solenoid base sub-assembly and remove core assembly, core spring and body gasket.
3. All parts are now accessible for cleaning or replacement. Replace worn or damaged parts with a complete Spare Parts Kit for best results.
4. Reassemble in reverse order of disassembly paying careful attention to exploded views provided for identification and placement of parts.
5. Replace body gasket, core assembly, core spring and solenoid base sub-assembly. Torque solenoid base sub-assembly to 175 ± 25 inch-pounds.
6. After maintenance, operate the valve a few times to be sure of proper operation.

SPARE PARTS KITS

Spare Parts Kits and Coils are available for ASCO valves.
Parts marked with an asterisk (*) are supplied in Spare Parts Kit.

ORDERING INFORMATION FOR SPARE PARTS KITS

When Ordering Spare Parts Kits or Coils, Specify Valve Catalog Number, Serial Number and Voltage.

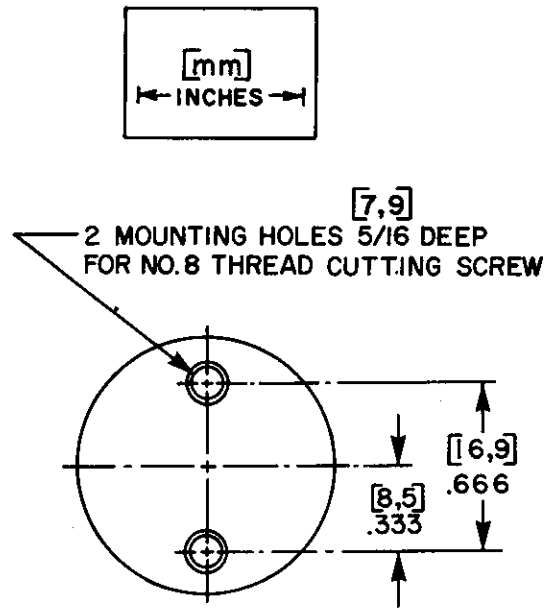

Figure 1. Body Mounting

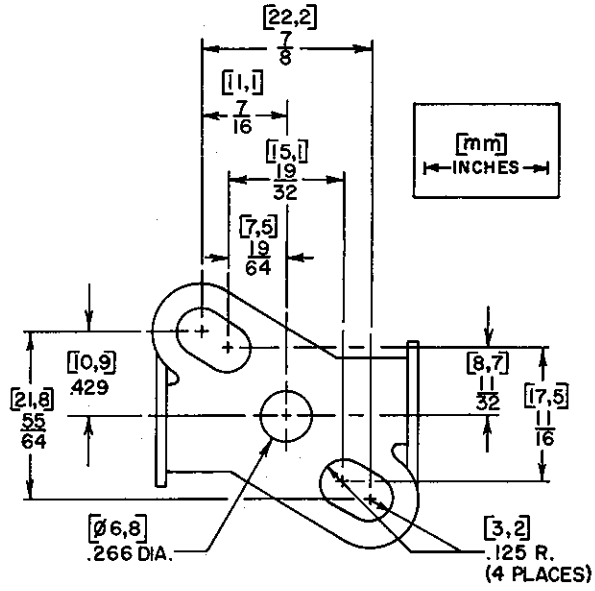

Figure 2. Mounting Bracket Mounting Dimensions

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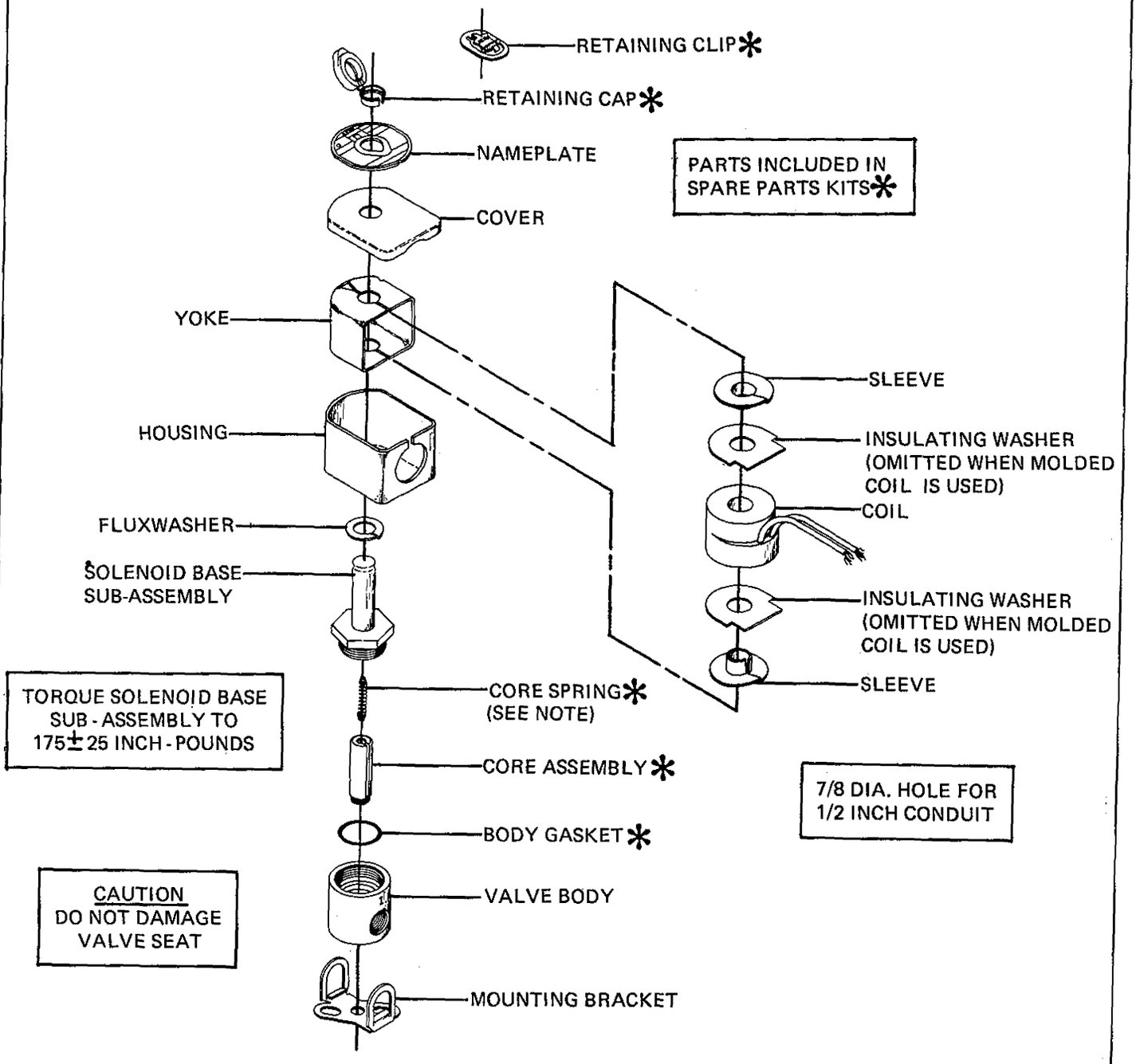
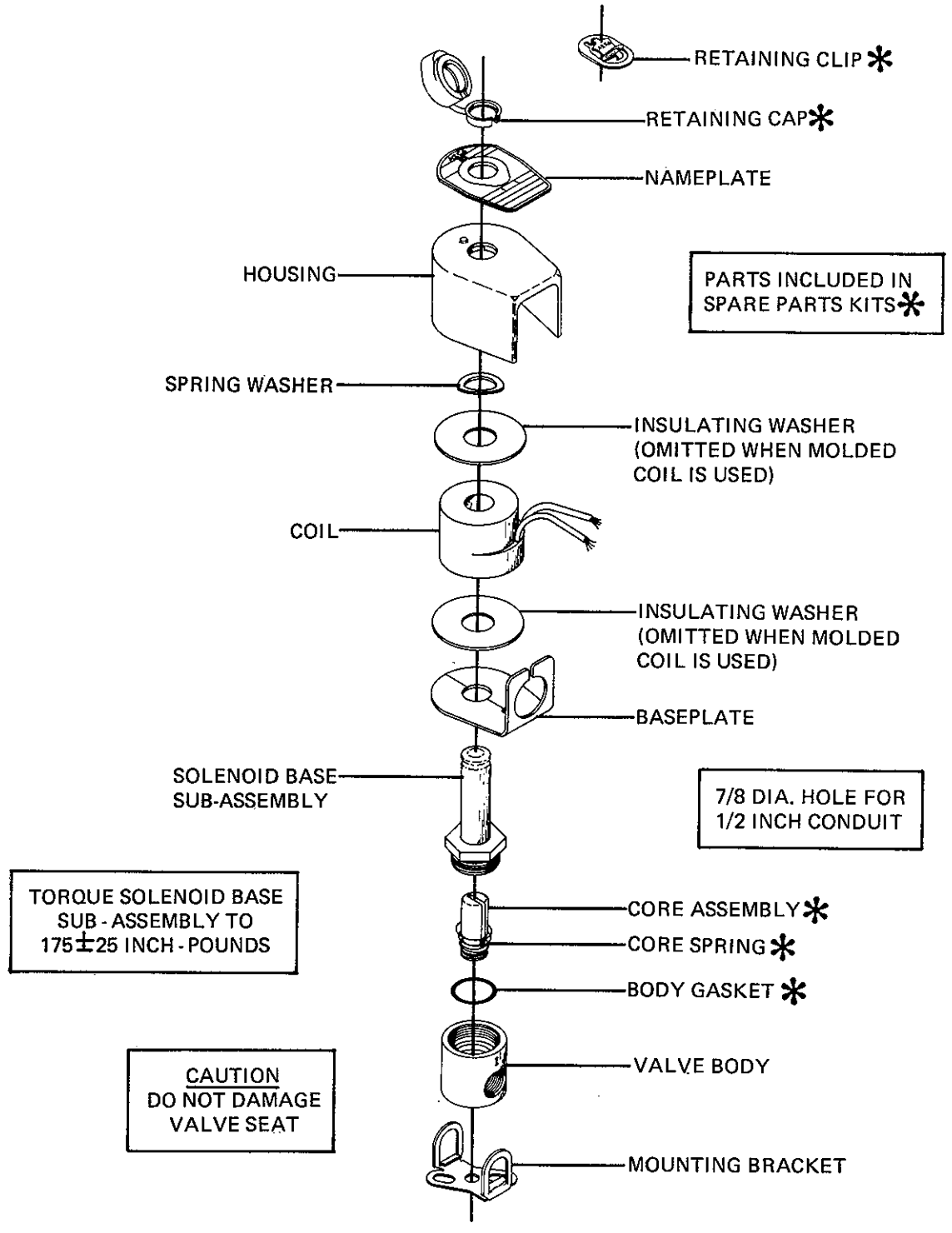


NOTE: A-C (ALTERNATING CURRENT) CONSTRUCTION SHOWN. FOR A-C CONSTRUCTION, EITHER END OF THE SPRING MAY BE INSTALLED INTO TOP OF CORE ASSEMBLY. FOR D-C (DIRECT CURRENT) CONSTRUCTION, INSTALL WIDE END OF CORE SPRING IN CORE ASSEMBLY FIRST, CLOSED END OF CORE SPRING PROTRUDES FROM TOP OF CORE ASSEMBLY.

Figure 3. **Bulletin 8262 (6 A-C, 9.7 D-C Or 9 Watts A-C)**
General Purpose Solenoid Enclosure Shown
For Explosion-Proof/Watertight Solenoid Enclosure, See Form No. V-5391



Bulletin 8262 (10.5 A-C, 11.2 D-C or 16.7 Watts A-C)
General Purpose Solenoid Enclosure Shown
For Explosion-Proof/Watertight Solenoid Enclosure, See Form No. V-5380

Figure 4.

ASCO Valves
Automatic Switch Co. FLORHAM PARK, NEW JERSEY 07932 Form No. V-5927 PRINTED IN U.S.A. 1977

Installation & Maintenance Instructions

ASCO® Red-Hat II™

OPEN–FRAME, GENERAL PURPOSE, WATERTIGHT/EXPLOSIONPROOF SOLENOIDS

SERIES

8016G

Form No.V6583R7

—SERVICE NOTICE—

ASCO® solenoid valves with design change letter "G" in the catalog number (example: 8210G 1) have an epoxy encapsulated ASCO® Red Hat II™ solenoid. This solenoid replaces some of the solenoids with metal enclosures and open–frame constructions. Follow these installation and maintenance instructions if your valve or operator uses this solenoid.

DESCRIPTION

Catalog numbers 8016G1 and 8016G2 are epoxy encapsulated pull–type solenoids. The green solenoid with lead wires and 1/2″ conduit connection is designed to meet Enclosure Type 1–General Purpose, Type 2–Dripproof, Types 3 and 3S–Raintight, and Types 4 and 4X–Watertight. The black solenoid on catalog numbers prefixed "EF" is designed to meet Enclosure Types 3 and 3S–Raintight, Types 4 and 4X–Watertight, Types 6 and 6P–Submersible, Type 7 (A, B, C, & D) Explosionproof Class I, Division 1, Groups A, B, C, & D and Type 9 (E, F, & G)–Dust–Ignitionproof Class II, Division 1, Groups E, F, & G. The Class II, Groups F & G Dust Locations designation is not applicable for solenoids or solenoid valves used for steam service or when a class "H" solenoid is used. See *Temperature Limitations* section for solenoid identification and nameplate/retainer for service. When installed just as a solenoid and not attached to an ASCO valve, the core has a 0.250–28 UNF–2B tapped hole, 0.38 minimum full thread.

Series 8016G solenoids are available in:

- **Open–Frame Construction**
  The green solenoid may be supplied with 1/4″ spade, screw, or DIN terminals (Refer to Figure 4).
- **Panel Mounted Construction**
  These solenoids are specifically designed to be panel mounted by the customer through a panel having a .062 to .093 maximum wall thickness. (Refer to Figure 3 and section on *Installation of Panel Mounted Solenoid).*

Optional Features For Type 1 – General Purpose Construction Only

- **Junction Box**
  This junction box construction meets Enclosure Types 2,3,3S,4, and 4X. Only solenoids with 1/4″ spade or screw terminals may have a junction box. The junction box provides a 1/2″ conduit connection, grounding and spade or screw terminal connections within the junction box (See Figure 5).
- **DIN Plug Connector Kit No. K236034**
  Use this kit only for solenoids with DIN terminals. The DIN plug connector kit provides a two pole with grounding contact DIN Type 43650 construction (See Figure 6).

OPERATION

When the solenoid is energized, the core is drawn into the solenoid base sub–assembly. **IMPORTANT: When the solenoid is de–energized, the initial return force for the core, whether developed by spring, pressure, or weight, must exert a minimum force to overcome residual magnetism created by the solenoid. Minimum return force for AC construction is 11 ounces, and 4 ounces for DC construction.**

INSTALLATION

Check nameplate for correct catalog number, service, and wattage. Check front of solenoid for voltage and frequency.

⚠ WARNING: Electrical hazard from the accessibility of live parts. To prevent the possibility of death, serious injury or property damage, install the open – frame solenoid in an enclosure.

FOR BLACK ENCLOSURE TYPES 7 AND 9 ONLY

⚠ CAUTION: To prevent fire or explosion, do not install solenoid and/or valve where ignition temperature of hazardous atmosphere is less than 165° C. On valves used for steam service or when a class "H" solenoid is used, do not install in hazardous atmosphere where ignition temperature is less than 180°C. See nameplate/retainer for service.

NOTE: These solenoids have an internal non–resetable thermal fuse to limit solenoid temperature in the event that extraordinary conditions occur which could cause excessive temperatures. These conditions include high input voltage, a jammed core, excessive ambient temperature or a shorted solenoid, etc. This unique feature is a standard feature only in solenoids with black explosionproof/dust–ignitionproof enclosures (Types 7 & 9).

⚠ CAUTION: To protect the solenoid valve or operator, install a strainer or filter, suitable for the service involved in the inlet side as close to the valve or operator as possible. Clean periodically depending on service conditions. See ASCO Series 8600, 8601, and 8602 for strainers.

Temperature Limitations

For maximum valve ambient temperatures, refer to chart. The temperature limitations listed, only indicate maximum application temperatures for field wiring rated at 90°C. Check catalog number prefix and watt rating on nameplate to determine maximum ambient temperature. See valve installation and maintenance instructions for maximum fluid temperature.

NOTE: For steam service, refer to *Wiring* section, *Junction Box* for temperature rating of supply wires.

Temperature Limitations For Series 8016G Solenoids for use on Valves Rated at 6.1, 8.1, 9.1, 10.6, or 11.1 Watts

Watt Rating	Catalog Number Coil Prefix	Class of Insulation	Maximum † Ambient Temp.
6.1, 8.1, 9.1, & 11.1	None, FB, KF, KP, SF, SP, SC, & SD	F	125°F (51.7°C)
6.1, 8.1, 9.1, & 11.1	HB, HT, KB, KH, SS, ST, SU, & ST	H	140°F (60°C)
10.6	None, KF, SF, & SC	F	104°F (40°C)
10.6	HT, KH, SU, & ST	H	104°F (40°C)

†Minimum ambient temperature –40°F (–40° C).

Positioning

This solenoid is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub–assembly area.

Wiring

Wiring must comply with local codes and the National Electrical Code. All solenoids supplied with lead wires are provided with a grounding wire which is green or green with yellow stripes and a 1/2″ conduit connection. To facilitate wiring, the solenoid may be rotated 360°. For the watertight and explosionproof solenoid, electrical fittings must be approved for use in the approved hazardous locations.

Additional Wiring Instructions For Optional Features:

- **Open–Frame solenoid with 1/4″ spade terminals**

For solenoids supplied with screw terminal connections use #12–18 AWG stranded copper wire rated at 90°C or greater. Torque terminal block screws to

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10 ± 2 in−lbs [1,0 ± 1,2 Nm]. A tapped hole is provided in the solenoid for grounding, use a #10−32 machine screw. Torque grounding screw to 15 −20 in−lbs [1,7 − 2,3 Nm]. On solenoids with screw terminals, the socket head screw holding the terminal block to the solenoid is the grounding screw. Torque the screw to 15 − 20 in−lbs [1,7 − 2,3 Nm]. with a 5/32″ hex key wrench.

- **Junction Box**

The junction box is used with spade or screw terminal solenoids only and is provided with a grounding screw and a 1/2″ conduit connection. Connect #12−18 AWG standard copper wire only to the screw terminals. Within the junction box use field wire that is rated 90°C or greater for connections. For steam service use 105°C rated wire up to 50 psi or use 125°C rated wire above 50 psi. After electrical hookup, replace cover gasket, cover, and screws. Tighten screws evenly in a crisscross manner.

- **DIN Plug Connector Kit No.K236−034**

1. The open−frame solenoid is provided with DIN terminals to accommodate the DIN plug connector kit.
2. Remove center screw from plug connector. Using a small screwdriver, pry terminal block from connector cover.
3. Use #12−18 AWG stranded copper wire rated at 90°C or greater for connections. Strip wire leads back approximately 1/4″for installation in socket terminals. The use of wire−end sleeves is also recommended for these socket terminals. Maximum length of wire−end sleeves to be approximately 1/4″. Tinning of the ends of the lead wires is not recommended.
4. Thread wire through gland nut, gland gasket, washer, and connector cover.

NOTE: Connector cover may be rotated in 90° increments from position shown for alternate positioning of cable entry.

5. Check DIN connector terminal block for electrical markings. Then make electrical hookup to terminal block according to markings on it. Snap terminal block into connector cover and install center screw.
6. Position connector gasket on solenoid and install plug connector. Torque center screw to 5 ± 1 in−lbs [0,6 ± 1,1 Nm].

NOTE: Alternating current (AC) and direct current (DC) solenoids are built differently. To convert from one to the other, it may be necessary to change the complete solenoid including the core and solenoid base sub−assembly, not just the solenoid. Consult ASCO.

Installation of Solenoid

Solenoids may be assembled as a complete unit. Tightening is accomplished by means of a hex flange at the base of the solenoid. The 3/4″ bonnet construction (Figure 1) must be disassembled for installation and installed with a special wrench adapter.

Installation of Panel Mounted Solenoid (See Figure 3)

Disassemble solenoid following instruction under *Solenoid Replacement* then proceed

3/4″ Valve Bonnet Construction

1. Install retainer (convex side to solenoid) in 1.312 diameter mounting hole in customer panel.
2. Then position spring washer over plugnut/core tube sub−assembly.
3. Install plugnut/core tube sub−assembly through retainer in customer panel. Then replace solenoid, nameplate/retainer and red cap.

15/16″ Valve Bonnet Construction

1. Install solenoid base sub−assembly through 0.69 diameter mounting hole in customer panel.
2. Position spring washer on opposite side of panel over solenoid base sub−assembly then replace.

Solenoid Temperature

Standard solenoids are designed for continuous duty service. When the solenoid is energized for a long period, the solenoid becomes hot and can be touched by hand only for an instant. This is a safe operating temperature.

MAINTENANCE

⚠ WARNING: To prevent the possibility of death, serious injury or property damage, turn off electrical power, depressurize solenoid operator and/or valve, and vent fluid to a safe area before servicing.

Cleaning

All solenoid operators and valves should be cleaned periodically. The time between cleaning will vary depending on medium and service conditions. In general, if the voltage to the solenoid is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. Clean strainer or filter when cleaning the valve.

Preventive Maintenance

- Keep the medium flowing through the solenoid operator or valve as free from dirt and foreign material as possible.
- While in service, the solenoid operator or valve should be operated at least once a month to insure proper opening and closing.
- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. Replace any worn or damaged parts.

Causes of Improper Operation

- **Faulty Control Circuit:** Check the electrical system by energizing the solenoid. A metallic *click* signifies that the solenoid is operating. Absence of the *click* indicates loss of power supply. Check for loose or blown fuses, open−circuited or grounded solenoid, broken lead wires or splice connections.
- **Burned−Out Solenoid:** Check for open−circuited solenoid. Replace if necessary. Check supply voltage; it must be the same as specified on nameplate/retainer and marked on the solenoid. Check ambient temperature and check that the core is not jammed.
- **Low Voltage:** Check voltage across the solenoid leads. Voltage must be at least 85% of rated voltage.

Solenoid Replacement

1. On solenoids with lead wires disconnect conduit, coil leads, and grounding wire.

NOTE: Any optional parts attached to the old solenoid must be reinstalled on the new solenoid.

2. Disassemble solenoids with optional features as follows:

- **Spade or Screw Terminals**
  Remove terminal connections, grounding screw, grounding wire, and terminal block (screw terminal type only).

NOTE: For screw terminals, the socket head screw holding the terminal block serves as a grounding screw.

- **Junction Box**
  Remove conduit and socket head screw (use 5/32″ hex key wrench) from center of junction box. Disconnect junction box from solenoid.
- **DIN Plug Connector**
  Remove center screw from DIN plug connector. Disconnect DIN plug connector from adapter. Remove socket head screw (use 5/32″ hex key wrench), DIN terminal adapter, and gasket from solenoid.

3. Snap off red cap from top of solenoid base sub−assembly.
4. Push down on solenoid. Then using a suitable screwdriver, insert blade in slot provided between solenoid and nameplate/retainer. Pry up slightly and push to remove. Then remove solenoid from solenoid base sub−assembly.
5. Reassemble using exploded views for parts identification and placement

Disassembly and Reassembly of Solenoids

1. Remove solenoid, see *Solenoid Replacement*.
2. Remove finger washer or spring washer from solenoid base sub−assembly.
3. Unscrew solenoid base sub−assembly.

NOTE: Some solenoid constructions have a plugnut/core tube sub−assembly, bonnet gasket and bonnet in place of the solenoid base sub−assembly. To remove bonnet use special wrench adapter supplied in ASCO Rebuild Kit. For wrench adapter only, order ASCO Wrench Kit No.K218948.

4. The core is now accessible for cleaning or replacement.
5. If the solenoid is part of a valve, refer to basic valve installation and maintenance instructions for further disassembly.
6. Reassemble using exploded views for identification and placement of parts.

ORDERING INFORMATION FOR ASCO SOLENOIDS

When Ordering Solenoids for ASCO Solenoid Operators or Valves, order the number stamped on the solenoid. Also specify voltage and frequency.

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Torque Chart

Part Name	Torque Value in Inch—Pounds	Torque Value in Newton—Meters
solenoid base sub—assembly	175 ± 25	19,8± 2,8
valve bonnet (3/4″ bonnet construction)	90 ± 10	10,2 ± 1,1
bonnet screw (3/8″ or 1/2″ NPT pipe size)	25	2,8
bonnet screw (3/4″ NPT pipe size)	40	4,5

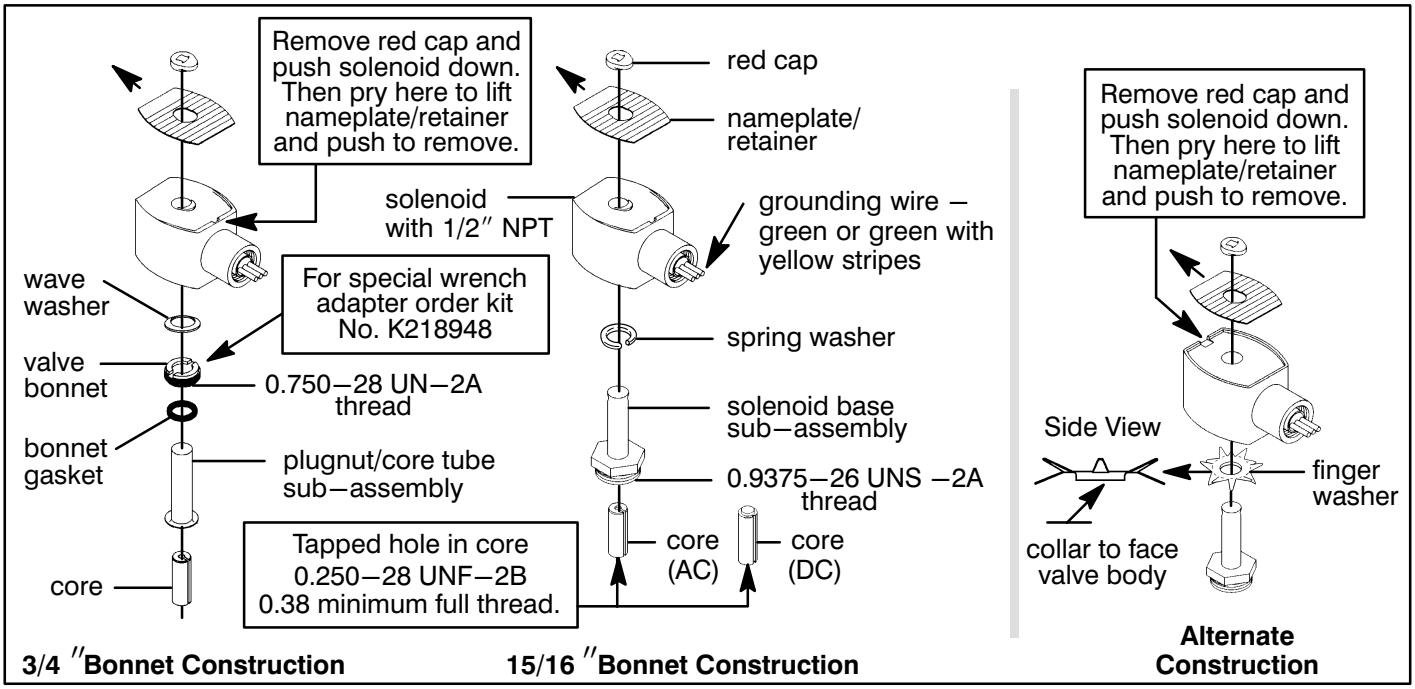

Figure 1. Series 8016G solenoids

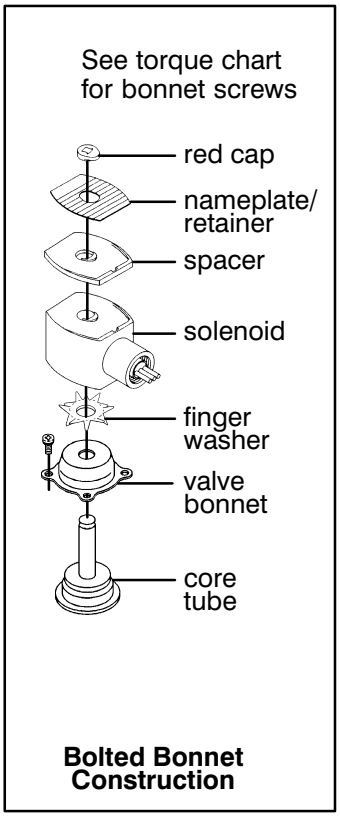

Figure 2. Series 8016G solenoid

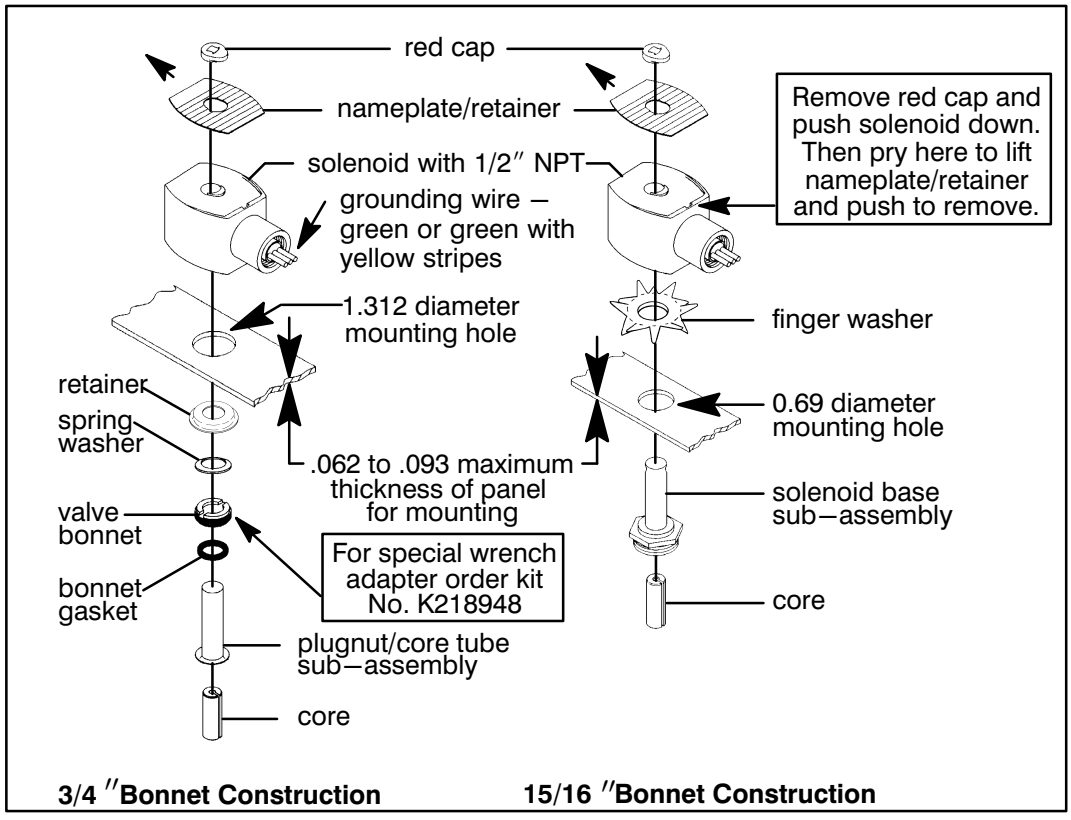

Figure 3. Series 8016G panel mounted solenoids

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Torque Chart

Part Name	Torque Value in Inch—Pounds	Torque Value in Newton—Meters
terminal block screws	10 ± 2	1,1 ± 0,2
socket head screw	15 – 20	1,7 – 2,3
center screw	5 ± 1	0,6 ± 0,1

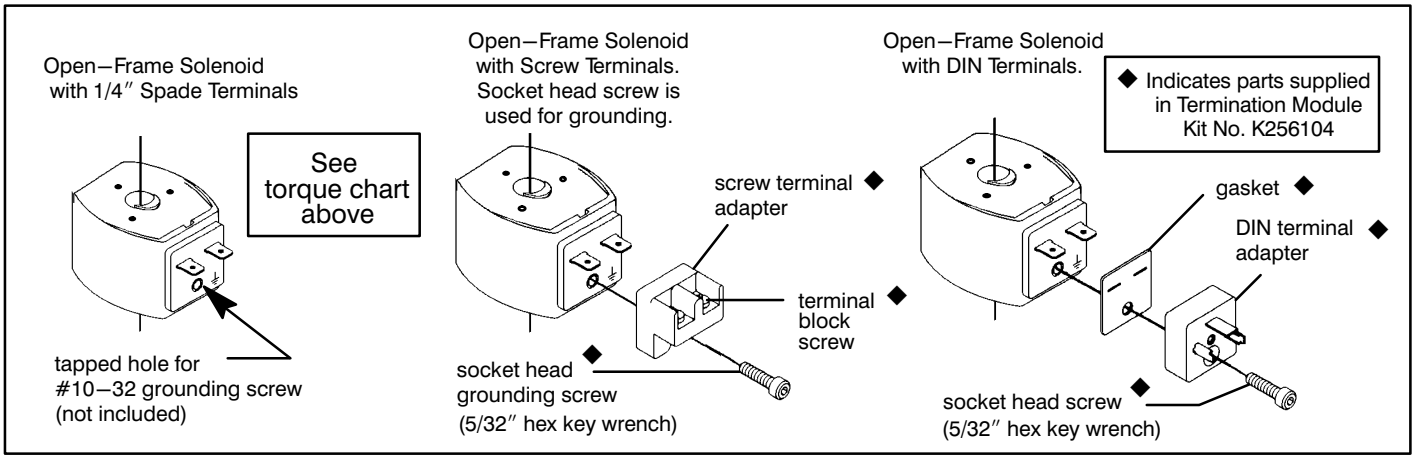


Figure 4. Open—frame solenoids

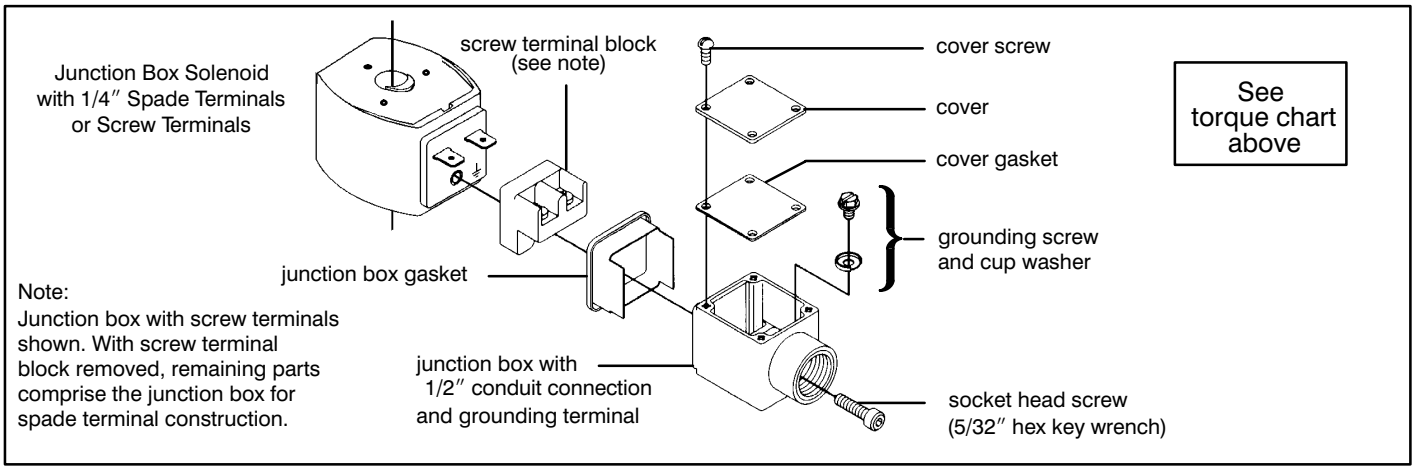


Figure 5. Junction box (optional feature)

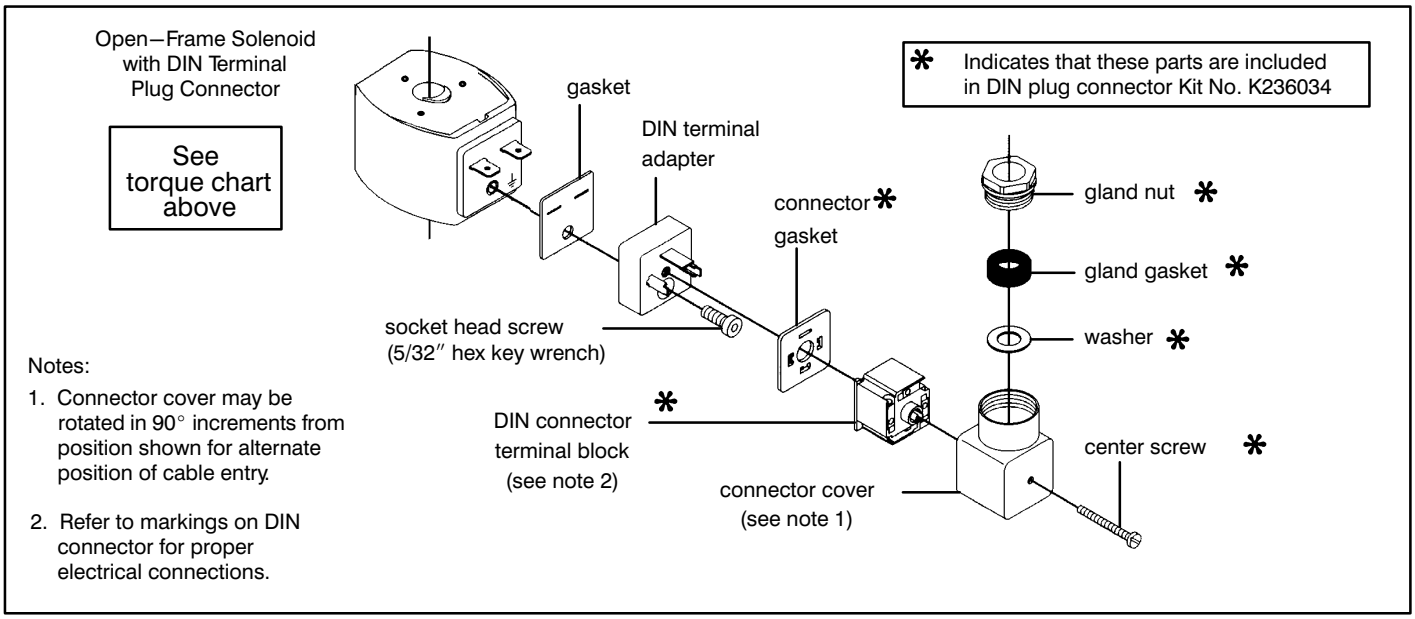


Figure 6. DIN plug connector kit No. K236034 (optional feature)

ASCO® 50 Hanover Road, Florham Park, New Jersey 07932 www.ascovalve.com

TECHNICAL INFORMATION

Installation, Operation and Maintenance
Balston® Compressed Air and Gas In-Line Filters

These instructions must be thoroughly read and understood before installing and operating this product. If you have any questions or concerns, please call the Technical Services Department at 800-343-4048, 8AM to 8PM Eastern Time. (In the UK, call 01622-676670. In Germany, call +49 551 5043319. For other locations, please contact your local representative.)

General

When properly installed on a compressed air or gas line, Balston in-line filters effectively remove oil, water, and particulate contamination from a gas supply. The quantity of oil and water and the size of the particulate contamination removed from a gas supply is dependent upon the grade of Balston filter cartridge installed in a Balston filter housing.

Warning: Do not expose filter assemblies with plastic or nylon components to solvents, alcohols, or glycols. Exposure to these materials could cause failure of the housing. Use only non-detergent mineral base oils with housings containing polycarbonate components. Use of any other types of oils could lead to dangerous failure of the product.

Filter Housing Installation

Filter housings are pressure vessels and all system connections and accessory outlets must be leak-tight. It is good practice to apply pipe sealant to the male threads before connecting the pipe to the filter ports. **For all stainless steel filters, a non-galling thread lubricant must be used on the threads of the filter bowl.** Any lubricant used must be compatible with the filtered media. The use of lubricant facilitates disassembly at a later time, if necessary.

The flow direction through the filter cartridge should be from the **inside-to-outside.** Some Balston filters have a flow arrow indicating the flow direction from inside-to-outside through the cartridge. Other Balston filters have numbered ports. The filters with numbered ports should be piped from Port 2 to Port 1 to provide inside-to-outside flow through the cartridge.

In coalescing applications, the flow of compressed gas through the filter cartridge should be from inside-to-outside. Suspended liquids will be coalesced throughout the cartridge and will drain from the outside of the cartridge into the bowl of the filter assembly. Accumulated liquids may be drained from the filter bowl by automatic or manual drains. For more details on coalescing filtration and liquid drains, request Literature Pack 1.

For slip stream or bypass sampling applications, the flow through the filter housing should be from Port 1 to Port 2 (outside-to-inside). For more details on slip stream or bypass sampling applications, request information on Balston Sample Filters (Literature Pack 2).

For liquid filtration using a Grade X, Q or H cartridge, the flow direction through the cartridge within the housing should be outside-to-inside (Port 1 to Port 2). In these applications, a support core should be installed to support the cartridge and maintain its structural integrity. See the Replacement Parts drawing for the support core designed to fit your particular housing.

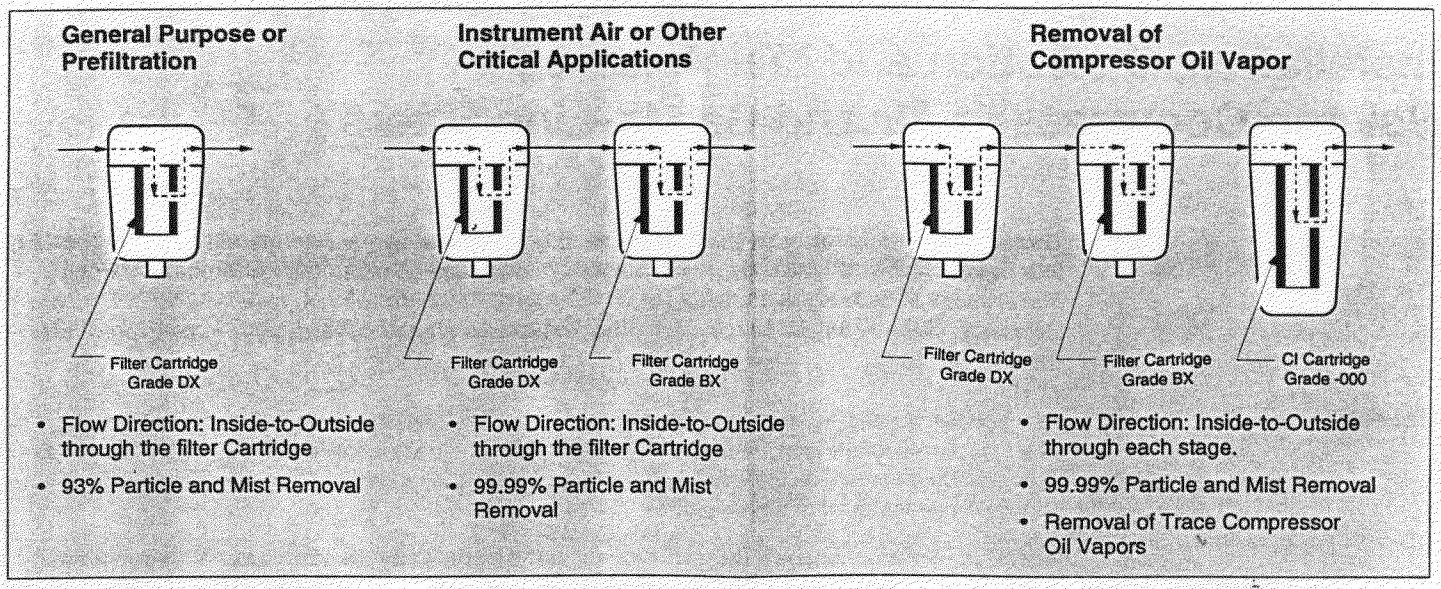
For installations where the compressed gas is sourced from an overhead line, the gas should be piped from the top of the header to the filter. In this way, excessive moisture and dirt are not gravity-fed to the Balston in-line filter. For installations in which long runs of piping carry filtered gas from the filter to the point of use, filters should be located as close to the point of use as possible to trap condensation and particulate which may have been picked up in the pipe.

Mounting bracket kits are available for most Balston filters. Some Balston filter assemblies may be pipe mounted if the size and weight of the housing and piping permit it. All fittings must be leak tight before applying gas pressure to the filter.

To avoid personal injury and/or property damage, factory installed bowl guards must remain on the filter assembly while in service.

Do not install Balston 900 Series, 94 Series, and 15/80 Series filter housings in corrosive environments.

The Schematic shows typical schematic installations for three commonly required coalescing applications in compressed air systems.



All installation and maintenance activities should be performed by suitable personnel using reasonable care. Turn off the compressed gas supply and depressurize the filter housing prior to performing routine maintenance.

Filter Cartridge Installation

Most Balston filter housings are ordered separately from Balston filter cartridges. Balston 900 Series coalescing filter assemblies (e.g., A912A-DX), however, are shipped from the factory with the filter cartridge installed. Balston 900 Series adsorbent filter assemblies (e.g., A912A-000) are shipped from the factory with the adsorbent filter packaged separately from the filter housing. The adsorbent cartridge must be installed into the housing prior to installing the housing on the compressed air line. This packaging procedure extends the life of the cartridge by preventing exposure to the atmosphere prior to initial use.

An adhesive-backed label indicating the grade of the filter cartridge is packed inside each box of filter cartridges. This label should be affixed to the filter housing when the first filter cartridge is installed. Using the cartridge grade label will help ensure that the correct filter cartridge is used when maintenance is performed on the housing. The date that the replacement cartridge is installed may be recorded, with a marking pen or grease pencil, on the filter housing label; to provide a ready reference for scheduling routine maintenance.

Balston Microfibre® filter cartridges are sealed in place by compression against a flat surface. Gaskets are not required between the filter cartridge and the filter housing. The filter cartridge is centered by guides on the housing which fit the inside diameter of the cartridge at each end. In most Balston housing designs, the filter cartridge is sealed by tightening a threaded element retainer on a tie rod. Do not use excessive force or tools on the element retainer. The filter cartridge is securely sealed by tightening the element retainer 1-1/2 to 2 turns after it first contacts the filter cartridge. (**Note:** In high flow, multi-cartridge housings, it may be necessary to tighten the element retainer 3 to 4 turns after contact with the filter cartridge.)

⚠ **Always replace the filter bowl guard, when applicable, after servicing the Balston filter.**

Filter Cartridge Life

The efficiency of the Balston Microfibre filter cartridge is relatively unaffected by liquids entrained in the compressed air or gas stream. The life of the filter cartridge is determined by the increase in flow resistance caused by solids trapped within the depth of the filter cartridge. The change in pressure through the filter cartridge should be monitored while the filter is in use. The filter cartridge should be changed when the flow through the housing falls below an acceptable level, or when the pressure drop becomes too high for the application. In any case, **the filter cartridge should be changed when the pressure drop reaches 5-7 psid**. (**Note:** The Balston Microfibre filter cartridge cannot be cleaned by back-flushing because the solids are trapped within the depth of the cartridge, not on the surface.)

⚠ **Failure of the filter cartridge resulting from a high pressure drop or excessive solids loading may cause damage to the filter housing and/or any downstream equipment.**

Operation and Maintenance

In many applications, the pressure drop through the filter assembly may be measured using two pressure gauges, one directly upstream from the filter assembly, and one directly downstream from the filter assembly. In compressed air filtration, however, the pressure drop through the filter assembly is difficult to measure in this way because of inaccuracies in the pressure gauges and rapid fluctuations in system pressure. For monitoring pressure drop through a compressed air filter assembly, Whatman offers a differential pressure indicator. Please refer to Product Bulletins PK1-11, PK1-12 for more details on the Balston Differential Pressure Indicator.

Ordering Replacement Filter Cartridges

Some Balston filter assemblies have filter cartridges installed when shipped from the factory. If filter cartridges are being ordered separately, either as replacements for an existing assembly or as an original for a new installation, specify both the size and grade of the filter cartridge. Filter cartridges for compressed air and gas filter assemblies are available in boxes of 3 (except X-Grade), 5, or 10. The size of the filter is designated by a three-digit number followed by a two digit number (e.g., 100-12, 150-19, 200-80). The retention efficiency of the filter is designated by a series of letters or numbers following the size designation (e.g., 100-12-DQ, 150-19-BX, 200-80-BH).

Ordering Filter Assembly Replacement Parts

An assembly drawing and a replacement parts list are included with each filter housing. When ordering replacement parts, order by part number and description, as detailed on the replacement parts drawing shipped with the filter. Inspect all seals when changing filter cartridges and replace as needed. Lubricate all replacement seals prior to installation. Use a lubricant which is compatible with the gas being filtered.

Accessories

Automatic Float Drains

If the filter housing is equipped with an automatic float drain, the drain is installed at the factory.

Float drains are available on select assemblies with DX or BX cartridges. They are not available for assemblies with grade CI adsorbent cartridges, grade SA sterile air cartridges, or with the smaller volume housings.

If the filter housing is not equipped with a drain, Whatman offers several different drain assemblies which may be integrated into the housing. See Product Literature Pack 1 or contact your local stocking representative for details.

Differential Pressure Indicators (DPI)

Several Balston Compressed Air Filter Assemblies are shipped with Differential Pressure Indicators (DPIs) installed. The DPI monitors the pressure drop across the filter, and may be used to measure pressure drop across other components in the compressed air system. Differential Pressure Indicators may also be purchased as accessories for other Balston filter assemblies. Balston offers two different models of DPIs: 41-071 and 41-082. More information on these products may be found in Literature Pack 1.

Connect the indicator to the HIGH (upstream) and LOW (downstream) sides of the line as indicated by the marking on the indicator. Some typical installations are illustrated on the last page.

The Balston Differential Pressure Indicators give a quick visual indication of the pressure drop in the line. It is not intended to be an accurate pressure gauge.

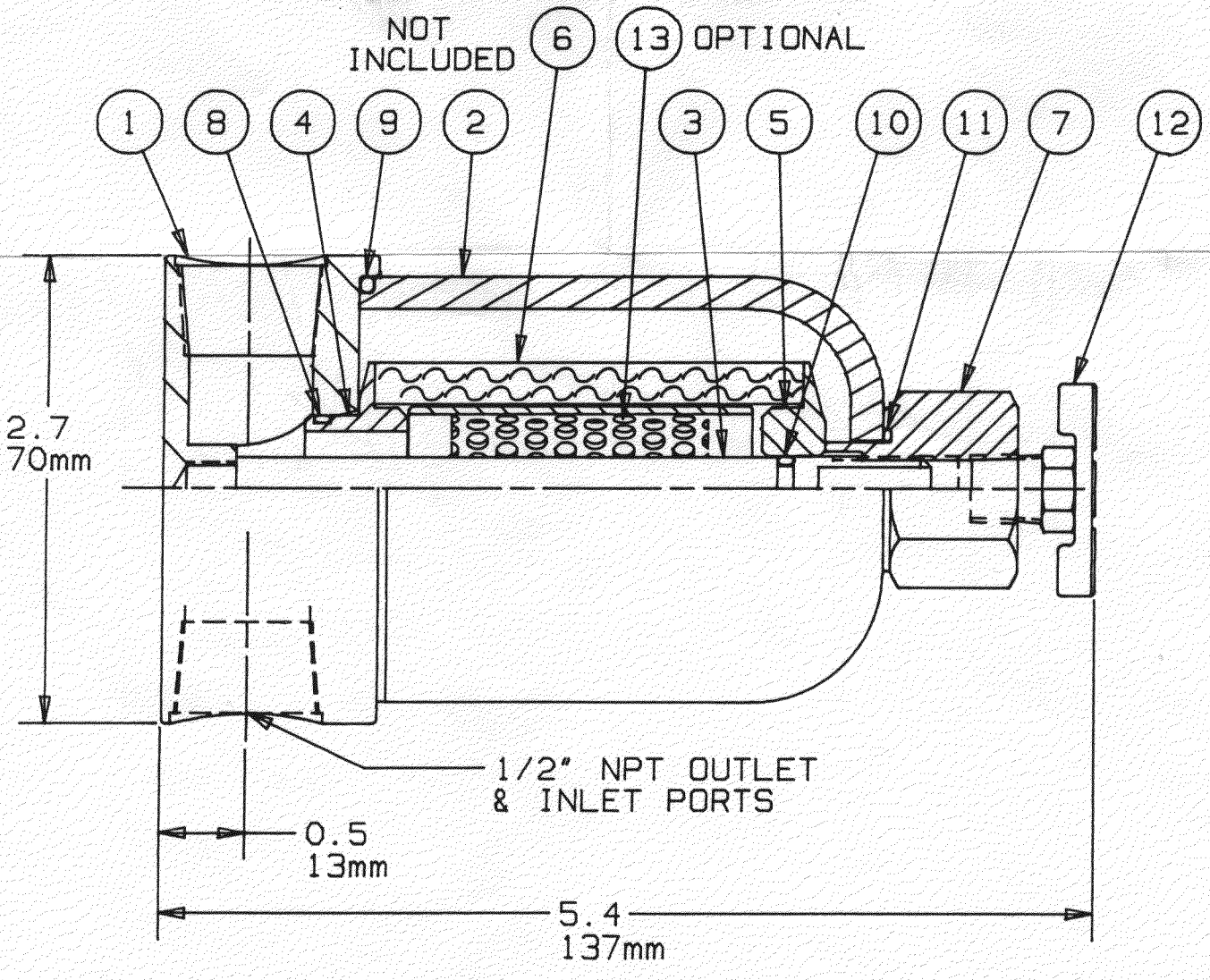
Ordering Information

Model	Ports	Maximum Pressure	Maximum Temperature
41-071	1/8" NPT	250 psig	130°F (54°C)
41-082	3/8"-24 UNF	300 psig	150°F (65°C)

REPLACEMENT PARTS FOR TYPE 92-812A				
ITEM	DESCRIPTION	PART NO.	MAT'L	⊕
1	HEAD	92712	ALUM.	
2	BOWL	92910	ALUM.	
3	TIEROD	92720	ST.STL	
4	HEAD ADAPTER	92410	ALUM.	
5	ELEMENT RETAINER	92730	ALUM.	
6	FILTER TUBE	100-12-[]	----	
7	TIENUT	92745	ALUM.	
8,9, 10,11	SEAL SET	22082	BUNA	
8,9, 10,11	SEAL SET	22083	VITON	⊕
12	DRAIN VALVE	20120	BRA/STL	
13	SUPPORT CORE	SS-100-12	ST.STL.	⊕
--	MOUNTING BRACKET KIT	11038	STL/PLD	⊕

[] SPECIFY FILTER TUBE GRADE ⊕ = OPTIONAL PARTS

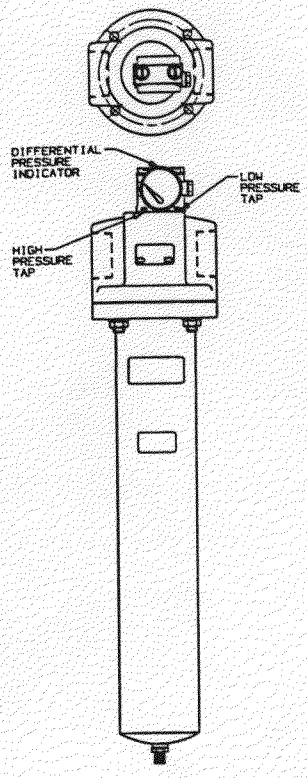
ORDER BY PART NUMBER AND DESCRIPTION



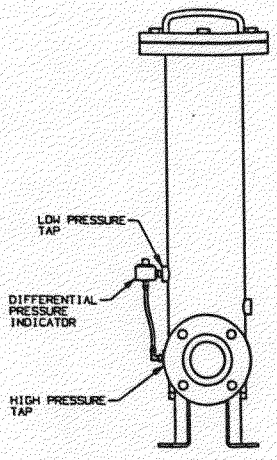
Whatman®

Whatman Inc
260 Neck Rd., Box 8223
Haverhill, MA 01835-0723
800-343-4048 or 508-374-7400
Fax: 508-374-7070

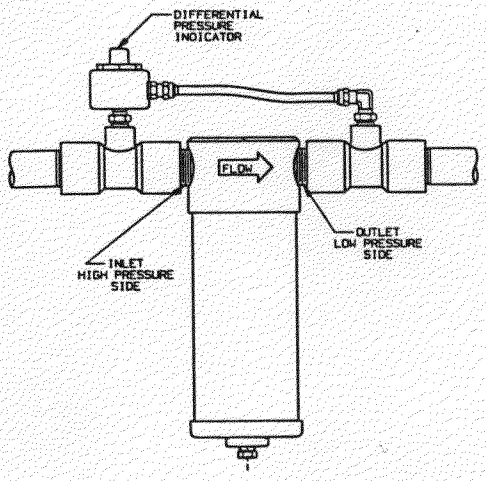
Whatman Canada Ltd
2495 Haines Rd.
Mississauga
Ontario L4Y 1Y7
905-272-1516



MODEL A15/80



K-SERIES



TYPICAL LINE MOUNTING

Whatman BALSTON®

Whatman Inc
100 Ames Pond Drive, P.O. Box 1262
Tewksbury, MA 01876-0962
800-343-4048 or 978-858-0505 Fax: 978-858-0625

Whatman Canada Ltd
2851 Brighton Road
Oakville, Ontario L6H 6C9
905-277-0331

Whatman International Ltd
Springfield Mill, James Whatman Way
Maidstone, Kent ME14 2LE, England
Tel: +44 (01622) 692022 Fax: +44 (01622) 691425

Magnehelic® Differential Pressure Gage

OPERATING INSTRUCTIONS

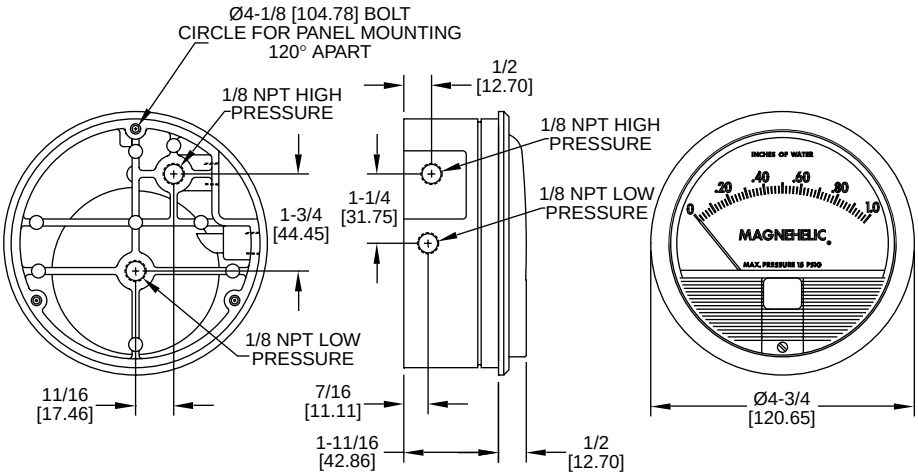
SPECIFICATIONS

Dimensions: 4-3/4″ dia. x 2-3/16″ deep.
Weight: 1 lb. 2 oz.
Finished: Baked dark gray enamel.
Connections: 1/8″ NPT high and low pressure taps, duplicated, one pair side and one pair back.
Accuracy: Plus or minus 2% of full scale, at 70°F. (Model 2000-0, 3%; 2000-00, 4%).
Pressure Rating: 15 PSI (0,35 bar)
Ambient Temperature Range: 20° to 140°F (-7 to 60°C).
Standard gage accessories include two 1/8″ NPT plugs for duplicate pressure taps, two 1/8″ NPT pipe thread to rubber tubing adapters, and three flush mounting adapters with screws.

Caution: For use with air or compatible gases only.

For repeated over-ranging or high cycle rates, contact factory.

Not for use with Hydrogen gas. Dangerous reactions will occur.



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Fax: 219/872-9057
Lit-by-Fax: 888/891-4963

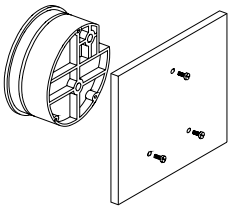
www.dwyer-inst.com
e-mail: info@dwyer-inst.com

MAGNEHELIC® INSTALLATION

1.Select a location free from excessive vibration and where the ambient temperature will not exceed 140°F. Also, avoid direct sunlight which accelerates discoloration of the clear plastic cover. Sensing lines my be run any necessary distance. Long tubing lengths will not affect accuracy but will increase response time slightly. Do not restrict lines. If pulsating pressures or vibration cause excessive pointer oscillation, consult the factory for ways to provide additional damping.

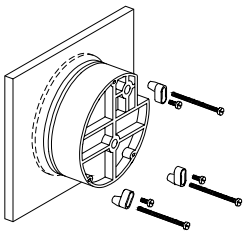
2. All standard Magnehelic gages are calibrated with the diaphragm vertical and should be used in that position for maximum accuracy. If gages are to be used in other than vertical position, this should be specified on the order. Many higher range gages will perform within tolerance in other positions with only rezeroing. Low range Model 2000-00 and metric equivalents must be used in the vertical position only.

3. Surface Mounting



Locate mounting holes, 120° apart on a 4-1/8″ dia. circle. Use No. 6-32 machine screws of appropriate length.

4. Flush Mounting



Provide a 4-9/16″ dia. opening in panel. Insert gage and secure in place with No. 6-32 machine screws of appropriate length, with adapters, firmly secured in place. To mount gage on 1-1/4″-2″ pipe, order optional A-610 pipe mounting kit.

5. To zero the gage after installation

Set the indicating pointer exactly on the zero mark, using the external zero adjust screw on the cover at the bottom. Note that the zero check or adjustment can only be made with the high and low pressure taps both open to atmosphere.

Operation

Positive Pressure: Connect tubing from source of pressure to either of the two high pressure ports. Plug the port not used. Vent one or both low pressure ports to atmosphere.

Negative Pressure: Connect tubing from source of vacuum or negative pressure to either of the two low pressure ports. Plug the port not used. Vent one or both high pressure ports to atmosphere.

Differential Pressure: Connect tubing from the greater of two pressure sources to either high pressure port and the lower to either low pressure port. Plug both unused ports.

When one side of the gage is vented in dirty, dusty atmosphere, we suggest an A-331 Filter Vent Plug be installed in the open port to keep inside of gage clean.

A. For portable use of temporary installation use 1/8″ pipe thread to rubber tubing adapter and connect to source of pressure with rubber or Tygon tubing.

B. For permanent installation, 1/4″ O.D., or larger, copper or aluminum tubing is recommended. See accessory bulletin S-101 for fittings.

Ordering Instructions:

When corresponding with the factory regarding Magnehelic® gage problems, be sure to include model number, pressure range, and any special options. Field repair is not recommended; contact the factory for repair service.

MAINTENANCE

Maintenance: No lubrication or periodic servicing is required. Keep case exterior and cover clean. Occasionally disconnect pressure lines to vent both sides of gage to atmosphere and re-zero. Optional vent valves, (bulletin S-101), should be used in permanent installations.

Calibration Check: Select a second gage or manometer of known accuracy and in an appropriate range. Using short lengths of rubber or vinyl tubing, connect the high pressure side of the Magnehelic gage and the test gage to two legs of a tee. Very slowly apply pressure through the third leg. Allow a few seconds for pressure to equalize, fluid to drain, etc., and compare readings. If accuracy unacceptable, gage may be returned to factory for recalibration. To calibrate in the field, use the following procedure.

Calibration:

1. With gage case, held firmly, loosen bezel, by turning counterclockwise. To avoid damage, a canvas strap wrench or similar tool should be used.
2. Lift out plastic cover and "O" ring.
3. Remove scale screws and scale assembly. Be careful not to damage pointer.
4. The calibration is changed by moving the clamp. Loosen the clamp screw(s) and move slightly toward the helix if gage is reading high, and away if reading low. Tighten clamp screw and install scale assembly.
5. Place cover and O-ring in position. Make sure the hex shaft on inside of cover is properly engaged in zero adjust screw.
6. Secure cover in place by screwing bezel down snug. Note that the area under the cover is pressurized in operation and therefore gage will leak if not properly tightened.
7. Zero gage and compare to test instrument. Make further adjustments as necessary.

Caution: If bezel binds when installing, lubricate threads sparingly with light oil or molybdenum disulphide compound.

Warning: Attempted field repair may void your warrenty. Recalibration or repair by the user is not recommended. For best results, return gage to the factory. Ship prepaid to:

Dwyer Instruments, Inc.

Attn: Repair Dept.

102 Indiana Highway 212

Michigan City, IN 46360

Trouble Shooting Tips:

•G*age won't indicate or is sluggish.*

1. Duplicate pressure port not plugged.
2. Diaphragm ruptured due to overpressure.
3. Fittings or sensing lines blocked, pinched, or leaking.
4. Cover loose or "O"ring damaged, missing.
5. Pressure sensor, (static tips, Pitot tube, etc.) improperly located.
6. Ambient temperature too low. For operation below 20°F, order gage with low temperature, (LT) option.

•Pointer stuck-gage can't be zeroed.

1. Scale touching pointer.
2. Spring/magnet assembly shifted and touching helix.

3. Metallic particles clinging to magnet and interfering with helix movement.

4. Cover zero adjust shaft broken or not properly engaged in adjusting screw.

We generally recommend that gages needing repair be returned to the factory. Parts used in various sub-assemblies vary from one range of gage to another, and use of incorrect components may cause improper operation. After receipt and inspection, we will be happy to quote repair costs before proceeding.

Consult factory for assistance on unusual applications or conditions.

Use with air or compatible gases only.

Printed in U.S.A. 4/01 FR# 12-440212-00 Rev. 3

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2. Lift out plastic cover and "O" ring.
3. Remove scale screws and scale assembly. Be careful not to damage pointer.
4. The calibration is changed by moving the clamp. Loosen the clamp screw(s) and move slightly toward the helix if gage is reading high, and away if reading low. Tighten clamp screw and install scale assembly.
5. Place cover and O-ring in position. Make sure the hex shaft on inside of cover is properly engaged in zero adjust screw.
6. Secure cover in place by screwing bezel down snug. Note that the area under the cover is pressurized in operation and therefore gage will leak if not properly tightened.
7. Zero gage and compare to test instrument. Make further adjustments as necessary.

Caution: If bezel binds when installing, lubricate threads sparingly with light oil or molybdenum disulphide compound.

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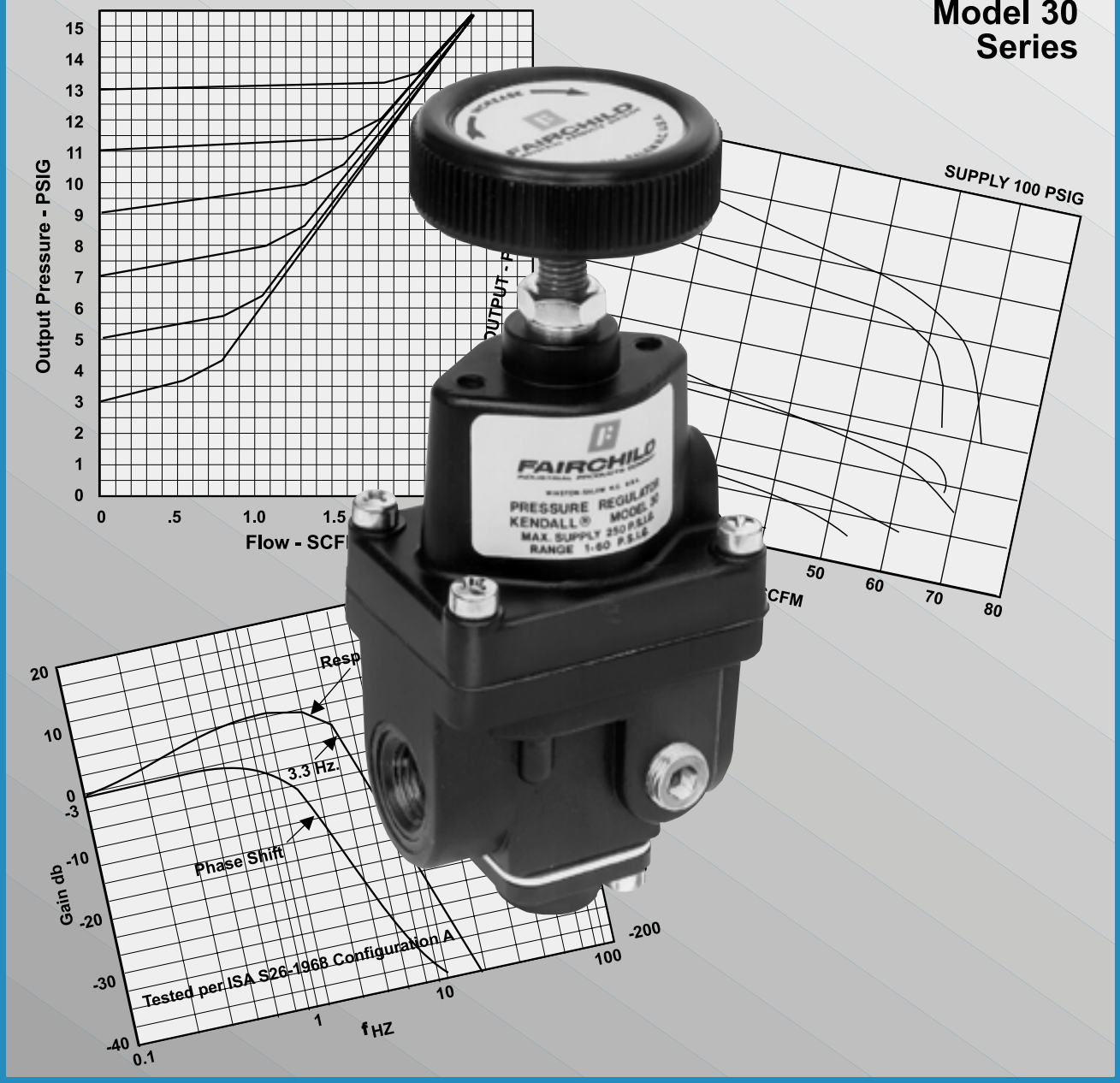
FAIRCHILD

MIDGET PRECISION REGULATOR

Model 30 Series



FAIRCHILD®

FAIRCHILD

INDUSTRIAL PRODUCTS COMPANY

GENERAL INFORMATION

MODEL 30 SERIES MIDGET PRECISION REGULATOR

APPLICATIONS

The Model 30 Series Midget Precision Regulator is designed for use in systems which require precision pressure control.

The combination of high capacity and compact size make the Model 30 Series an excellent choice for a wide range of precision applications including: Precise Control of Paper Machinery Felt Guides, Supply of a Precise Repeatable Signal to a Pneumatic Clutch, or Control of Cylinder Supply Pressure.

FEATURES

Performance

- The Model 30 Series is sensitive to 1/4" Water Column variation which permits use in precision processes.
- A Compensating Diaphragm allows the regulator to remain unaffected by supply pressure changes.

Functional

- Flow of up to 40 SCFM with 100 psig Supply allow use in applications with high flow requirements.

Physical

- A Separate Control Chamber and Aspirator Tube isolates the diaphragm from the main flow eliminating hunting and buzzing.
- Construction with Standard Removable Components allows in-line servicing.

OUTLINE DIMENSIONS

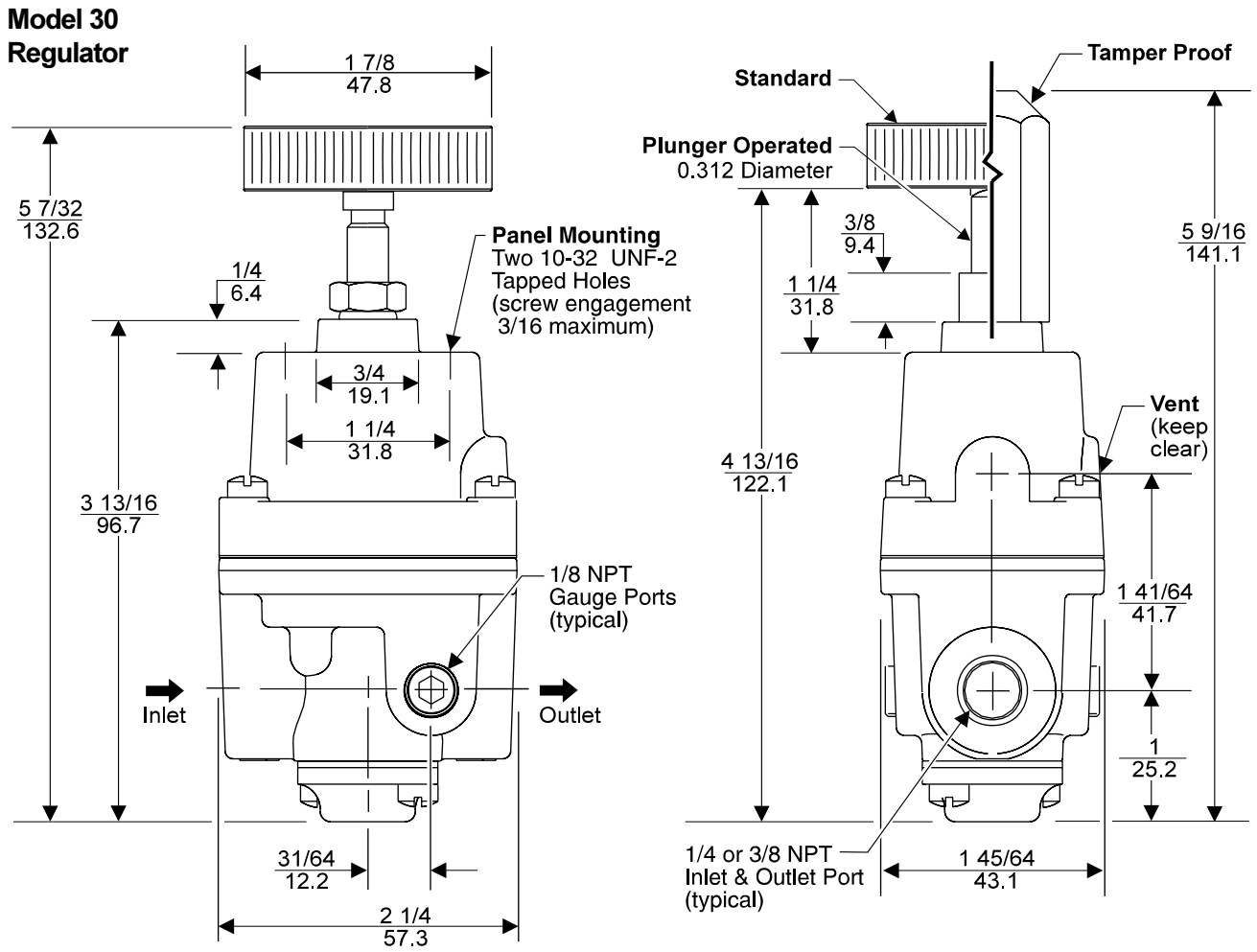


Figure 1. *Outline Dimensions.*

SPECIFICATIONS

FUNCTIONAL SPECIFICATIONS

Supply Pressure	250 psig, [17.0 BAR] (1700 kPa) Maximum
Flow Capacity (SCFM)	40 (68 m^3/HR) @ 100 psig, [7.0 BAR], (700 kPa) supply & 20 psig, [1.5 BAR], (150 kPa) setpoint.
Exhaust Capacity (SCFM)	2.0 (3.4 m^3/HR) where downstream pressure is 5 psig, [.35 BAR], (35 kPa) above 20 psig, [1.5 BAR], (150 kPa) setpt.
Ambient Temperature	-40° F to +200° F (-40° C to +93° C)

PERFORMANCE SPECIFICATIONS

Sensitivity	1/4" (.63 cm) Water Column.
Supply Pressure Effect	Less than 0.2 psig, [.014 BAR], (1.4 kPa) for 100 psig, [7.0 BAR], (700 kPa) change in supply pressure.

Materials of Construction

Body and Housing . . . . . Aluminum
Trim . . . . . Brass
Diaphragms . . . . . Nitrile on Dacron

CROSS SECTION

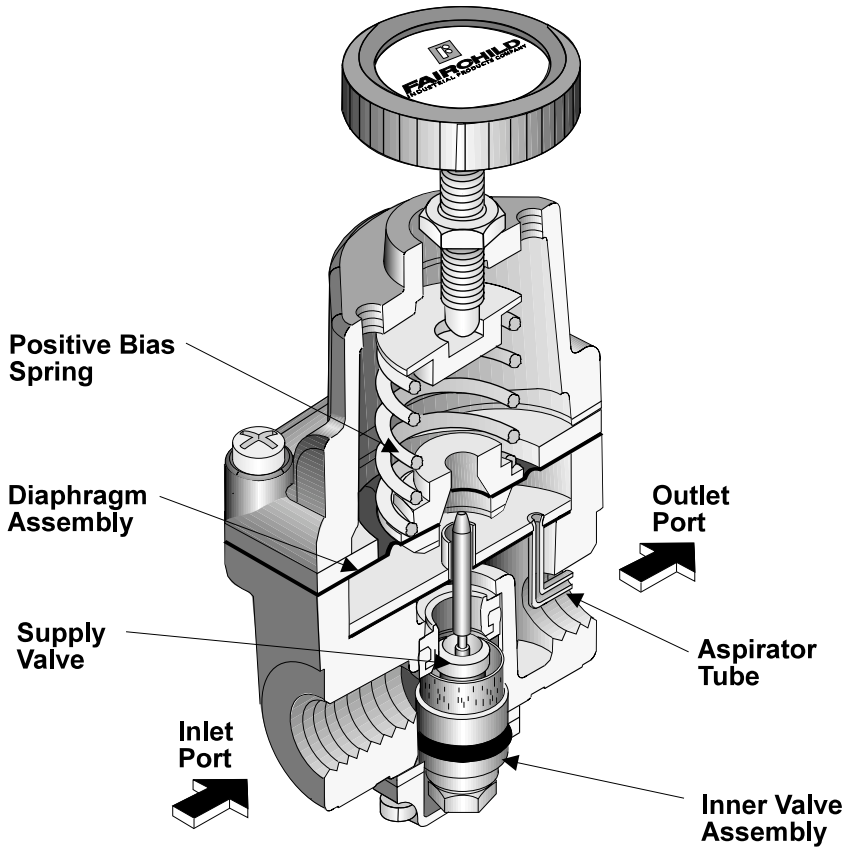


Figure 3. *Model 30 Detail Drawing.*

OPERATING PRINCIPLES

The Model 30 Regulator uses the force balance principal to control the movement of the valve assembly which in turn controls the output pressure. When the regulator is adjusted for a specific set point, the downward force of the Positive Bias Spring causes the Diaphragm Assembly to move downward. The Supply Valve opens and allows air to pass to the Outlet Port. As the set point is reached, the downward force exerted by the Positive Bias Spring is balanced by the upward force of the downstream pressure acting on the bottom of the Diaphragm Assembly. The resultant force moves the Supply Valve upward to reduce the flow of air to the Outlet Port.

Outlet pressure is maintained as a result of balance between forces acting on the top and bottom of the Diaphragm Assembly. For more information, see Figure 3. "Model 30 Detail Drawing" above.

INSTALLATION

For Installation Instructions refer to the *Fairchild Model 30 Midget Precision Regulator IOM,* **IS-10000030.**

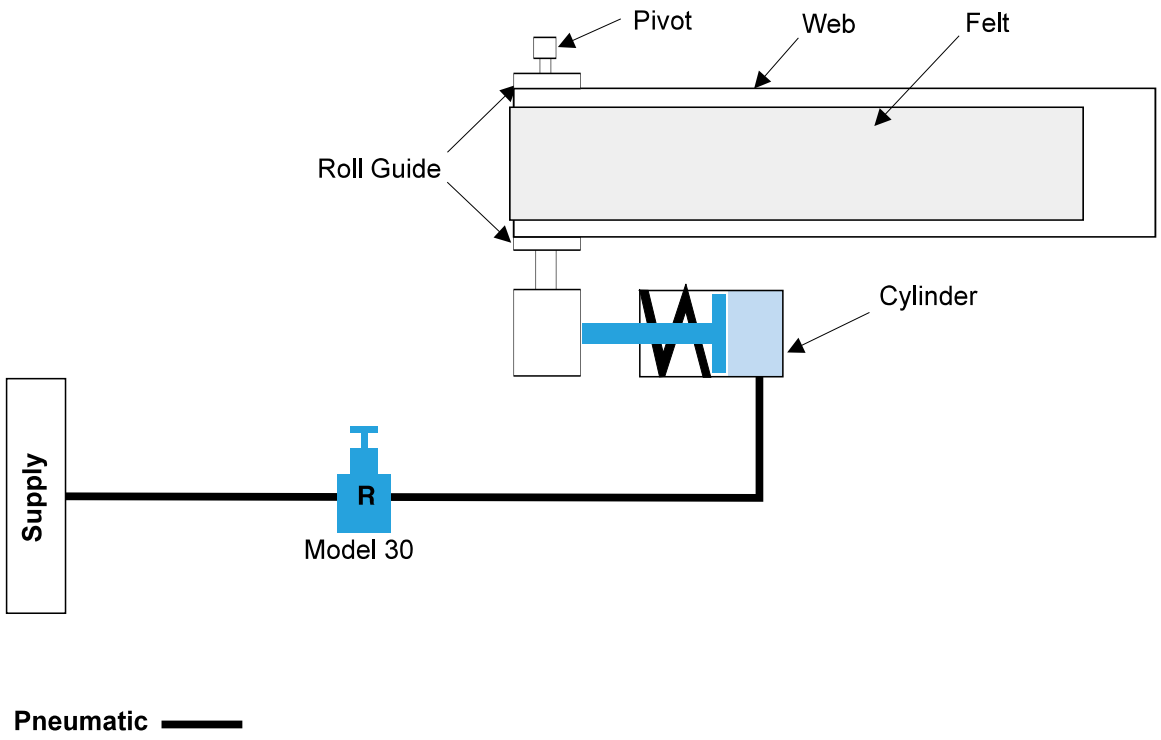


Figure 4. *Paper Machinery Felt Guide Application for the Model 30 Regulator.*

TYPICAL APPLICATIONS

The Model 30 Regulator is used to precisely control the position of a paper machinery felt guide. The roll guide on which the felt travels is attached to a pivot at the opposite end. Air is supplied to the inlet port of the Model 30 and the range screw is adjusted for a specific pressure input to the air cylinders.

The air cylinder piston is attached to a rod which exerts pressure against the roll guide axle. As the roll guide axle turns around the pivot, the web will move along the roll guide toward one side or the other as the air cylinder rod extends or retracts. Precise corrections are made by adjusting the regulator range screw. For more information, see Figure 4. “Paper Machinery Felt Guide Application for the Model 30 Regulator” above.

ORDERING INFORMATION

Catalog Number 3 0 2 ☐ ☐ ☐

Pressure Range

psig	[BAR]	(kPa)	
0-2	[0-0.1]	(0-15)	**(1)**
0-10	[0-0.7]	(0-70)	**(2)**
.5-30	[.03-2]	(3-200)	**(3)**
1-60	[0.1-4]	(10-400)	**(4)**
2-100	[0.1-7]	(15-700)	**(5)**

Pipe Size

1/4" NPT	**(2)**
3/8" NPT	**(3)**

Options

Compatability

		T	L	R	N	B	S	A	J	U	H
Tamper Proof	**(T)**	-	Y	N	Y	Y	N	Y	Y	Y	Y
Low Flow	**(L)**	Y	-	Y	N	N	Y	Y	Y	Y	Y
Plunger Operated [1]	**(R)**	N	Y	-	Y	Y	Y	Y	Y	Y	Y
Non-Relieving	**(N)**	Y	N	Y	-	N	Y	Y	Y	Y	Y
Low Bleed	**(B)**	Y	N	Y	N	-	Y	Y	Y	Y	Y
Screwdriver Adjust	**(S)**	N	Y	N	Y	Y	-	Y	Y	Y	Y
Silicone Elastomers [2]	**(A)**	Y	Y	Y	Y	Y	Y	-	N	Y	Y
Viton Elastomers	**(J)**	Y	Y	Y	Y	Y	Y	N	-	Y	Y
BSPT (Tapered)	**(U)**	Y	Y	Y	Y	Y	Y	Y	Y	-	N
BSPP (Parallel) [3]	**(H)**	Y	Y	Y	Y	Y	Y	Y	Y	N	-

Table 1. Plunger Operated Regulator.

Range	Push Rod Travel *(inches)*	Push Rod Thrust *(lbs.)*
0-2 psig	.244 ± 10%	3.2 ± 10%
0-10 psig	.344 ± 10%	15.7 ± 10%
0-30 psig	.333 ± 10%	47.0 ± 10%
0-60 psig	.395 ± 10%	94.0 ± 10%
0-100 psig	.354 ± 10%	157.0 ± 10%

[1] *Refer to Table 1. for Push Rod Travel and Thrust.*
[2] *Maximum Supply Pressure - 75 psig, [5.0 BAR], (500 kPa)*
[3] *BSPP Threads in Inlet & Outlet Ports Only. Others BSPT.*

ISO 9002 Certified

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Fisher Controls

Instruction Manual

Type 67, 67H, 67HR, 67R, 67SS, and 67SSR Regulators Without Filters

FISHER

Form 5040

Introduction

Scope of Manual

This manual describes and provides instructions and parts lists for the Type 67, 67H, 67HR, 67R, 67SS, and 67SSR regulators without filters. These regulators usually are shipped separately for line or panel mounting, although sometimes they are shipped installed on other equipment. Instructions and parts lists for other equipment, as well as for other 67 Series regulators not covered in this manual, are found in separate manuals.

Product Description

Type 67, 67H, 67HR, 67R, 67SS, and 67SSR self-operated, small-volume regulators (figure 1) provide constant reduced pressures in a variety of applications. Although most of these regulators may be used only with air or other gases, or certain liquefied gases, those with brass or stainless steel bodies additionally may be used for water and similar liquid service.

A Type 67HR, 67R, or 67SSR regulator has an integral low-capacity internal relief valve. In these constructions, the stem seats against a soft-seated orifice in the diaphragm assembly. A downstream pressure increase above the outlet pressure setting moves the diaphragm assembly off the stem, venting the excess pressure through a hole drilled or tapped in the spring case.

Specifications

Table 1 gives some general Type 67, 67H, 67HR, 67R, 67SS, and 67SSR regulator ratings and other specifications. A label on the spring case gives the recommended and actual control spring range for a given regulator as it comes from the factory.

TYPE 67 OR 67R REGULATOR WITH HANDWHEEL AND SPRING CASE FOR 3-HOLE PANEL MOUNTING

STANDARD TYPE 67H OR 67HR REGULATOR WITH PRESSURE GAUGE

TYPE 67SS OR 67SSR REGULATOR WITH CLOSING CAP

Figure 1.Type 67, 67H, 67HR, 67R, 67SS, and 67SSR Regulators Without Filters

D100250 X012

Table 1. Specifications

TYPE NUMBER DESCRIPTION	**Type 67:** Regulator with aluminum body and spring case **Type 67R:** Type 67 with internal relief **Type 67H:** Regulator with brass body and spring case **Type 67HR:** Type 67H with internal relief **Type 67SS:** Regulator with stainless steel body and 1/4-inch NPT tapped stainless steel spring case **Type 67SSR:** Type 67SS with inter nal relief
BODY SIZE AND END CONNECTION STYLE	1/4-inch NPT screwed
MAXIMUM ALLOWABLE INLET PRESSURE(1)	**Type 67 or 67R Regulator:** 250 psig (17 bar) **Type 67H, 67HR, 67SS, or 67SSR Regulator:** 400 psig (28 bar)
OUTLET PRESSURE RANGES	3 to 100 psig (0.21 to 6.9 bar) with the springs shown in parts list key 9
MAXIMUM EMERGENCY OUTLET PRESSURE(1)	50 psig (3.4 bar) over outlet pressure setting, or 100 psig (7.6 bar), whichever is greater
INTERNAL RELIEF PERFORMANCE (TYPE 67HR, 67R, OR 67SSR REGULATOR ONLY)	Low capacity for seat leakage only; external relief valve must be provided if inlet pressure can exceed maximum emergency outlet pressure
TEMPERATURE CAPABILITIES(1)	**Nitrile Parts:** -20°F to 150°F (-29°C to 66°C) **Fluoroelastomer Parts:** 0°F to 350°F (-18°C to 177°C)
PRESSURE REGISTRATION	Internal

1. The pressure/temperature limits in this manual and any applicable code or standard limitation, must not be exceeded.

Installation

WARNING

Personal injury, property damage, equipment damage, or leakage due to escaping gas or bursting of pressure-containing parts may result if this regulator is overpressured or is installed where service conditions could exceed the limits given in table 1, or where conditions exceed any ratings of the adjacent piping or piping connections. To avoid such injury or damage, provide pressure-relieving or pressure-limiting devices (as required by the appropriate code, regulation, or standard) to prevent service conditions from exceeding those limits. A Type 67HR, 67R, or 67SSR regulator, because of its low-capacity internal relief, does provide very limited downstream overpressure protection, but it should not be considered complete protection against overpressure.

Additionally, physical damage to the regulator could cause personal injury or property damage due to escaping gas. To avoid such injury or damage, install the regulator in a safe location.

Regulator operation within ratings does not preclude the possibility of damage from debris in the lines or from external sources. A regulator should be inspected for damage periodically and after any overpressure condition.

Note

If the regulator is shipped mounted on another unit, install that unit according to the appropriate instruction manual.

1. Only personnel qualified through training and experience should install, operate, and maintain a regulator. For a regulator that is shipped separately, make sure that there is no damage to, or foreign material in, the regulator. Also ensure that all tubing and piping have been blown free.

2. Install the regulator so that flow through it is from IN to OUT as marked on the regulator body. Panel-mounting cutout dimensions are shown in figure 2 for a Type 67, 67H, 67HR, or 67R regulator and in figure 3 for a Type 67SS or 67SSR regulator.

WARNING

A regulator may vent some gas to the atmosphere. In hazardous or flammable gas service, vented gas may accumulate and cause personal injury, death, or property damage due to fire or explosion. Vent a regulator in hazardous gas service to a remote, safe location away from air intakes or any hazardous area. The vent line or stack opening must be protected against condensation or clogging.

3. A clogged spring case vent hole may cause the regulator to function improperly. To keep this vent hole from being plugged (and to keep the spring case from collecting moisture, corrosive chemicals, and other foreign material) orient the vent to the lowest possible point on the spring case or otherwise protect it. Inspect the vent hole regularly to make sure it has not been plugged. Spring case vent hole orientation may be changed by rotating the spring case with respect to the regulator body. A Type 67, 67H, 67HR, 67R, 67SS, or 67SSR regulator with a tapped spring case may be remotely vented by first removing the vent screen if used (key 47, figure 3) and installing obstruction-free tubing or piping into the 1/4-inch NPT vent tapping. Provide protection on a remote vent by installing a screened vent cap into the remote end of the vent pipe.

4. For use in regulator shutdown, install upstream and downstream vent valves or provide some other suitable means of properly venting the regulator inlet and outlet pressures.

5. If using pipe, apply a good grade of pipe compound to the pipe threads before making the connections.

6. Install tubing or piping into the 1/4-inch NPT inlet connection on the body assembly (key 1, figure 2 or 3) and also into the 1/4-inch NPT outlet connection, unless this connection already has been factory-piped to another unit.

Startup and Adjustment

Key numbers are referenced in figure 2 for a Type 67, 67H, 67HR, or 67R regulator and in figure 3 for a Type 67SS or 67SSR regulator.

1. With proper installation completed and downstream equipment properly adjusted, slowly open the upstream and downstream shutoff valves while using pressure gauges to monitor pressure.

2. Regulator outlet pressure may be monitored on a gauge installed at some point downstream from the regulator. Or, outlet pressure may be monitored on a gauge (key 21, not shown) installed on the body of a regulator with a tapped side outlet. If the regulator has no gauge but the side outlet is tapped and plugged, the pipe plug (key 21, figure 3) may be removed and a gauge temporarily installed for monitoring.

WARNING

To avoid personal injury, property damage, or equipment damage caused by bursting of pressure containing parts or explosion of accumulated gas, never adjust the control spring to produce an outlet pressure higher than the upper limit of the outlet pressure range for that particular spring. If the desired outlet pressure is not within the range of the control spring, install a spring of the proper range according to the diaphragm parts maintenance procedure.

Note

Each regulator is factory-set for the pressure setting specified on the order. If no setting was specified, outlet pressure was factory-set at the midrange of the control spring.

3. If outlet pressure adjustment is necessary, monitor outlet pressure with a gauge during the adjustment procedure. A standard Type 67, 67H, 67HR, 67R, 67SS, or 67SSR regulator is adjusted by loosening the locknut (key 11, if used) and turning the adjusting screw or handwheel (key 10) clockwise to increase, or counterclockwise to decrease, the outlet pressure setting. Then tighten the locknut (if used) to maintain the adjustment position. On some regulators, a closing cap (key 28, figure 3) must be removed before adjustment and replaced afterward.

Shutdown

First close the nearest upstream shutoff valve and then close the nearest downstream shutoff valve to vent the regulator properly. Next, open the vent valve between the regulator and the downstream shutoff valve nearest to it. All pressure between these shutoff valves will be released through the open vent valve, since a Type 67, 67H, 67HR, 67R, 67SS, or 67SSR regulator remains open in response to the decreasing downstream pressure.

Maintenance

Regulator parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement of parts depends upon the severity of service conditions and upon applicable codes and government regulations.

If used, the inlet screen assembly (key 24, figure 3) may need to be cleaned periodically.

WARNING

To avoid personal injury, property damage, or equipment damage caused by sudden release of pressure or explosion of accumulated gas, do not attempt any maintenance or disassembly without first isolating the regulator from system pressure and relieving all internal pressure from the regulator.

Note

If sufficient clearance exists, the body assembly (key 1) may remain mounted in a line or panel or on other equipment unless the inlet screen assembly (key 24 if used, figure 3) needs to be cleaned or replaced or the entire regulator will be replaced.

Unless otherwise noted, key numbers are referenced in figure 2 for a Type 67, 67H, 67HR, or 67R regulator and in figure 3 for a Type 67SS or 67SSR regulator.

Trim Parts

1. Remove the body plug (key 3) to let the plug spring (key 6), plug spring seat (key 5), and plug/stem assembly (key 4) drop freely from the body.

2. Inspect the removed parts and body plug gasket (key 23, figure 2) or body plug O-ring (key 23, figure 3), replace as necessary, and make sure the plug seating surfaces are free from debris.

3. Install the body plug gasket (key 23, figure 2) or body plug O-ring (key 23, figure 3) over the body plug (key 3).

4. Stack the plug spring (key 6), plug spring seat (key 5), and plug/stem assembly on the body plug (key 3), and install the body plug with stacked parts into the body assembly (key 1).

Diaphragm Parts

1. Remove the closing cap if used (key 28, figure 3), loosen the locknut if used (key 11), and back out the adjusting screw or handwheel (key 10) until compression is removed from the control spring (key 9).

2. Remove the machine screws (key 12) and separate the spring case (key 2) from the body assembly (key 1). Remove the control spring seat and control spring (keys 8 and 9).

3. Remove the diaphragm assembly (key 7) and inspect the diaphragm.

4. Install the diaphragm assembly (key 7) and push down on it to see if the plug/stem assembly (key 4) strokes smoothly and approximately 1/16 inch (2 mm).

Note

In step 5, if installing a control spring of a different range from the one that was removed, be sure to delete the spring range originally appearing on the control spring label (key 20, not shown) and indicate the new spring range.

5. Sparingly apply Never-Seez(1) lubricant (key 46, figure 3) or equivalent to the control spring seat (key 8). Stack the control spring and control spring seat (keys 9 and 8) onto the diaphragm assembly (key 7).

6. Install the spring case (key 2) on the body assembly (key 1) with the vent hole oriented to prevent clogging or entrance of moisture. Install the machine screws (key 12) and torque to 5 to 7 foot-pounds (7 to 9 N•m).

7. When all maintenance is complete, refer to the startup and adjustment section to put the regulator back into operation and adjust the pressure setting. Tighten the locknut if used (key 11).

8. With a Type 67SS or 67SSR regulator, install a replacement closing cap gasket (key 32, figure 3) if necessary.

9. Install the closing cap if used (key 28, figure 3).

Parts Ordering

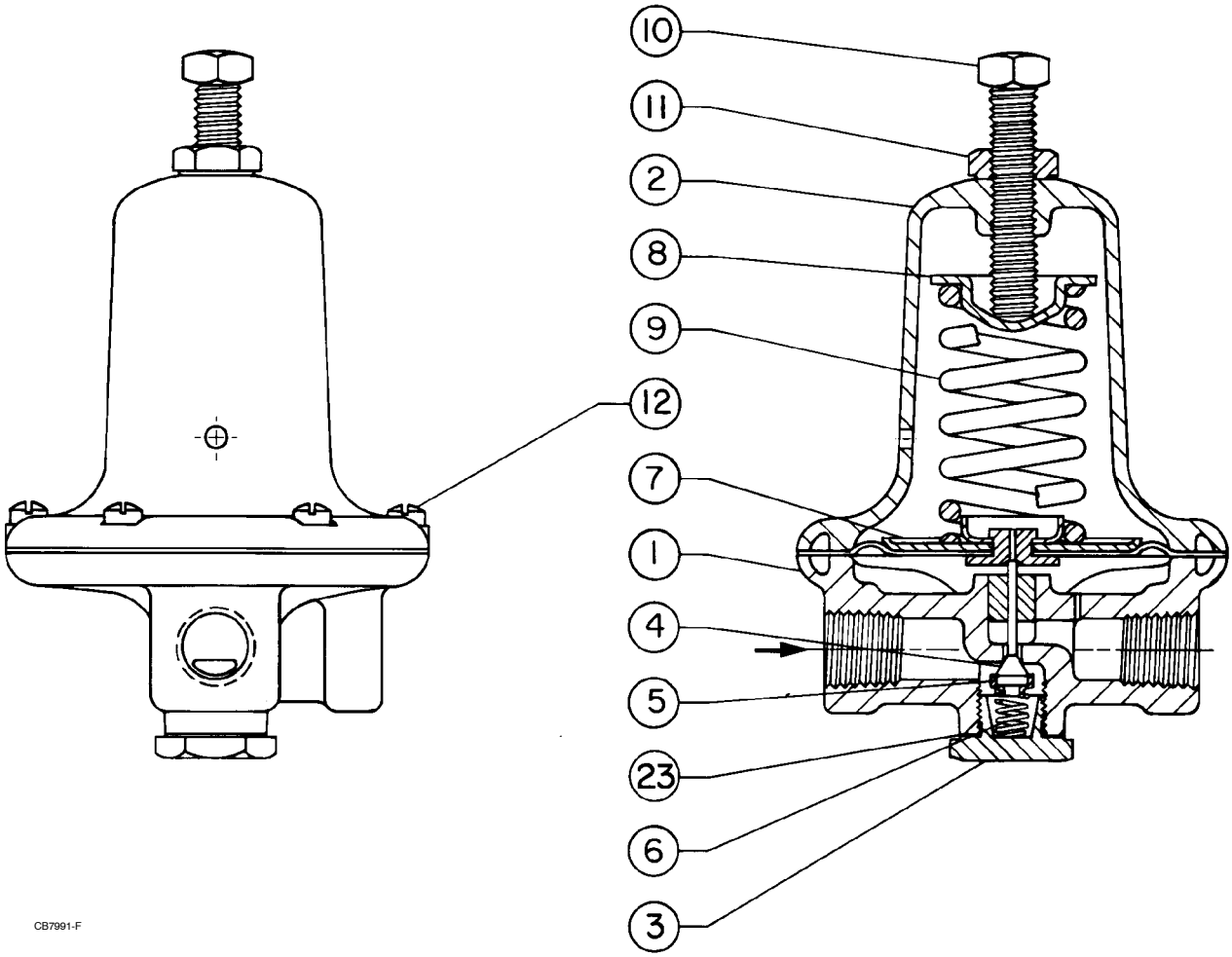
When corresponding with the Fisher sales office or sales representative about this regulator, include the type number and all other pertinent information stamped on the bottom of the body and on the control spring label. Specify the eleven-character part number when ordering new parts from the following parts list.

1. Trademark of Never-Seez Corp.

Parts List (figure 2 and 3)

Key	Description	Part Number
	Parts Kits (included are keys 4, 5, 6, 7, and 23)	
	W/nitrile & nonbrass parts to provide sour gas corrosion resistance capability[1]	
	For Type 67 regulator w/o internal relief	R67 X0000N12
	For Type 67R regulator w/ internal relief	R67R X000N12
	W/nitrile & nonbrass parts for other than sour gas corrosion resistance applications	
	For Type 67SS regulator w/o internal relief	R67SS X00012
	For Type 67SSR regulator w/ internal relief	R67SSR X0012
	W/nitrile & brass parts for other than sour gas corrosion resistance applications	
	For Type 67 or 67H regulator w/o internal relief	R67 X0000012
	For Type 67HR or 67R regulator w/internal relief	R67R X000012
1	Body Assembly	
	For Type 67 or 67R	
	To provide sour gas corrosion resistance capability, aluminum w/316 stainless steel bushing	
	One outlet	1B7971 X0212
	Two outlets	1B7971 X0202
	For other than sour gas corrosion resistance applications	
	Aluminum w/brass bushing	
	One outlet	1B7971 000C2
	Two outlets	1B7971 000E2
	Aluminum w/stainless steel bushing	
	One outlet	1B7971 000D2
	Two outlets	1B7971 000F2
	For Type 67H or 67HR, brass w/brass bushing	
	One outlet	1B7971 000A2
	Two outlets	1B7971 000B2
	For Type 67SS or 67SSR, stainless steel with stainless steel bushing	1B7971 X0222
2	Spring Case	
	For Type 67 or 67R	
	W/drilled-hole vent, aluminum	2B7974 08012
	W/1/4-inch NPT vent tapping	
	To provide sour gas corrosion resistance capability, aluminum	25A6220 X012
	For other than sour gas corrosion resistance applications, brass	
	W/o closing cap	1E1674 000A2
	W/closing cap	10A3075 X012
2	Spring Case (Continued)	
	For 1-hole panel mtg. aluminum	20B0667 X012
	For 3-hole panel mounting	
	Prepainted zinc w/stainless steel bushing	
	Right-hand thread	3B9855 T0022
	Left-handed thread	3L2230 000A2
	Brass w/o bushing	11A4695 X012
	For Type 67H or 67HR	
	W/drilled-hole vent, brass	1D5205 13012
	W/1/4-inch NPT vent tapping, brass	1E1674 000A2
	For 1-hole panel mtg, aluminum	20B0667 X012
	For 3-hole panel mtg, zinc w/ stainless steel bushing	3B9855 T0022
	For Type 67SS or 67SSR	
	stainless steel	28A9277 X012
	aluminum	25A6220 X012
3	Body Plug	
	For Type 67 or 67R, aluminum	1B7975 09032
	For Type 67H or 67HR, brass	1B7975 14012
	For Type 67SS or 67SSR, 316 stainless steel	1B7975 35072
4*	Plug/Stem Assembly	
	To provide sour gas corrosion resistance capability (for Type 67 or 67R only), nitrile plug w/stainless steel stem	1D5604 000B2
	For other than sour gas corrosion resistance applications	
	Nitrile plug w/brass stem	1D5604 000A2
	Nitrile plug w/stainless steel stem	1D5604 000B2
	Fluoroelastomer plug w/brass stem	1N3798 71662
	Fluoroelastomer plug w/stainless steel stem	1N3798 000C2
	All-brass plug and stem	1C7503 14012
	All-stainless steel plug and stem	1C7503 35032
5	Plug Spring Seat	
	For Type 67 or 67R	
	For use w/stainless steel stem and to provide sour gas corrosion resistance capability, 316 stainless steel	1L2511 35072
	For use w/brass stem and for other than sour gas corrosion resistance applications, aluminum	1E5322 11052
	For Type 67H or 67HR, 1. 1. brass	1J3630 14012
	For Type 67SS or 67SSR, 316 stainless steel	1L2511 35072
6	Plug Spring	
	For Type 67 or 67R	
	To provide sour gas corrosion resistance capability, Inconel[2]	19A2860 X012
	For other than sour gas corrosion resistance applications, stainless steel	
	For use w/nitrile or fluoroelastomer plug	1B7979 37022
	For use w/metal plug	1E7013 37022
	For Type 67H, 67HR, 67SS, or 67SSR, stainless steel	1B7979 37022
7*	Diaphragm Assembly	
	For Type 67 regulator w/o internal relief	
	To provide sour gas corrosion resistance capability, nitrile diaphragm w/pl steel diaphragm plate and pusher post	1B7980 000B2
	For other than sour gas corrosion resistance applications	
	Nitrile diaphragm w/pl steel diaphragm plate and pusher post	1B7980 000B2
	Nitrile diaphragm w/pl steel diaphragm plate and stainless steel pusher post	1B7980 X00A2
	Fluoroelastomer diaphragm w/pl steel diaphragm plate and pusher post	1B7980 000C2
	For Type 67H regulator w/o internal relief, nitrile diaphragm w/pl steel diaphragm plate and brass pusher post	1J3628 000A2
	For Type 67HR regulator w/internal relief, nitrile diaphragm w/brass relief valve seat and soft molded insert	19A7667 X012
	For Type 67R regulator w/internal relief	
	To provide sour gas corrosion resistance capability, nitrile diaphragm w/aluminum relief valve seat and soft molded insert	19A7667 X032
	For other than sour gas corrosion resistance applications	
	Nitrile diaphragm w/brass relief valve seat and soft molded insert	19A7667 X012
	Nitrile diaphragm w/stainless steel relief valve seat and soft molded insert	19A7667 X022
	Fluoroelastomer diaphragm w/brass relief valve seat and soft molded insert	19A7667 X042
	Fluoroelastomer diaphragm w/stainless steel relief valve seat and soft molded insert	19A7667 X052

*Recommended spare part.
1. As detailed in National Association of Corrosion Engineers (NACE) standard MR-01-75.
2. Trademark of International Nickel Co.



COMPLETE REGULA TOR WITHOUT CLOSING CAP

Figure 2. Type 67 and 67R Regulator Assemblies (Also Typical of Types 67H and 67HR)

Key	Description	Part Number
7*	Diaphragm Assembly (Cont'd)	
	For Type 67SS regulator w/o internal relief	
	Nitrile diaphragm w/pl steel diaphragm plate and stainless steel pusher post	1B7980 X00A2
	Fluoroelastomer diaphragm w/pl steel diaphragm plate and stainless steel pusher post	1B7980 X0022
	For Type 67SSR regulator w/internal relief	
	Nitrile diaphragm w/stainsteel relief valve seat and soft molded insert	19A7667 X022
	Fluoroelastomer diaphragm w/stainless steel relief valve seat and soft molded insert	19A7667 X052
8	Control Spring Seat	
	To provide sour gas corrosion resistance capability (for Type 67 or 67R only), heat-treated AISI steel	1B7985 X0012
	For other than sour gas corrosion resistance applications, Zn pl steel	1B7985 25062
9	Control Spring, Zn pl steel spring wire	See following table
10	Adjusting Screw, pl steel	
	For Type 67 or 67R	
	For spring case w/o closing cap	1B7986 28982
	For spring case w/closing cap	1H3050 28982
	For Type 67H or 67HR	1B7986 28982
	For Type 67SS or 67SSR	1H3050 28982
10	Handwheel (not used w/Type 67SS or 67SSR)	
	For Type 67 or 67R	
	For 1-hole panel mtg, Zn pl steel	20B2830 X012
	For 3-hole panel mtg w/right-hand thread	
	Zinc	1B7992 000A2
	Chrome pl steel	1U1715 000C2
	For 3-hole panel mtg w/left-hand thread, zinc	1L2232 44012
	For 67H or 67HR	
	For 1-hole panel mtg, Zn pl steel	20B2830 X012
	For 3-hold panel mtg w/right-hand thread	
	Zinc	1B7992 T0022
	Chrome pl steel	1U1715 000C2

*Recommended spare parts

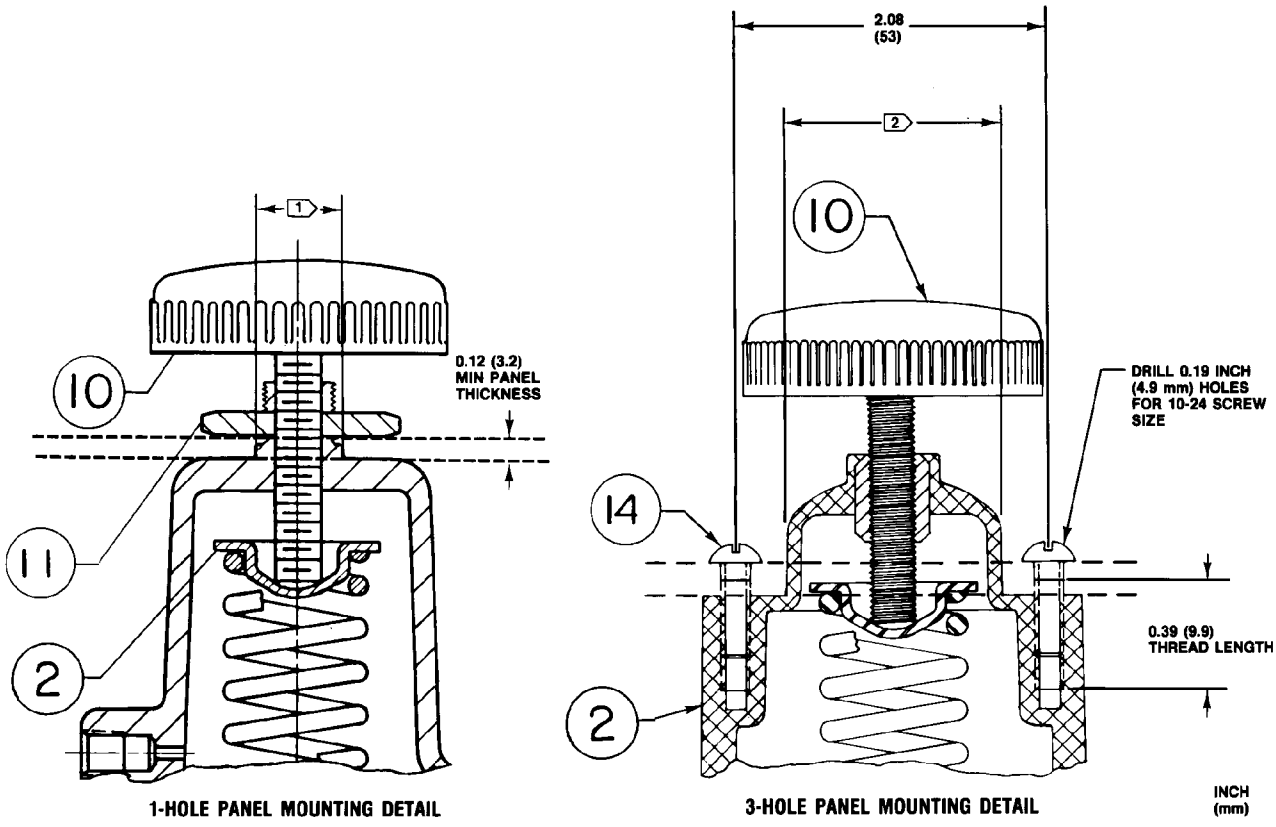
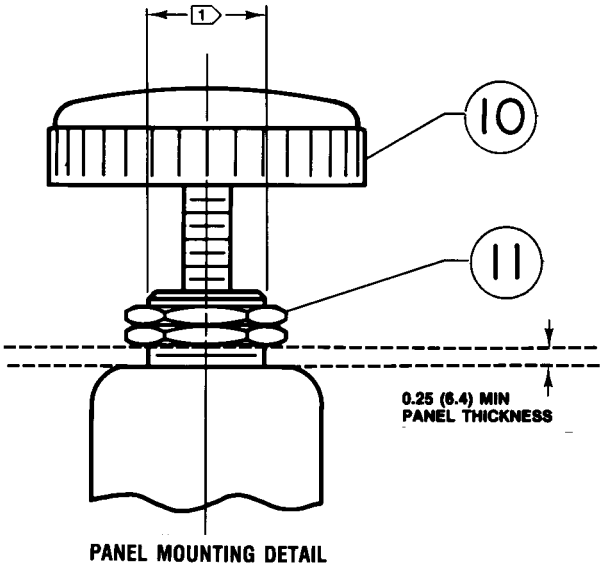


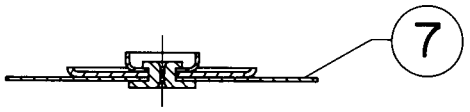
Figure 2. Type 67 and 67R Regulator Assemblies (Also Typical of Types 67H and 67HR) (Continued)

Key	Description	Part Number
11	Locknut (not used w/3-hole panel mtg spring case), pl steel	1A9463 24122
11	Mounting Nut (for use only w/1-hole panel mtg spring case), 303 stainless steel	10B2657 X012
12	Machine Screw, pl steel (6 req'd)	
	For Type 67 or 67R	
	For use w/spring case 2B7974 08012 or 3L2230 000A2	1B7839 28982
	For use w/all other spring cases	1B2752 28982
	For Type 67H or 67HR	
	For 3-hole panel mtg (6 req'd)	1B7839 28982
	For yoke mtg 3 req'd	1B2752 28982
	3 req'd	1C8969 28982
	For 1-hole panel mtg & all other constructions (6 req'd)	1B2752 28982
12	Machine Screw (Continued)	
	For Type 67SS or 67SSR	
	For stainless steel spring case	1H4217 38992
	For aluminum spring case	1H4217 28992
14	Mounting Screw (for use only w/yoke mtg or 3-hole panel mtg spring case), steel (2 req'd)	
	For yoke mtg spring case (not shown)	1A3816 24052
	For 3-hole panel mtg spring case	1C2760 28992
20	Control Spring Label (not shown), paper	See following table
21	Pipe Plug (for use only w/2-outlet body—not shown)	
	For Type 67 or 67R	
	Hex head to provide sour gas corrosion resistance capability, CD pl steel	1D7548 28982
21	Pipe Plug (Continued)	
	For other than sour gas corrosion resistance applications	
	Square head, brass	1A5726 14012
	Socket head, steel	1C3335 28992
	Hex head, Cd pl steel	1D7548 28982
	For Type 67H or 67HR	
	Square head, brass	1A5726 14012
	Socket head, steel	1C3335 28992
	Hex head, Cd pl steel	1D7548 28982
	For Type 67SS or 67SSR, 316 stainless steel	1A7675 35072
21	Pressure Gauge (for use only w/2-outlet body—not shown)	
	0 to 30 psig(3)	1J9460 99012
	0 to 60 psig(3)	1J9752 99012
	0 to 100 psig(3)	1J9753 99012
	0 to 160 psig(3)	1J9754 99012
23*	Body Plug Gasket (for use only w/Type 67, 67H, 67HR, or 67R), composition	1C4957 04022

3. Consult your Fisher sales office or sales representative for gauges in other units.

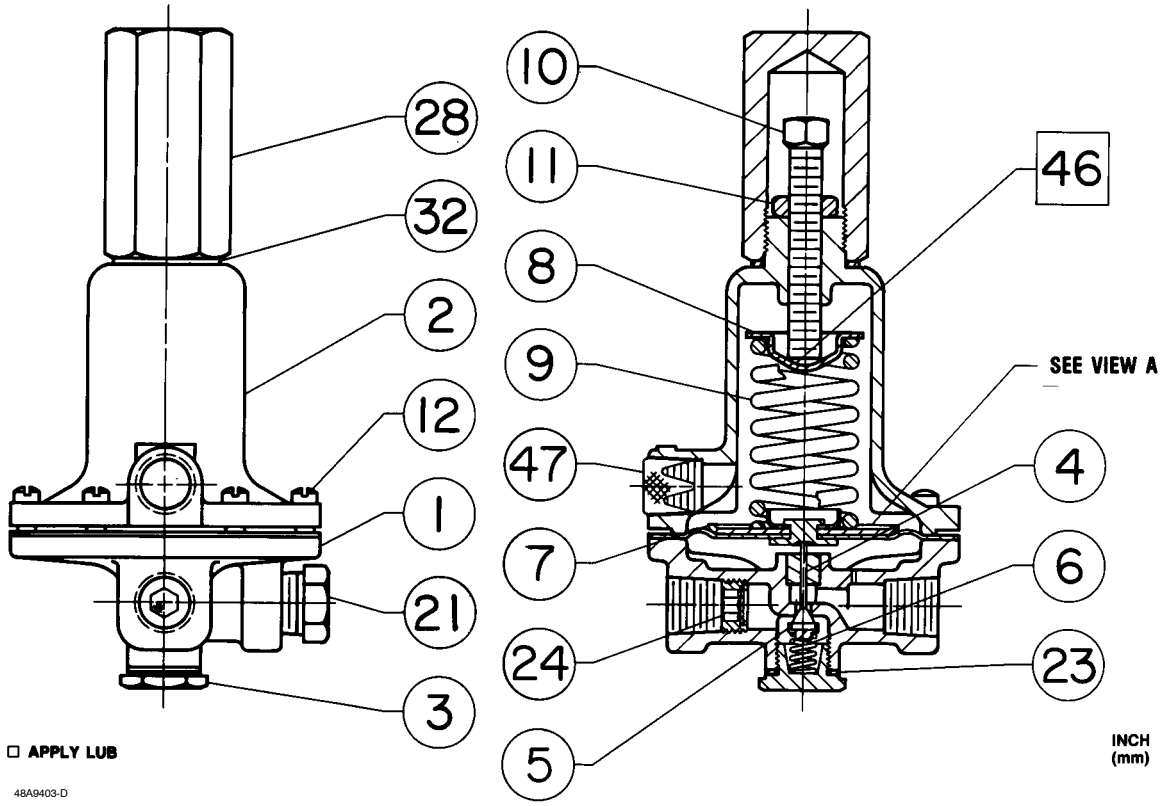


PANEL MOUNTING DETAIL



VIEW A (DETAIL OF TYPE 67SSR DIAPHRAGM ASSEMBLY)

NOTE:
1 0.72 (18.3) SPRING CASE PANEL BOSS.



COMPLETE TYPE 67SS REGULATOR ASSEMBLY

Figure 3. Type 67SS and 67SSR Regulator Assemblies

Key	Description	Part Number
23*	Body Plug O-Ring (for use only w/Type 67SS or 67SSR)	
	For use w/composition diaphragm, composition	1F1139 06992
	For use w/fluoroelastomer diaphragm, fluoroelastomer	1N4639 06382
24	Inlet Screen Assembly (for use only when specified)	
	For Type 67 or 67R	
	Brass and stainless steel	1C7712 000A2
	Steel and stainless steel	1C7712 000B2
	For Type 67H or 67HR, brass and stainless steel	1C7712 000A2
	For Type 67SS or 67SSR, steel and stainless steel	1C7712 000B2
28	Closing Cap	
	For use only w/Type 67 or 67R tapped spring case 10A3075 X012, brass	1H2369 14012
	For use only w/Type 67SS or 67SSR spring case	
	Aluminum	1H2369 X0012
	Steel	1H2369 X0022
	Stainless steel	1H2369 X0032
32*	Closing Cap Gasket, (for use only w/Type 67SS or 67SSR), composition	15A6218 X012
38	Spacer (for yoke mtg only—not shown), steel (3 req'd)	11A8146 X012
39	Mounting Bracket (for yoke mtg only—not shown), steel	21A8145 X012
44	NACE Tag (for use only w/Type 67 or 67R w/sour gas corrosion resistance capability—not shown), 18-8 stainless steel	19A6034 X012
45	Tag Wire (for use only w/NACE tag key 44—not shown), 304 stainless steel	1U7851 X0012
46	Never-Seez Lubricant, 8-pound (4 kg) can (not furnished with regulator)	1M5239 06992
47	Vent Screen (for use only w/Type 67SS or 67SSR spring case 28A9277 X012), Monel(2)	0L0783 43062

Keys 9 and 20 Type 67 and 67R Control Spring and Control Spring Label

SERVICE, MATERIAL	OUTLET PRESSURE RANGE				CONTROL SPRING KEY 9		CONTROL SPRING LABEL KEY 20
	U.S. Units, Psig		Metric Units, Bar				
	With Panel-Mtg Spring Case	With All Other Spring Cases	With Panel-Mtg Spring Case	With All Other Spring Cases	Part Number	Color Code	
For sour gas corrosion resistance capability, Inconel	- - - - - -	5 to 35 30 to 60	- - - - - -	0.34 to 3.4 2.1 to 4.1	19A2852 X012 19A2854 X012	Cad plated Blue	1C3764 06032 1C3766 06032
For other than sour gas corrosion resistance applications, pl steel	3 to 18 5 to 30 30 to 50 35 to 80	3 to 20 5 to 35 30 to 60 35 to 100	0.21 to 1.2 0.34 to 2.1 2.1 to 3.4 2.4 to 5.5	0.21 to 1.4 0.34 to 3.4 2.1 to 4.1 2.4 to 6.9	1B9860 27212 1B7883 27022 1B7884 27022 1K7485 27202	Green Cad plated Blue Red	1C3763 06032 1C3764 06032 1C3766 06032 1C3765 06032

Keys 9 and 20 Type 67, 67H, 67HR, 67SS, and 67SSR Control Spring and Control Spring Label

SERVICE, MATERIAL	OUTLET PRESSURE RANGE				CONTROL SPRING KEY 9		CONTROL SPRING LABEL KEY 20
	U.S. Units, Psig		Metric Units, Bar				
	With Panel-Mtg Spring Case	With All Other Spring Cases	With Panel-Mtg Spring Case	With All Other Spring Cases	Part Number	Color Code	
All, pl steel	3 to 18 5 to 30 30 to 50 35 to 80	3 to 20 5 to 35 30 to 60 35 to 100	0.21 to 1.2 0.34 to 2.1 2.1 to 3.4 2.4 to 5.5	0.21 to 1.4 0.34 to 3.4 2.1 to 4.1 2.4 to 6.9	1B9860 27212 1B788. 27022 1B7884 27022 1K7485 27202	Green Cad plated Blue Red	1C3763 06032 1C3764 06032 1C3766 06032 1C3765 06032

*Recommended spare parts
2. Tradmark of International Nickel Co.

Fisher Controls

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Singapore 0512

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SAFETY WARNING INSTRUCTIONS

FOR MAXITROL GAS PRESSURE REGULATORS

NOTE: GAS PRESSURE REGULATORS WILL ***NOT*** TURN OFF THE FLOW OF GAS.

SPECIAL WARNINGS

IF YOU DO NOT FOLLOW THESE INSTRUCTIONS EXACTLY, A FIRE OR EXPLOSION MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.
NO UNTRAINED PERSON SHOULD ATTEMPT TO INSTALL, MAINTAIN OR SERVICE GAS PRESSURE REGULATORS.

To minimize the possibility of FIRE, EXPLOSION, and OTHER HAZARDS:

1. All products, including gas pressure regulators, used with combustible gas must be installed and used strictly in accordance with the instructions of the manufacturer, with government codes and regulations, and plumbing codes and practices.

2. Do not use a gas pressure regulator if it appears to have been subjected to high temperatures, damaged in any way, or to have been taken apart or tampered with. Any of these may be signs of possible leakage or other damage that may affect proper operation and cause potentially dangerous combustion problems

3.

a. Install the regulator properly with gas flowing as indicated by the arrow on the casting.
b. Use pipe compound or thread sealant, properly threaded pipes and careful assembly procedure so that there is no cross threading, etc., which might cause damage or leakage.
c. Apply wrench or vise pressure only to the flat areas around the pipe tappings at the end being threaded to the pipe to avoid possible fracture of the regulator body which could result in leakage
d. Make sure markings or wording on regulator are not painted over or obliterated.

4. Check carefully for gas leaks immediately after the regulator has been installed and the gas turned on. Do this before attempting to operate the appliance or other gas burning device. Use a rich soap solution (or other accepted leak tester) around the diaphragm flanges, bottom plate, vent opening, seal cap, pipe connections, and all other joints. Wipe clean with a damp rag. It is a good practice to periodically check for leakage during use of the appliance. Absolutely no leakage should occur, otherwise there is a danger of fire or explosion depending upon conditions. Never use if leakage is detected.

CAUTION

NEVER CONNECT REGULATOR DIRECTLY TO THE PROPANE SUPPLY SOURCE. MAXITROL REGULATORS REQUIRE AN EXTERNAL REGULATOR (NOT SUPPLIED). INSTALL THE EXTERNAL REGULATOR BETWEEN THE PROPANE SUPPLY SOURCE AND MAXITROL REGULATOR.

5. Very high pressure surges in the gas supply line (or as a result of exposing the system to high pressure) may result in serious internal damage and cause leakage or affect regulator operation. If you suspect that a Maxitrol regulator has been exposed to more than twice the maximum operating inlet pressure, as shown in the following chart, turn off the gas and have the system checked by an expert.

(over)

INSTRUCCIONES PARA PRECAUCIONES DE SEGURIDAD

PARA REGULADORES DE PRESION DE GAS MAXITROL

NOTA: LOS REGULADORES DE PRESION DE GAS **NO** CORTAN EL FLUJO DE GAS

¡PRECAUCIONES ESPECIALES!

SI USTED NO SIGUE ESTAS INSTRUCCIONES EXACTAMENTE, PUEDE OCURRIR UN INCENDIO O UNA EXPLOSION, CAUSANDO DAÑOS A LA PROPIEDAD, LESIONES PERSONALES O PERDIDA DE VIDAS. NADIE QUE NO HAYA SIDO ENTRENADO DEBERA DE TRATAR DE INSTALAR, DAR SERVICIO O DAR MANTENIMIENTO A LOS REGULADORES DE PRESION DE GAS

Para reducir la posibilidad de INCENDIO, EXPLOSION Y OTROS RIESGOS:

1. Todos los productos, incluyendo los reguladores de presión de gas, que se usan con gases combustibles **deberán** instalarse y usarse **estrictamente** de acuerdo con las instrucciones del fabricante, usando los códigos y reglamentos gubernamentales así como los códigos y prácticas de plomería.

2. **No** usar un regulador de presión de gas si parece haber estado expuesto a altas temperaturas, dañado en alguna forma o que se haya desmantelado o maltratado. Cualquiera de éstas pueden ser señales de posibles fugas u otros daños que pueden afectar el funcionamiento correcto y causar problemas de combustión potencialmente peligrosos.

3.

a. Instalar el regulador correctamente con el gas fluyendo como se indica en la flecha en la carcasa de fundición.
b. Usar un compuesto sellador de tubería o hilo sellador de rosca, tuberías correctamente roscadas y procedimientos de ensamble cuidadoso, asegurándose de que no haya trasroscados, lo cual podría causar daños o fugas.
c. Aplicar únicamente la presión de una llave o tornillo de banco en las áreas planas alrededor de las roscas de la tubería del extremo a enroscar para evitar la posible rotura del cuerpo del regulador que podría resultar en fugas.
d. Asegurarse de que no se pinten o tachen las marcas o escritura en el regulador.

4. Verificar inmediatamente que no haya fugas de gas después de que el regulador haya sido instalado y se haya abierto el paso del gas. **Esto deberá hacerse antes de tratar de operar el aparato electrodoméstico o cualquier otro dispositivo quemador de gas.** Usar una solución espesa de jabón (u otro probador de fugas aceptado) alrededor de las bridas del diafragma, el fondo del plato, la apertura de ventilación, la tapa selladora y las conexiones de la tubería y todas las demás juntas. Limpiar con un trapo húmedo. Es una buena práctica verificar periódicamente que no haya fugas durante el uso del aparato electrodoméstico. **Absolutamente no deberá haber ninguna fuga. De otra forma hay peligro de incendio o explosión dependiendo de las condiciones. Nunca deberá usarse si se detectan fugas.**

¡PRECAUCION!

NUNCA CONECTAR EL REGULADOR DIRECTAMENTE AL SUMINISTRO DE PROPANO. LOS REGULADORES MAXITROL REQUIEREN UN REGULADOR EXTERNO (NO PROVISTO). INSTALAR EL REGULADOR EXTERNO ENTRE EL SUMINISTRO DE PROPANO Y EL REGULADOR MAXITROL

5. Aumentos grandes de presión en la línea de suministro de gas (o como resultado de exponer el sistema a alta presión) pueden resultar en daños internos y causar fugas o afectar el funcionamiento del regulador. Si usted sospecha que un regulador Maxitrol ha sido expuesto a más del doble de la presión máxima de entrada, como se muestra en la tabla siguiente, cierre el paso del gas y haga que el sistema sea verificado por un experto.

(a la vuelta)

MAXITROL company®

www.maxitrol.com

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Southfield, MI 48037-2230 U.S.A.
248.356.1400 • Fax 248.356.0829

6. Venting must be controlled in accordance with government and plumbing codes and regulations to avoid the danger of escaping gas should there be internal leakage. Vent pipes must be open and the open end protected against entry of foreign matter, including water.

7. The outlet pressure of the regulator must be measured to make sure it is in accordance with intended usage. If a spring change is required to develop the required outlet pressure, the spring must be one specified by MAXITROL

8. Caution should be used to guarantee that there is sufficient inlet pressure to achieve the desired outlet pressure and no readjustment of the outlet pressure setting should be made unless the inlet pressure is within the proper limits for the regulator. Failure to follow this may result in overfiring of the appliance or other gas burning device. The MAXITROL bulletin for the regulator should be consulted for specific inlet and outlet pressure relationships.

9. A MAXITROL regulator must be used within the temperature range and not in excess of the maximum inlet pressure shown in the following table and should be in the mounting position indicated. Maxitrol regulators can be used with all fuel gases.

10. In case of any doubt, please contact the Service Manager, Maxitrol Company, Southfield, MI USA. Phone: 248/356-1400.

6. La ventilación **deberá** estar controlada de acuerdo con los códigos y reglamentos gubernamentales de plomería para evitar el peligro de que se escape el gas en caso de una fuga interna. Los tubos de ventilación deberán estar abiertos y el extremo abierto deberá estar protegido contra cualquier materia extraña, incluyendo el agua.

7. La presión de salida del regulador **deberá** medirse para asegurarse que está de acuerdo para el uso que se pretende. Si se necesita cambiar un resorte para desarrollar la presión de salida requerida, el resorte **deberá ser especificado por MAXITROL** y la nueva presión de salida deberá anotarse en el regulador.

8. Deberá usarse precaución para garantizar que hay suficiente presión interna para alcanzar la presión de salida deseada y no deberá hacerse ningún reajuste en la presión de salida a menos que la presión interna esté dentro de los límites correctos para el regulador. Si esto no se lleva a cabo podría resultar en una llama excesiva del aparato electrodoméstico u otro dispositivo quemador de gas. **Deberá consultarse el boletín MAXITROL para el regulador** para ver la relación específica entre la presión de entrada y la de salida.

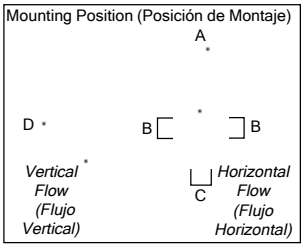
9. **Un regulador MAXITROL deberá usarse** dentro del rango de temperatura y no deberá excederse la presión máxima de entrada que se muestra en la tabla siguiente y deberá estar en la posición indicada de montaje. Los reguladores MAXITROL pueden usarse con todo tipo de gases combustibles.

10. En caso de dudas, favor de comunicarse con el Service Manager (Gerente de Servicio), Maxitrol Company, Southfield, MI USA. Teléfono: 248-356-1400.

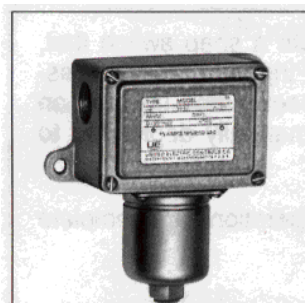
Model Number (Número de Modelo)	Maximum Operating Inlet Pressure (Presión Máxima de Entrada para Operación)	Ambient Temperature Range (Rango de Temperatura Ambiente)	Mounting Position [see below] (Posicióndе Montaje) [ver abajo]
RV12LT, RV20LT	1/2 psi (34 mbar)	-40° to 275° F (-40° to 135° C)	A, B, C, D
RV20L	2 psi (138 mbar)	-40° to 225° F (-40° to 107° C)	A, B, C, D
RV47, RV48 (*1)	1/2 psi (34 mbar)	32° to 225° F (0° to 107° C)	A, B, C, D, (*1)
RV48T (*1)	1/2 psi (34 mbar)	32° to 275° F (0° to 135° C)	A, B, C, D, (*1)
RV52, RV53, (*1)	1/2 psi (34 mbar)	-40° to 205° F (-40° to 96° C)	A, B, C, D, (*1)
RV61, (*1)	1 psi (69 mbar)	-40° to 205° F (-40° to 96° C)	A, B, C, D, (*1)
RV81, RV91	1 psi (69 mbar)	-40° to 205° F (-40° to 96° C)	A only (únicamente)
RV111	1 psi (69 mbar)	-40° to 205° F (-40° to 96° C)	A only (únicamente)
RV131	2 psi (138 mbar)	-40° to 125° F (-40° to 52° C)	A only (únicamente)
R400, R500, R600, (*1)	1 psi (69 mbar)	-40° to 205° F (-40° to 96° C)	A, B, C, D, (*1)
R400S, R500S, R600S, (*1)	5 psi (345 mbar)	-40° to 205° F (-40° to 96° C)	A, B, C, D, (*1)
R400Z, R500Z, R600Z	1psi (69 mbar)	-40° to 205° F (-40° to 96° C)	A, B, C, D, (*1)
210D, E, G, J	10 psi (690 mbar)	-40° to 205° F (-40° to 96° C)	A only (únicamente)
210DZ, EZ, GZ, JZ	5 psi (345 mbar)	-40° to 205° F (-40° to 96° C)	A only (únicamente)
220D, E, G, J	10 psi (690 mbar)	-40° to 205° F (-40° to 96° C)	A only (únicamente)
325-3 (*1), 325-5A (*1), 325-7	10 psi (690 mbar) (*1)	-40° to 205° F (-40° to 96° C)	A, B, C, D, (*1)

(*1) When equipped with a ball-check type automatic vent limiting device (12A04, 12A09, 12A39), regulators must be in upright position (A) with non-integral vent limiter installed directly into vent threads. Any other mounting position may interfere with lockup or cause pilot outage, where applicable. Maximum inlet pressure for regulators with 12A09 or 12A39 is 2 psi (LP) or 5 psi (natural). Inlet pressures exceeding 2 psi (LP) or 5 psi (natural) require a vent line.

(*1) Para estar seguro que el regulador responde con rapidez cuando está equipado con un dispositivo limitador de ventilación automático tipo bola (12A04, 12A09,12A39), los reguladores deberán estar en posición vertical (A) con el limitador de ventilación instalado directamente a las roscas del tubo de ventilación. **Si se usa cualquier otra posición durante su instalación, esto podrá interferir con el cierre o causar que el piloto se apague.** La presión máxima de admisión para reguladores con los dispositivos 12A09 o 12A39 es de 2 psi (gas licuado) o 5 psi (gas natural). Las presiones de admisión que excedan 2 psi (gas licuado) o 5 psi (gas natural) requerirán una línea de ventilación.



LITHO IN U.S.A. 110MMP



6 Series
Pressure Controls

UNITED ELECTRIC CONTROLS
Installation and Maintenance Instructions

Please read all instructional literature carefully and thoroughly before starting. Refer to the final page for the listing of Recommended Practices, Liabilities and Warranties.

GENERAL

J6 pressure controls are activated when a bellows, diaphragm or piston sensor responds to a pressure change. This response actuates a single snap-action switch, converting the pressure signal into an electrical signal.

Control set point may be varied by turning the internal adjustment screw (or dial) according to procedures outlined below.

Part I - Installation

Tools Needed
-Adjustable wrench
- Flatblade screwdriver

MOUNTING

J6 controls may be mounted and operated in any position. They may be surface mounted via the two mounting ears on either side of the enclosure, or the controls may be mounted directly to a rigid pipe by using the pressure connection.

LOCATE THE UNIT WHERE VIBRATION, SHOCK AND AMBIENT TEMPERATURE CHANGES ARE MINIMAL. SHOULD THE CONTROL BE INSTALLED WHERE CONDENSATION IS EXPECTED, VERTICAL MOUNTING IS RECOMMENDED.

NEVER USE THE ENCLOSURE FOR LEVERAGE TOHAND TIGHTEN THE PRESSURE CONNECTION. ALWAYS USE A WRENCH TO TIGHTEN THE PRESSURE CONNECTION TO THE PIPE. TO PREVENT DAMAGING THE PRESSURE SENSOR, USE A BACK-UP WRENCH TO HOLD THE HEX CONNECTION IN PLACE WHEN SURFACE MOUNTING.

On models supplied with an external manual reset button, be sure to leave sufficient finger space over the reset button for the operator to reset the control.

WIRING

Remove the four screws retaining the cover and cover gasket. A 1/2" NPT conduit connection is provided on the upper left hand side of the enclosure. The three switch terminals are clearly labeled common, normally open and normally closed.

If lead wires are supplied, color coding is as follows:

	SPIDT	DPDT (Option 1010)	
		SWT1	SWT2
Common	Violet	Violet	Yellow
Normally Open	Blue	Blue	Orange
Normally Closed	Black	Black	Red

A threaded grounding boss, tapped #10-32, is provided in the lower left corner of the enclosure. Keep the wires as short as possible to prevent interference with the plunger, manual reset button and, when provided, the adjustable differential switch wheel.

WIRE IN ACCORDANCE WITH LOCAL OR NATIONAL CODES. BE SURE ALL LIVE SUPPLY CIRCUITS ARE DISCONNECTED BEFORE WIRING THE CONTROL. MAXIMUM WIRE SIZE #14 AWG.

Part 11 - Adjustments

Tools Needed

Models 126,134, S1 26, S1 34, S1261B, S1341B: 3/16" & 1/4" open end wrenches. Use 3/16" wrench to keep item C from turning. See Figure 2.

Models 136-160, S1 36-Sl 60, S1361B-S1 601B, 50-55, and 680: 5/8" open end wrench

Models 258-274 and 354-364: 11/16" open end wrench

Models 218-230: 1/4" open end wrench

Models 610-614: 3/16" open end wrench

Non-Calibrated Models, type

Remove cover and gasketing. The right hand adjusting screw, labele "A" Figures I- and 2, is located beneath the switch and is turned to adjust the control setpoint. On pressure controls, turning this screw clockwise will increase the setpoint; for vacuum ranges, this screw is turned counterclockwise to raise the setpoint.

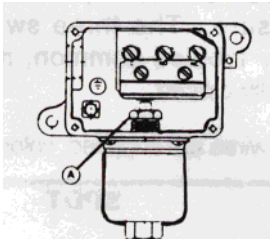


Figure 1: Models 50-55,136-160, S136-S160, S136B-S160B, 258-274, and 354-364, 680

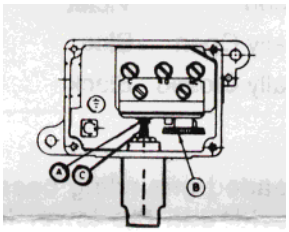


Figure 2: Models 126, 134, S 126, S 134, S 126B, S134B, 218-230, 610-614

NOTE: Models 50-55 have 3116" hex head screw directly beneath the switch plunger. This is a factory set adjustment and is not to be disturbed.

Adjustable Differential Switches, Options 1520 & 1521

These controls are equipped with a special snap switch that allows the control differential to be manually varied by turning the wheel on the underside of the switch, and using the switch mounting screw on the right as an index. As the letters advance, the differential widens.

Manual Reset Switches, 1530 Option

These controls incorporate a snap switch that, when activated, remains tripped until the pressure changes and the reset button (located on top of the controller) is manually depressed to reset the switch.

Replace cover when all operations are complete and before using.

Part III - Replacements

Tools Needed

-Adjustable wrench
- Flat blade screwdriver

Replace electrical switch according to the following procedures.

ALWAYSDISCONNECT SUPPLY CIRCUITS BEFORE ATTEMPTING TO REPLACE PARTS.

Switch Replacement (All Models)

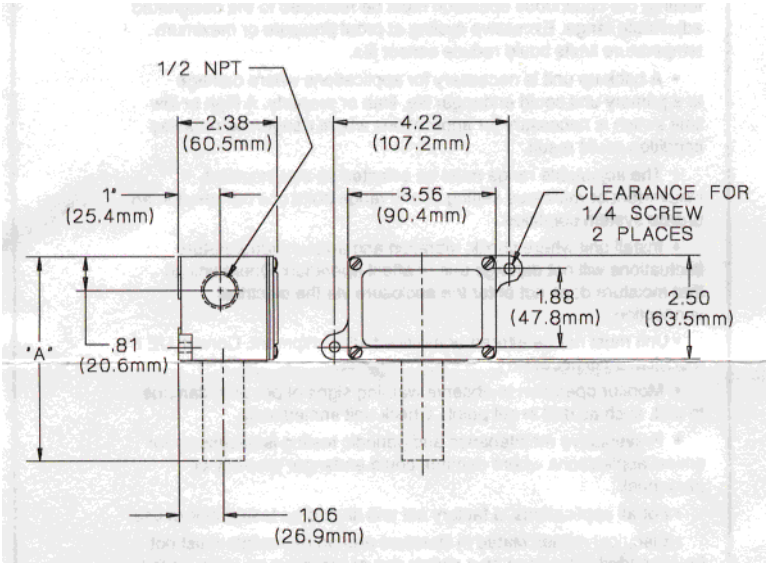
1 . Remove cover.
2. Disconnect lead wires from the terminals.
3. Note position of switch plunger before removing switch. Remove two switch mounting screws and take out the switch and insulator.
4. Insert insulator and replacement switch. Position switch plunger over the adjusting screw; tighten switch mounting screws securely. On models 50-55, verify that gapping is correct.

Gapping

Turn 5/8" hex adjustment screw in approximately mid range. This puts a load on the sensor. Using a 1/4" wrench on the plunger and a 3/16" wrench on the plunger hex screw, turn hex screw out from plunger until switch actuates. (If switch is already actuated proceed to the next step.) Turn plunger hex screw in until switch just transfers. Turn hex screw in an additional 2 - 2/12 flats from this point (approximately 1/3 turn). This will provide a 9 - 11 Mil gap. Follow set point adjustment procedure.

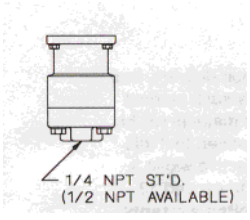
5. Check set point and readjust, if necessary.
6. Re-connect wires.
7. Replace cover.

Dimensions J6 Series
General Purpose
Service; NEMA 4

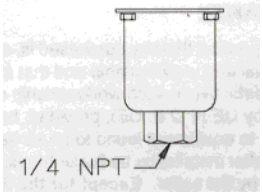


Dimension A

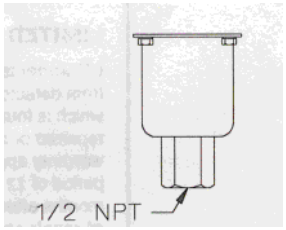
Models	Inches	mm	NPT
50-55	5.75	146,1	1/4
S50B-S55B	5.75	146,1	1/2
126,160	5.06	128,5	1/4
S126B-SI60B	5.40	137,2	1/2
218-230	4.31	109,5	1/4
258-274	4.75	120,7	1/4
354-364	4.75	120,7	1/4
610-614	5.69	144,5	1/4
680	4.5	114,3	1/4



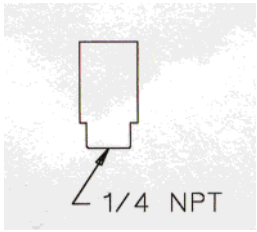
Models 50-55, S50B-S55B



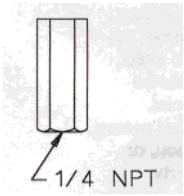
Models 126-160



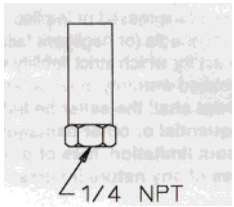
Models S1261B-S160B



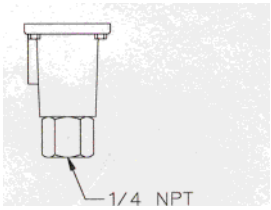
Models 218-230



Models 2SS-274



Models 354-364, 680



Models 610-

RECOMMENDED PRACTICES AND WARNINGS

United Electric Controls Company recommends careful consideration of the following factors when specifying and installing UE pressure and temperature units. Before installing a unit, the Installation and Maintenance instructions provided with unit must be read and understood.

• To avoid damaging unit, proof pressure and max temperature limits stated in literature and on nameplates must never be exceeded, even by surges in the system. Operation of the unit up to proof pressure or max temperature is acceptable on a limited basis (i.e. start-up, testing) but continuous operation must be restricted to the designated adjustable range. Excessive cycling at proof pressure or maximum temperature limits could reduce sensor life.

• A back-up unit is necessary for applications where damage to a primary unit could endanger life, limb or property. A high or low limit switch is necessary for applications where dangerous runaway condition could result.

• The adjustable range must be selected so that incorrect, inadvertent or malicious setting at any range point can not result in an unsafe 'system condition.

• Install unit where shock, vibration and ambient temperature fluctuations will not damage unit or affect operation. Orient unit so that moisture does not enter the enclosure via the electrical connection.

• Unit must not be altered or modified after shipment. Consult UE if modification is necessary.

• Monitor operation to observe warning signs of possible damage to unit, such as drift in set point. Check unit immediately.

• Preventative maintenance and periodic testing is necessary for critical applications where damage could endanger property or personnel.

For all applications, a factory set unit should be tested before use.

Electrical ratings stated in literature and on nameplate must not be exceeded. Overload on a switch can cause damage, even on the first cycle. Wire unit according to local and national electrical codes, using wire size recommended in installation sheet.

Use only factory authorized replacement parts and procedures.

Do not mount unit in ambient temp. exceeding published limits.

For remote mounted temperature units, capillary lengths beyond 10 feet can increase chance of error, and may require re-calibration of set point and indication.

LIMITED WARRANTY

UE warrants that the product thereby purchased is, upon delivery, free from defects in material and workmanship and that any such product which is found to be defective in such workmanship or material will be repaired or replaced by UE (F.O.B. UE); provided, however, that this warranty applies only to equipment found to be so defective within a period of 12 months after installation by buyer but not to exceed 18 months after delivery by the seller. **Except for the limited warranty of repair and replacement stated above, UE disclaims all warranties whatsoever with respect to the product, including all implied warranties of merchantability or fitness for any particular purpose.**

LIABILITY LIMITATION

The sole and exclusive remedy of buyer for any liability or seller for any claim, including incurred in connection with (1) breach of any warranty whatsoever expressed or implied, (11) a breach of contract, (111) a negligent act or acts (or negligent failure to act) committed by seller, or (IV) an act for which strict liability will be imputed to seller, is limited to the limited warranty or repair and replacement stated herein. **In no event shall the seller be liable for any special, indirect, consequential or other damages of a like general nature, including, without limitation, loss of profits or production, or loss or expenses of any nature incurred by any third party.**

UNITED ELECTRIC CONTROLS
180 Dexter Avenue, P.O. Box 9143 Watertown,
MA 02471-9143 USA
Telephone: 617-926-1000 Fax: 617-926-2568
http://www.ueonline.com

1. Mounting Sparklite Unit
   a. Mount the Sparklite unit convenient to pilot, so that cable will reach electrode. Be sure location is such that Sparklite unit ambient temperature will not exceed 175° F. Mount with screws provided.

2. Mounting Electrode
   a. Position and securely fasten electrode so that tip of electrode is in pilot flame path and tip is approximately 5/32" from grounded pilot burner head or thermocouple tip. Use round plastic gage provided to obtain correct spark gap. Gage should touch but slide through easily. (See above Figure 1, 2 and 3 for easy mounting methods.)

CAUTION

Ceramic part of electrode and high voltage ignition wire must be kept out of fire.

   b. Connect high voltage ignition lead wire from Sparklite unit to ignition electrode. Terminal at electrode should be covered with insulation boot provided.

3; Wiring 24 Volt or 120 Volt
   a. Connect input leads to Sparklite unit ahead of all controls or switches. Power source may be 24 volt or 120 volt. If 24 volt application is used, connection can be made to existing transformer. No additional transformer is needed due to low current draw of the Sparklite unit.
   b. Be sure ground terminal is connected to a good ground, such as a water pipe or ground wire in the house wiring. It is recommended that a switch be installed in the power line to control the Sparklite unit.

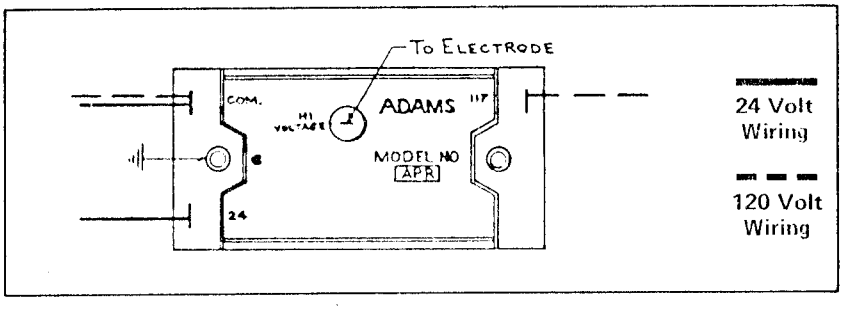
CAUTION

If 120 volt is erroneously connected to 24 volt terminal, Sparklite unit will suffer permanent electrical damage not covered under our warranty and must be replaced.

CHECK OUT PROCEDURE:

A. Be sure all gas is shut off.
B. Apply power to unit and observe spark.
C. Open pilot valve. Pilot should light.
D. Sparking should stop.
E. If sparking does not stop:
   (a) Electrode tip must be readjusted in the fire.
   (b) Ground connection to Sparklite unit must be checked.
   (c) Pilot burner must be checked for grounding through appliance.
F. Turn pilot on and off several times to be sure it lights properly.

WIRING SCHEMATIC



LIMITED WARRANTY

Adams ("Manufacturer") warrants that all Sparklite Pilot relight systems are manufactured free from defects in material and workmanship and will remain in such condition for a period of 12 months from date of installation, but not to exceed 18 months from date of manufacture. Defects arising from damage in shipment, installation, misuse or negligence by others are not covered by this warranty. The exclusive remedy for such defects is the repair or replacement of products or parts which, upon inspection by Manufacturer, appear to be so defective. Any defective parts must be returned to Manufacturer's plant at buyer's cost. MANUFACTURER WILL IN NO EVENT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND WHATSOEVER. ALL WARRANTIES IMPLIED BY LAW ARE LIMITED IN DURATION TO 18 MONTHS. This warranty extends only to the original owner.

APPENDIX A

GA500-W
Component Information

MODEL 2408*i* INDICATOR

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2408*i* Indicator and Alarm Unit

1 Installing and Operating Instructions

Thank you for choosing the 2408*i* panel mounted indicator. It will provide accurate measurement and display of temperature and other process variables. A modular build accepts a wide range of plug-in modules allowing: up to four alarm outputs, two process variable (PV) inputs, direct strain gauge/pressure sensor measurements, custom linearisation, analogue retransmission, remote setpoint (SP) input and digital communications.

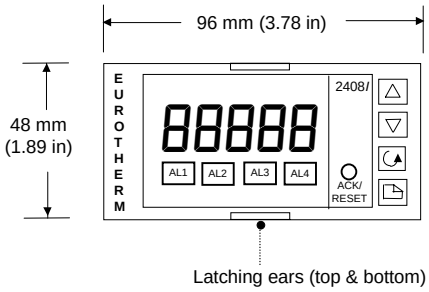
The indicator is supplied configured in accordance with the order code. The order code and instrument serial number is shown on a label fixed to the top of the case, and this can be checked against the order code given in section 5 of these instructions.

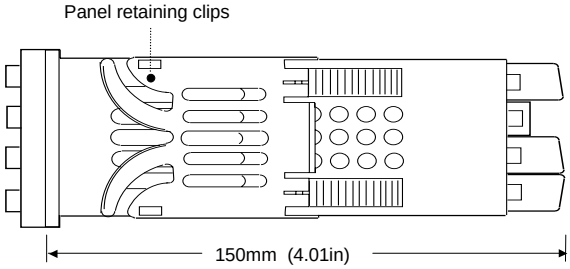
1.1 CONTENTS OF PACKAGE

1. A peel-off label set - a convenient position is to fix a label to the top right of the display.
2. A 2.49Ω resistor used as the load resistor for mA inputs
3. Two panel retaining clips

°C	°F	K	kPa	V	mV
m/s	cm/s	l/h	mWG	A	mA
x10	1x10	l/min	T/h	%	%RH
p.s.i	bar	mbar	mPas	%pH	pH
p.s.i.x10	mmHg	Kg/cm^2	gal/min	rev/min	mile/h
					Amps

1.2 DIMENSIONS AND INSTALLATION

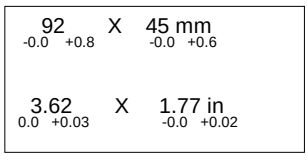


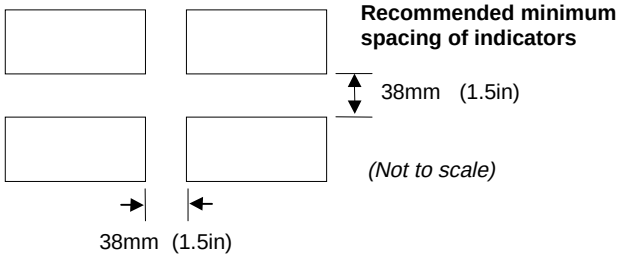


1.2.1 To Install the Indicator

Please read the safety information in section 6 before proceeding.
The indicator is intended to be mounted on a panel within an enclosure such as a control cubicle.

1. Prepare the panel cut-out to the size shown.
2. Insert the indicator through the cut-out.
3. Spring the panel retaining clips into place. Secure the indicator in position by holding it level and pushing both retaining clips forward.
4. Peel off the plastic film protecting the front of the indicator.



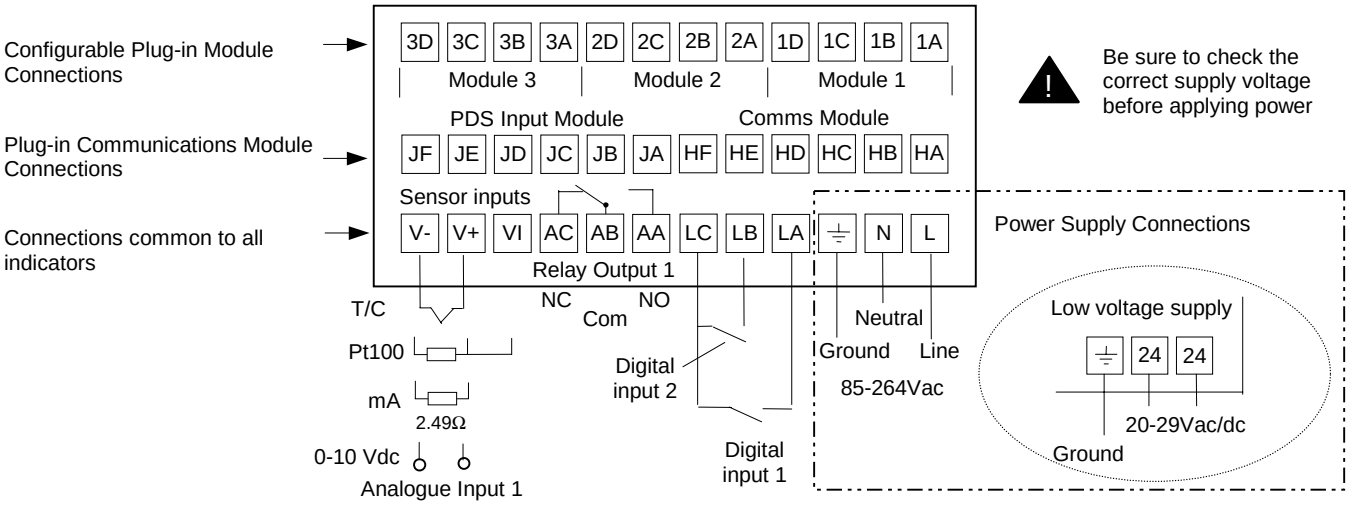


1.2.2 Removing The Indicator From The Sleeve

The indicator can be removed from its sleeve by easing the latching ears outwards and pulling it forward out of the sleeve. When plugging the indicator back into its sleeve, ensure that the latching ears click into place to maintain the moisture sealing protection.
It is recommended that power to the controller is turned off when removing or replacing the controller into its sleeve, to prevent premature wear on the connectors when current is flowing through them.

CE This indicator meets the European directives on safety and EMC

1.3 ELECTRICAL CONNECTIONS



1.3.1 Wiring

The screw terminals accept wire sizes from 0.5 to 1.5 mm (16 to 22 AWG) and should be tightened to a torque of 0.4Nm (3.5lb in). Hinged terminal covers provide IP20 protection.

1.3.2 Plug-in Module Connections

Modules are fitted in positions 1, 2 and 3 in accordance with the ordering code. The tables below show the connections for each module and the possible functions they can perform.

Note: On the wiring label the module number precedes the terminal identity letter given in the table below. For example, 1A, 1B, 1C.

Module Type	Terminal Identity A	B	C	D	Typical Functions
Relay; changeover					Alarm or Event
Dual relay (normally open)					Alarms or events
DC retransmission	+	-			Retrans. of PV
Transmitter supply 24V	+	-			To power transmitters
Strain Gauge Transducer supply (see note 1)	+	-	Cal resistor		To power strain gauges. (5V or 10V selectable)

Module Type	Terminal Identity A	B	C	D	Typical Functions
2nd Analogue Input (Analogue Input 2) (module 3 only)			+	-	Thermocouple
					PRT
			+	-	mA (2.49Ω sense resistor)
			+	-	High impedance 0 - 2.0Vdc
			+	-	millivolts
	+			-	0 - 10Vdc
Triple contact input	ip1	ip2	ip3	Com	
Triple digital input	ip1	ip2	ip3	Com	
Triple digital output	op1	op2	op3		

Notes:-

1. By default:
   The transducer supply for input 1 is installed in module position 2
   The transducer supply for input 2 is installed in module position 1
2. All module connections are isolated from the process value, earth, incoming supply and connections to other modules.
3. Digital inputs are non-isolated from the process value.
   Digital inputs are powered by the indicator. Switching voltage and current 24Vdc/20mA.

See Section 7 for specifications and maximum safety limits

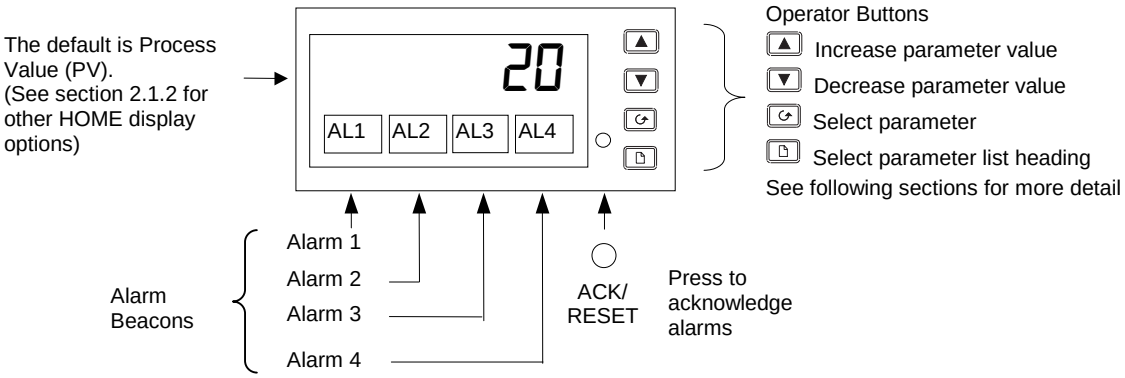
1.3.3 Communications Modules

Digital Communications Module					
	Terminal identity				
Module type	HB	HC	HD	HE	HF
RS232	-	-	Com	Rx	Tx
RS485 (2-wire)	-	-	Com	A (+)	B (-)
RS485 (4-wire)	Rx+	Rx-	Com	Tx+	Tx-
Profibus	Shield	VP	B	A	DGND

PDS Module			
	Terminal identity		
	JD	JE	JF
Setpoint Input	-	Signal	Common

2 Operation

Switch on the indicator. After a 3 second self-test sequence, you will see the display shown below. This is called the '**HOME'** display.



2.1.1 To View The Display Units

If the indicator has been configured for a thermocouple or RTD input, the temperature units can be viewed as follows:

Do This	This Is The Display You Should See	Additional Notes
1. Press and quickly release the [▯] or [↻] button.	0.5 sec °C 20 [▯] or [↻]	**Display Units** °C Celsius OR °F Fahrenheit OR °K Kelvin The display units are shown for 0.5 second Note: For linear inputs no units are displayed and, in this case: Pressing [↻] goes directly to the diSP display - see section 2.1.2.. Pressing [▯] goes directly to the AL List - see section 2.2.4.

2.1.2 Home Display Options

When shipped from the factory the HOME display will show the measured temperature or process value. This is the '**front**' display. If either [▼] or [▲] is pressed the display changes to the '**back**' display for a period of two seconds. The back display can show an alternative measurement, such as alarm setpoint or second PV input value.

Do This	This Is The Display You Should See	Additional Notes
1 Example 1. From the HOME display, press [▼] or [▲] 2. Press [▼] or [▲] again to adjust the Alarm Setpoint between hi & lo limits	'back' display = Alarm setpoint. 2 secs 100 20 [▼] or [▲] 'front' display = Process Value	Parameters which can be allocated to the Front and Back displays <nonE> The HOME display will be blank and only alarm messages will be flashed <SP> Setpoint (for deviation alarms) <rmSP> Remote setpoint (for deviation alarms) <PUHi> Displays the maximum value on input 1 <PULo> Displays the minimum value on input 1 <PU> Process Value <AL.SP> Alarm 1 setpoint <L1> Linearised input 1 <L2> Linearised input 2 Note: If the indicator has been ordered to read the highest (order code HI) or lowest values (order code LO) between input 1 and 2, the display shows only this value. If PV function ordered as FN, the displayed reading will be derived from inputs 1 and 2. The back display is not selectable in this mode

i **Pressing [▯] and [↻] together will always return you to the HOME display.**
OR
The display will always return to the HOME display if no button is pressed within 45 seconds.
This time is reduced to 10 seconds if an alarm is being displayed.

2.2 ALARMS

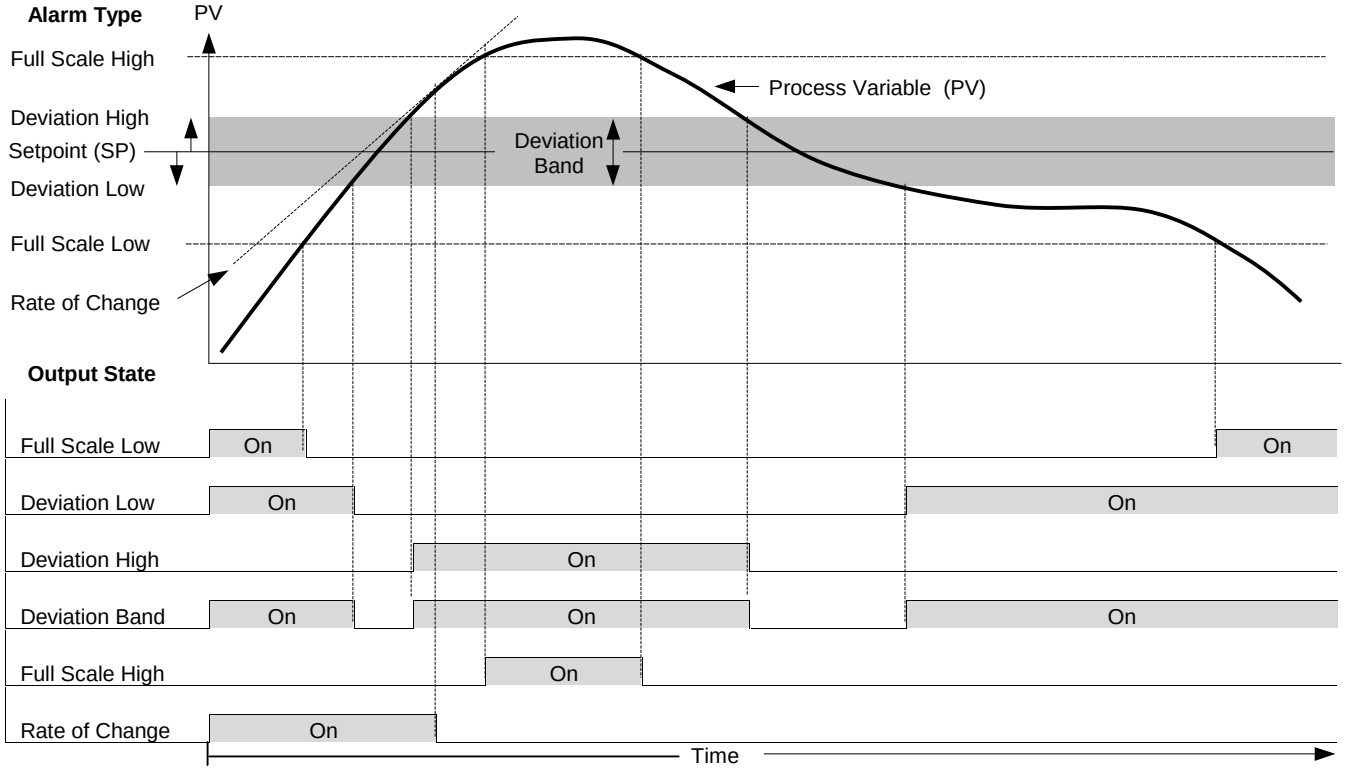
Alarms are used to alert an operator when a pre-set level has been exceeded. They are normally used to switch an output (see section 2.2.2.) – usually a relay – to provide external actions to the process.

Soft Alarms are indication only and do not operate an output.

Events are generally defined as conditions, which occur as part of the operation of the plant. They do not require operator intervention and, therefore, do not cause an alarm message to be displayed. They can be attached to operate an output (relay) in the same way as an alarm.

2.2.1 Types of Alarm Used In The 2408i

This section shows graphically the operation of different types of alarm used in the indicator. The graphs show changes in PV plotted against time. The PV may be derived from input 1, input 2 or the main PV which is derived from input 1 & 2.



Rate of change alarms detect if the rate of change in PV, set as units per minute or per second, exceeds the setpoint value. An alarm setpoint set + will detect positive rates of change. An alarm setpoint set - will detect negative rates of change. Therefore, if it is required to measure the rate of change in both directions then two alarms must be configured. Since rate of change alarms are calculated over a period of time a small delay may be apparent before the alarm is indicated. This is generally only noticeable if the PV changes very quickly.

Hysteresis is the difference between the point at which the alarm switches ON and the point at which it switches OFF.
It is used to prevent relay chatter.

Latching Alarms see 2.2.6

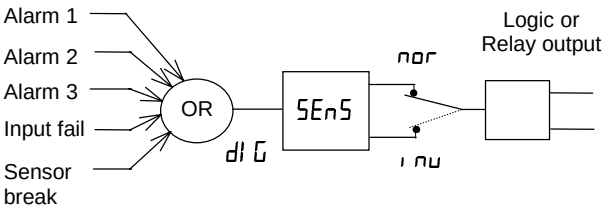
Deviation Alarms. The setpoint used for deviation alarms is normally derived as a remote input from another device - for example, a temperature controller. The setpoint can also be internally set within the controller - in this case called the local setpoint value.

Delay a settable time between an alarm occurring and it being displayed on the indicator

Blocking Alarms only occur <u>after</u> the start up phase when the alarm has first entered a safe state. The alarm is only indicated the next time it is active. It is used, for example, to ignore start up conditions which are not representative of running conditions.

2.2.2 Alarm Relay Output

Alarms can operate a specific relay or logic output. Any individual alarm can operate an individual output or any combination of alarms can operate an individual output. They are either supplied pre-configured in accordance with the ordering code or set up in configuration level.



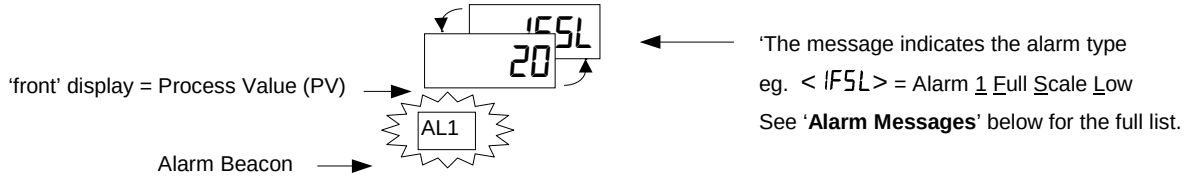
Any combination of alarms can operate the relay or logic output. Typical alarms are shown

2.2.3 Alarm Indication

An alarm occurs when the process conditions exceed a pre-set level (setpoint). It will be displayed on the indicator as follows:-

1. The relevant alarm beacon will begin to flash
2. A four character alarm message will be shown as a double repeating flash in the main display. This message specifies the alarm number (first character) and the type of alarm that has occurred (next three characters). The message is flashed in addition to the 'front' displayed value

If more than one alarm is present the relevant beacon illuminates and further messages are flashed in the main display. The alarm indication will continue while the alarm condition is present and is not acknowledged.



2.2.4 Alarm Messages

Display	Alarm type	Input Source	Alarm description and function	
First character				
1---			Alarm 1 is active	
2---			Alarm 2 is active	
3---			Alarm 3 is active	
4---			Alarm 4 is active	
Last three characters				
-FSL	Full Scale Low	Main PV	The process value is:-	below the low alarm setting on the main PV
-FL 1		PV 1		below the low alarm setting on PV 1
-FL2		PV 2		below the low alarm setting on PV 2
-FSH	Full Scale High	Main PV		above the high alarm setting on the main PV
-FH 1		PV 1		above the high alarm setting on PV 1
-FH2		PV 2		above the high alarm setting on PV 2
-dLo	Deviation Low	Main PV		below the low deviation setting on main PV
-dL 1		PV 1		below the low deviation setting on PV1
-dL2		PV 2		below the low deviation setting on PV2
-dHi	Deviation High	Main PV		above the high deviation setting on main PV
-dH 1		PV 1		above the high deviation setting on PV1
-dH2		PV 2		above the high deviation setting on PV2
-dEu	Deviation Band	Main PV		above or below the high and low deviation setting on main PV
-du 1		PV 1		above or below the high and low deviation setting on PV1
-du2		PV 2		above or below the high and low deviation setting on PV2
-rAt	Rate of change (minutes)	Main PV		changing faster than the rate-of change alarm setting in minutes for main input.
-rAS	Rate of change (seconds)	Main PV		changing faster than the rate-of change alarm setting in seconds for main input.
-rt 1	Rate of change (minutes)	Input 1		changing faster than the rate-of change alarm setting in minutes for input 1.
-rS 1	Rate of change (seconds)	Input 1		changing faster than the rate-of change alarm setting in seconds for input 1.
-rt2	Rate of change (minutes)	Input 2		changing faster than the rate-of change alarm setting in minutes for input 2.
-rS2	Rate of change (seconds)	Input 2		changing faster than the rate-of change alarm setting in seconds for input 2.
-LSP	Setpoint Low	Main PV	The setpoint is:-	below the low alarm setting
-HSP	Setpoint High	Main PV		above the high alarm setting
Sbr				Sensor Break alarm (open circuit input on whichever input is being used as the PV)

i If the **process value flashes** but no other alarm message is displayed, this indicates that the input which is being used as the PV is out of range.

2.2.5 Diagnostic Alarms

In addition to the process alarms given in the previous column the following diagnostic alarms may also appear.
These warn that a fault exists in either the indicator or the connected devices.

Alarm	What it means	What to do about it
EE.Er	*Electrically Erasable Memory Error:* The value of an operator or configuration parameter has been corrupted.	This fault will automatically select configuration level. Check all configuration parameters before returning to operator level. Once in operator level, check all operator parameters before resuming normal operation. If the fault persists or occurs frequently, return the unit for repair.
LLLL	*Out of range low reading*	Check the value of the input
HHHH	*Out of range high reading*	Check the value of the input
Err 1	*Error 1:* ROM self-test fail	Return the indicator for repair
Err2	*Error 2:* RAM self-test fail	Return the indicator for repair
Err3	*Error 3:* Watchdog fail	Return the indicator for repair
Err4	*Error 4: Keyboard failure.* Stuck button, or a button was pressed during power up.	Switch the power off and then on without touching any of the indicator buttons. If the error continues return the unit for repair.
Err5	*Error 5: Input circuit failure*	Return the unit for repair
Hw.Er	*Hardware error* Indication that a module is of the wrong type, missing faulty, or a new module has been fitted.	Check that the correct modules are fitted. Go to configuration mode and set up the required parameter(s). See section 4 for further information.
Pwr.F	*Power failure: The line voltage is too low*	Check that the supply is within rated limits
rmt.F	*Remote input fail*	Connect an input device (eg. transducer, thermocouple, mA source) to input 2

2.2.6 To Acknowledge An Alarm

An alarm can be acknowledged in two ways:-

1. Press the ACK/RESET button. (If this does not work it may have been disabled when the indicator was configured).
2. Press  and  together.

The action, which now takes place, will depend on the type of latching, which has been configured

Non Latched Alarms

If the indicator has been configured for non-latching alarms the following action occurs:-

Alarm condition present when the alarm is acknowledged, will be indicated by a single repeating flash of the alarm message and the beacon will continuously illuminate. This state will continue for as long as the alarm condition remains. When the alarm condition disappears the indication will also disappear.

If a relay has been attached to the alarm output, it will operate when the alarm condition occurs and remain in the operated condition until the alarm is acknowledged **AND** it is no longer present.

If the alarm condition disappears before it is acknowledged the alarm indication disappears as soon as the condition disappears.

Latched Alarms

The indicator may have been configured for Automatic or Manual reset. The action which occurs when the acknowledge button is pressed is described below:-

Automatic.

The alarm continues to be active until both the alarm condition is removed AND the alarm is acknowledged. The acknowledgement can occur **BEFORE** the alarm condition is removed.

Manual

The alarm continues to be active until both the alarm condition is removed AND the alarm is acknowledged. The acknowledgement can only occur **AFTER** the alarm condition is removed.

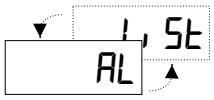
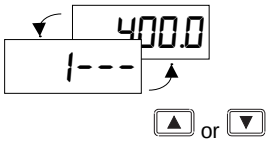
2.2.7 Alarm Inhibit

If a digital input has been configured for alarm inhibit, then all process alarm indication will be prevented for as long as the input is ON. When the input is turned to OFF any alarms which are active will be displayed. If a delay has been set on the alarm, the delay period will start from the time when the input is turned OFF. If the alarm has been configured as latching the latching action is also inhibited whenever the input is ON. See section 4.5.4 and 4.5.6.

2.2.8 To Change The Alarm Setpoints (trip levels)

Parameters are grouped in 'lists' according to their function. Each list has a heading.

The [D] button steps through the parameter list headings (see section 2.4.1.)
The first list is the alarm setpoints list AL

Do This	This Is The Display You Should See	Additional Notes
1. From any display press [D] as many times as necessary to show the **'Alarm List'** header		*i* If [▲] or [▼] are pressed the word <L, St> is displayed for 2 secs 
2. Press [G] to show the first parameter in the list 3. Press [▲] or [▼] to change the alarm setpoint	 [▲] or [▼]	*i* There are four alarm setpoints. The first character is the alarm number, the next three the alarm type (see section 2.2.4.) If an alarm has been disabled in configuration level, it will not appear in this list.

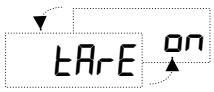
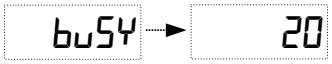
4. To return to the HOME display:-
   - Press [G] and [D] together
   - **or** continue to press [D]
   - **or** the indicator will return to the HOME display if no button is pressed for 45 seconds (10 seconds if an alarm condition is present).

2.3 AUTO-TARE (DISPLAY ZERO)

The auto-tare function is used, for example, when it is required to weigh the contents of a container but not the container itself. Alternatively, it can be used to set a fixed offset on an initial measured value.

2.3.1 To Use Auto Tare

Place the empty container on the weigh-bridge. Then:-

Do This	This Is The Display You Should See	Additional Notes
1. From any display press [D] as many times as necessary to show the <CAL 1> **List'** header		*i* Use <CAL2> if the load cell is connected to input 2
2. Press [G] to scroll to <tArE> 3. Press [▲] or [▼] and change from <OFF> to <on>		*i* The indicator automatically calibrates itself to the empty container. When <tArE> is turned to <on>, the display will change to <buSY>. When calibration is complete the display will return to the HOME display. It will then return to the main display. If the calibration fails the alarm message <tdr.F> (transducer fail) will flash. Press [D] and [G] to acknowledge. 

4. Return to the HOME display as described above

Note:-
The indicator will not return to the HOME display until the calibration procedure completes.

If calibration does not complete after a period of 5 minutes, then calibration is aborted.

The full list of parameters available in these lists is shown in the parameter tables is shown in the following section.

2.4 TO ACCESS AND CHANGE PARAMETER VALUES

Parameters are settings within the indicator, which determine how it will operate. Examples are Alarm Setpoints and Tare Values already mentioned. They are organised into different lists. Each list has a named heading which describes a particular subject, for example 'Alarms' <AL>

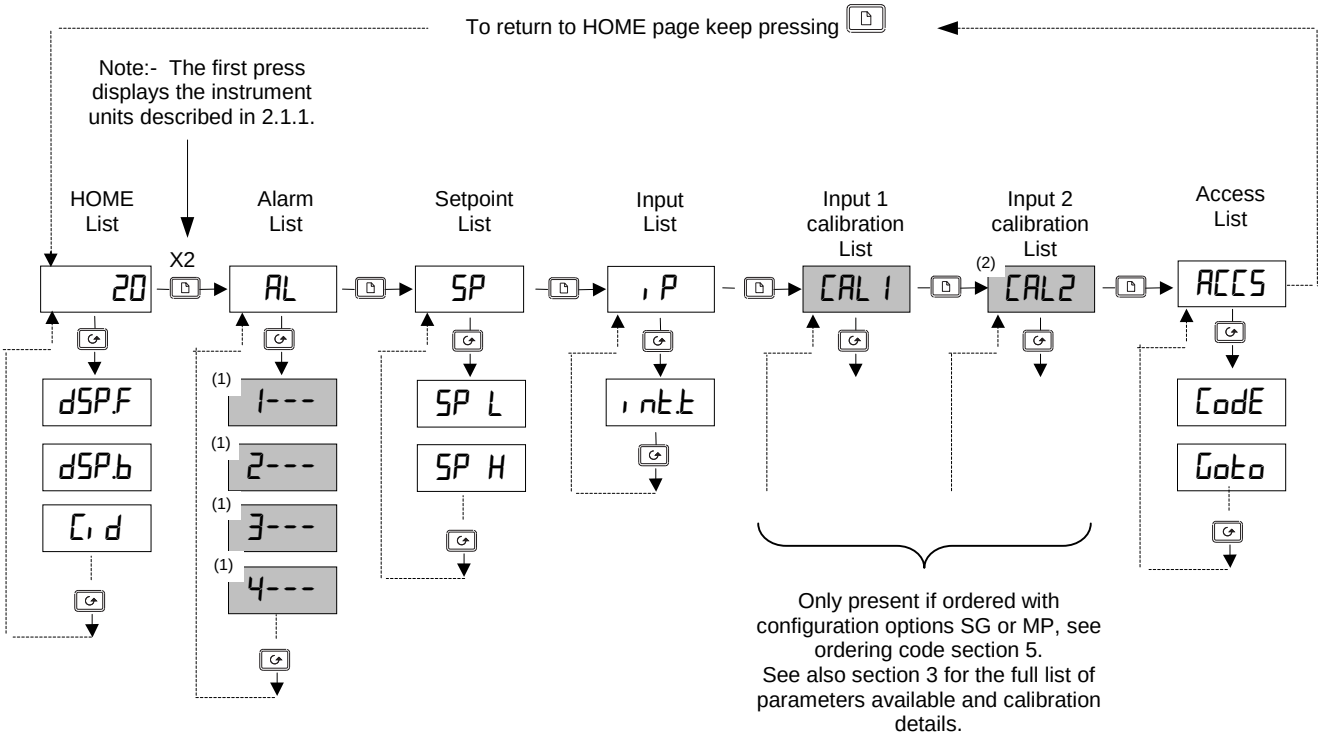
2.4.1 Operator Level Navigation Diagram (factory default)

This list shows the parameters available in operator level in a new instrument.

To find a parameter:-

Press [▯] to select the list heading
Press [↻] to select the parameter
Press [▲] or [▼] to change its value

} Examples are shown in sections 2.2 8. and 2.3.1.



- Blocks shown shaded are dependant upon the order code as follows:-

  (1) These parameters are only shown if the alarm has been configured

  (2) CAL2 list is only shown if Input 2 has been configured

- The above list can be customised to suit the requirements of a particular process. Complete lists or individual parameters in a list can be added during commissioning. The procedure is described in section 3.4 'To Hide. Reveal and Promote Parameters'.

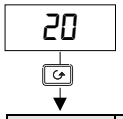
2.5 PARAMETER TABLES

The parameter tables provide a full list of parameters, an explanation of their use and where to find them.

Use these lists to adjust:-

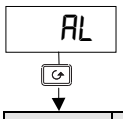
- The alarm setpoints
- The alarm setpoint limits
- The User calibration
- The input filter time constant
- The communications address

2.5.1 HOME List



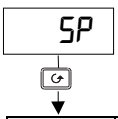
HOME	Home List	Selectable options		Default
dSP.F	HOME display front	<nonE>	The HOME display will be blank and only alarm messages will be flashed	PU
		<SP>	Setpoint (for deviation alarms)	
		<rm.SP>	Remote setpoint (for deviation alarms)	
		<PU.Hi>	Displays the maximum value on input 1. This parameter is the same as <LOG.H> in <inFo> list	
		<PU.Lo>	Displays the minimum value on input 1. This parameter is the same as <LOG.L> in <inFo> list	
		<PU>	Process Value	
		<AL.SP>	Alarm 1 setpoint	
		<L 1>	Linearised input 1	
dSP.b	HOME display back	<L2>	Linearised input 2	
C.id	Customer defined identity number - an indicator can be associated with a physical position	0 to 9999		0

2.5.2 Alarm List



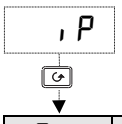
AL	Alarm list	Comments	Adjustable Range	Default
1---	Alarm 1 setpoint	The last three letters indicate the	Between low and high setpoint limits which	0
2---	Alarm 2 setpoint	Alarm type. See section 2.2.4.	As set in the SP list.	0
3---	Alarm 3 setpoint	If the alarm is disabled the parameter	Rate of change alarms are direction sensitive	0
4---	Alarm 4 setpoint	will not appear in this list	from-9999 to +99999 units/sec or min	0

2.5.3 Setpoint List



SP	Setpoint list	Adjustable Range	Default
SP L	Setpoint low limit – PV alarms	Input range min and max (combination of	As per
SP H	Setpoint high limit – PV alarms	inputs 1 & 2	order code

2.5.4 Input List



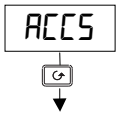
iP	**Setpoint list**	Adjustable Range	Default
inLt	Input filter integrating time constant Set to a value which reduces the effect of any input noise to an acceptable level. The higher the value the more sluggish the response	OFF to 999.9 seconds	1.6

2.5.5 User Calibration Lists – Inputs 1 and 2

CAL.1 or CAL2 (CAL 2 only appears if input 2 has been configured)

CAL.-	**User calibration 1 or 2 list**	Adjustable Range	Default
tArE	Performs automatic 'Tare' correction See also section 2.3.	OFF = Off on = start correction buSY = inputting value donE = finished inputting value	OFF

2.5.6 Access List



The Access List provides password protected access to further levels of operation as listed below. See section 3 for further details.

codE	A code number can be entered using the ▼ or ▲ buttons. If an incorrect code number is entered the display will revert to <codE>. If no button is pressed within 45 seconds the indicator will automatically return to the HOME display.

For information on further levels of access, see the following sections.

3 Password Protected Levels of Operation

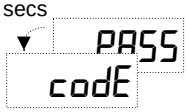
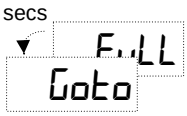
3.1 ACCESS LEVELS

Parameters are protected under different levels of access for which numerical password codes can be set up. The levels are:-

Access Level	What you can do	Default Code
OPEr	To view and adjust a limited set of parameters within limits set in higher levels	
FuLL	To view and adjust all parameters which are required to operate the indicator	1
Edit	Allows parameters to be hidden or promoted to operator levels (see section 3.4)	1
ConF	Allows access to configure the fundamental characteristics of the indicator	2
CAL.P	This special level which appears in the CAL1 and CAL2 lists allows access to the calibration procedure for the indicator	3

The following sections this manual describe the features available in Full, Edit and Configuration levels.

3.1.1 To Select Full or Edit Access Levels

Do This	This Is The Display You Should See	Additional Notes
1. From any display press [▯] as many times as necessary to access the **'Access List'** header menu	ACCS	If [▲] or [▼] are pressed the word <L1 St> is displayed for 2 secs 
2. Press [⟳] to show <codE> Press [▼] or [▲] to enter the password 3. Press [⟳] to show <Goto>	2 secs 	The factory default password is 1 <PASS> will be displayed momentarily when the correct password is been entered In the special case that the passcodes have been configured as 0, it will not be necessary to enter a passcode
4. Press [▼] or [▲] to select <FuLL> level	2 secs 	Options are: <OPEr> Operator level - shows selected operator parameters <FuLL> Reveals the 'FULL' set of parameters <Edit> Allows parameters to be hidden or promoted <ConF> Gives access to configuration level (see section 4). The factory default password is 2

⚠ Having entered a higher level you can select <OPEr>, <FuLL> or <Edit> levels at will.
Remember to return to <OPEr> level following completion of commissioning or configuring the instrument..
This may be done by:-

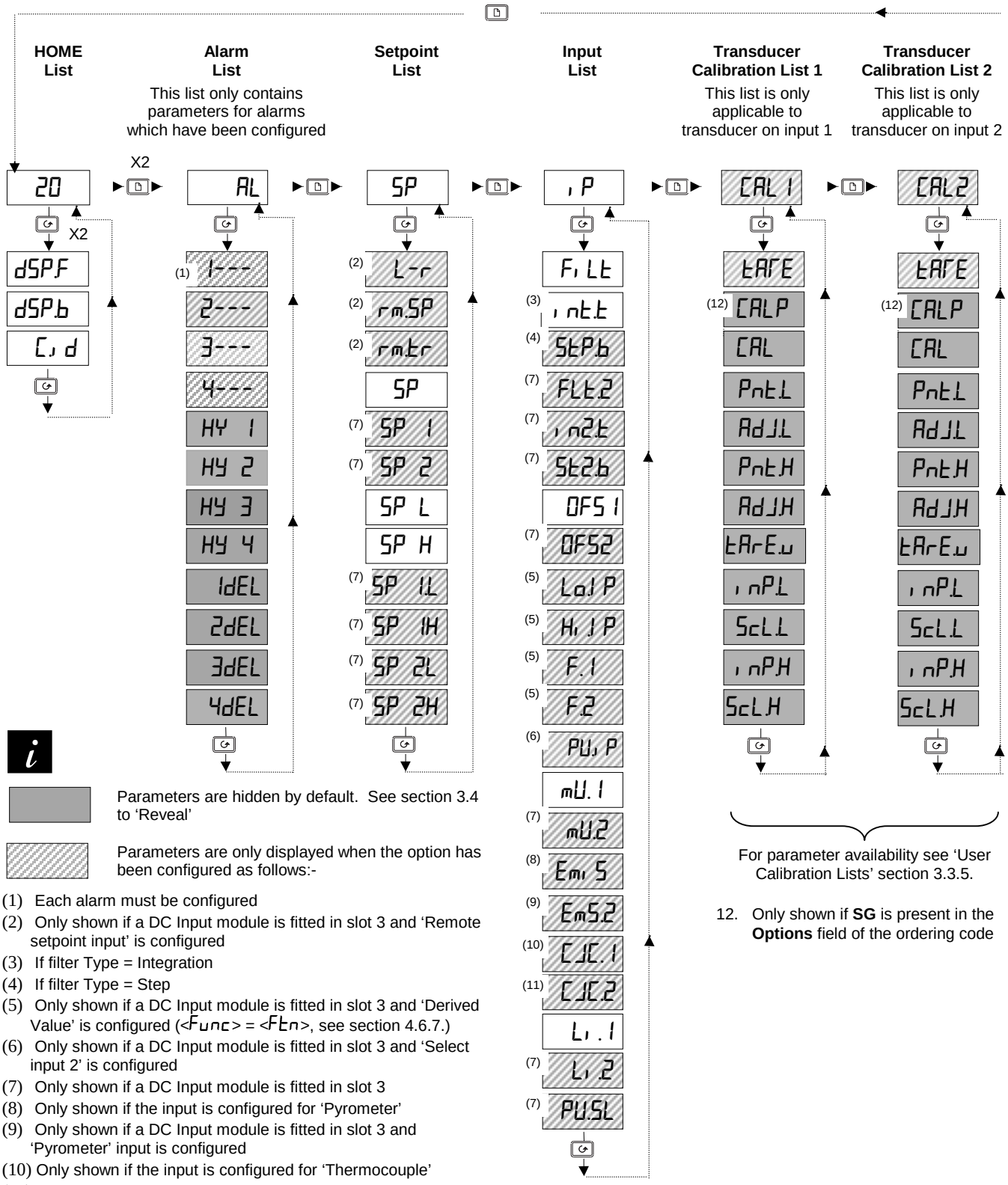
i 1. Switching the indicator off and back on again.
OR
2. Go to <OPEr> level and enter a false password number to re-lock the indicator in this level.

3.2 NAVIGATION DIAGRAM (FULL AND EDIT LEVELS)

Use the following lists to adjust:

- The alarm setpoints
- The alarm setpoint limits
- The input filter time constant
- The User calibration
- The communications address

The diagram below shows the complete list of possible parameters which may be shown in Full and Edit access levels. In practice, the parameters that appear will depend upon the configuration of your particular indicator .



Parameters are hidden by default. See section 3.4 to 'Reveal'

Parameters are only displayed when the option has been configured as follows:-

(1) Each alarm must be configured
(2) Only shown if a DC Input module is fitted in slot 3 and 'Remote setpoint input' is configured
(3) If filter Type = Integration
(4) If filter Type = Step
(5) Only shown if a DC Input module is fitted in slot 3 and 'Derived Value' is configured (<Func> = <Ftn>, see section 4.6.7.)
(6) Only shown if a DC Input module is fitted in slot 3 and 'Select input 2' is configured
(7) Only shown if a DC Input module is fitted in slot 3
(8) Only shown if the input is configured for 'Pyrometer'
(9) Only shown if a DC Input module is fitted in slot 3 and 'Pyrometer' input is configured
(10) Only shown if the input is configured for 'Thermocouple'
(11) Only shown if a DC Input module is fitted in slot 3 and 'Thermocouple' input is configured

For parameter availability see 'User Calibration Lists' section 3.3.5.

12. Only shown if **SG** is present in the **Options** field of the ordering code

Figure 3-1: Navigation Diagram

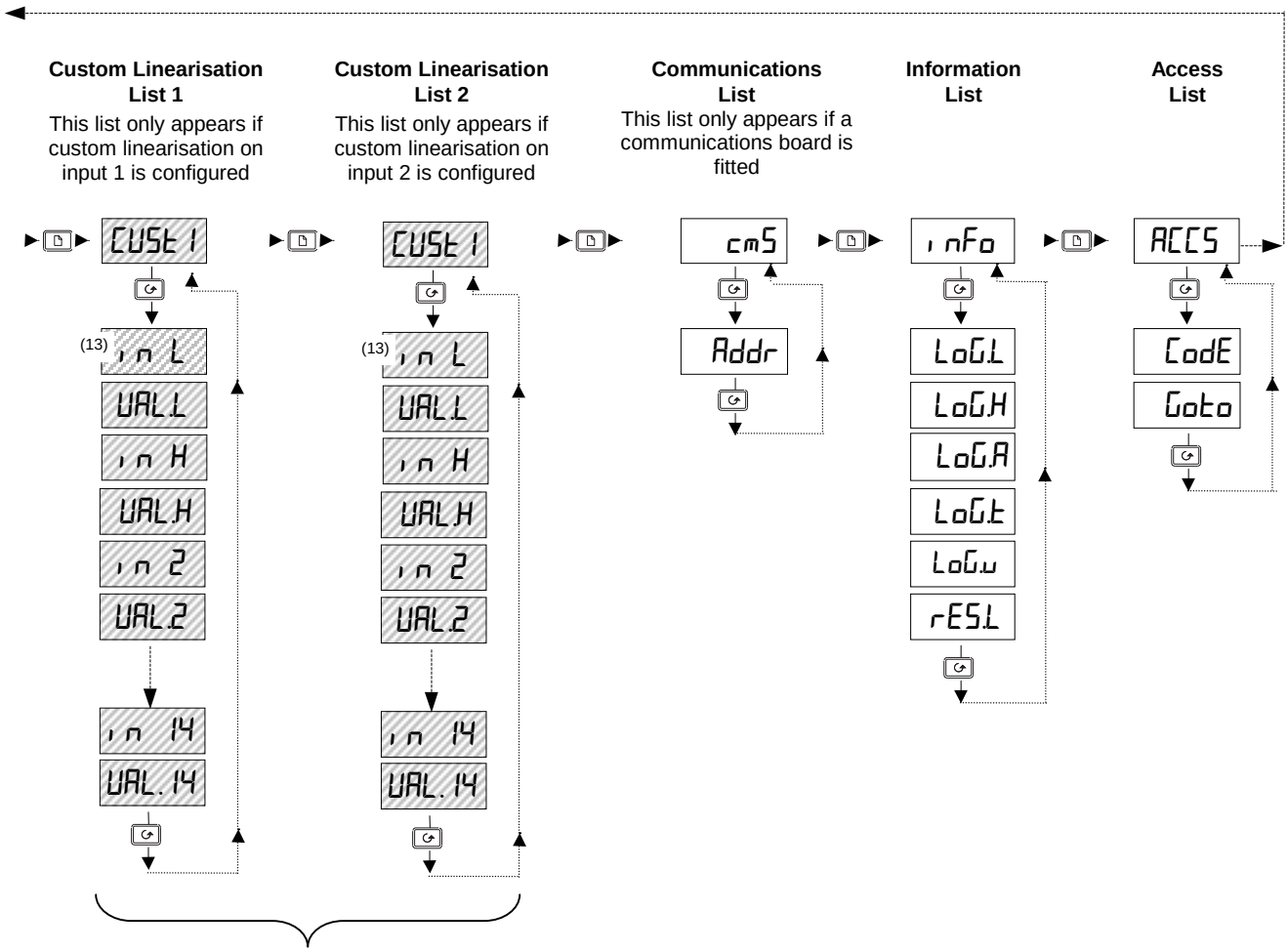
Summary

A. Press [D] to step across the list headings.

B. Press [C] to step down the parameters within a particular list. You will eventually return to the list heading.

C. Press [▼] to view the value of a selected parameter. Keep pressing to decrease the value.

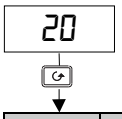
D. Press [▲] to view the value of a selected parameter. Keep pressing to increase the value.



13. Only shown if:- <mU.C>, <U.C> or <mA.C> are configured, see Sensor Input Configuration List section 4.5.2.

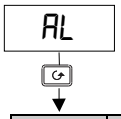
3.3 PARAMETER TABLES

3.3.1 HOME List



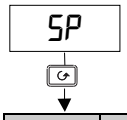
Mnem-onic	Meaning	Adjustable Range	Default setting	Customer setting
dSP.F	HOME display front	See 'HOME display options' section 2.1.2.	PU	
dSP.b	HOME display back		None	
C.id	Customer defined identity number	0 to 9999	0	

3.3.2 Alarm List



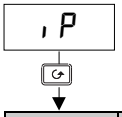
Mnem-onic	Meaning		Adjustable Range	Default setting	Customer setting
1---	Alarm 1 setpoint	In place of dashes, the last three letters indicate the alarm type: as shown in the **'Alarm Messages'** table section 2.2.4.	Between low and high setpoint limits which are set in the <SP> list	0	
2---	Alarm 2 setpoint		Rate of change alarms are direction sensitive from-9999 to +99999 units/sec or min	0	
3---	Alarm 3 setpoint			0	
4---	Alarm 4 setpoint			0	
If the alarm is disabled the parameter will not appear in this list					
HY 1	Alarm 1 Hysteresis	Prevents relay 'chatter' by setting a difference between the relay ON and OFF points	1 to 99999 display units	1	
HY 2	Alarm 2 Hysteresis		1 to 99999 display units	1	
HY 3	Alarm 3 Hysteresis		1 to 99999 display units	1	
HY 4	Alarm 4 Hysteresis		1 to 99999 display units	1	
1dEL	Alarm 1 delay	Used to ignore transient alarms. Alarms must be true for the delay time before they become active	0 to 999.9 seconds	0	
2dEL	Alarm 2 delay		0 to 999.9 seconds	0	
3dEL	Alarm 3 delay		0 to 999.9 seconds	0	
4dEL	Alarm 3 delay		0 to 999.9 seconds	0	
Inh.AL	Inhibit alarm timer	To inhibit alarms for a time see section 4.5.5	On/OFF	OFF	
InHt	Time alarm inhibited		0 to 999.9 seconds	0	

3.3.3 Setpoint List



Mnem-onic	Meaning	Adjustable Range	Default setting	Customer setting
L-r	Remote setpoint enable	Loc Select local SP rmt Select remote SP	Loc	
rm.SP	Remote master setpoint (for deviation alarms)	Displays remote SP value	N/A	Read only
rm.tr	Remote setpoint track. This parameter only appears if remote setpoint has been configured	OFF No tracking trAc Local SP tracks remote SP	OFF	
SP 1	Local master setpoint value for deviation alarms on input 1	SP 1.L to SP 1.H	20	
SP 2	Local master setpoint value for deviation alarms on input 2	SP2.L to SPH.2	20	
SP	Setpoint value when the combination of inputs 1 & 2 provide the measured value to the indicator (for deviation alarms)	SPL to SPH		
SP L SP H	PV Alarms Setpoint low limit Setpoint High limit	Input range min and max (combination of input 1 2)	As per order code	
SP 1.L SP 1.H	Input 1 Alarms Setpoint Low Setpoint High	Between input 1 sensor range min and max	As per order code	
SP2.L SP2.H	Input 2 Alarms Setpoint Low Setpoint High	Between input 2 sensor range min and max	As per order code	

3.3.4 Input List



Mnem-onic	Meaning		Adjustable Range		Default setting	Customer setting
F, LE	Input 1 Filter Type	For explanation of filter action see section 3.3.4.2.	OFF I nt StEP	No input filter Integrating Step		
I ntE	Input 1 filter time constant	Appears if Filter Type = <I nt> Used to reduce process value flicker on any input other than weigh scales	OFF to 999.9 seconds		1.6	
StP.b	Input 1 filter Step Band	Appears if Filter Type = <StEP> Used to reduce process value flicker on weigh scale inputs	1 to 100 (% maximum noise band)		10	
The above three parameters are repeated for input 2 as <FLt2>, <I nt2.t> and <St2.b> respectively						
OFS 1	Input 1 calibration Offset	See section 3.5.1	999.9 to 999.9			
OFS2 (1)	Input 2 calibration Offset		999.9 to 999.9			
Lo.I P Hi .I P	Transition of indication between input 1 and 2 (if configured) • The displayed value is derived from input 1when PV is below <Lo.I P> and from input 2 when PV is above <Hi .I P> • When PV is between <Lo.I P> and <Hi .I P> the displayed value is a combination of both inputs • <Lo.I P> cannot be set to a value above <Hi .I P> This is described further in section 4.6.9.1		Between input sensor range minimum and maximum.		As per order code	
F. 1 (2)	<F. 1> and <F.2> are constants to achieve a derived PV where PV = <F. 1> x input 1 + <F.2> x input 2		-9.99 to 10.00		0.5	
F.2 (2)			-9.99 to 10.00		0.5	
PU, P(1)	Selects input 1 or input 2		, P. 1 , P.2	Input 1 selected Input 2 selected	, P. 1	
mU. 1	Input 1 mV measured at the rear terminals				Read-only	Read-only
mU.2(1)	Input 2 mV measured at the rear terminals (module 3)				Read-only	Read-only
CJC. 1	Input 1 Cold junction compensation temperature measured at the rear terminals. Only applies if the input 1 type = thermocouple				Read-only	Read-only
CJC.2(1)	Input 2 Cold junction compensation temperature measured at the rear terminals (module 3) Only applies if the input 2 type = thermocouple				Read-only	Read-only
Em, S	Input 1 Emissivity. Only applies if the input 1 type = pyrometer					
EmS.2 (1)	Input 2 Emissivity. Only applies if the input 2 type = pyrometer					
L, .1	Input 1 Linearised value				Read-only	Read-only
L, .2 (1)	Input 2 Linearised value (module 3)				Read-only	Read-only
PU.SL	Shows the currently selected PV input	, P. 1 , P.2 both	Input 1 selected Input 2 selected Both input 1 and input 2 are configured		, P. 1	

Notes:
(1) These parameters only appear if input 2 has been configured
(2) These parameters only appear if a derived input has been configured

3.3.4.1 Example: To Measure to Differential Between Input 1 and Input 2

1. From the above list, select <F. 1> and set its value to 1.
2. From the above list, select <F.2> and set its value to -1.
3. The derived PV will read the difference between Input 1 and Input 2

3.3.4.2 Filter Type

There are three settings for the filter type

1. **Filter Type = Off.** The display will respond immediately to any change in the PV input. If, however, there is any input noise this will result in fluctuations of the reading
2. **Filter Type = Integrating action.** This is designed for all process input types with the exception of weigh cell transducers as explained in section 3.6. The function is exponential which means that, for a step change in the input, the displayed value will move rapidly at first towards the new reading then gradually slow as the reading approaches the PV value. The effect is that small rapidly changing input values are ignored. The rate of response is set, in seconds, by the parameter `InT.t`, which only appears for this type of filter. The larger the value the more sluggish the response
3. **Filter Type = Step Band**. This is specifically designed for weighing applications. The filter only responds when the displayed value becomes close to the measured value. This means that for a step change in the input the displayed value will change rapidly towards the measured value then slow as it reaches this value. The step band is set by the parameter `StP.b` which only appears for this type of filter. The units approximate to 1µV steps – the larger the setting more sluggish the response over the final stages of the reading. This type of filter is used, for example, where a weigh bridge or load cell is subject to vibrations

3.3.5 User Calibration Lists

These lists only appear if the 'Type of Calibration', <`tYPE`>, is configured for strain gauge type transducer applications (see Configuration Chapter for further details). The lists below are shown for each type of calibration. If <`tYPE`> = <`OFF`> the lists are not displayed.
Some parameter mnemonics remain the same for each type of transducer, but their functions may vary in detail between the different types. The tables are repeated, therefore, for each calibration type.
The tables are followed by a description of procedure to use for each type of calibration.

3.3.5.1 Calibration Type = Shunt (<`tYPE`> = <`Shnt`>)

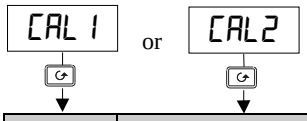
See also section 3.6.1.

`CAL 1` or `CAL2`

Mnem-onic	Meaning		Adjustable Range	Default setting	Customer setting
`tArE`	Performs automatic 'Tare' correction See 'USER CALIBRATION' section for further description		`OFF` = Off `on` = Start correction `buSY` = Calculating value	`OFF`	
`CAL.P`	Calibration password -See 'USER CALIBRATION'		`0` to `99999`	`3`	
The following three parameters only appear when the correct password has been entered					
`CAL`	Calibration type		`FAct` Factory calibration restored `USEr` User calibration enabled	`FAct`	
The following two parameters are only shown if <`USEr`> is selected as the calibration type					
`Pnt.L`	Start point low calibration Note: In shunt mode this parameter starts both zero and span calibration. Its mnemonic is common to other transducer applications		`OFF` Calibration complete `on` Start calibration	`OFF`	
`tArE.u`	Tare Value	This allows a fixed offset to be applied to the displayed reading. It must be set before auto tare is started	`-999.9` to `99999` display units	`0.0`	
`S.Gru`	Specific gravity multiplier	For materials with specific gravity different from water (1)	`0.01` to `999.9`	`1.00`	
`ScL.L`	Scale Low point	Defines the low calibration point for the transducer (normally 0% of the transducer range)	`-999.9` to `99999` display units	`0`	
`ScL.H`	Scale High point	Defines the high calibration point for the transducer (normally 80% of the transducer range)	`-999.9` to `99999` display units	`0`	

3.3.5.2 Calibration Type = Load Cell (<tYPE> = <Ld.C>)

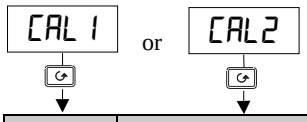
See also section 3.6.3.



Mnem-onic	Meaning		Adjustable Range	Default setting	Customer setting
tArE	Performs automatic 'Tare' correction See 'USER CALIBRATION' section for further description		OFF = Off on = Start correction buSY = Calculating value	OFF	
CAL.P	Calibration password -See 'USER CALIBRATION'		0 to 99999	3	
The following four parameters only appear when the correct password has been entered					
CAL	Calibration type		FACt Factory calibration restored USEr User calibration enabled	FACt	
The following three parameters are only shown if <USEr> is selected as the calibration type					
Pnt.L	Start point low calibration		OFF Calibration complete on Start low point calibration	OFF	
Pnt.H	Start point high calibration		OFF Calibration complete on Start high point calibration	OFF	
tArE.u	Tare Value	This allows a fixed offset to be applied to the displayed reading. It must be set before auto tare is started	-999.9 to 99999 display units	0.0	
S.Gru	Specific gravity multiplier	For materials with specific gravity different from water (1)	0.01 to 999.9	1.00	
ScL.L	Scale Low point	Defines the value which will be displayed when the load is removed from the cell	-999.9 to 99999 display units	0	
ScL.H	Scale High point	Defines the value which will be displayed when the load is placed on the cell	-999.9 to 99999 display units	0	

3.3.5.3 Calibration Type = Comparison <tYPE> = <Cm.P>

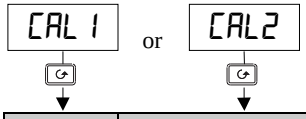
See also section 3.6.5.



Mnem-onic	Meaning		Adjustable Range	Default setting	Customer setting
tArE	Performs automatic 'Tare' correction See 'USER CALIBRATION' section for further description		OFF = Off on = Start correction buSY = Calculating value	OFF	
CAL.P	Calibration password -See 'USER CALIBRATION'		0 to 99999	3	
The following four parameters only appear when the correct password has been entered					
CAL	Calibration type		FACt Factory calibration restored USEr User calibration enabled	FACt	
The following three parameters are only shown if <USEr> is selected as the calibration type					
Pnt.L	Start point low calibration		OFF Calibration complete on Start low point calibration	OFF	
Pnt.H	Start point high calibration		OFF Calibration complete on Start high point calibration	OFF	
tArE.u	Tare Value	This allows a fixed offset to be applied to the displayed reading. It must be set before auto tare is started	-999.9 to 99999 display units	0.0	
S.Gru	Specific gravity multiplier	For materials with specific gravity different from water (1)	0.01 to 999.9	1.00	
ScL.L	Scale Low point	Automatically adjusts to the value entered at <Pnt.L>	-999.9 to 99999 display units		
ScL.H	Scale High point	Automatically adjusts to the value entered at <Pnt.H>	-999.9 to 99999 display units		

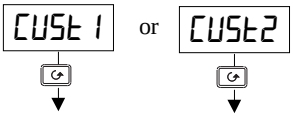
3.3.5.4 Calibration Type = Manual <tYPE> = <mAn>

See also section 3.6.7.



Mnem-onic	Meaning		Adjustable Range	Default setting	Customer setting
CAL.P	Calibration password -See 'USER CALIBRATION'		0 to 99999	3	
The following four parameters only appear when the correct password has been entered					
CAL	Calibration type		FACt Factory calibration restored USEr User calibration enabled	FACt	
The following three parameters are only shown if <USEr> is selected as the calibration type					
inP.L	Input low	Set to the low electrical input which is to correspond to the low display reading	-999.9 to 99999 display units		
ScL.L	Scale Low point	Set to the display reading corresponding to <inP.L>	-999.9 to 99999 display units	0	
inP.H	Input high	Set to the high electrical input which is to correspond to the high display reading	-999.9 to 99999 display units		
ScL.H	Scale High point	Set to the display reading which corresponds to<inP.H>	-999.9 to 99999 display units	0	

3.3.6 Custom Linearisation List 1 or 2



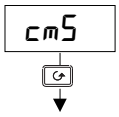
Mnem-onic	Meaning	Adjustable Range	Default setting	Customer setting
in L	Adjust low input value		min input	
UAL.L	Adjust displayed value corresponding to input low		min display	
in H	Adjust high input value		Max input	
UAL.H	Adjust displayed value corresponding to input high		max display	
in 2	Adjust input break point 2 value			
UAL.2	Adjust displayed value corresponding to point 2			
to		The values entered must be continuously increasing or decreasing		
in 14	Adjust input break point 14 value			
UAL.14	Adjust displayed value corresponding to point 14			

This list only appears if a custom download input has been configured.

Further information on Custom Linearisation is given in section 3.7.

i **Having entered the values for the custom linearisation it is necessary to power down the instrument and power back up again to enter the values otherwise they will be clamped to zero. Alternatively enter then leave configuration level.**

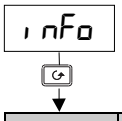
3.3.7 Digital Communications List



Mnem-onic	Meaning	Adjustable Range	Default setting	Customer setting
Addr	Indicator communications address	1 to 99 EI Bisynch 1 to 254 Modbus	1	

This list only appears if digital communications has been configured.

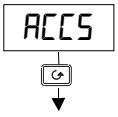
3.3.8 Information List



Mnem-onic	Meaning		Adjustable Range	Default setting	Customer setting
LoG.L	Logged Minimum Process Value	These values are logged by the indicator from switch on To reset switch the indicator supply off and on again or scroll to <rESL> and select <YES>	Can be manually adjusted	Read-only	Read-only
LoG.H	Logged Maximum Process Value		Can be manually adjusted	Read-only	Read-only
LoG.A	Logged Average Process Value			Read-only	Read-only
LoG.t	Time process value is above threshold level		Time displayed in minutes	Read-only	Read-only
LoG.u	Process value threshold for timer log		Between display min and max	0	
rES.L	Logging reset		no Logging in progress YES Will reset logged values	no	

3.3.9 Access List

The Access List is the same as section 2.5.6.



Mnem-onic	Meaning
OPEr	To view and adjust a limited set of parameters within limits set in higher levels
FuLL	To view and adjust all parameters which are required to operate the indicator
Edit	Allows parameters to be hidden or promoted to operator levels (see section 3.4.)
ConF	Allows access to configure the fundamental characteristics of the indicator
CAL.P	This special level which appears in the CAL1 and CAL2 lists allows access to the calibration procedure for the indicator

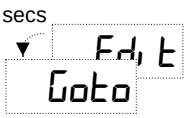
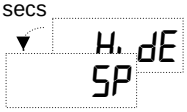
3.4 TO HIDE, REVEAL AND PROMOTE PARAMETERS

In Edit level you can choose customise the operator level display by choosing which parameters can be made available. The choices are:-

<ALtr> The parameter will be alterable
<Hi dE> The parameter will be hidden
<rEAd> The parameter will be read-only
<Pro> The parameter will be 'promoted' into the HOME list (see below)

3.4.1 List Headers

Any list of parameters shown in the Navigation Diagram, section 3.2. can be made available or hidden in Operator level.

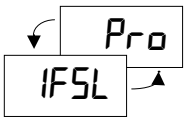
Do This	This Is The Display You Should See	Additional Notes
1. Enter <Edit> level as described in 3.1.1.	2 secs 	
2. Press [▯] to select the list to be hidden eg <SP> the setpoint parameters 3. Press [▼] or [▲] to select <Hi dE> or <rEAd>	2 secs 	If <Hi dE> is selected the complete list will not be available in Operator level

3.4.2 Parameters

Any parameter in a list can be made available or hidden in the same way as the complete list header as described above. They can also be made read only or promoted as shown in the two following examples.

3.4.2.1 The <Pro> (Promote) option

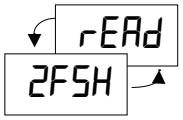
Up to twelve commonly used parameters can be 'promoted' into the HOME list. This will give the operator quick access to them by simply pressing the [↻] button. This feature, used in combination with 'hide' and 'read only' allows you to organise the way in which you want your indicator formatted.



Low alarm 1 has been selected
Press [▼] or [▲] to choose <Pro>.

The parameter < 1FSL> will now appear in the HOME list. Repeat the procedure for any other parameters you wish to promote.
To de-promote a parameter go to <Edit> level, select the parameter from the relevant list and change the choice from <Pro> back to <ALtr>, <rEAd> or <Hi dE>.

3.4.2.2 Read Only Example



In this example Full scale High alarm 2 will be read only. This means that its value will be displayed in operator level but it cannot be changed.

3.5 CALIBRATION

The indicator is calibrated in three ways. These are:-

1. **Factory Calibration.** The controller is calibrated to very high accuracy during manufacture and the calibration values are permanently stored within the controller. Factory calibration is not available to the user
2. **Transducer Scaling.** Transducer scaling allows offsets to be entered to compensate for errors or differences in the process measurement system
3. **User Calibration.** This allows the instrument to be calibrated against a certified field calibration source

See also section 3.3.5. for the full list of calibration parameters

3.5.1 User Calibration

User calibration allows you to:-

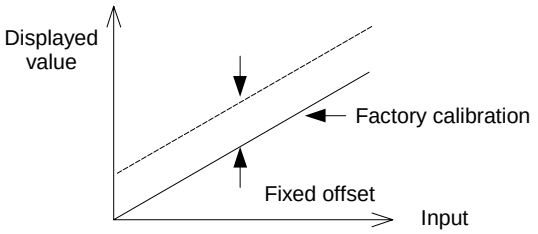
1. Calibrate the controller to the your reference standards
2. Match the calibration of the controller to that of a particular transducer or sensor input
3. Calibrate the controller to suit the characteristics of a particular installation

The following can be calibrated:

1. **Input 1.** This applies to the fixed PV input on terminals V1, V+, V-. It allows you to set the displayed reading to correspond to the electrical input range on linear mV volt or mA inputs
2. **Input 2.** This applies to module 3 when fitted with a DC Input module. It allows you to set the displayed reading to correspond to the electrical input range on linear mV volt or mA inputs
3. **Analogue I/O Modules c**onfigured as DC Retransmission. It allows you set up the electrical output to correspond with the displayed value

3.5.1.1 Single Point Offset

A single offset applies to Inputs 1 & 2 and applies a fixed offset over the full display range of the controller.



To calibrate, proceed as follows:

1. Connect the input of the controller to the source device to which you wish to calibrate.
2. Set the source to the desired calibration value.
3. The controller will display the current measurement of the value.
4. If the displayed value is correct, then the controller is correctly calibrated and no further action is necessary. If it is incorrect, then follow the steps shown below.

Figure 3-2: Fixed Offset

3.5.1.2 To Apply an Offset to Input 1

Do This	This Is The Display You Should See	Additional Notes
1. From any display press [▯] as many times as necessary to access the <, P **List**> header menu	, P	
2. Press [⟳] to show <OFS. 1> **(**Offset on input 1) 3. Press [▼] or [▲] to enter the required offset	OFS. 1 1.0	*i* An offset on Input 1 of +1.0 unit will be applied over the full range of the input. The same procedure is followed to apply an offset to Input 2

3.5.1.3 Two Point Calibration

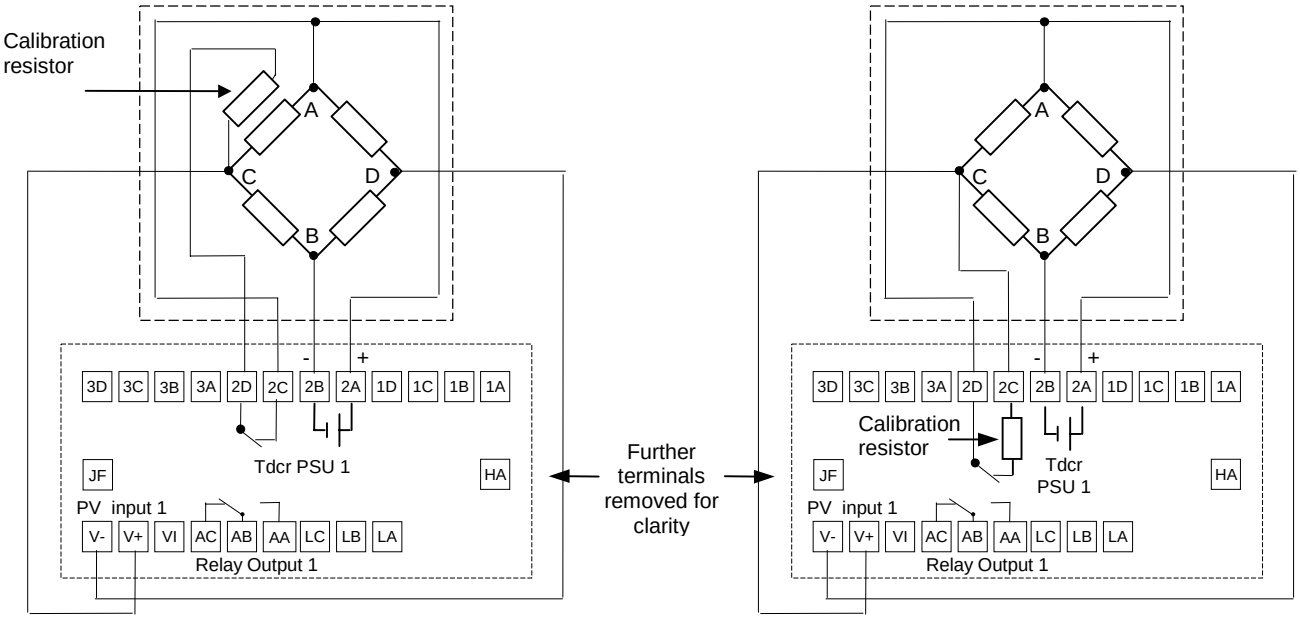
Two point calibration is only available in Configuration level and allows you to adjust both the low point (zero) and high point (span) independently when using a mV, volt or mA input. The examples in sections 4.5.2. and 4.6.10. show how this is applied to a process input and retransmission value respectively.

3.6 TRANSDUCER CALIBRATION

This indicator supports a number of different two and four wire transducer types. Each type is explained in this section.

3.6.1 Shunt Calibration

Shunt calibration is so called since it refers to switching a calibration resistor across one arm of the four wire measurement bridge in a strain gauge transducer. It also requires the use of a Transducer Power Supply module wired as shown in Figure 3-3.



Wiring for Transducer with Internal Calibration Resistor **Wiring for Transducer with External Calibration Resistor**

Both diagrams show connections to Input 1/main input.
If Input 2 is used in module position 3, the transducer output can be connected to terminals 3C (+) and 3D (-)

Figure 3-3: Wiring for Strain Gauge Calibration

3.6.2 To Calibrate a Strain Gauge Bridge Transducer

The strain gauge transducer is calibrated as follows:-

1. Remove any load from the transducer to establish a zero reference
2. Enter 'Scale Low' <ScLL> and 'Scale High' <ScLH> values which are normally set at 0% and 80% of the span of the transducer
3. Start the procedure using the low point calibration parameter <PntL>, or a digital input wired to this parameter

The indicator will automatically perform the following sequence for a transducer with its own integrated calibration resistor:

1. Disconnect the shunt resistor
2. Calculate the low point calibration value by continuously averaging two lots of 50 measurements of the input until stable readings are obtained
3. Connect the shunt resistor by closing a contact between terminals D and C.
4. Calculate the high point calibration value by averaging two lots of 50 measurements of the input

For transducers which do not contain a calibration resistor the indicator will switch in its own internal calibration resistor.

3.6.2.1 First - Enter The Calibration Password

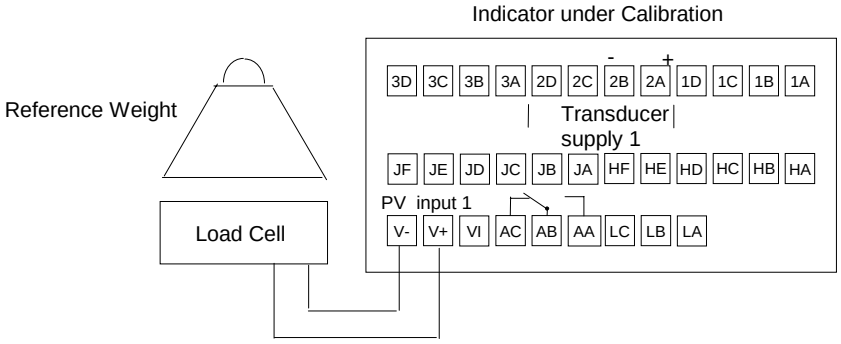
Do This	This Is The Display You Should See	Additional Notes
1. From any display press [▯] as many times as necessary to access the <CAL 1> **(or <2>) List'** header	CAL 1	
2. Press [↻] to scroll to <CAL.P>	CAL.P	The first parameter in the list is <tArE> Calibration of Tare weight has already been described in Operator Level Section 2.3
3. Press [▼] or [▲] to enter the calibration password. In a new instrument the default is <3>	3	When the correct password is entered <PASS> will flash briefly on the display A password of <0> allows the instrument to proceed directly to the next parameter
4. Press [↻] to show <CAL> 5. Press [▼] or [▲] to turn calibration to <USEr>	USEr CAL	See start of this section for a description of User and Factory calibration

3.6.2.2 Next – Calibrate the Strain Gauge Transducer

Do This	This Is The Display You Should See	Additional Notes
6. Press [↻] to scroll to <ScL.L> 7. Press [▼] or [▲] to enter the scale low value (normally 0)	ScL.L 0	This sets the minimum (zero) point at which the transducer is to be calibrated. This is typically 0%.
8. Press [↻] to scroll to <ScL.H> 9. Press [▼] or [▲] to enter the scale high value	ScL.H 80.00	This sets the maximum (span) point at which the transducer is to be calibrated. This is typically 80% of the transducer range.
10. Press [↻] to show <Pnt.L> 11. Press [▼] or [▲] to turn calibration to <on>	on Pnt.L	The indicator will show 'busy' while calibrating before returning to <Pnt.L> If the calibration fails the alarm message <tdr.F> is flashed
		The <Pnt.L> parameter may have been wired to a digital input for activation by an external switch The operation is identical except that the indication will return to the display which was being shown prior to the activation of the switch

3.6.3 Load Cell Calibration

A load cell with V, mV or mA output may be connected to Input 1 or Input 2.



This diagram shows connections to input 1/main input

If Input 2 is used in module position 3, the transducer output can be connected to terminals 3C (+) and 3D (-)

Figure 3-4: Load Cell Calibration

3.6.4 To Calibrate a Load Cell

The load cell is calibrated as follows:

1. Set <SCL.L> and <SCL.H> for the required 'zero' and 'span' readings on the display
2. Remove any load and start the procedure using the low point calibration parameter <PNT.L>
3. or a digital input wired to this parameter. The indicator will calculate the low calibration point
4. Place a reference weight on the load cell and turn on the high point calibration parameter <PNT.H>, or a digital input wired to this parameter. The indicator will then calculate the high calibration point.

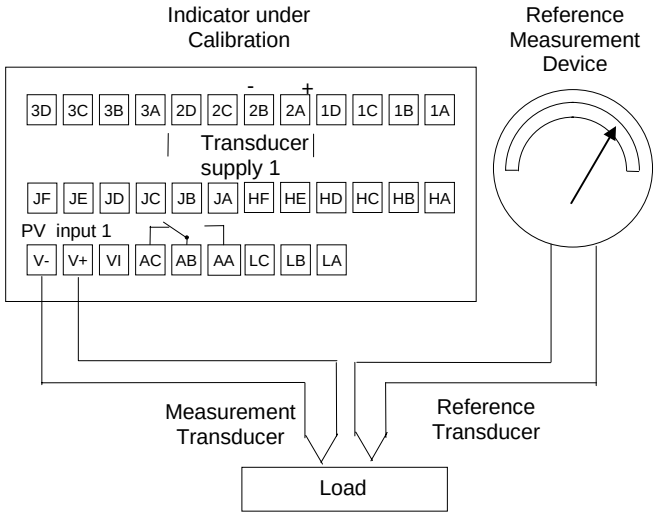
Note:-
If <PNT.L>'= 'On', <PNT.H> cannot be turned to <on>
If <PNT.H>'= 'On', <PNT.L> cannot be turned to <on>
Either must complete before the other can be set to <on>

First enter the calibration password as described in section 3.6.2.1.
Then:-

Do This	This Is The Display You Should See	Additional Notes
Set the required display 'Span' and 'Zero' parameters		
6. Press [⟳] to scroll to <SCL.L> 7. Press [▼] or [▲] to enter the scale low value (normally 0) 8. Repeat for <SCL.H>	SCL.L 0	This sets the minimum (zero) display reading when the transducer has its lowest weight This sets the maximum (span) display reading when the transducer has its highest weight
Set the load cell to its 'zeroed' condition		
9. Press [⟳] to show <PNT.L> 10. Press [▼] or [▲] to turn calibration to <on>	PNT.L on	busy The indicator will show 'busy' while calibrating If the calibration fails the alarm message <tdr.F> is flashed
When the calibration low point is complete, place the reference load on the load cell		
11. Press [⟳] to show <PNT.H> 12. Press [▼] or [▲] to turn calibration to <on>	PNT.H on	busy The indicator will show 'busy' while calibrating and will flash <donE> when complete . If the calibration fails the alarm message <tdr.F> is flashed The <PNT.L> and <PNT.H> parameters may have been wired to digital inputs for activation by external switches The operation is identical except that the indication will return to the display which was being shown prior to the activation of the switches

3.6.5 Comparison Calibration

Comparison calibration is most appropriate when calibrating the indicator against a second reference instrument.



This diagram shows connections to Input 1/main input

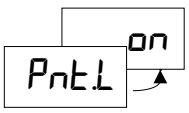
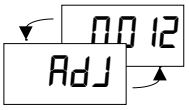
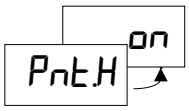
If Input 2 is used in module position 3, the transducer output can be connected to terminals 3C (+) and 3D (-)

Figure 3-5: Comparison Calibration

3.6.6 To Calibrate by Comparison with an External Reference

In this case the process calibration points are not entered ahead of performing the calibration. The input may be set to any value and, when the system is stable, a reading is taken from the reference measurement device and entered into the indicator. The indicator stores both this new target value and the actual reading taken from its input.
The process is repeated at a different value, with the indicator storing both the new target value and the reading taken from its input.

First enter the calibration password as described in section 3.6.2.1
Then:-

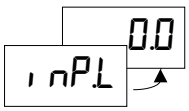
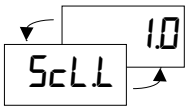
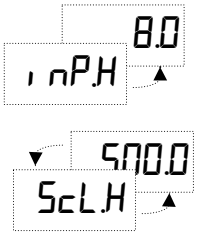
Do This	This Is The Display You Should See	Additional Notes
	Allow the process to settle at the low calibration point	
6. Press [⟳] to show <Pnt.L> 7. Press [▼] or [▲] to turn calibration to <on>		The indicator will alternate between the message 'Adjust' and the value shown in the main display If no key is pressed for 45 seconds the indicator will return to the HOME display This parameter can be configured to operate from a digital input which, in turn, may be connected to a push-button switch
8. Press [▼] or [▲] to enter the value read by the reference instrument		The indicator will resume the alternating display The values will only be accepted by scrolling away from <Adj>, unless this parameter has been activated by a digital input
	Allow the process to settle at the high calibration point	
9. Repeat 2 to 4 above for <Pnt.H>		This parameter can be configured to operate from a digital input which, in turn, may be connected to a push-button switch Note:- The low calibration point cannot be higher than the high calibration point These inputs can, however, be scaled to values which are inverted

The indicator is now calibrated against the reference source. When complete the indication returns to the HOME display.

3.6.7 Manual Calibration

Manual calibration sets the minimum and maximum displayed reading to correspond to the minimum and maximum electrical input values. For example, 0 to 8mV to read 1.0 to 500.0 units.

First enter the calibration password as described in section 3.6.2.1
Then:-

Do This	This Is The Display You Should See	Additional Notes
6. Press [⟳] to show <inP.L> 7. Press [▼] or [▲] to adjust the input to the minimum electrical input, e.g. <0.0>		
8. Press [⟳] to show <SCL.L> 9. Press [▼] or [▲] to adjust the input to the minimum display reading, e.g. < 1.0>		
10. Repeat 6 to 9 above for <inP.H> and <SCL.H>		

3.6.8 Auto-Tare or Display Zero

The auto-tare (display zero) function is used, for example, when it is required to weigh the contents of a container but not the container itself.
The procedure is to place the empty container on the weigh bridge and 'zero' the controller. Since it is likely that following containers may have different tare weights the auto-tare feature is always available in the indicator at Operator access level.

The effect of auto-tare is to introduce a DC bias to the measurement, as shown in Figure 3-6 below.

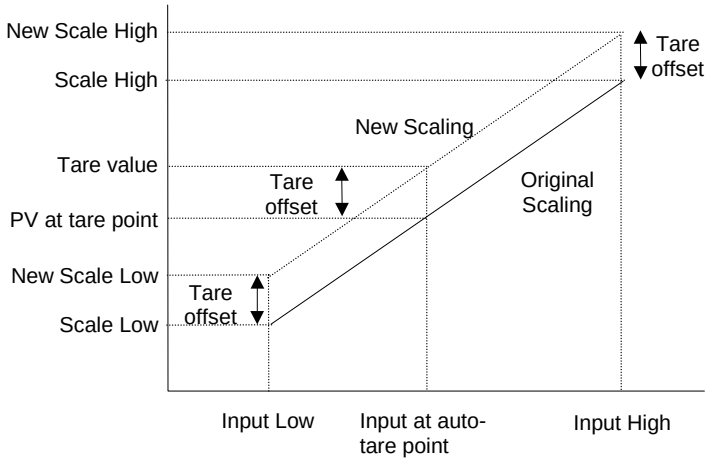


Figure 3-6: Effect of Auto-Tare

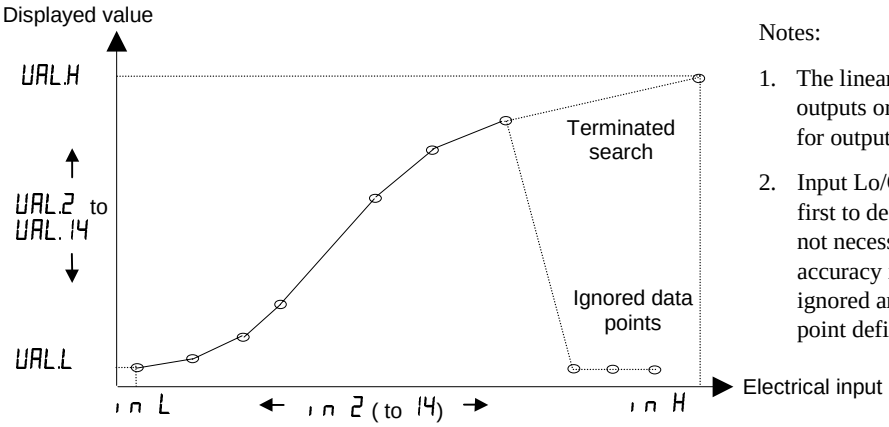
Note:- A Tare calibration will change the values of 'Scale High' <SCL.L> and 'Scale Low' <SCL.H>

The parameter <tArE.u> sets a fixed offset on the tare value. This may be used, for example, if containers of different weights are placed on a pallet of known weight. This known weight can then be entered in <tArE.u>.

The procedure to initiate tare calibration was described in 2.3.

3.7 CUSTOM LINEARISATION

The linearisation uses a 15 point straight line fit.
Figure 3-7 shows an example of a curve to be linearised and is used to illustrate the terminology used in the parameter list



Notes:

1. The linearisation block works on rising inputs/rising outputs or rising inputs/falling outputs. It is not suitable for outputs which rise and fall on the same curve.
2. Input Lo/Output Lo and Input Hi/Output Hi are entered first to define the low and high points of the curve. It is not necessary to define all 15 intermediate points if the accuracy is not required. Points not defined will be ignored and a straight line fit will apply between the last point defined and the Input Hi/Output Hi point.

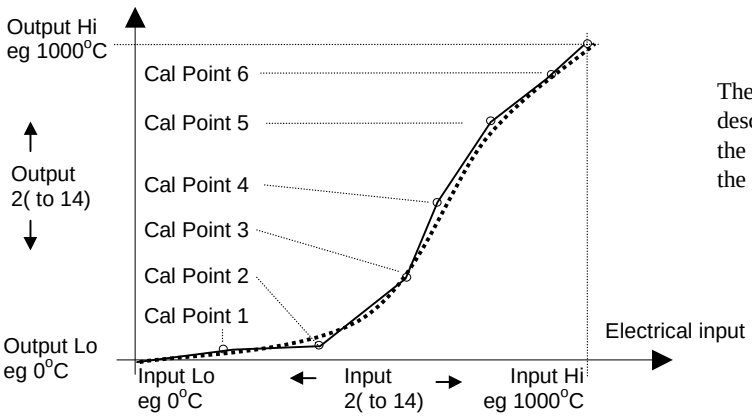
Figure 3-7: Linearisation Example

3.7.1 Example: To Linearise Input 1

Do This	This Is The Display You Should See	Additional Notes
1. Press [▯] as many times as necessary to access the <CUSt 1> list header menu	CUSt 1	
2. Press [↻] to show <In L>	In L	Input 1 is set to +1.0 units
3. Press [▼] or [▲] to enter the low electrical input value	1.0	
4. Press [↻] to show <UAL.L>	UAL.L	The display will read 2.0 corresponding to the low electrical input (+1 unit)
5. Press [▼] or [▲] to enter the low electrical input value	2.0	
6. Repeat steps 2 to 5 for the high end and then for all intermediate steps		Note:- The values entered must be continuously increasing or decreasing

3.7.2 Compensation for Sensor Non-Linearities

The custom linearisation feature can also be used to compensate for errors in the sensor or measurement system, so that discontinuities in the curve can be calibrated out. Figure 3.8 shows an example of the type of discontinuity which can occur in the linearisation of a temperature sensor.



The calibration of the sensor uses the same procedure as described above. Adjust the output (displayed) value against the corresponding input value to compensate for any errors in the standard linearisation of the sensor

Figure 3-8: Sensor Non-linearities

4 CONFIGURATION LEVEL

The 2408I indicator is supplied configured in accordance with the ordering code (see section 5). The configuration of the indicator, as defined by columns 11 to 16 of the order code, can be changed on site, if necessary, to meet the requirements of the installation. Similarly, the positions or types of plug in module can be changed if required. This section describes the procedures to be followed.

4.1 HARDWARE CONFIGURATION - I/O MODULES

Optional plug-in modules are fitted simply by sliding them into the relevant position as shown in Figure 4-1. The connections for these modules are made to the upper row of connector blocks as shown in section 1.3.

When a module is added, removed or changed the indicator will flash hardware error '<HwEr> on power up. To acknowledge this it is necessary to go into configuration level.

1. Press either [Page] or [Scroll] until <conF> is displayed.
2. Press [Down] or [Up] to enter the configuration level password passcode (factory default 2)
3. Press either [Page] or [Scroll] again and the hardware error is acknowledged

The full list of modules available is shown in the ordering code.

Figure 4-1: View of the Plug-in Modules

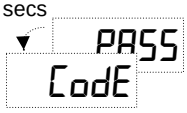
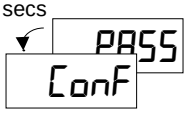
4.2 SOFTWARE CONFIGURATION

Configuration level allows you to set up parameters in the indicator which defines how it will operate. Examples are:-

- The configuration of the alarms
- The digital input functions
- The relay output configuration
- The configuration of the modules
- The passwords

Parameter tables in this section give the full list of configuration parameters.

4.2.1 To Select Configuration Access Level

Do This	This Is The Display You Should See	Additional Notes
1. From any display press [Page] as many times as necessary to access the **'Access List'** header	ACCS	If [Up] or [Down] are pressed the word <L, St> is displayed for 2 secs 
2. Press [Scroll] to show <CodE> 3. Press [Down] or [Up] to enter the passcode	2 secs 	The factory default passcode is <1> <PASS> will be displayed momentarily when the correct password has been entered In the special case that the passcodes have been configured as <0>, it will not be necessary to enter a passcode
4. Press [Scroll] to show <Goto> 5. Press [Down] or [Up] to select <conF> level	2 secs 	
6. Press [Scroll] to show <ConF> 7. Press [Down] or [Up] to enter the configuration level passcode	2 secs 	The configuration factory default passcode is <2> '<PASS> will be displayed momentarily when the correct password has been entered In the special case that the passcodes have been configured as <0>, it will not be necessary to enter a passcode

The indicator is now in configuration level

4.3 LOCATION OF PARAMETERS – FROM INDICATOR BLOCK DIAGRAM

The indicator consists of a number of internal function blocks connected together. Each function block has a number of parameters found in lists to which the user has access. The block diagram shows location of these parameters within the indicator.

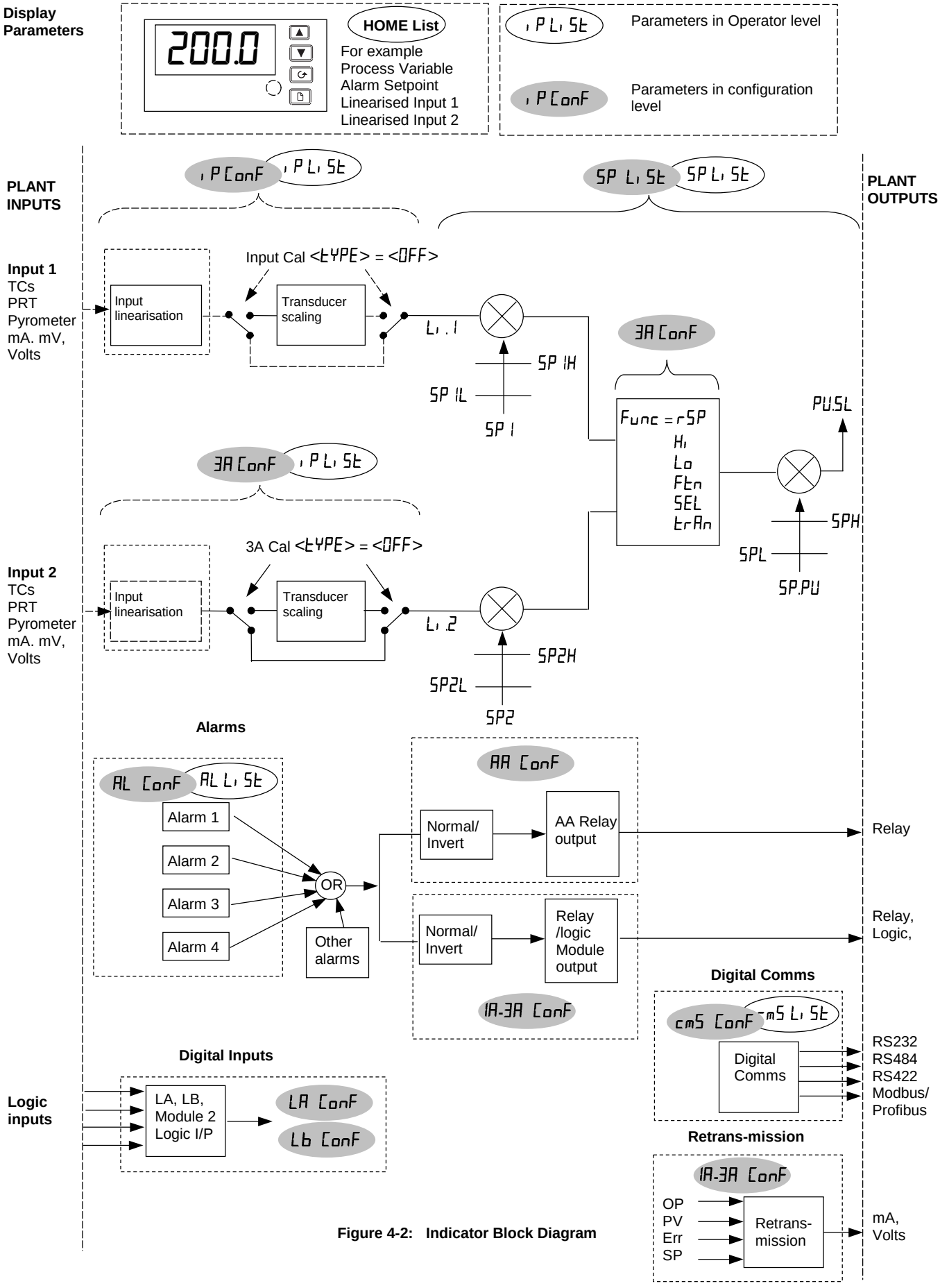


Figure 4-2: Indicator Block Diagram

4.4 NAVIGATION DIAGRAM (CONFIGURATION LEVEL)

he navigation diagram shows the location of configuration parameters.

A. Press [▯] to step across the list headings. This is a continuous list.

B. Press [↻] to step down the parameters within a particular list. You will eventually return to the list heading.

C. Press [▼] to view the value of a selected parameter. Keep pressing to decrease the value.

D. Press [▲] to view the value of a selected parameter. Keep pressing to increase the value.

The diagram below shows the full list of possible parameters. In practice, the parameters that appear will depend upon the configuration of your particular indicator .

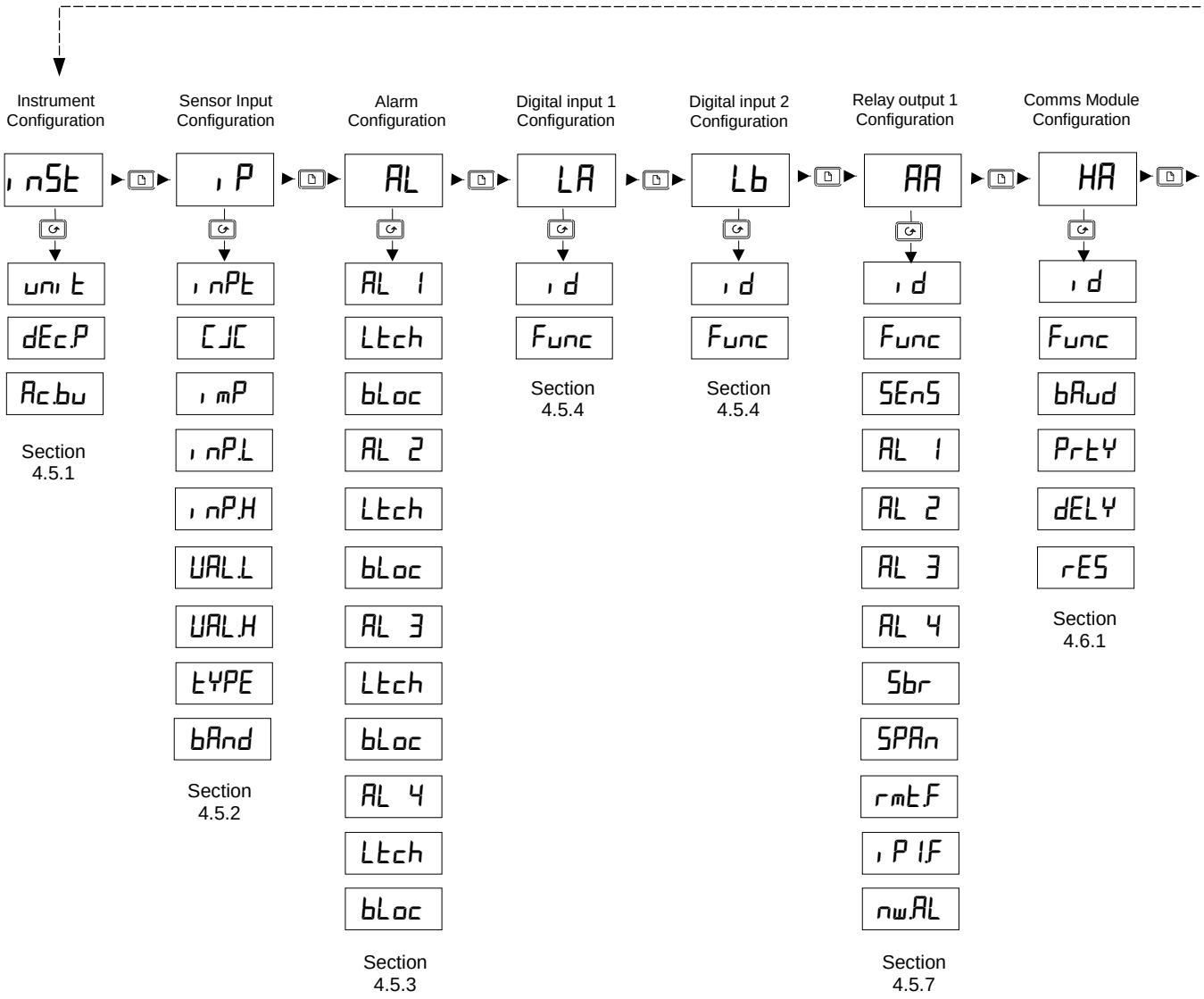
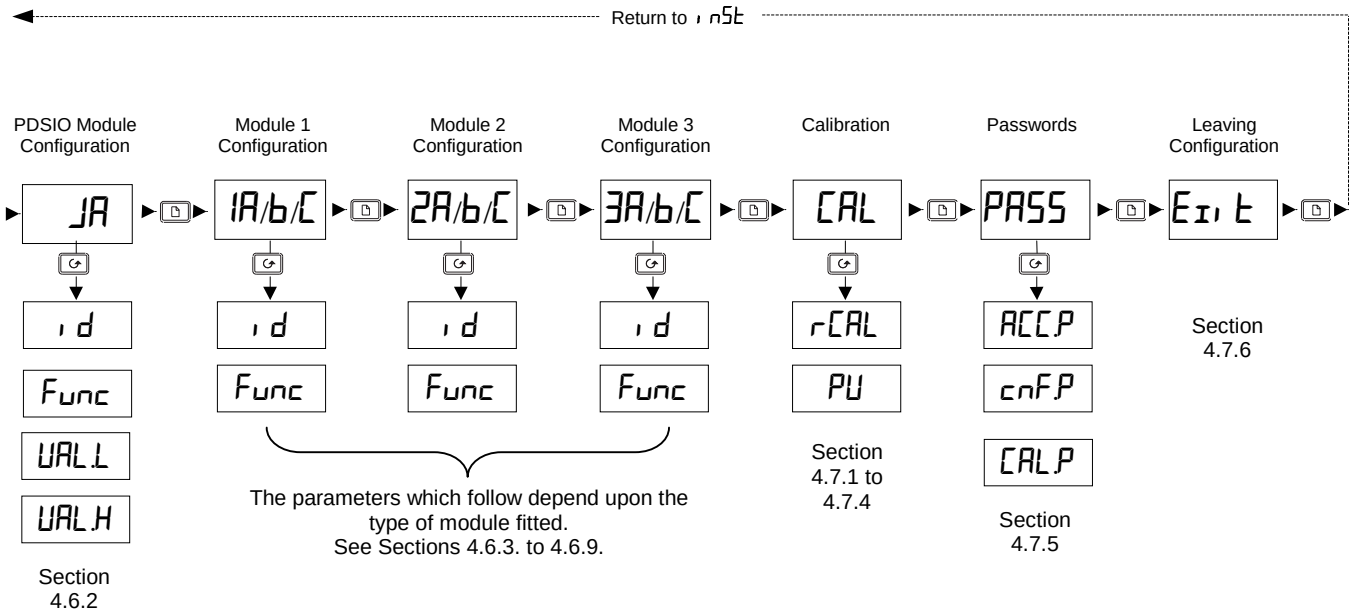


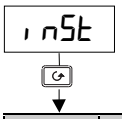
Figure 4-3: Navigation Diagram


Return to inSt
PDSIO Module Configuration
Module 1 Configuration
Module 2 Configuration
Module 3 Configuration
Calibration
Passwords
Leaving Configuration
JA
1A/b/C
2A/b/C
3A/b/C
CAL
PASS
Exit
id
Func
VALL
VALH
rCAL
PU
ACCP
cnFP
CALP
Section 4.6.2
The parameters which follow depend upon the type of module fitted.
See Sections 4.6.3. to 4.6.9.
Section 4.7.1 to 4.7.4
Section 4.7.5
Section 4.7.6

4.5 CONFIGURATION PARAMETER TABLES - ALL INDICATORS

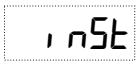
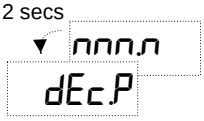
The tables in this section list the parameters available for the fixed functionality of the indicator.

4.5.1 Instrument configuration list

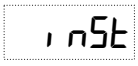
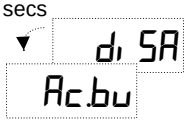


InSt	Instrument list	Option	Meaning	Default setting	Customer setting
Unit	To select display units	°C °F °K nonE	Celsius Fahrenheit Kelvin None (for linear inputs)	Defined by the ordering code, otherwise °C	
dEC.P	To set the number of decimal places in the display	nnnn nnn.n nn.nn n.nnn	None One Two Three	Defined by the ordering code, otherwise nnnn	
Ac.bu	To enable Front panel Ack/Reset button	EnAb diSA	Button enabled Button disabled	EnAb	

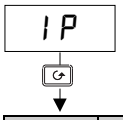
4.5.1.1 Example: To Change the Number of Decimal Places in the Display

Do This	This Is The Display You Should See	Additional Notes
	Enter configuration level as described in section 4.2.1.	
1. Press [▯] until the **'Instrument List'** header is shown		
2. Press [↻] until <dEc.P> is shown 3. Press [▼] or [▲] to move the decimal point position	2 secs ▼ 	The display will return to <dEc.P> after approximately 2 seconds

4.5.1.2 Example: To Disable the Front Panel Ack/Reset Button

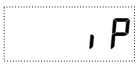
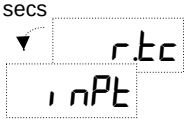
Do This	This Is The Display You Should See	Additional Notes
	Enter configuration level as described in section 4.2.1.	
1. Press [▯] until the **'Instrument List'** header is shown		
2. Press [↻] until <Ac.bu> is shown 3. Press [▼] or [▲] to select disabled	2 secs ▼ 	The display will return to <Ac.bu> after approximately 2 seconds

4.5.2 Sensor Input Configuration List



IP	Sensor Input	Option	Meaning	Default setting	Customer setting
InPt	To configure input type See also example 4.4.2.1. NOTE: *After selecting an input type, do not forget to adjust the setpoint limits in Full Access level.*	J.tc K.tc L.tc r.tc b.tc n.tc t.tc S.tc PL 2 nonE rtd mV voLt mA Sr V Sr A mV.C V.C mA.C	J thermocouple K thermocouple L thermocouple R thermocouple B thermocouple N thermocouple T thermocouple S thermocouple Platinell II Custom downloaded input 100Ω Platinum resistance thermometer Linear millivolt Linear voltage Linear milliamps Square root volts Square root milliamps 16-point millivolt custom linearisation 16-point Voltage custom linearisation 16-point milliamp custom linearisation	Defined by the ordering code, otherwise Ktc * *If a different custom input is supplied, nonE will be replaced by the reference number shown in **the** ORDERING CODE section 5*	
See 15-point CuSt list					
CJC	Cold junction compensation *(CJC does not appear for Process or RTD inputs. For process see 'Linear input scaling' below*	Auto 0°C 45°C 50°C OFF	Automatic compensation 0°C external reference 45°C external reference 50°C external reference No cold junction compensation	Auto	
ImP	Input impedance threshold for sensor break alarm	OFF Auto Hi Hi Hi	Sensor break alarm disabled 1.5KΩ / 5KΩ / 15KΩ — If the sensor impedance exceeds this value, sensor break alarm activates	Auto	
Linear input scaling (-9.99 to +80.00mV). These parameters appear after <i nPt> whenever <mV>, <voLt>, <mA>, <Sr V> or <Sr A> are chosen as the input type. This allows for the low and high displayed values to be set up against the corresponding electrical input values.					
tYPE	Type of calibration (see 3.3.5.)	OFF Shnt Ld.C CmP mAn	Off Shunt Load Cell Comparison Manual		
bAnd	Settling band. The indicator automatically determines when the input has become stable by continuous sampling. When the average value between two consecutive samples is within the settling band the indicator will then allow calibration to take place. If readings are not stable within this period the indicator will abort the calibration	0-99.99	0-99.99	0.5	
The following parameters appear for process inputs and allow the display to be calibrated to the electrical input. See also example 4.5.2.2.					
InP.L	Electrical input low	-100.0 to 100.0 mV 0.0 to 20.0 mA 0.0 to 10.0 Volts		0.0	
InP.H	Electrical input high			100.0 if mV 20.0 if mA 10.0 if volts	
VAL.L	Displayed value low	-9999 to 99999		Defined by the SP limits in ordering code, else 0	
VAL.H	Displayed value high	-9999 to 99999		Defined by the SP limits in ordering code, else 100	

4.5.2.1 Example: To Select a Different Thermocouple Type

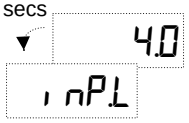
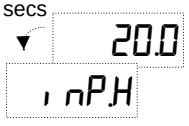
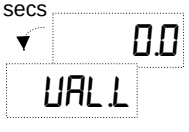
Do This	This Is The Display You Should See	Additional Notes
Enter configuration level as described in section 4.2.1.		
1. Press [▯] until the **'Input List'** header is shown		
2. Press [⟳] until <i nPt> is shown 3. Press [▼] or [▲] to select the input type	2 secs ▼ 	The display will return to <i nPt> after approximately 2 seconds

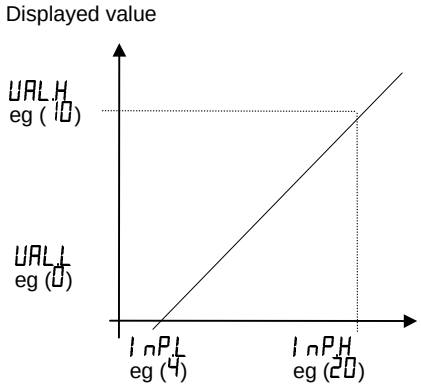
Notes:
The next parameter is cold junction compensation, <CJC>. It is used to compensate for ambient temperature changes measured at the point at which the thermocouple (or compensating) cable connects to the indicator. Automatic, Auto, measures the temperature at the rear terminals and compensates for any ambient temperature changes. It will only be necessary to change the <CJC> parameter if an external temperature reference source is to be used.

Sensor break is measured by the impedance, <i mP>, of the sensor circuit and an alarm is given if this is greater than a set amount. For thermocouples set this to <Auto>. For certain types of sensor its working impedance may be greater than the 1.5KΩ set by Auto. It will only be necessary to change <i mP> if this type of sensor is to be used.

4.5.2.2 Example: To Adjust Display Reading for a Process Type Input

This example is 4 – 20mA input to read 0 to 100 on the display

Do This	This Is The Display You Should See	Additional Notes
Enter configuration level as described in section 4.2.1.		
The mA input is selected in the same way as the thermocouple input above.		
1. In the input list press [⟳] until <i nPL> is shown 2. Press [▼] or [▲] to set the low input eg 4mA	2 secs ▼ 	
3. Press [⟳] until <i nPH> is shown 4. Press [▼] or [▲] to set the high input eg 20mA	2 secs ▼ 	
5. Press [⟳] until <VAL.L> is shown 6. Press [▼] or [▲] to set the low displayed value eg 0.0	2 secs ▼ 	
7. Press [⟳] until <VAL.H> is shown 8. Press [▼] or [▲] to set the low displayed value eg 100.0	2 secs ▼ 	The display will return to <i nPt> after approximately 2 seconds



4.5.3 Alarm Configuration

Alarms are used to alert an operator when the process value has exceeded a pre-set level or when some other fault condition has occurred. They normally switch an output - usually relay - to provide an interlock on a machine/process or audio/visual indication to an operator.

The Model 2408*i* has four internal 'soft' alarms which are configured in the <AL> list below. A soft alarm means indication only. To make a soft alarm activate a physical output it must be 'attached' to that output. See: section 4.5.8. 'Relay Output Configuration'

ALARM DEFINITIONS: The following alarm types can be configured:

Full Scale High	The Process Value is above a set high level
Full Scale Low	The Process Value is below a set low level
Deviation band	The difference between setpoint and the process value is outside a set band
Deviation high	The difference between setpoint and the process value is above a set value
Deviation low	The difference between setpoint and the process value is below a set value
Rate of change	The Process Value is changing faster than a set rate

AL	Alarm list	Option	Meaning	Default setting	Customer setting			
AL 1	To select Alarm 1 Type	OFF	The alarm is disabled	Defined by the ordering code, otherwise OFF	Alarm number			
		FSL	Full Scale Low alarm - main process value		1	2	3	4
		FSH	Full Scale High alarm - main process value					
		dEu	Deviation band alarm - main process value					
		dHi	Deviation High alarm - main process value					
		dLo	Deviation Low alarm - main process value					
		du 1	Deviation band alarm - input 1					
		dH 1	Deviation High alarm - input 1					
		dL 1	Deviation Low alarm - input 1					
		du2	Deviation band alarm - input 2					
		dH2	Deviation High alarm - input 2					
		dL2	Deviation Low alarm - input 2					
		FL2	Full Scale Low alarm on Process Value input 2					
		FH2	Full Scale High alarm on Process Value input 2					
		LSP	Master Setpoint Low alarm					
		HSP	Master Setpoint High alarm					
		FL 1	Full scale low alarm on linearised input 1					
		FH 1	Full scale high alarm on linearised input 1					
		rAt	Rate of change alarm, minutes – main PV					
		rAS	Rate of change alarm, seconds – main PV					
		rt 1	Rate of change alarm, minutes - input 1					
		rS 1	Rate of change alarm, seconds - input 1					
		rt2	Rate of change alarm, minutes - input 2					
		rS2	Rate of change alarm, seconds - input 2					
Ltch	To select alarm latching type	no	Non-latching	no				
		YES	Latched with automatic resetting (See note 1)					
		Evnt	Event output (See note 3)					
		mAn	Latched with manual resetting (See note 2)					
bLoc	To select alarm blocking	no	No blocking	no				
		YES	Blocked until first good (See note 4)					
Sbr.t	To inhibit process alarms in sensor break	di SA	Disabled. Inhibits alarms (See note 5)	EnAb				
		EnAb	Enabled. Alarms operate when in sensor break					
The above sequence is repeated for: <AL 2> (alarm 2), <AL 3> (alarm 3) and <AL 4> (alarm 4)								

Note 1 **Automatic Resetting** means that, once the alarm has been acknowledged, it will automatically clear when it is no longer true

Note 2 **Manual resetting** means that the alarm must first clear before it can be reset

Note 3 **Events** can be used to operate an output in the same way as an alarm but will NOT flash an alarm message, and can be used to trigger external events. For example, an event output could be used to open/close a vent at a pre-set temperature

Note 4 **Blocking Mode.** After power on, the process value must first enter a good state before the alarm becomes active. When once this process has been completed the alarm operates in its normal mode and does not become relevant again until power to the indicator is turned off and on again. This is particularly useful for low alarms which can be 'blocked' while the process is warming up. It is advised that blocking alarms are not used with rate of change alarms

Note 5 **Sbr.t** When this parameter is set to 'Disabled', all alarms from the process will be inhibited should a sensor break condition occur. When Enabled process alarms will be shown (as in previous software versions) even in a sensor break condition.

4.5.3.1 Example: To Configure Alarm 2 to Operate When Input 2 Exceeds A Set Value

Do This	This Is The Display You Should See	Additional Notes
Enter configuration level as described in section 4.2.1.		
1. Press [▯] until the **'Alarm List'** header is shown	AL	
2. Press [↻] until the <AL 2> is shown 3. Press [▼] or [▲] until <FH2> is shown	2 secs FH2 AL 2	The display will return to <AL 2> after approximately 2 seconds <FH2> is Full Scale High alarm on input 2

The next two parameters – Alarm Latching and Alarm Blocking may be set in the same way if they are required.

4.5.4 Alarm Inhibit

The alarm inhibit feature may be used to prevent any alarms from being indicated until a 'noisy' process variable has settled. Alarm inhibit is activated by a digital input on either Digital Input 1 or 2 - see section 4.5.4. When the digital input is turned to OFF any alarms which are active will be displayed. If a delay has been set on the alarm, the delay period will start from the time when the input is turned OFF. Entering Alarm Inhibit resets both the alarm delay timer and latched alarms.
The action of Alarm Inhibit is shown in the diagram below for a Full Scale High Alarm.

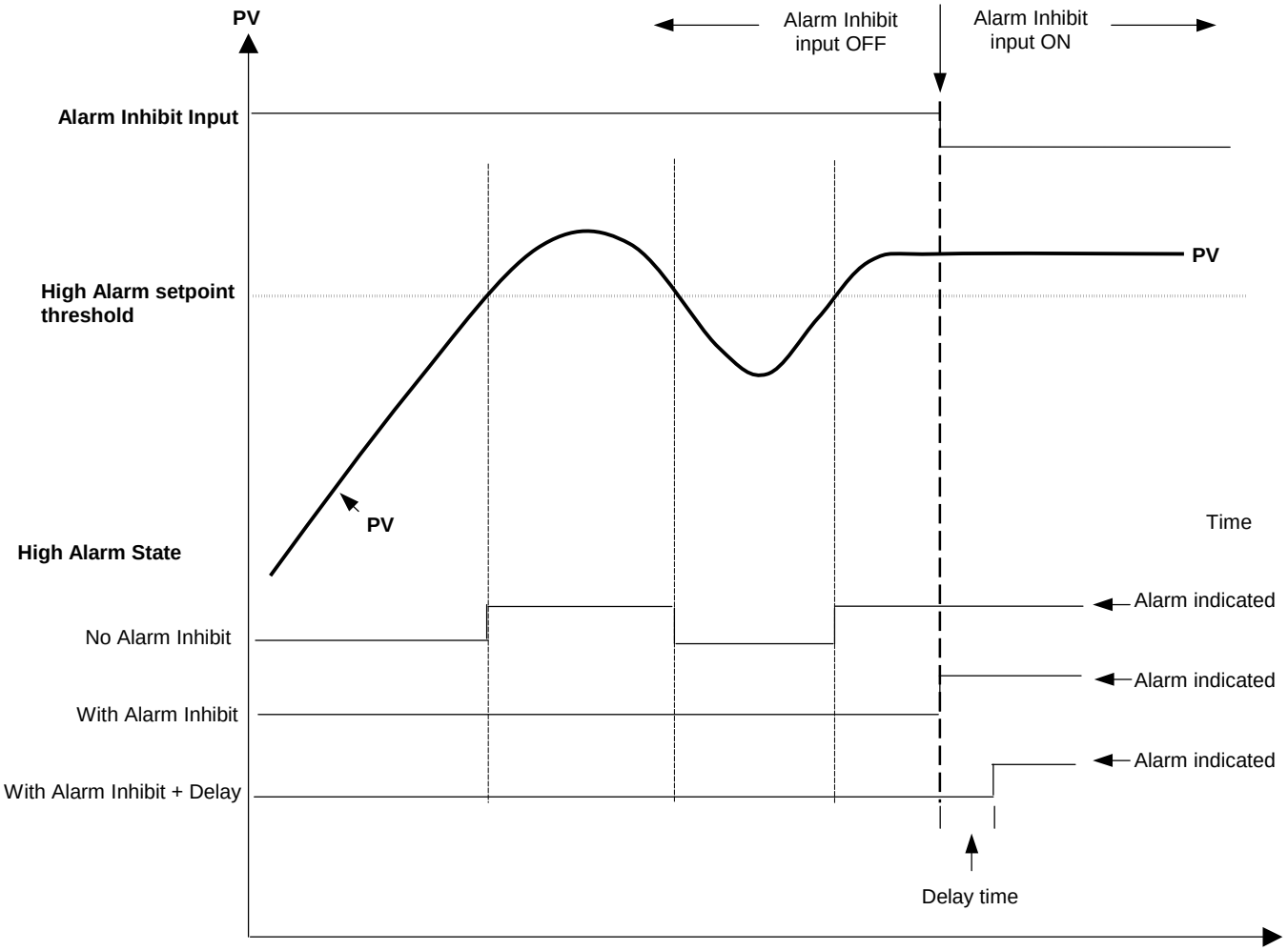


Figure 4-4: Effect of Alarm Inhibit

4.5.5 2408i Indicator With Alarm Inhibit Timer

2408i indicators fitted with software versions 3 and greater contain an alarm inhibit timer which is used to inhibit alarms for a set period after power-up and when a digital input is closed.

4.5.5.1 Operation

In the '**AL**' list in Operator Level there are two parameters associated with the inhibit function see section 3.3.2. These are the alarm inhibit status' **1 n.AL**' and the inhibit time '**1 nH.t**'. To adjust the alarm inhibit time:-

Do This	This Is The Display You Should See	Additional Notes
1. In Operator Level, press [▯] as many times as necessary to select '**AL**'	2 secs ↙ **L, St** / **AL**	Press [▲] or [▼] to show '**L, St**' if required. The display will revert to '**AL**' after 2 seconds
2. Press [↻] to read '**1 nAL**' 3. Press [▲] or [▼] to select '**On**' or '**OFF**'	2 secs ↙ **OFF** / **1 n.AL**	This sets the Alarm Inhibit status: **On/OFF**. The display will revert to '**1 n.AL**' after 2 seconds
4. Press [↻] to read '**1 nH.t**' 5. Press [▲] or [▼] to select the Alarm Inhibit Time	2 secs ↙ **10.0** / **1 nH.t**	This sets the Alarm Inhibit Time 0 to 999.9 seconds. The display will revert to '**1 nH.t**' after 2 seconds

On power up alarms will be inhibited for the set time. When the inhibit time is set to OFF, the timed inhibit is disabled.

4.5.5.2 Configuration of Digital Inputs for Alarm Inhibit

Two digital input functions can be configured for the alarm inhibit.

Permanent alarm inhibit

The permanent inhibit function '**, n.AL**' is level triggered. It permanently inhibits all alarms when closed and enable all alarms when open.

Do This	This Is The Display You Should See	Additional Notes
1. In Configuration Level, press [▯] as many times as necessary to select '**LA**' or '**Lb**' – the digital inputs. See also section 4.5.6.	2 secs ↙ **Conf** / **LA/Lb**	Digital input configuration
2. Press [↻] to read '**Func**' 3. Press [▲] or [▼] to select '**, n.AL**'	2 secs ↙ **, n.AL** / **Func**	Level triggered alarm inhibit **Please note: when using this function ensure that the inhibit timer is set to OFF.**

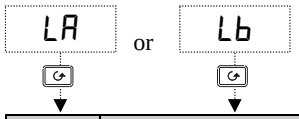
Timed alarm inhibit

The timed inhibit function '**tm.AL**' is edge triggered. It will start the inhibit timer when closed and do nothing when opened. Alarms will be inhibited during the timing period at the end of which they will be enabled again.

From stage 1 above:-

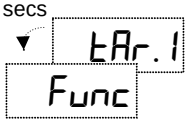
Do This	This Is The Display You Should See	Additional Notes
4. Press [↻] to read '**Func**' 5. Press [▲] or [▼] to select '**, n.AL**'	2 secs ↙ **tm.AL** / **Func**	Timed alarm inhibit

4.5.6 Digital inputs 1 and 2 Configuration



LA	Digital input 1	Option	Meaning	Default setting	Customer setting
Lb	**Digital input 2**				
id	Identity of input	LoG.i	Logic input	LoG.i	Read only
Func	Function	nonE	Function not configured	nonE	
		rmt	Remote setpoint select		
		Ac.AL	Alarm acknowledge		
		Acc5	Select full access level		
		Loc.b	Keylock (disables all front panel buttons except the ACK/RESET button)		
		uP	Simulate pressing of the ▲ button		
		dwn	Simulate pressing of the ▼ button		
		ScrL	Simulate pressing of the ↻ button		
		PAGE	Simulate pressing of the 🗋 button		
		PU.SL	Process value select. Closed = input 1 Open = input 2		
		tAr.1	Initiate automatic tare calibration of input 1		
		tAr.2	Initiate automatic tare calibration of input 2		
		PtL.1	Start the calibration at point 1, normally the low point		
		PtL.2	Start the calibration at point 2, normally the low point		
		PtH.1	Start the calibration at point 1, normally the high point		
		Pth.2	Start the calibration at point 2, normally the high point		
		in.AL	Alarm inhibit (often used in conjunction with transducer calibration to prevent alarms during the calibration process)		
		P.HLd	Peak hold		
		HLd1	Sample and Hold on PV input 1		
		HLd2	Sample and Hold on PV input 2		
		UCAL	Enables calibration access for CAL 1 and CAL2 lists		

4.5.6.1 Example: To Configure Digital Input 'A' for Tare Calibration

Do This	This Is The Display You Should See	Additional Notes
Enter configuration level as described in section 4.2.1.		
2. Press 🗋 until the <LA> **List'** header is shown		
2. Press ↻ until the <Func> is shown 3. Press ▼ or ▲ until <tAr. 1> is shown	2 secs 	The display will return to Func after approximately 2 seconds When a connection is made between rear terminals LC and LA a tare calibration is initiated.

The same procedure applies to any other option shown in the Digital Inputs table and also to the second digital input which uses list <Lb>.

4.5.7 Peak Hold and Sample and Hold

Peak Hold logs the maximum and minimum values that the indicator reads during a particular process. The peak hold value can be displayed as the main front or back display parameter, as described in section 2.1.2.

Sample and Hold logs the reading at the moment that the digital input becomes true.

Both functions are initiated by turning digital input 1 or digital input 2 to ON. They are edge triggered so to reset and re-start the input must be turned OFF and ON again, as detailed in Figure 4.5 below.
The values may be read in two ways:-
1. From Information List <i nFo> as:-

LoG.L	Minimum process variable
LoG.H	Maximum process variable
LoG.A	Average process variable

These values are reset when the parameter <rES.L> in the <i nFo> list is turned to <YES>, or the indicator power is cycled.

2. Maximum and minimum values can be promoted to the main front or back display as <PU.Hi> or <PU.Lo>, see section 2.1.2. They are reset when the power to the controller is cycled or by setting the values of <LoG.L> and <LoG.H> to zero in the <i nFo> list.

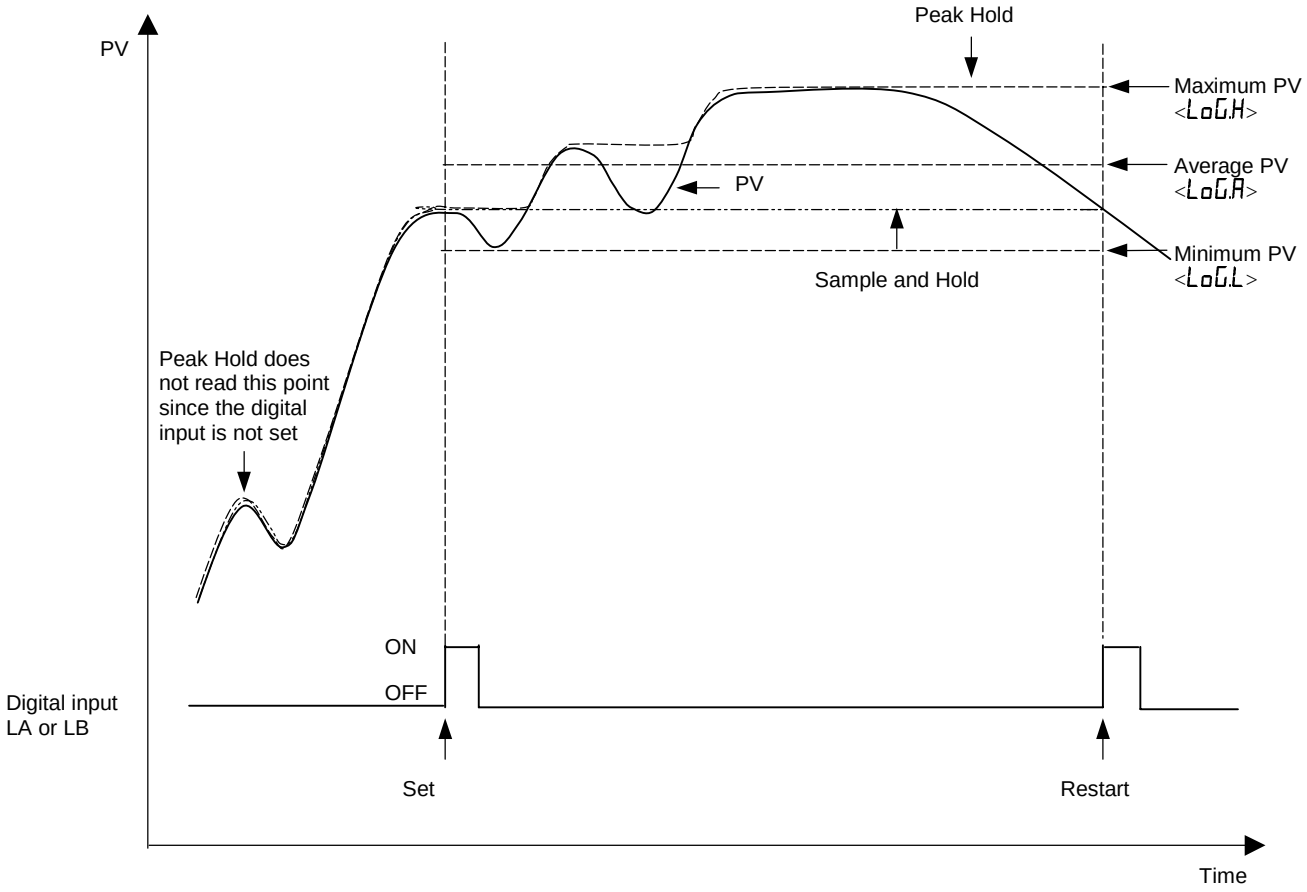


Figure 4-5: Action of Sample and Hold and Peak Hold

4.5.8 Relay Output 1 Configuration

The controller can be supplied so that Relay 1 will operate when a particular alarm occurs. This will be defined in the order code, see section 5.

This list defines which of the internal 'soft' alarms are attached to relay output 1. It is possible to attach more than one alarm to operate this relay. The procedure is described below:-

AA

AA	Relay output 1	Option	Meaning	Default setting	Customer setting
id	Identity of output	rELY	Relay	rELY	Read only
Func	Function of output	nonE diG	None Output disabled Digital alarm output. Output enabled	diG	
SEnS	Sense of the output.	nor inu	Normal (relay energised in alarm) Inverted (relay de-energised in alarm)	inu	

To Attach Alarms to the Relay Output.

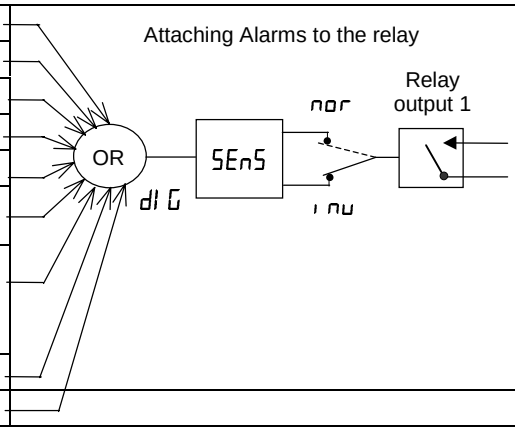
Any combination of the following alarms can be attached to relay output 1.

Press [⟳] to select a particular alarm.

Press [▲] or [▼] to select YES if you want it to activate the relay. Select no to disconnect a given alarm.

These parameters only appear if Func = diG

1---*	Alarm 1	YES / no	YES	
2---*	Alarm 2	YES / no	no	
3---*	Alarm 3	YES / no	no	
4---*	Alarm 4	YES / no	no	
Sbr	Sensor break alarm	YES / no	no	
SPAn	Span The Process value exceeds the display limits	YES / no	no	
rmt.F	Remote failure. Either PDS remote setpoint input, OR 2nd analogue input open circuit	YES / no	no	
inP1.F	Input 1 fail	YES / no	no	
nw.AL	New alarm	YES / no	no	



1. The three dashes correspond to the alarm type set in the <AL> list. If the alarm is disabled, <AL 1> or <AL 2> or <AL 3> or <AL 4> will be shown.

4.5.8.1 Example 1: To Attach Alarm 1 to Relay Output AA

It is recommended that an external device is connected so that an alarm condition is indicated when the relay is de-energised. In this way if the indicator is removed or its power is removed an alarm is indicated. To achieve this set relay sense to inverted operation.

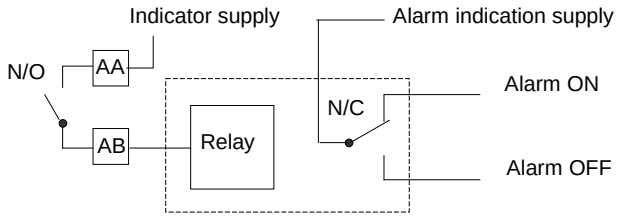


Figure 4-6: Example External Alarm Wiring

Do This	This Is The Display You Should See	Additional Notes
Enter configuration level as described in section 4.2.1. and configure Alarm 1 to the required type – see example 4.4.3.1.		
1. Press ▢ until the <AA> List header is shown	AA	
2. Press ▢ until the <Func> is shown 3. Press ▼ or ▲ to select <diG>	2 secs diG Func	The display will return to <Func> after approximately 2 seconds
4. Press ▢ until the <SEnS> is shown 5. Press ▼ or ▲ to select <inu>	2 secs inu SEnS	
6. Press ▢ until the <1---> is shown 7. Press ▼ or ▲ to select <YES>	2 secs YES 1---	When alarm 1 is active the AA relay connected to terminals AA and AB will operate

4.5.8.2 Example 2: To Operate Relay 1 of a Dual Relay Output Module Fitted in Slot 2 when Both Alarms 2 and 3 are Active

The wiring should be as shown in Section 1.3 using rear terminals 2A and 2B

Do This	This Is The Display You Should See	Additional Notes
Enter configuration level as described in section 4.2.1. and configure Alarms 2 and 3 to the required types – see example 4.4.3.1.		
1. Press ▢ until the <2A> **List'** header is shown 2. Repeat steps 3 to 5 above	2A	
3. Press ▢ until the <2---> is shown 4. Press ▼ or ▲ to select <YES>	2 secs YES 2---	*i* The display will return to <2---> after approximately 2 seconds
5. Press ▢ until the <3---> is shown 6. Press ▼ or ▲ to select <YES>	2 secs YES 3---	The display will return to <inPt> after approximately 2 seconds Relay 1 of module 2 will operate when either Alarm 2 or Alarm 3 is active This procedure can be repeated for all alarms which require to operate an output relay. Notes: 1. Logic module outputs can also be attached to alarms 2. Do not forget to say <no> to any alarm which may already be attached to an output if it is not required

4.6 CONFIGURATION PARAMETER TABLES – PLUG IN MODULES

4.6.1 Communications Module

The 2408*i* indicator can be fitted with the following digital communications modules:-

Protocol	Module Fitted	Order Code
ModBus	2-wire RS485 4-wire RS422 RS232	2YM 2FM 2AM
EI-Bisynch	2-wire RS485 4-wire RS422 RS232	2YE 2FE 2AE
DeviceNet		2DN

4.6.2 Communications Parameters

HA

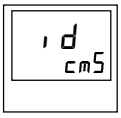
HA	Comms Module configuration	Option	Meaning	Default setting	Customer setting
id	Identity of module	cmS	Communications	cmS	Read only
Func	Function (selects the comms. protocol)	mod	Modbus protocol		
		EI.bi	EI-Bisynch protocol		
		dnEt	Devicenet - if the Devicenet module is fitted		
		ProF	Profibus - if the Profibus module is fitted		
bAud	Selects the baud rate	1200, 2400, 4800, 9600, 19.20 (19,200)		9600	
dELY	Response delay: required by some communications adapters	no	No delay	no	
		YES	10mS delay		
PrtY	Selects the parity (Modbus only)	nonE	No parity	nonE	
		EuEn	Even parity		
		Odd	Odd parity		
rES	Selects the resolution (Modbus and Profibus only)	FuLL	Full resolution	FuLL	
		Int	Integer resolution		

4.6.3 PDS input Module

JA

JA	Comms Module configuration	Option	Meaning	Default setting	Customer setting
id	Identity of module	Pdsi	PDS input	Pdsi	Read only
Func	Function	nonE	No function configured	nonE	
		SPiP	Setpoint input (to accept an input signal from a master source such as a controller with pds output)		
UALL	Setpoint low value	-9999 to 99999		0	
UALH	Setpoint high value	-9999 to 99999		0	

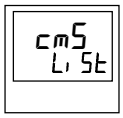
4.6.3.1 Example: To configure Function, Baud Rate, Resolution and Node Address:-

Do This	This Is The Display You Should See	Additional Notes
6. Press [▯] as many times as necessary to select 'HA'.		This is the position in which a digital communications module is fitted
7. Press [↻] to read 'id'		If the module is present 'id' = CmS (digital communications) or 'nonE' if the module is not present
8. Press [↻] to read 'Func' 9. Press [↻] to read 'bAud'		If Modbus or EI Bisync module is fitted, 'Func' = 'mod' or 'EI.bi' If Profibus module is fitted, 'Func' = 'ProF' If the DeviceNet module is fitted, 'Func' = 'dnEt' These ware be read only
10. Press [▲] or [▼] to select the baud rate		For Modbus or EI Bisync baud rate can be set to 1200, 2400, 4800, 9600, or 19,200 For Profibus baud rate is set automatically to a maximum of 1M5 For Devicenet baud rate can be set to 125(K), 250(K) or 500(K)
11. Press [↻] to read 'rES' 12. ' Press [▲] or [▼] to select 'FuLL' or 'Int'		'FuLL' the decimal point position is implied, eg 100.1 is transmitted as 1001. 'Int' rounded to the nearest the integer value

Node Address is set up in Full Access level

Exit configuration level as described in the Installation and Operation Handbook, Chapter 6.

Then:-

Do This	This Is The Display You Should See	Additional Notes
1. Press [▯] as many times as necessary to select 'cmS'.		
2. Press [↻] to read 'Addr' 3. Press [▲] or [▼] to select the address for the instrument		Valid addresses are from 0 - 63
4. Press [↻] to read 'nw.St'		Indicates the network status:- 'run' = network connected and operational 'rdy' = network connected but not operational 'OFF.L' = network not connected

4.6.4 DeviceNet Communications

The following is applicable to DeviceNet only.

4.6.4.1 The EDS File

The EDS (Electronic Data Sheet) file for the 2408*i* is named 2400.EDS and is available from your supplier, or electronically by going to Web site (www.eurotherm.com). The EDS file is designed to automate the DeviceNet network configuration process by precisely defining vendor-specific and required device parameter information. Following a data sheet metaphor, the EDS file describes a device's configurable parameters, including its legal and default values and the public interfaces to those parameters. Software configuration tools utilize the EDS files to configure a DeviceNet network.

4.6.4.2 ODVA Compliance

This interface has been tested to comply with the full requirements of the ODVA (Open DeviceNet Vendors Association) conformity tests.

4.6.4.3 DeviceNet Wiring Connections

Terminal Reference	CAN Label	Color Chip	Description
HA	V+	Red	DeviceNet network power positive terminal. Connect the red wire of the DeviceNet cable here. If the DeviceNet network does not supply the power, connect to the positive terminal of an external 11-25 Vdc power supply.
HB	CAN_H	White	DeviceNet CAN_H data bus terminal. Connect the white wire of the DeviceNet cable here.
HC	SHIELD	None	Shield/Drain wire connection. Connect the DeviceNet cable shield here. To prevent ground loops, ground the DeviceNet network in only one location.
HD	CAN_L	Blue	DeviceNet CAN_L data bus terminal. Connect the blue wire of the DeviceNet cable here.
HE	V-	Black	DeviceNet network power negative terminal. Connect the black wire of the DeviceNet cable here. If the DeviceNet network does not supply the power, connect to the negative terminal of an external 11-25 Vdc power supply.
HF			Connect to instrument earth

⚠ Note: Power taps are recommended to connect the DC power supply to the DeviceNet trunk line. Power taps include:

A Schottky Diode to connect the power supply V+ and allows for multiple power supplies to be connected.

- 2 fuses or circuit breakers to protect the bus from excessive current which could damage the cable and connectors.
- The earth connection, HF, to be connected to the main supply earth terminal.

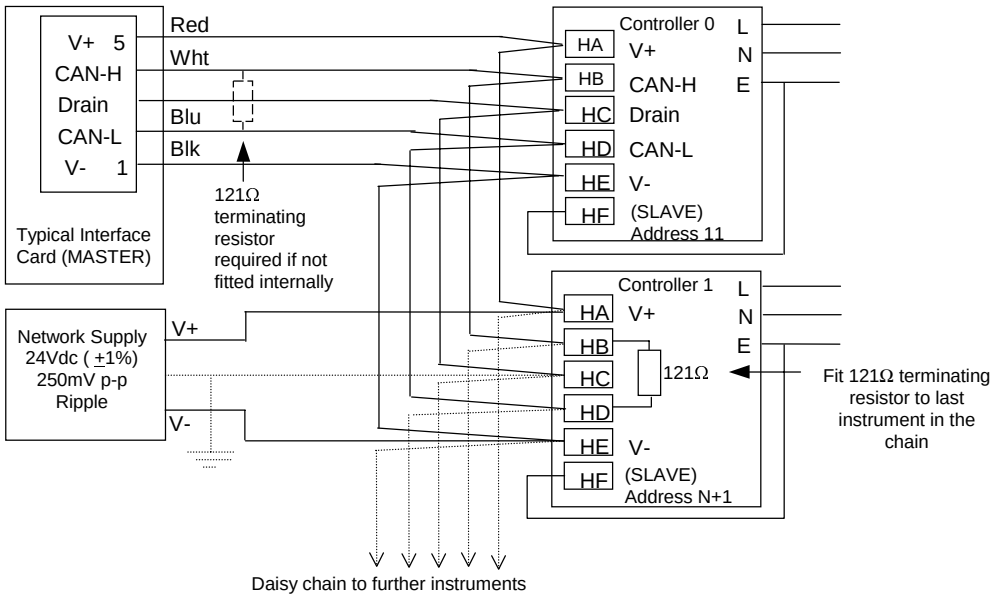


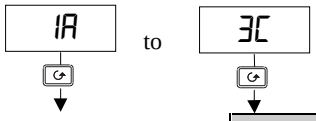
Figure 4-7: Typical DeviceNet Wiring Diagram

4.6.5 Module 1, 2 and 3 Configuration Lists

The identity of a module fitted in slots 1, 2 or 3 is shown by the first parameter in the module lists.

- If the module is a single output only channel <1A> is shown
- If the module is a dual output channel <1A> and channel <1C> are shown
- If the module is a triple output Channel <1A>, channel <1b> and channel <1C> are shown

Module configuration lists are summarised below:-



	MODULE 1	MODULE 2	MODULE 3	
LIST HEADINGS:	1A, 1b, 1C	2A, 2b, 2C	3A, 3b, 3C	(Note: The list heading corresponds to the terminal number to which the input/output is wired)

Note: Channel '1b' only appears if a dual or triple channel module is fitted. Channel '1C' only appears if a triple channel module is fitted

				Customer setting in each channel number								
Module Parameters		**Option**	**Meaning**	1A	1b	1C	2A	2b	2C	3A	3b	3C
id	Identity of module	nonE	Module not fitted									
		rELY	Relay output									
		LoG	Logic output									
		LoG.I	Logic or contact closure input									
		dC.IP	2nd analogue input module (Module 3 only)									
		dc.rE	DC retransmission									
		tPSU	Transmitter power supply									
		SG.SU	Strain gauge power supply									

4.6.6 Changeover Relay or Dual Relay Output Module

4.6.7 Triple Logic Output Module

The parameter lists are the same for each of these modules as listed below:-

				Customer settings in each channel								
id	Identity of module	rELY	Relay	1A	1b	1C	2A	2b	2C	3A	3b	3C
		LoG	Logic									
Func	Function of output	nonE	Module operation turned off									
		diG	Digital									
SEnS	Sense of the output	nor	Output energises when TRUE									
		Inu	Output de-energises when TRUE (default for alarms)									
If Func = nonE no further parameters are shown												
1---	Alarm 1	YES / no										
2---	Alarm 2	YES / no										
3---	Alarm 3	YES / no	Alarms are									
4---	Alarm 4	YES / no	attached to the									
Sbr	Sensor break alarm	YES / no	output in the same									
SPAn	Span	YES / no	way as relay									
rmt.F	Remote failure	YES / no	output 1									
IP1.F	Input 1 fail	YES / no										
nw.AL	New alarm	YES / no										

The changeover relay output module has a single output so the above parameters are shown under list <-1A> only

The triple logic module has three outputs so the above parameters are shown under lists ' <-1A>, <-1b>, and ' <-1C>

The dual relay module has two outputs so the above parameters are shown under lists ' <-1A> and <-1C>

4.6.8 Triple Logic Input or Triple Contact Closure Input Module

The triple logic input module allows further digital inputs in addition to those in the basic instrument. The list of parameters is the same as the fixed digital inputs 1 & 2, section 4.5.6. as follows:-

				Customer settings in each channel								
				1A	1b	1C	2A	2b	2C	3A	3b	3C
id	Identity of module	LoGi	Logic input	Read only								
Func	Function	nonE	Function not configured									
		rmt	Remote setpoint select									
		Ac.AL	Alarm acknowledge									
		Acc5	Select full access level									
		Loc.b	Keylock (disables all front panel buttons except the ACK/RESET button)									
		uP	Simulate pressing of the button									
		dwn	Simulate pressing of the button									
		ScrL	Simulate pressing of the button									
		PAGE	Simulate pressing of the button									
		PV.SL	Process value select. Closed = input 1 Open = input 2									
		tAr.1	Initiate automatic tare calibration of input 1									
		tAr.2	Initiate automatic tare calibration of input 2									
		PtL.1	Start the calibration at point 1, normally the low point									
		PtL.2	Start the calibration at point 2, normally the low point									
		PtH.1	Start the calibration at point 1, normally the high point									
		Pth.2	Start the calibration at point 2, normally the high point									
		in.AL	Alarm inhibit									
		P.HLd	Peak hold									
		HLd1	Sample and Hold on PV input 1									
		HLd2	Sample and Hold on PV input 2									
		UCAL	Enables calibration access for CAL 1 and CAL2 lists									
The triple logic or triple contact closure module has three inputs so the above parameters are shown under lists <-A>, <-b>, and <-C>												

4.6.9 DC input Module

The DC Input module can only be fitted in slot 3. The following parameters appear:-

Module Parameters		Option	Meaning	Customer settings 3b
id	Identity of module	dC.in	DC input	Read only
Func	Function	nonE	No function. Input used for monitoring and alarm only	
		rSP	Remote setpoint input. When selected this becomes the setpoint for deviation alarms. In <FuLL> access level, set Remote SP Enable, <L-r> = <rmt> (Remote SP selected)	
		Hi	Process Value = the highest of Input 1 and input 2 is displayed in normal operation. In normal operation the display cannot be switched between 'front' and 'back' views. The reading shows the highest or lowest value only.	
		Lo	Process Value = the lowest of Input 1 and input 2 is displayed in normal operation. In normal operation the display cannot be switched between 'front' and 'back' views. The reading shows the highest or lowest value only.	
		Ftn	Derived value. Process Value = (<F. 1> x Input 1) + (<F.2> x input 2), where <F. 1> and <F.2> are scalars found in the <in P> list in Full Access level. Refer to section 3.3.4. for an example of differential measurement.	
		SEL	Select input 1 or input 2 via comms, a digital input, or in the Operator <in P> list. If a digital input is configured use the parameter <PU.SL>. If the input is selected through the Operator list in Full Access use the parameter <PUin P>	
		trAn	Transition region between <in P. 1> and <in P.2>, set by <Lo.in P> and <Hi.in P> in Operator Level. See example 4.6.7.1.	
If <Func> = <nonE> no further parameters are shown. When <Func> ≠ <nonE>, input 2 parameters are shown in the Input List in Full access level. The parameters that follow are the same as those in the <in P> configuration list **plus** <Hi Ln> - the high impedance input option				
inPt		Refer to <in P> list section 4.5.2. plus the following parameter		**Customer settings**
		Hi In	0 to 2volt high impedance input	
CJC		Refer to <in P> list		
ImP				
InP.L				
ImP.H				
UAL.L				
UAL.H				
tYPE	Type of calibration	oFF	Off	
		Shnt	Shunt	
		Ld.C	Load Cell	
		CmP	Comparison	
		mAn	Manual	
bAnd	Settling band.	0-99.99 (Default 0.5)	The indicator automatically determines when the input has become stable by continuous sampling. When the average value between two consecutive samples is within the settling band the indicator will then allow calibration to take place. If readings are not stable within this period the indicator will abort the calibration	
The DC input module has a single input so the above parameters are shown under list <3A> only				

4.6.9.1 Example: Input 1 and Input 2 are Configured for Transition

An example of the use for this could be the measurement of temperature over a wide range. The lower temperatures may be measured by a base metal thermocouple connected to Input 1 and higher temperatures may be measured by a pyrometer or precious metal thermocouple connected to input 2. The reason for such a combination is to provide the most accurate readings over the full temperature range where the thermocouple cannot be used at high temperatures and the pyrometer is too insensitive at low temperatures to provide an accurate reading. The thermocouple may be withdrawn, to prevent damage to it, using a high alarm set around the upper limit of the thermocouple.

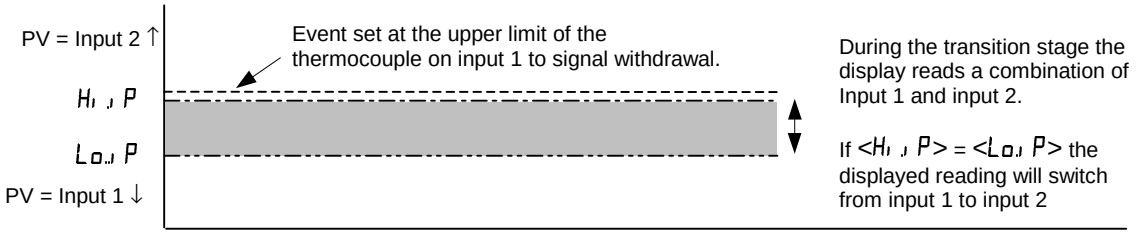
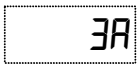
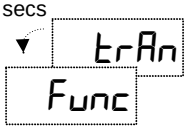
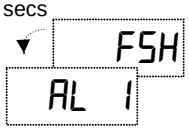
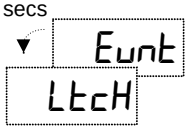
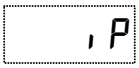
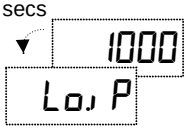
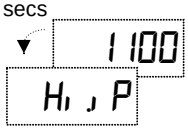
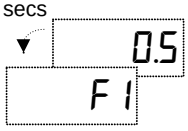
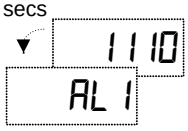


Figure 4-8: Input 1/Input 2 Transition

Do This	This Is The Display You Should See	Additional Notes
A. Configure the DC Input Module fitted in slot 3 for transition function		
1. Press ▯ until the <3A> List header is shown		
2. Press ↻ until <Func> is shown 3. Press ▼ or ▲ to select <trAn>	2 secs ▼ 	The display will return to <Func> after approximately 2 seconds
B. Configure an alarm as a full scale high event		
1. Press ▯ until the **'Alarm List'** header is shown		
2. Press ↻ to select alarm 1, 2, 3, or 4 as appropriate 3. Press ▼ or ▲ to select <FSH>	2 secs ▼ 	This configures alarm 1 for full scale high
4. Press ↻ to select <LtcH> 5. Press ▼ or ▲ to select <Eunt>	2 secs ▼ 	This configures alarm 1 for an event so that an alarm message is not displayed as the PV exceeds the alarm setpoint.
C. Attach the alarm to a relay output as described in examples 4.4.5.1 or 4.4.5.2.		
D. Exit configuration level and enter Full access level to set the transition values and full scale high alarm (event) setpoint		
1. Press ▯ until the **'Input List'** header is shown		
2. Press ↻ until the <Lo, P> is shown 3. Press ▼ or ▲ to set a level at which the sensor on input 1 is to be phased out	2 secs ▼ 	
4. Press ↻ until the <Hi , P> is shown 5. Press ▼ or ▲ to set a level at which the sensor on input 2 is to be phased in	2 secs ▼ 	If <Lo, P> is set to the same value as <Hi , P> the displayed reading will jump from Input 1 to input 2 at this value
6. Press ↻ until the <F 1> is shown 7. Press ▼ or ▲ to set a multiplying factor on input 1 if necessary 8. Repeat for <F2>	2 secs ▼ 	<F. 1> and <F.2> are constants to achieve a derived PV where PV = <F. 1> x input 1 + <F.2> x input 2 As the displayed reading, in normal operation, moves between Input 1 and input 2 it will do so in a controlled manner. Some experiment may be necessary with the four parameters to achieve ideal settings
9. Press ▯ until the **'Alarm List'** header is shown		
10. Press ↻ until the <AL 1> is shown 11. Press ▼ or ▲ to set the level at which the base metal thermocouple is to be removed	2 secs ▼ 	

4.6.10 DC Retransmission Module

The following parameters appear.

Module Parameters		Option	Meaning	Customer settings		
				1A	2A	3A
id	Identity of module	dc.rE	DC retransmission			
Func	Function	nonE	None configured			
		PU	Process value retransmission			
		wSP	Setpoint retransmission			
		Err	Error from setpoint retrans.			
		I P. 1	Input 1 retransmission			
		I P.2	Input 2 retransmission			
If Func = nonE no further parameters are shown						
UAL.L			Retransmission value low			
UAL.H			Retransmission value High			
Unit			Electrical output units uoLt = Volts, mA = milliamps			
OutL			Minimum electrical output			
OutH			Maximum electrical output			
The DC retransmission module has a single output so the above parameters are shown under list -A only						

4.6.10.1 Example: To Scale the DC Retransmission Output

The retransmission output can be scaled so that the output value corresponds to the range of the signal to be transmitted.
Figure 4.5 shows an example where the retransmitted signal is <PU> or <wSP > and an electrical output of 4-20mA represents a displayed value of 20.0 to 200.0 units.

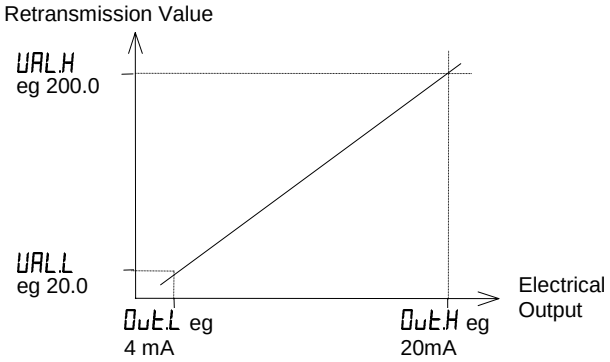


Figure 4-9: Scaling a Retransmission Output

4.6.11 Strain Gauge Transducer Supply

The following parameters appear:-

Module Parameters		Option	Meaning	Customer settings		
				1A	2A	3A
id	Identity of module	SG.SU	Strain Gauge supply			
Func	Function	nonE I P 1 I P 2	None Bridge supply for input 1 Bridge supply for input 2			
brG.U	Bridge voltage	5 10	5 volt bridge supply 10 volt bridge supply			
SHnt	Calibration shunt resistor	EXt Int	External shunt resistor used Internal shunt resistor used			
The strain guage transducer module has a single input so the above parameters are shown under list -A only						

4.6.12 Transmitter Power Supply

The following parameters appear:-

Module Parameters		Option	Meaning
id	Identity of module	tP.SU	Transmitter power supply
Func	Function	nonE	Fixed 24Vdc 20mA supply

4.7 INDICATOR CALIBRATION

This section explains how to calibrate PV inputs 1 and 2, and retransmission outputs. It should not be confused with User Calibration described in section 3.6 which allows the user to add offsets to compensate for external measurement inaccuracies. Calibration of the indicator should not normally be necessary and must only be carried out using calibrated reference sources. It is always possible to revert to factory calibration settings if necessary.

4.7.1 To Calibrate Input 1 or 2

- A mV calibration should be carried out before thermocouple and RTD calibrations.
- Connect a mV, volt source to the input which you wish to calibrate.
- If the input is RTD connect a resistance box.

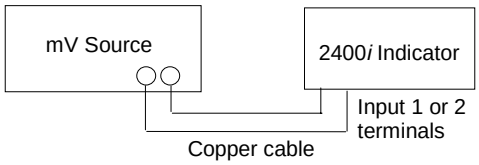
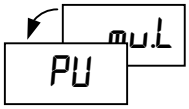
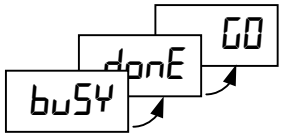
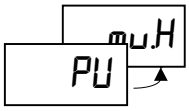


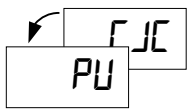
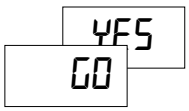
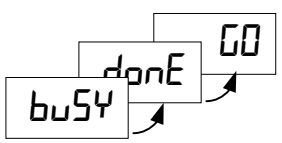
Figure 4-10: mV Input Calibration

4.7.1.1 To Calibrate mV or Volt Inputs:-

Do This	This Is The Display You Should See	Additional Notes
1. From any display press [▯] as many times as necessary to access the <CAL> **List'** header		
Set the mV source to 0.000mV		
2. Press [⟳] to show <rcAL> 3. Press [▼] or [▲] to select input 1 or 2 <PU. 1> or <PU.2>		For 0 - 10V input range and high impedance input range, set the volt source to 0.000V
4. Press [⟳] to show <PU> 5. Press [▼] or [▲] to select <mu.L>		This allows you to choose the parameter to be calibrated
6. Press [⟳] to show <GO> 7. Press [▼] or [▲] to select <YES>		 When the indicator is calibrating the message <buSY> is shown. When complete the message <donE> is flashed briefly and the display returns to <GO>. The low point calibration is now complete
Set the mV source to 10.000mV		
8. Repeat the above steps for <mU.H>		For 0 - 10V input range, set the volt source to 10.000V For RTD input range, set the resistance box to 400.00Ω For high impedance input range, set volt source to 1.000V

4.7.1.2 To Calibrate CJC

Having calibrated mV inputs as above it is then only necessary to calibrate Cold Junction Compensation (CJC), as follows:-

Do This	This Is The Display You Should See	Additional Notes
1. Replace the copper cable from the mV source with the appropriate compensating cable 2. Configure the indicator for a thermocouple type. A base metal thermocouple such as type K is recommended 3. Set the mV source to the same thermocouple compensation 4. Set the mV source to 0.000mV 5. From the <PU> list press [▼] or [▲] as many times as necessary to access <CJC>		
6. Press [⟳] to show <GO> 7. Press [▼] or [▲] to select <YES>		 When the indicator is calibrating the message <buSY> is shown. When complete the message <donE> is flashed briefly and the display returns to <GO>. The CJC calibration is now complete.

4.7.2 To Calibrate Retransmission Output

Connect the retransmission output to a multi-meter set to volts or mV as appropriate.

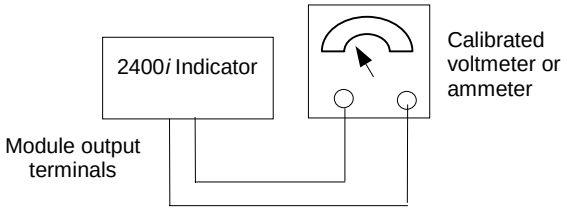
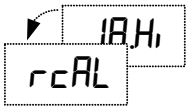
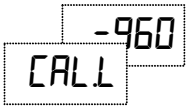
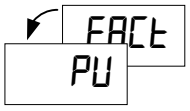


Figure 4-11: Retransmission output calibration

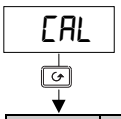
Do This	This Is The Display You Should See	Additional Notes
1. From the <rcAL> list press ▼ or ▲ as many times as necessary to select the module to be calibrated, e.g. <A.Hi>		In this example module 1 will be calibrated. The high output is calibrated first
2. Press ⟳ to show <CAL.H> 3. Press ▼ or ▲ to adjust the required output read on the meter		The reading on the indicator can be adjusted between –999 and +999. This is an arbitrary value which acts as a trim on the output
4. Press ⟳ to select the <rcAL> list 5. Press ▼ or ▲ as many times as necessary to select the module to be calibrated, e.g. <A.Lo>		The low output is calibrated next
6. Press ⟳ to show <CAL.L> 7. Press ▼ or ▲ to adjust the required output read on the meter		The reading on the indicator can be adjusted between –999 and +999. This is an arbitrary value which acts as a trim on the output

4.7.3 To Restore Factory Calibration

Factory calibration of PV input and PV input 2 can be restored as follows:-

Do This	This Is The Display You Should See	Additional Notes
1. From the <PU> list press ▼ or ▲ as many times as necessary to select <FACt>		The factory set calibration values are restored

4.7.4 Calibration Parameters

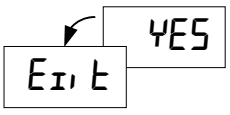


CAL	Basic Indicator Calibration		Selected parameter	
rCAL	Selected re-calibration parameter	nonE	Idle state - no calibration performed	
		PU.1	Main process value input selected	
		PU.2	Second analogue input selected (this will always be in module position 3)	
		1A.Hi	Module 1 DC retransmission high output (if installed)	
		1A.Lo	Module 1 DC retransmission low output (if installed)	
		2A.Hi	Module 2 DC retransmission high output (if installed)	
		2A.Lo	Module 2 DC retransmission low output (if installed)	
		3A.Hi	Module 3 DC retransmission high output (if installed)	
		3A.Lo	Module 3 DC retransmission low output (if installed)	
If rCAL = PU 1 or PU2 the following parameters appear:			**Calibration point**	**Calibration value**
PU	PU or PU.2 calibration point	I dLE	Idle	
		mu.L	mV low calibration point selected	0.000 mV
		mu.H	mV high calibration point selected	50.000 mV
		U 0	0 Volt calibration point selected	0.000V
		U 10	10 Volt calibration point selected	10.000V
		CJC	Cold junction calibration	See below
		rtd	Resistance input calibration	400.00Ω
		HI 0	High impedance input. 0 Volt calibration point selected	0.000V
		HI 1.0	High impedance input. 1.0 Volt calibration point selected	1.000V
		FACt	Restore factory calibration selected	
GO	Start calibration	no	Waiting to calibrate PV point	
		YES	Start calibration	
		buSY	Busy calibrating	
		donE	Calibration complete	
		FAiL	Calibration failed	
If rCAL = 1AHi to 3ALo (DC output module calibration) the following parameters appear:				
cAL.L	DC output calibration low point	0	0 = Factory cal. Trim value to give output = + 1V or +2mA	
cAL.H	DC output calibration high point	0	100 = Factory cal. Trim value to give output = + 9V or +18mA	

4.7.5 Password Configuration

PASS	Passwords	Range	Notes	Default setting	Customer setting
ACC.P	Full and Edit level password	0-9999	Having once entered the correct password, operator, full or edit level can be selected at will. To return to operator level and lock the indicator in this level, either switch the indicator off and on again or enter an invalid password as described in section 4.2.1.	1	
cnF.P	Configuration level password	0-9999	Configuration level can only be entered from the above level. You must exit this level to return to operator level by following the exit procedure in section 4.7.6.	2	
CAL.P	User calibration password	0-9999	User calibration level (described in Section 3.5.1.) can be entered from operator level. To return to normal operation: 1. Enter an incorrect password 2. Switch power off and on again	3	

4.7.6 To Leave Configuration Level

Do This	This Is The Display You Should See	Additional Notes
1. Press [▯] to reach the <Exit> display 2. Press [▼] or [▲] to select <YES>		*i* After 2 secs the display will blank then return to the HOME display in Operator level

5 Ordering Code

Model number	Function	Display colour	Supply voltage	Module 1	Module 2	Module 3	Relay Output 1	Comms Module	PDS Module	Manual
2408*i*										

Function	
AL	Indicator/Alarm unit
AP	Profibus Indicator

Display colour	
GN	Green display
RD	Red display

Supply voltage	
VH	85-264Vac
VL	20-29Vac/dc

Note 1: By default, alarm 1 will be assigned to relay output 1 and alarms 2, 3 and 4 will be assigned to Modules 1, 2 and 3 respectively.

Note 2: The allocation of alarms to the dual relay outputs must be performed in configuration by the customer.

Note 3: Triple contact or logic inputs can be configured, by the user, for any of the functions listed under Digital Inputs 1 and 2.

Note 4: The triple logic output can configured as alarm outputs or as telemetry outputs via digital communications.

Modules 1, 2 and 3	
XX	Module not fitted
Alarm Relay output (change-over)	
R4	Module fitted unconfigured
OR Select alarm configuration from table A.	
DC retransmission	
D6	Module fitted unconfigured
First character	
V-	Process Value retransmission
S-	Setpoint retransmisssion
Z-	Error retransmission
Second character	
-1	0-20mA
-2	4-20mA
-3	0-5Vdc
-4	1-5Vdc
-5	0-10Vdc
Dual relay (Note 2)	
RR	Module fitted unconfigured
Triple contact input (Note 3)	
TK	Module fitted unconfigured
Triple logic input (Note 3)	
TL	Module fitted unconfigured
Triple logic output (Note 4**)**	
TP	Module fitted unconfigured
20mA Transmitter supply	
MS	24Vdc, 20mA supply
Strain Gauge Transducer supply (modules 1 & 2 only) (note 5)	
G3	5V transducer supply
G5	10v transducer supply
2nd analogue input (module 3 only)	
D5	Module fitted unconfigured For configuration, see PV Function field

Relay Output 1	
XX	Not fitted
RF	Fitted unconfigured
OR Select alarm configuration from table A	

Table A:

Alarm relay configuration (See note 1)	
Non-latched alarms	
FH	High alarm
FL	Low alarm
DB	Deviation band alarm
DL	Deviation low alarm
DH	Deviation high alarm
RA	Rate-of -change alarm
Latched alarms	
HA	High alarm
LA	Low alarm
BD	Deviation band alarm
WD	Deviation low alarm
AD	Deviation high alarm
RT	Rate-of -change alarm
NW	New alarm

Note 5: By default, the transducer supply for input 1 will be installed in module position 2 and the transducer supply for input 2 in module position 1.

Comms module	
XX	Module not fitted
RS232 Module	
A2	Module fitted unconfigured
AM	Modbus protocol
AE	EI-Bisynch protocol
RS485 (2-wire) Module	
Y2	Module fitted unconfigured
YM	Modbus protocol
YE	EI-Bisynch protocol
RS485 (4-wire) (= RS422) Module	
F2	Module fitted unconfigured
FM	Modbus protocol
FE	EI-Bisynch protocol
Profibus Module	
PB	High speed RS485

PDS module	
XX	Module not fitted
M6	Module fitted unconfigured
RS	Remote setpoint input

Manual	
XXX	None
ENG	English
FRA	French
GER	German
NED	Dutch
SPA	Spanish
SWE	Swedish
ITA	Italian

SOFTWARE CONFIGURATION						Configuration of 2nd analogue input requires D5 in module 3				
Sensor Input	Setpoint min	Setpoint max	Display Units	Digital input 1	Digital input 2	2nd DC Input	PV Function	2nd Input Display Min	2nd Input Display Max	Configurat-ion option
	Note 6	Note 6				Note 7		Note 8	Note 8	

Sensor input & 2nd DC input			Setpoint min & max			
			°C		° F	
Thermocouples			Min	Max	Min	Max
J	Type J		-210	1200	-340	2192
K	Type K		-200	1372	-325	2500
T	Type T		-200	400	-325	750
L	Type L		-200	900	-325	1650
N	Type N		-250	1300	-418	2370
R	Type R		-50	1768	-58	3200
S	Type S		-50	1768	-58	3200
B	Type B		0	1820	32	3308
P	Platinell II		0	1369	32	2496
Z	Pt100		-200	850	-325	1562
Process inputs (Scaled to setpoints max & min)			Range Min		Range Max	
F	-100 to +100mV		-9999		99999	
Y	0 to 20mA (note 2)		-9999		99999	
A	4 to 20mA (note 2)		-9999		99999	
W	0 to 5Vdc		-9999		99999	
G	1 to 5Vdc		-9999		99999	
V	0 to 10Vdc		-9999		99999	
Factory downloaded input						
C	Type C -W5%Re/W26%Re (default downloaded input)	"Table Reference Number" tbc	0 to 2319		32 to 4200	
D	Type D - W3%Re/W25%Re	"T035"	0 to 2399		32 to 4350	
E	E thermocouple	"T012"	-270 to 999		-450 to 1830	
1	Ni/Ni18%Mo	"T033"	0 to 1399		32 to 2550	
2	Pt20%Rh/Pt40%Rh	"T025"	0 to 1870		32 to 3398	
3	W/W26%Re (Engelhard)	"T09"	0 to 2000		32 to 3632	
4	W/W26%Re (Hoskins)	"T029"	0 to 2010		32 to 3650	
5	W5%Re/W26%Re (Engelhard)	"T011"	10 to 2300		50 to 4172	
6	W5%Re/W26%Re (Bucose)	"T038"	0 to 2000		32 to 3632	
7	Pt10%Rh/Pt40%/Rh	"T023"	200 to 1800		392 to 3272	
8	Exergen K80 I.R. Pyrometer	"ErBO"	-45 to 650		-49 to 1202	

Display Units			
C	°C	K	°K
F	°F	X	Blank

PV function	
XX	Input 1 displayed
LO	PV = the lowest of i/p 1 and 2
HI	PV = the highest of i/p 1 and 2
FN	PV derived from i/p 1 and 2
RS	Remote setpoint

Digital inputs 1 & 2	
XX	Disabled
AC	Alarm acknowledge
KL	Keylock
SR	Remote setpoint select
PV	Select process value input 2
M5	CTX mode 5 (digital input 2 only). For use with PDTCX 'smart' current transformer.
J1	Initiate tare correction on strain gauge input 1
J2	Initiate tare correction on strain gauge input 2
J3	Initiate automatic calibration of strain gauge input 1
J4	Initiate automatic calibration of strain gauge input 2

Configuration Option	
XX	Standard
SG	Load cell/strain gauge
MP	pressure transducer

Note 6: Setpoint min and max: Include the decimal points required in the displayed value; up to one for temperature, up to two for process inputs.

Note 7: Select the code required from the Sensor Input table.

Note 8: These two fields are used to scale the 2nd DC input if it is a linear process input, otherwise it should be left blank.

Note 9: For mA inputs, a 1% 2.49Ω current sense resistor is supplied. If greater accuracy is required, a 0.1% resistor can be ordered as Part No. SUB2K/249R.1.

6 Safety and EMC Information

Safety

This indicator complies with the European Low Voltage Directive 73/23/EEC, amended by 93/68/EEC, by the application of the safety standard EN 61010.

Electromagnetic compatibility

This indicator conforms to the essential protection requirements of the EMC Directive 89/336/EEC, amended by 93/68/EEC, by the application of a Technical Construction File. This indicator satisfies the general requirements of the industrial environment defined in EN 50081-2 and EN 50082-2.

General

The information contained in these instructions is subject to change without notice. While every effort has been made to ensure the accuracy of the information, your supplier shall not be held liable for errors contained herein.

Unpacking and storage

The packaging should contain the indicator, two panel retaining clips, a 2.49Ω current sense resistor and this instruction leaflet.
If the packaging or the indicator is damaged, do not install the product but contact your supplier.

This indicator has no user serviceable parts. Contact your supplier for repair.

Caution: Charged capacitors

Before removing the indicator from its sleeve, switch off the supply and wait two minutes to allow capacitors to discharge. Failure to observe this precaution may damage the indicator or cause mild electric shock.

Precautions Against Electrostatic Discharge Damage

When the indicator is removed from its sleeve, it is vulnerable to damage by electrostatic. To avoid this, observe anti-static handling precautions.

Cleaning

Do not use water or water based products to clean labels or they will become illegible. Isopropyl alcohol may be used to clean labels. A mild soap solution may be used to clean other exterior surfaces of the product.

Safety Symbols

The following safety symbols are used on the controller and in this manual:

Caution, Important safety information

Functional earth (ground) terminal

Useful information or hint

Personnel

Installation must be carried out by qualified personnel.

Enclosure of live parts

The indicator must be installed in an enclosure to prevent hands or metal tools touching parts that may be electrically live.

Caution: Live sensors

The alarm acknowledge/keylock input is electrically connected to the sensor input (e.g. thermocouple). In some installations the temperature sensor may become live. The indicator is designed to operate under these conditions, but you must ensure that this will not damage other equipment connected to the logic input/output and that service personnel do not touch this connection while it is live. With a live sensor, all cables, connectors and switches for connecting the sensor and non-isolated inputs and outputs must be mains rated.

Wiring

Wire the indicator in accordance with the wiring data given in these instructions. Take particular care not to connect AC supplies to the low voltage sensor input or logic outputs. Only use copper conductors for connections, (except thermocouple). Ensure that the installation complies with local wiring regulations, and observe maximum voltage safety limits.

Power Isolation

The installation must include a power isolating switch or circuit breaker that disconnects all current carrying conductors. The device should be mounted in close proximity to the indicator, within easy reach of the operator and marked as the disconnecting device for the indicator.

Voltage rating

The maximum continuous voltage applied between any connection and ground must not exceed 264Vac.

For the above reason the indicator should not be wired to a three-phase supply with an unearthed star connection. Under fault conditions such a supply could rise above 264Vac with respect to ground and the product would not be safe.

Conductive pollution

Electrically conductive pollution must be excluded from the cabinet in which the indicator is mounted. For example, carbon dust is a form of electrically conductive pollution. Where condensation is likely, for example at low temperatures, include a thermostatically controlled heater in the cabinet.

Installation requirements for EMC

- For general guidance refer to EMC Installation Guide, HA025464.
- It may be necessary to fit a filter across the relay output to suppress conducted emissions. The filter requirements will depend on the type of load. For typical applications we recommend Schaffner FN321 or FN612.

Routing of wires

To minimise the pick-up of electrical noise, the sensor input wiring should be routed away from high-current power cables. Where it is impractical to do this, use shielded cables with the shield grounded at both ends.

7 Technical Specification

Main process value input and second DC input

Low level range	-100 to +100mV
High level range	0-20mA or 0-10Vdc
Sample rate	9Hz
Resolution	<2µV for low level inputs <2mV for high level inputs
Linearity	Better than 0.2°C
Calibration accuracy	±0.2% of reading, or ±1°C or ±1LSD, whichever is the greater
User calibration	Low and high offsets can be applied
Input filtering	OFF to 999.9 seconds
Thermocouple types	Refer to ordering code sensor input table
Cold junction compensation	In automatic mode, >30:1 rejection of ambient temperature change.
3-wire Pt100 input Bulb current:	0.3mA
Maximum lead resistance	Up to 22Ω in each lead without error
2nd analogue input functions	2nd process value, remote setpoint, select min, select max, derived value
Input impedance, mV inputs	>10MΩ
Input impedance, Volt inputs	>69KΩ

Digital inputs

Contact closure or open collector inputs

Note: These are powered by the controller

Digital inputs 1 & 2 (Non isolated from PV)	Switching voltage/current: 24Vdc/20mA nominal Off state resistance <100Ω On state resistance >28KΩ
Triple contact closure inputs	Isolated. Specification as dig. inputs 1 & 2

Externally powered inputs

Triple logic inputs	Off state: <5Vdc On state: 10.8 to 30Vdc @ 2.5mA

Digital input functions

As per digital inputs 1 & 2 in the ordering code

Digital outputs

Relay rating	2A, 264Vac resistive
Triple logic output	8mA, 12Vdc per channel
Digital output functions	as per the ordering code

DC retransmission

Range	Scaleable between 0-20mA and 0-10Vdc
Resolution	1 part in 10,000
Retransmission values	Process value, setpoint or error from

Transmitter supply

Rating	20mA, 24Vdc

Strain gauge bridge supply

Bridge voltage	Software selectable, 5 or 10Vdc
Bridge resistance	300Ω to 10KΩ
Internal shunt resistor	30.1KΩ at 0.25%, used for calibration of 350Ω bridge

Alarms

Number of alarms	Four
Alarm types	High, low, deviation high, deviation low, deviation band, rate of change in units/sec, rate of change in units/min, new alarm status. Sensor break alarm
Alarm modes	Latching or non-latching. Blocking Energised or de-energised in alarm
Alarm delay	OFF to 999.9 secs

Communications

Module types	RS232, 2-wire RS485 and 4-wireRS485
Protocols	Modbus® or EI-Bisynch (ASCII)

PDS

Functions	Remote setpoint input from master controller

General

Display colour	Red or green options
Number of digits	Five with up to three decimal places
Supply	100 to 240Vac -15%+10% OR 24 Vdc or ac -15%+20%
Power consumption	15W max
Operating ambient	0 to 55°C and 5 to 95% RH non-condensing
Storage temperature	-10 to +70°C
Panel sealing	IP65
Dimensions	96W x 48H x 150D
Weight	400g max
EMC Standards:	EN50081-2 & EN50082-2 generic standards for industrial environments
Safety standards	Meets EN 61010, Installation category II, pollution degree 2.
Atmospheres	Not suitable for use above 2000m or in explosive or corrosive atmospheres

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APPENDIX A

GA500-WC
Component Information

DL205 User Manual

Automationdirect.com

WARNING

Thank you for purchasing automation equipment from ***Automationdirect.com***™. We want your new ***Direct***LOGIC™ automation equipment to operate safely. Anyone who installs or uses this equipment should read this publication (and any other relevant publications) before installing or operating the equipment.

To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and usually change with time. It is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation is in compliance with the latest revision of these codes.

At a minimum, you should follow all applicable sections of the National Fire Code, National Electrical Code, and the codes of the National Electrical Manufacturer's Association (NEMA). There may be local regulatory or government offices that can also help determine which codes and standards are necessary for safe installation and operation.

Equipment damage or serious injury to personnel can result from the failure to follow all applicable codes and standards. We do not guarantee the products described in this publication are suitable for your particular application, nor do we assume any responsibility for your product design, installation, or operation.

If you have any questions concerning the installation or operation of this equipment, or if you need additional information, please call us at 770-844-4200.

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Environmental Specifications

The following table lists the environmental specifications that generally apply to the DL205 system (CPU, Bases, I/O Modules). The ranges that vary for the Handheld Programmer are noted at the bottom of this chart. I/O module operation may fluctuate depending on the ambient temperature and your application. Please refer to the appropriate I/O module specifications for the temperature derating curves applying to specific modules.

Specification	Rating
Storage temperature	-4° F to 158° F (-20° C to 70° C)
Ambient operating temperature*	32° F to 131° F (0° C to 55° C)
Ambient humidity**	30% - 95% relative humidity (non-condensing)
Vibration resistance	MIL STD 810C, Method 514.2
Shock resistance	MIL STD 810C, Method 516.2
Noise immunity	NEMA (ICS3-304)
Atmosphere	No corrosive gases

* Operating temperature for the Handheld Programmer and the DV-1000 is 32° to 122° F (0° to 50° C) Storage temperature for the Handheld Programmer and the DV-1000 is -4° to 158° F (-20° to70° C).
**Equipment will operate below 30% humidity. However, static electricity problems occur much more frequently at lower humidity levels. Make sure you take adequate precautions when you touch the equipment. Consider using ground straps, anti-static floor coverings, etc. if you use the equipment in low humidity environments.

Power

The power source must be capable of supplying voltage and current complying with the base power supply specifications.

Specification	AC Powered Bases	24 VDC Powered Bases	125 VDC Powered Bases
Part Numbers	D2-03B, D2-04B, D2-06B, D2-09B	D2-03BDC-1, D2-04BDC-1, D2-06BDC-1, D2-09BDC-1	D2-03BDC-2, D2-04BDC-2, D2-06BDC-2, D2-09BDC-2
Input Voltage Range	85-132 VAC (110 range) 170-264 VAC (220 range)	10.2 - 28.8VDC (24VDC) with less than 10% ripple	90-264 VDC (125 VDC) with less than 10% ripple 115-264 VDC (9-slot base)
Maximum Inrush Current	30 A	10A	20A
Maximum Power	50 VA 80 VA (D2-09B)	15W 25 W (D2-09BDC-1)	30W
Voltage Withstand (dielectric)	1 minute @ 1500 VAC between primary, secondary, field ground, and run relay		
Insulation Resistance	> 10 M□ at 500 VDC		
Auxiliary 24 VDC Output	20-28 VDC, less than 1V p-p 200 mA max. (300 mA max., 9-slot base)	None	20-28 VDC, less than 1V p-p 200 mA max. (300 mA max., 9-slot base)

Agency Approvals

Some applications require agency approvals. Typical agency approvals which your application may require are:

- UL (Underwriters' Laboratories, Inc.)
- CSA (Canadian Standards Association)
- FM (Factory Mutual Research Corporation)
- CUL (Canadian Underwriters' Laboratories, Inc.)

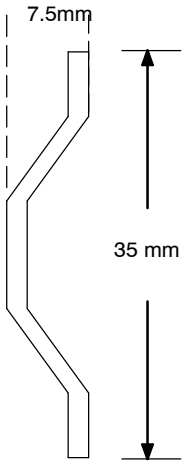
Using Mounting Rails

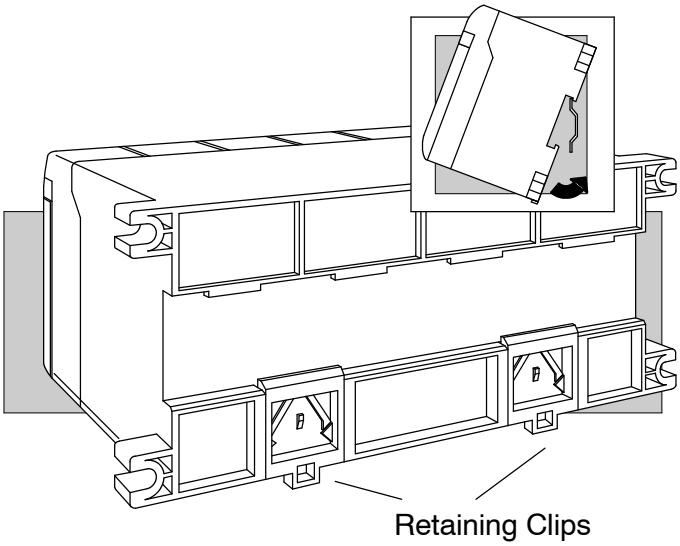
The DL205 bases can also be secured to the cabinet by using mounting rails. You should use rails that conform to DIN EN standard 50 022. Refer to our catalog for a complete line of DIN rail and DINnectors, DIN rail mounted apparatus. These rails are approximately 35mm high, with a depth of 7.5mm. If you mount the base on a rail, you should also consider using end brackets on each end of the rail. The end bracket helps keep the base from sliding horizontally along the rail. This helps minimize the possibility of accidentally pulling the wiring loose.

If you examine the bottom of the base, you'll notice two small retaining clips. To secure the base to a DIN rail, place the base onto the rail and gently push up on the retaining clips. The clips lock the base onto the rail.

To remove the base, pull down on the retaining clips, lift up on the base slightly, and pull it away from the rail.

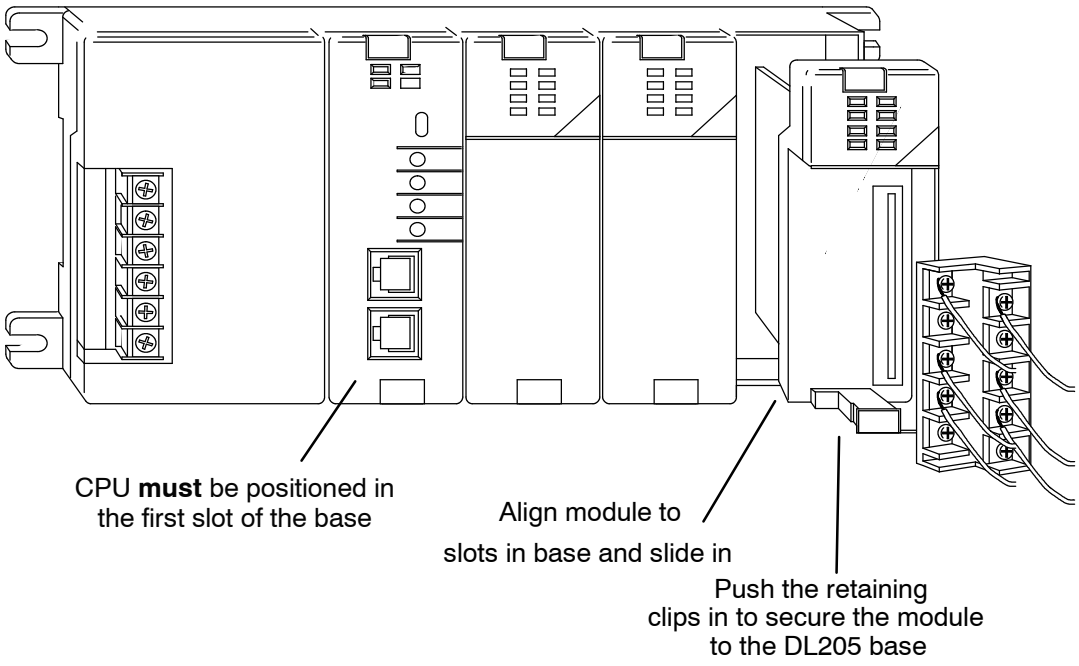
DIN Rail Dimensions

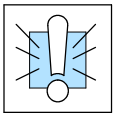




Installing Components in the Base

When inserting components into the base, align the PC board(s) of the module with the grooves on the top and bottom of the base. Push the module straight into the base until it is firmly seated in the backplane connector. Once the module is inserted into the base, push in the retaining clips (located at the top and bottom of the module) to firmly secure the module to the base.





WARNING: Minimize the risk of electrical shock, personal injury, or equipment damage, always disconnect the system power before installing or removing any system component.

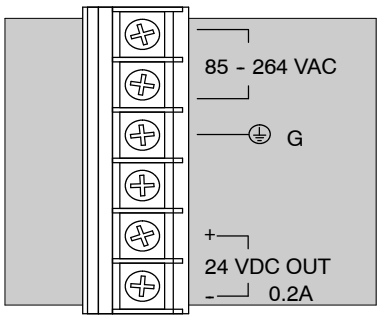
Base Wiring Guidelines

Base Wiring

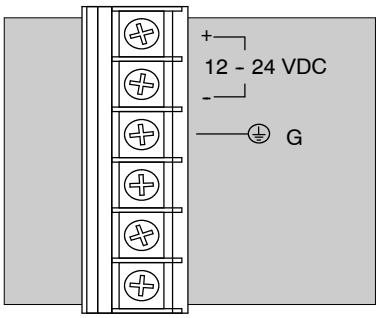
The diagram shows the terminal connections located on the power supply of the DL205 bases. The base terminals can accept up to 16 AWG. You may be able to use larger wiring depending on the type of wire used, but 16 AWG is the recommended size. Do not overtighten the connector screws; recommended torque value is 7.81 pound-inches (0.882 N•m).

NOTE: You can connect either a 115 VAC or 220 VAC supply to the AC terminals. Special wiring or jumpers are not required as with some of the other ***Direct***LOGIC™ products.

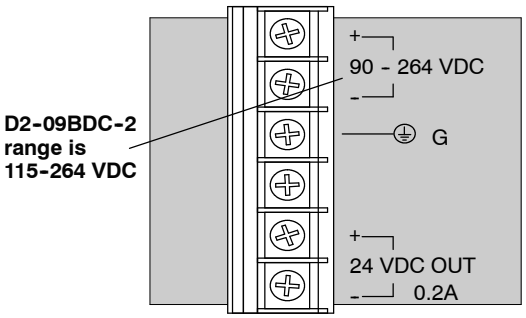
110/220 VAC Base Terminal Strip



12/24 VDC Base Terminal Strip



125 VDC Base Terminal Strip

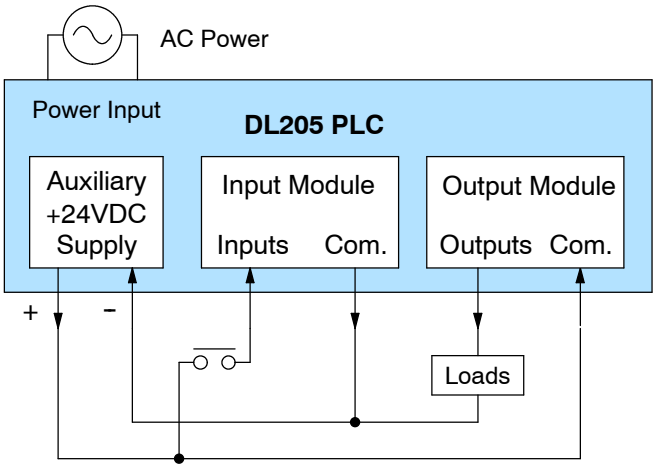


WARNING: Once the power wiring is connected, install the plastic protective cover. When the cover is removed there is a risk of electrical shock if you accidentally touch the wiring or wiring terminals.

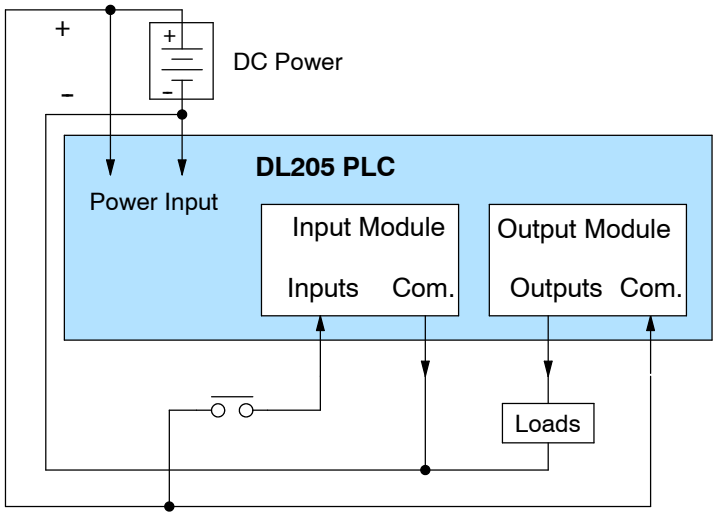
In some cases, using the built-in auxiliary +24VDC supply can result in a cost savings for your control system. It can power combined loads up to 200 mA on 3-6 slot bases and 300mA on the 9-slot base. Be careful not to exceed the current rating of the supply. If you are the system designer for your application, you may be able to select and design in field devices which can use the +24VDC auxiliary supply.

Powering I/O Circuits with the Auxiliary Supply

All AC powered DL205 bases feature the internal auxiliary supply. If input devices AND output loads need +24VDC power, the auxiliary supply may be able to power both circuits as shown in the following diagram.



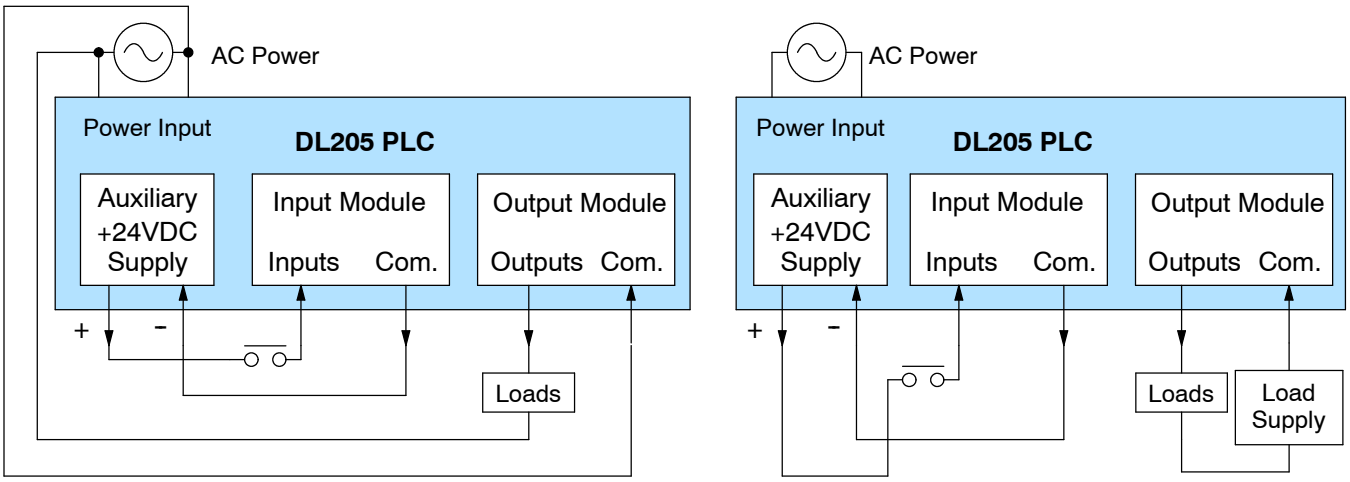
DC-powered DL205 bases are designed for application environments in which low-voltage DC power is more readily available than AC. These include a wide range of battery-powered applications, such as remotely-located control, in vehicles, portable machines, etc. For this application type, all input devices and output loads typically use the same DC power source. Typical wiring for DC-powered applications is shown in the following diagram.



Powering I/O Circuits Using Separate Supplies

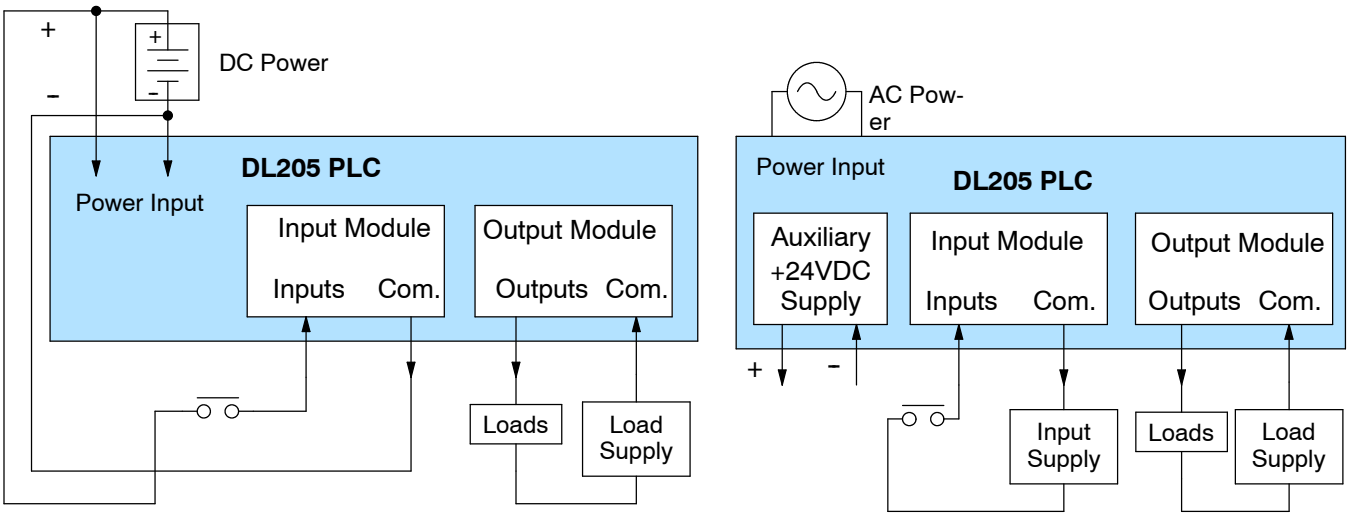
In most applications it will be necessary to power the input devices from one power source, and to power output loads from another source. Loads often require high-energy AC power, while input sensors use low-energy DC. If a machine operator is likely to come in close contact with input wiring, then safety reasons also require isolation from high-energy output circuits. It is most convenient if the loads can use the same power source as the PLC, and the input sensors can use the auxiliary supply, as shown to the left in the figure below.

If the loads cannot be powered from the PLC supply, then a separate supply must be used as shown to the right in the figure below.



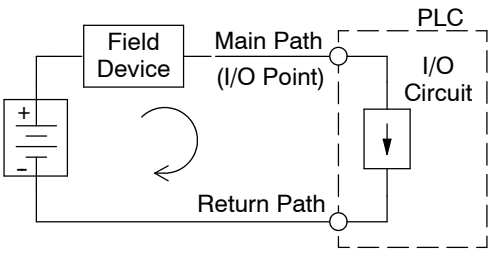
Some applications will use the PLC external power source to also power the input circuit. This typically occurs on DC-powered PLCs, as shown in the drawing below to the left. The inputs share the PLC power source supply, while the outputs have their own separate supply.

A worst-case scenario, from a cost and complexity view-point, is an application which requires separate power sources for the PLC, input devices, and output loads. The example wiring diagram below on the right shows how this can work, but also the auxiliary supply output is an unused resource. You will want to avoid this situation if possible.

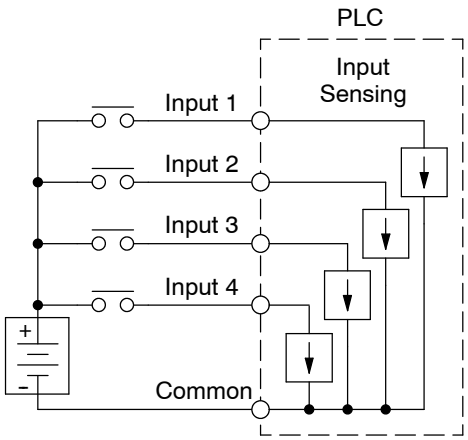


I/O "Common" Terminal Concepts

In order for a PLC I/O circuit to operate, current must enter at one terminal and exit at another. Therefore, at least two terminals are associated with every I/O point. In the figure to the right, the Input or Output terminal is the *main path* for the current. One additional terminal must provide the *return path* to the power supply.



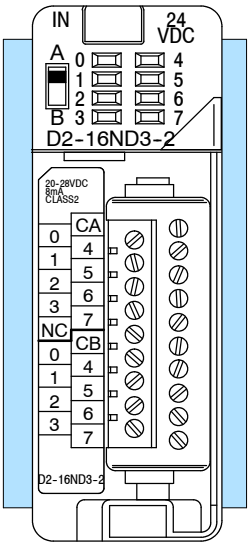
If there was unlimited space and budget for I/O terminals, every I/O point could have two dedicated terminals as the figure above shows. However, providing this level of flexibility is not practical or even necessary for most applications. So, most Input or Output points on PLCs are in groups which share the return path (called *commons*). The figure to the right shows a group (or *bank*) of 4 input points which share a common return path. In this way, the four inputs require only five terminals instead of eight.

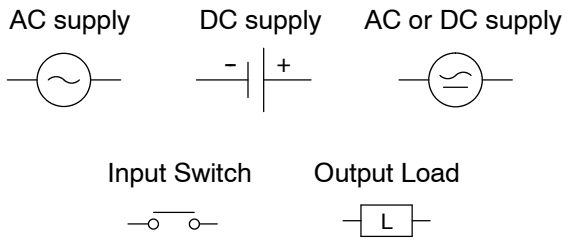


NOTE: In the circuit above, the current in the common path is 4 times any channel's input current when all inputs are energized. This is especially important in output circuits, where heavier gauge wire is sometimes necessary on commons.

Most DL205 input and output modules group their I/O points into banks that share a common return path. The best indication of I/O common grouping is on the wiring label, such as the one shown to the right. The miniature schematic shows two circuit banks with eight input points in each. The common terminal for each is labeled "CA" and "CB", respectively.

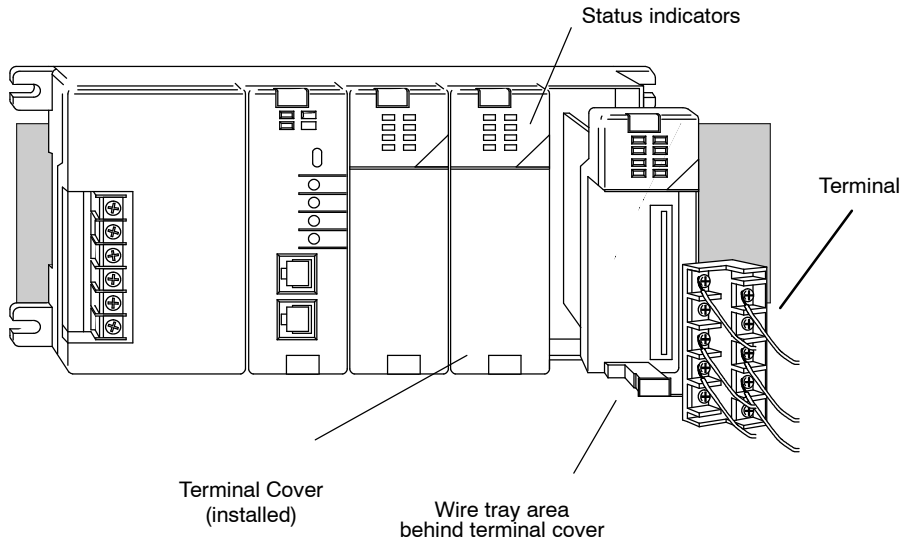
In the wiring label example, the positive terminal of a DC supply connects to the common terminals. Some symbols you will see on the wiring labels, and their meanings are:





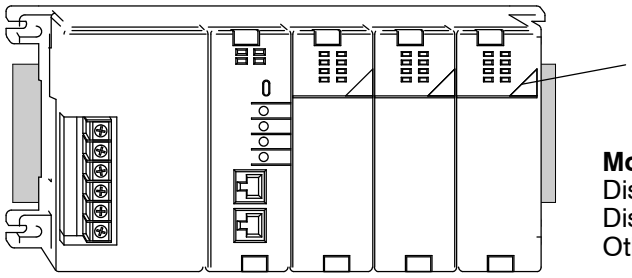
Discrete Input Module Status Indicators

The discrete modules provide LED status indicators to show the status of the input points.



Color Coding of I/O Modules

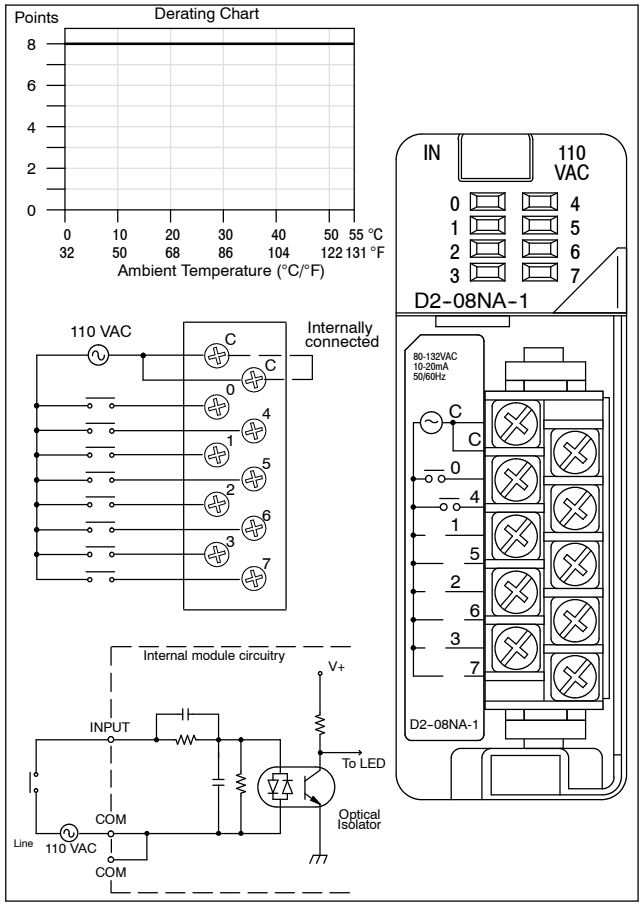
The DL205 family of I/O modules have a color coding scheme to help you quickly identify if a module is either an input module, output module, or a specialty module. This is done through a color bar indicator located on the front of each module. The color scheme is listed below:



Module Type	Color Code
Discrete/Analog Output	Red
Discrete/Analog Input	Blue
Other	White

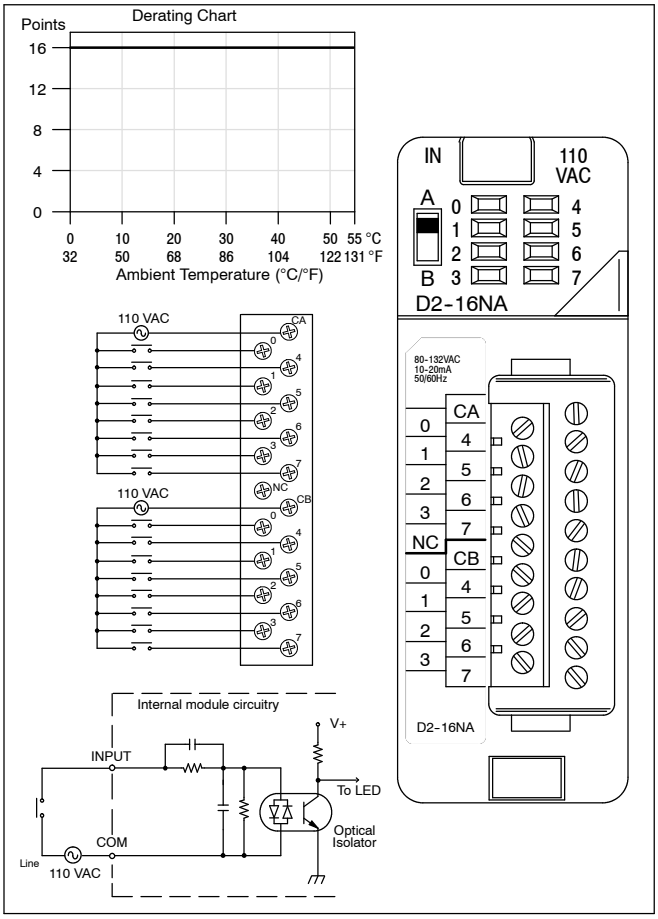
D2-08NA-1 AC Input

Inputs per module	8
Commons per module	1 (2 I/O terminal points)
Input voltage range	80-132 VAC
Peak voltage	132 VAC
AC frequency	47-63 Hz
ON voltage level	75 VAC minimum
OFF voltage level	20 VAC maximum
Input impedance	12K @ 60 Hz
Input current	13mA @ 100VAC, 60Hz 11mA @ 100VAC, 50Hz
Minimum ON current	5 mA
Maximum OFF current	2 mA
Base power required	50 mA Max
OFF to ON response	5 to 30 ms
ON to OFF response	10 to 50 ms
Terminal type	Removable
Status indicator	Logic side
Weight	2.5 oz. (70 g)



D2-16NA AC Input

Inputs per module	16
Commons per module	2 (isolated)
Input voltage range	80-132 VAC
Peak voltage	132 VAC
AC frequency	47-63 Hz
ON voltage level	70 VAC minimum
OFF voltage level	20 VAC maximum
Input impedance	12K @ 60 Hz
Input current	11mA @ 100VAC, 50Hz 13mA @ 100VAC, 60Hz 15mA @ 132VAC, 60Hz
Minimum ON current	5 mA
Maximum OFF current	2 mA
Base power required	100 mA Max
OFF to ON response	5 to 30 ms
ON to OFF response	10 to 50 ms
Terminal type	Removable
Status indicator	Logic side
Weight	2.4 oz. (68 g)

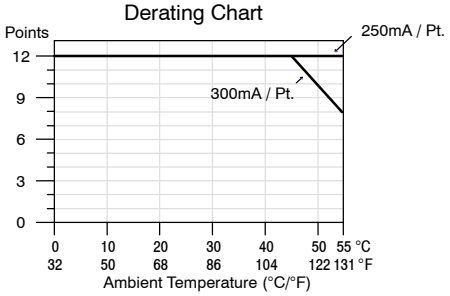


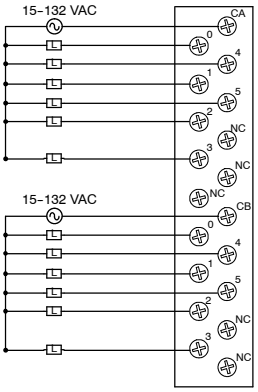
D2-12TA AC Output

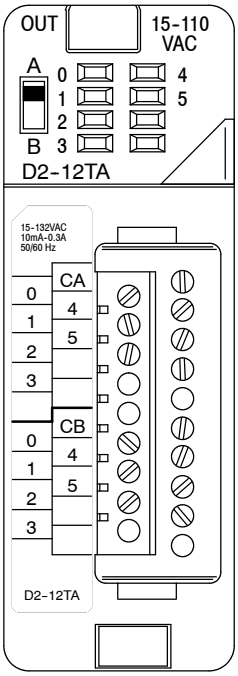
Outputs per module	12
Output Points Consumed	16 (4 unused, see chart below)
Commons per module	2 (isolated)
Operating voltage	15-132 VAC
Output type	SSR (Triac)
Peak voltage	132 VAC
AC frequency	47 to 63 Hz
ON voltage drop	< l.5 VAC (> 50mA) < 4.0 VAC (< 50mA)
Max load current	0.3A / point, 1.8A / common

Max leakage current	2mA (132VAC, 60Hz)
Max inrush current	10A for 10 ms
Minimum load	10 mA
Base power required	350 mA Max
OFF to ON response	1 ms
ON to OFF response	1 ms +1/2 cycle
Terminal type	Removable
Status indicators	Logic Side
Weight	2.8 oz. (80 g)
Fuses	(2) 1 per common 3.15A slow blow, replaceable Order D2-FUSE-1 (5 per pack)

Derating Chart



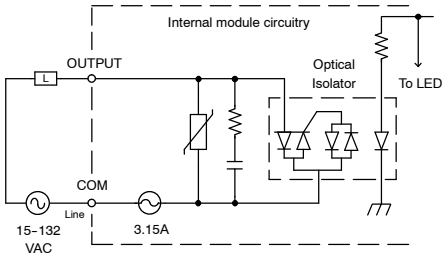




Addresses Used

Points	Used?	Points	Used?
Yn+0	Yes	Yn+10	Yes
Yn+1	Yes	Yn+11	Yes
Yn+2	Yes	Yn+12	Yes
Yn+3	Yes	Yn+13	Yes
Yn+4	Yes	Yn+14	Yes
Yn+5	Yes	Yn+15	Yes
Yn+6	No	Yn+16	No
Yn+7	No	Yn+17	No

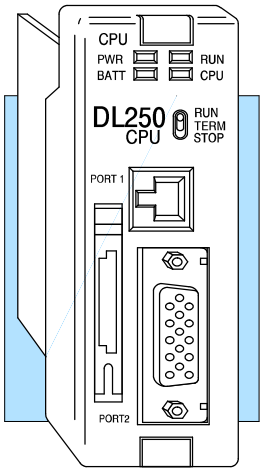
n is the starting address



Overview

The CPU is the heart of the control system. Almost all system operations are controlled by the CPU, so it is important that it is set-up and installed correctly. This chapter provides the information needed to understand:

- the differences between the different models of CPUs
- the steps required to setup and install the CPU



General CPU Features

The DL230, DL240, and DL250 are modular CPUs which can be installed in 3, 4, 6, or 9 slot bases. All I/O modules in the DL205 family will work with any of the CPUs. The DL205 CPUs offer a wide range of processing power and program instructions. All offer RLL and Stage program instructions (See Chapter 5). They also provide extensive internal diagnostics that can be monitored from the application program or from an operator interface.

DL230 CPU Features

The DL230 has 2.4K words of memory comprised of 2.0K of ladder memory and approximately 400 words of V-memory (data registers). It has 90 different instructions available for programming, and supports a maximum of 128 I/O points.

Program storage is in the EEPROM which is installed at the factory. In addition to the EEPROM there is also RAM on the CPU which will store system parameters, V-memory, and other data which is not in the application program.

The DL230 provides one built-in RS232C communication port, so you can easily connect a handheld programmer or a personal computer without needing any additional hardware.

DL240 CPU Features

The DL240 has a maximum of 3.8K of memory comprised of 2.5K of ladder memory and approximately 1.3K of V-memory (data registers). There are129 instructions available for program development and a maximum of 128 points local I/O and 896 points with remote I/O are supported.

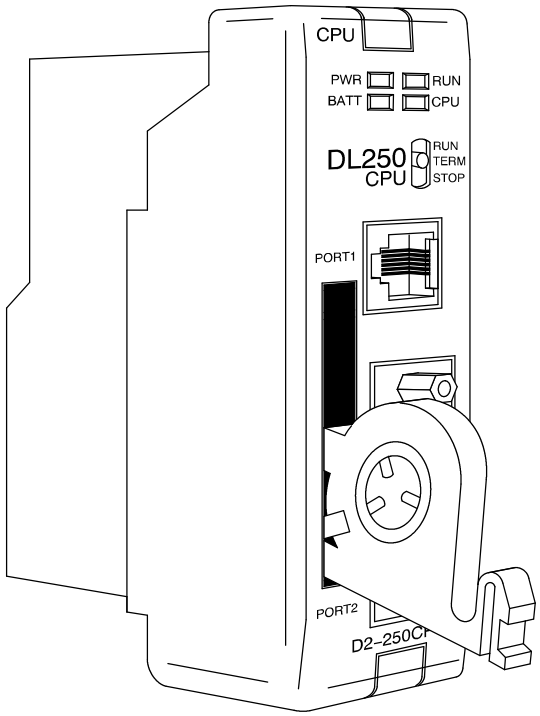
Program storage is in the EEPROM which is installed at the factory. In addition to the EEPROM there is also RAM on the CPU which will store system parameters, V-memory and other data which is not in the application program.

The DL240 has two communication ports. The top port is the same port configuration as the DL230. The bottom port also supports the ***Direct***LINK™ protocol, so you can use the DL240 in a ***Direct***NET™ network. Since the port is RS232C, you must use an RS232C/RS422 converter for multi-drop connections.

DL250 CPU Features

The new DL250 offers all the DL240 features, plus more , program instructions, and built-in Remote I/O Master. It has a maximum of 14.8K of program memory comprised of 7.6K of ladder memory and 7.2K of V-memory (data registers). It supports a maximum of 128 points of local I/O, and 2048 points with remote I/O if you use the DL250 as a Remote master. It includes an additional internal RISC-based microprocessor for greater processing power. The DL250 has 170 instructions. The additional 41 instructions to the DL240 instruction set include drum timers, a print function, floating point math, and PID loop control for 4 loops.

The DL250 has a total of two communications ports. The top port is identical to the top port of the DL240 with the exception of ***Direct***Net slave feature. The bottom port is a 15-pin RS232C/RS422 port. It will interface with ***Direct***SOFT, and operator interfaces, and provides ***DirectNet*** and MODBUS RTU Master/Slave connections.

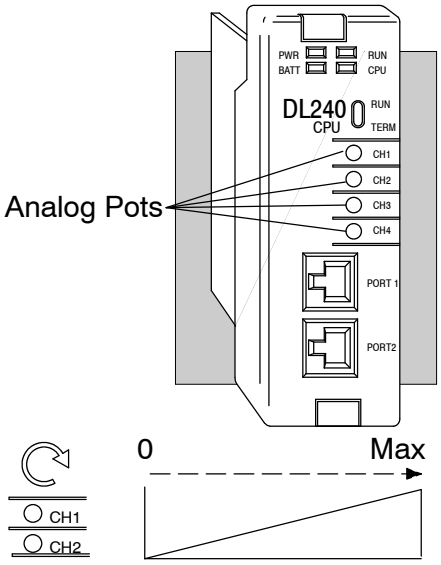


Adjusting the Analog Potentiometers

✗	✓	✗
230	240	250

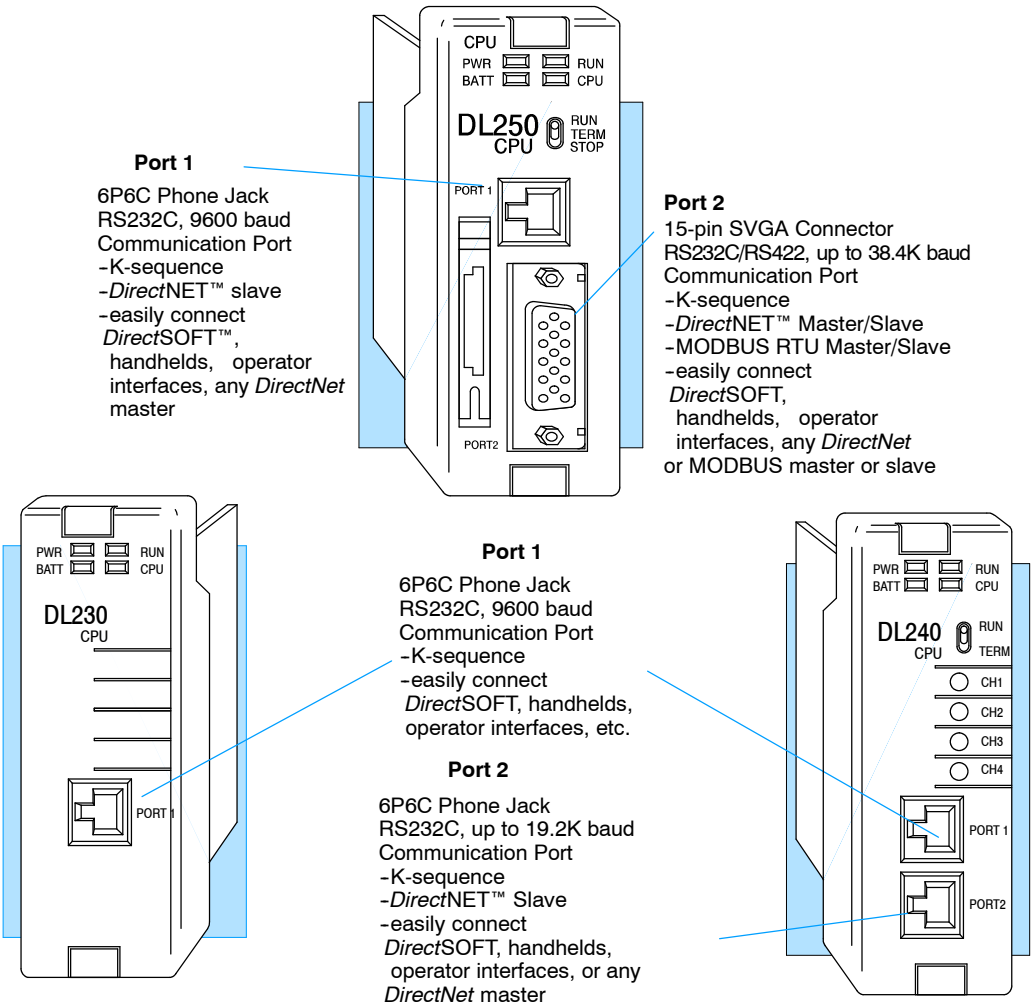
There are 4 analog potentiometers (pots) on the face plate of the DL240 CPU. These pots can be used to change timer constants, frequency of pulse train output, etc. Each analog channel has corresponding V-memory locations for setting lower and upper limits for each analog channel. The setup procedures are covered later in this chapter.

To increase the value associated with the analog pot, turn the pot clockwise. To decrease the value, turn the pot counter clockwise.



Communication Ports

DL205 CPUs provide up to two communications ports. The DL240 and DL250 CPUs have two ports while the DL230 has only one.

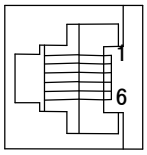


Port 1 Specifications

✓ ✓ ✗
230 240 250

The operating parameters for Port 1 on the DL230 and DL240 CPUs are fixed.

- 6 Pin female modular (RJ12 phone jack) type connector
- K-sequence protocol
- RS232C, 9600 baud
- Connect to ***Direct***SOFT, D2-HPP, DV-1000, operator interface panels
- Fixed station address of 1



6-pin Female
Modular Connector

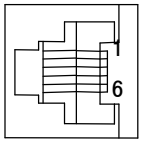
Port 1 Pin Descriptions (DL230 and DL240)		
1	0V	Power (-) connection (GND)
2	5V	Power (+) connection
3	RXD	Receive Data (RS232C)
4	TXD	Transmit Data (RS232C
5	5V	Power (+) connection
6	0V	Power (-) connection (GND)

Port 1 Specifications

✗ ✗ ✓
230 240 250

The operating parameters for Port 1 on the DL250 CPU are fixed.

- 6 Pin female modular (RJ12 phone jack) type connector
- ***Direct***Net (slave), K-sequence protocol
- RS232C, 9600 baud
- Connect to ***Direct***SOFT, D2-HPP, DV1000 or ***DirectNet*** master



6-pin Female
Modular Connector

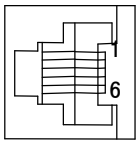
Port 1 Pin Descriptions (DL250 only)		
1	0V	Power (-) connection (GND)
2	5V	Power (+) connection
3	RXD	Receive Data (RS232C)
4	TXD	Transmit Data (RS232C
5	5V	Power (+) connection
6	0V	Power (-) connection (GND)

Port 2 Specifications

✗ ✓ ✗
230 240 250

The operating parameters for Port 2 on the DL240 CPU is configurable using Aux functions on a programming device.

- 6 Pin female modular (RJ12 phone jack) type connector
- ***Direct***Net (slave), K-sequence protocol
- RS232C, Up to 19.2K baud
- Address selectable (1-90)
- Connect to ***Direct*** SOFT, D2-HPP, DV1000, MMI, or ***DirectNet*** master



6-pin Female
Modular Connector

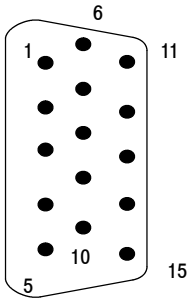
Port 2 Pin Descriptions (DL240 only)		
1	0V	Power (-) connection (GND)
2	5V	Power (+) connection
3	RXD	Receive Data (RS232C)
4	TXD	Transmit Data (RS232C
5	RTS	Request to Send
6	0V	Power (-) connection (GND)

Port 2 Specifications

230	240	250
X	X	✓

Port 2 on the DL250 CPU is located on the 15 pin D-shell connector. It is configurable using AUX functions on a programming device.

- 15 Pin female D type connector
- Protocol: K sequence, ***DirectNet*** Master/Slave, MODBUS RTU Master/Slave, Remote I/O
- RS232C, non-isolated, distance within 15 m (approx. 50 feet)
- RS422C, non-isolated, distance within 1000 m
- Up to 38.4K baud
- Address selectable (1-90)
- Connects to ***Direct***SOFT, D2-HPP, operator interfaces, any ***DirectNet*** or MODBUS master or slave



15-pin Female
D Connector

Port 2 Pin Descriptions (DL250 CPU)		
1	5V	5 VDC
2	TXD2	Transmit Data (RS232C)
3	RXD2	Receive Data (RS232C)
4	RTS2	Ready to Send (RS-232C)
5	CTS2	Clear to Send (RS-232C)
6	RXD2-	Receive Data - (RS-422)
7	0V	Logic Ground
8	0V	Logic Ground
9	TXD2+	Transmit Data + (RS-422)
10	TXD2 -	Transmit Data - (RS-422)
11	RTS2 +	Request to Send + (RS-422)
12	RTS2 -	Request to Send - (RS-422)
13	RXD2 +	Receive Data + (RS-422)
14	CTS2 +	Clear to Send + (RS422)
15	CTS2 -	Clear to Send - (RS-422)

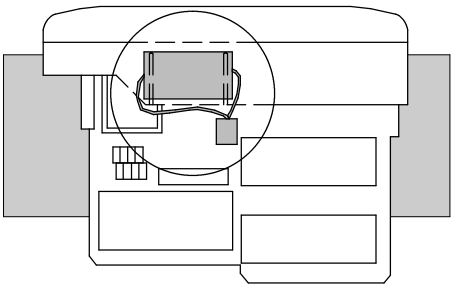
Using Battery Backup

An optional lithium battery is available to maintain the system RAM retentive memory when the DL205 system is without external power. Typical CPU battery life is five years, which includes PLC runtime and normal shutdown periods. However, consider installing a fresh battery if your battery has not been changed recently and the system will be shutdown for a period of more than ten days.

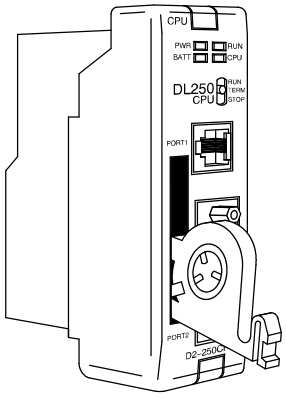
NOTE: Before installing or replacing your CPU battery, back-up your V-memory and system parameters. You can do this by using ***Direct***SOFT to save the program, V-memory, and system parameters to hard/floppy disk on a personal computer.

To install the D2-BAT CPU battery in DL230 or DL240 CPUs:

1. Gently push the battery connector onto the circuit board connector.
2. Push the battery into the retaining clip. Don't use excessive force. You may break the retaining clip.
3. Make a note of the date the battery was installed.



DL230 and DL240



DL250

To install the D2-BAT-1 CPU battery in the DL250 CPU:

1. Press the retaining clip on the battery door down and swing the battery door open.
2. Place the battery into the coin-type slot.
3. Close the battery door making sure that it locks securely in place.
4. Make a note of the date the battery was installed.

WARNING: Do not attempt to recharge the battery or dispose of an old battery by fire. The battery may explode or release hazardous materials.

Enabling the Battery Backup

The battery can be enabled by setting bit 12 in V7633 ON. In this mode the battery Low LED will come on when the battery voltage is less than 2.5VDC (SP43) and error E41 will occur. In this mode the CPU will maintain the data in C,S,T,CT, and V memory when power is removed from the CPU, provided the battery is good. The use of a battery can also determine which operating mode is entered when the system power is connected. See CPU Setup, which is discussed later in this chapter.

Even if you have installed a battery, the battery circuit can be disabled by turning off bit 12 in V7633. However, if you have a battery installed and select "No Battery" operation, the battery LED will not turn on if the battery voltage is low.

Setting the CPU Network Address

✗ ✓ ✓
230 240 250

The DL240 and DL250 CPUs have built in ***DirectNet*** ports. You can use the Handheld Programmer to set the network address for the port and the port communication parameters. The default settings are:

- Station Address 1
- Hex Mode
- Odd Parity
- 9600 Baud

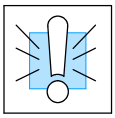
The ***DirectNet*** Manual provides additional information about choosing the communication settings for network operation.

Setting Retentive Memory Ranges

The DL205 CPUs provide certain ranges of retentive memory by default. The default ranges are suitable for many applications, but you can change them if your application requires additional retentive ranges or no retentive ranges at all. The default settings are:

Memory Area	DL230		DL240		DL250	
	Default Range	Avail. Range	Default Range	Avail. Range	Default Range	Avail. Range
Control Relays	C300 – C377	C0 – C377	C300 – C377	C0 – C377	C1000 – C1777	C0 – C1777
V Memory	V2000 – V7777	V0 – V7777	V2000 – V7777	V0 – V7777	V1400 – V3777	V0 – V17777
Timers	None by default	T0 – T77	None by default	T0 – T177	None by default	T0 – T377
Counters	CT0 – CT77	CT0 – CT77	CT0 – CT177	CT0 – CT177	CT0 – CT177	CT0 – CT177
Stages	None by default	S0 – S377	None by default	S0 – S777	None by default	S0 – S1777

You can use AUX 57 to set the retentive ranges. You can also use ***Direct***SOFT™ menus to select the retentive ranges.



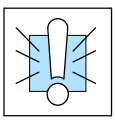
WARNING: The DL205 CPUs do not come with a battery. The super capacitor will retain the values in the event of a power loss, but only for a short period of time, depending on conditions. If the retentive ranges are important for your application, make sure you obtain the optional battery.

Password Protection

The DL205 CPUs allow you to use a password to help minimize the risk of unauthorized program and/or data changes. The DL240 and DL250 offer multi-level passwords for even more security. Once you enter a password you can "lock" the CPU against access. Once the CPU is locked you must enter the password before you can use a programming device to change any system parameters.

You can select an 8-digit numeric password. The CPUs are shipped from the factory with a password of 00000000. All zeros removes the password protection. If a password has been entered into the CPU you cannot enter all zeros to remove it. Once you enter the correct password, you can change the password to all zeros to remove the password protection.

For more information on passwords, see the appropriate appendix on auxiliary functions.



WARNING: Make sure you remember your password. If you forget your password you will not be able to access the CPU. The CPU must be returned to the factory to have the password removed.

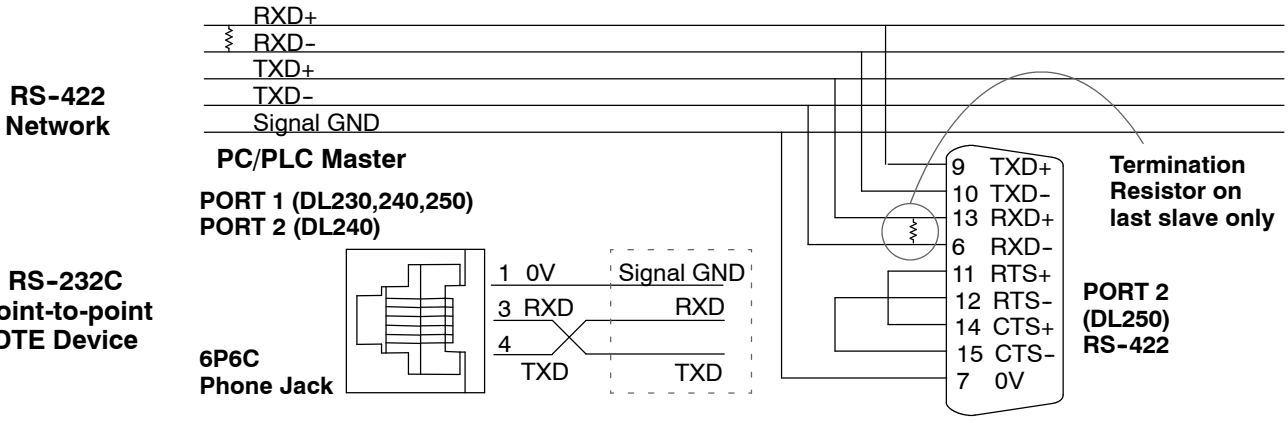
Network Connections to MODBUS® and *Direct*Net

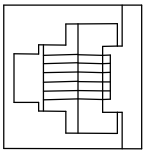
Configuring the CPU's Comm Ports

✗	✓	✓
230	240	250

This section describes how to configure the CPU's built-in networking ports. for either MODBUS or ***Direct***NET. This will allow you to connect the DL205 PLC system directly to MODBUS networks using the RTU protocol, or to other devices on a ***Direct***NET network. MODBUS hosts system on the network must be capable of issuing the MODBUS commands to read or write the appropriate data. For details on the MODBUS protocol, please refer to the Gould MODBUS Protocol reference Guide (P1-MBUS-300 Rev. B). In the event a more recent version is available, check with your MODBUS supplier before ordering the documentation. For more details on ***Direct***NET, order our ***Direct***NET manual, part number DA-DNET-M.

You will need to determine whether the network connection is a 3-wire RS-232 type, or a 5-wire RS-422 type. Normally, the RS-232 signals are used for shorter distances (15 meters max), for communications between two devices. RS-422 signals are for longer distances (1000 meters max.), and for multi-drop networks (from 2 to 247 devices). Use termination resistors at both ends of RS-422 network wiring, matching the impedance rating of the cable (between 100 and 500 ohms).

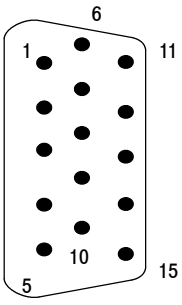




6-pin Female Modular Connector

Port 1 Pinouts (DL230, DL240,DL250)		
1	0V	Power (-) connection (GND)
2	5V	Power (+) conection
3	RXD	Receive Data (RS232C)
4	TXD	Transmit Data (RS232C
5	5V	Power (+) conection
6	0V	Power (-) connection (GND)

Port 2 Pin Descriptions (DL240 only)		
1	0V	Power (-) connection (GND)
2	5V	Power (+) conection
3	RXD	Receive Data (RS232C)
4	TXD	Transmit Data (RS232C
5	RTS	Request to Send
6	0V	Power (-) connection (GND)



15-pin Female D Connector

Port 2 Pin Descriptions (DL250 CPU)		
1	5V	5 VDC
2	TXD	Transmit Data (RS-232C)
3	RXD	Receive Data (RS-232C)
4	RTS	Ready to Send (RS-232C)
5	CTS	Clear to Send (RS-232C)
6	RXD -	Receive Data (RS-422)
7	0V	Logic Ground
8	0V	Logic Ground
9	TXD +	Transmit Data + (RS-422)
10	TXD -	Transmit Data - (RS-422)
11	RTS +	Request to Send + (RS-422)
12	RTS -	Request to Send - (RS-422)
13	RXD +	Receive Data + (RS-422)
14	CTS +	Clear to Send + (RS-422)
15	CTS -	Clear to Send - (RS-422)

The recommended cable for RS422 is Belden 9729 or equivalent.

Hardware Maintenance

Standard Maintenance

The DL205 is a low maintenance system requiring only a few periodic checks to to help reduce the risks of problems. Routine maintenance checks should be made regarding two key items.

- Air quality (cabinet temperature, airflow, etc.)
- CPU battery

Air Quality Maintenance

The quality of the air your system is exposed to can affect system performance. If you have placed your system in an enclosure, check to see the ambient temperature is not exceeding the operating specifications. If there are filters in the enclosure, clean or replace them as necessary to ensure adequate airflow. A good rule of thumb is to check your system environment every one to two months. Make sure the DL205 is operating within the system operating specifications.

Low Battery Indicator

The CPU has a battery LED that indicates the battery voltage is low. You should check this indicator periodically to determine if the battery needs replacing. You can also detect low battery voltage from within the CPU program. SP43 is a special relay that comes on when the battery needs to be replaced. If you are using a DL240 CPU, you can also use a programming device or operator interface to determine the battery voltage. V7746 contains the battery voltage. For example, a value of 32 in V7746 would indicate a battery voltage of 3.2V.

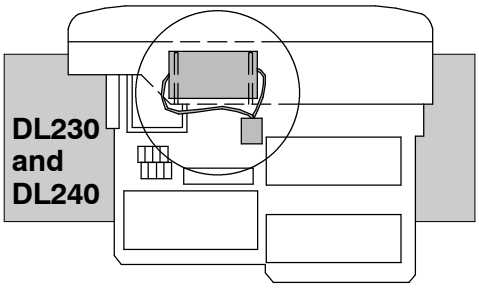
CPU Battery Replacement

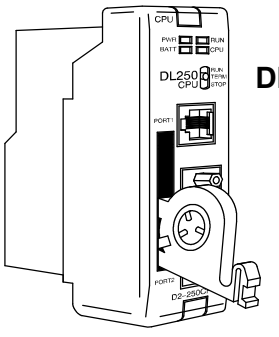
The CPU battery is used to retain program V memory and the system parameters. The life expectancy of this battery is five years.

NOTE: Before installing or replacing your CPU battery, back-up your V-memory and system parameters. You can do this by using ***Direct***SOFT to save the program, V-memory, and system parameters to hard/floppy disk on a personal computer.

To install the D2-BAT CPU battery in DL230 or DL240 CPUs:

1. Gently push the battery connector onto the circuit board connector.
2. Push the battery into the retaining clip. Don't use excessive force. You may break the retaining clip.
3. Make a note of the date the battery was installed.

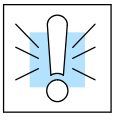




DL250

To install the D2-BAT-1 CPU battery in the DL250 CPU:

1. Press the retaining clip on the battery door down and swing the battery door open.
2. Place the battery into the coin-type slot.
3. Close the battery door making sure that it locks securely in place.
4. Make a note of the date the battery was installed.

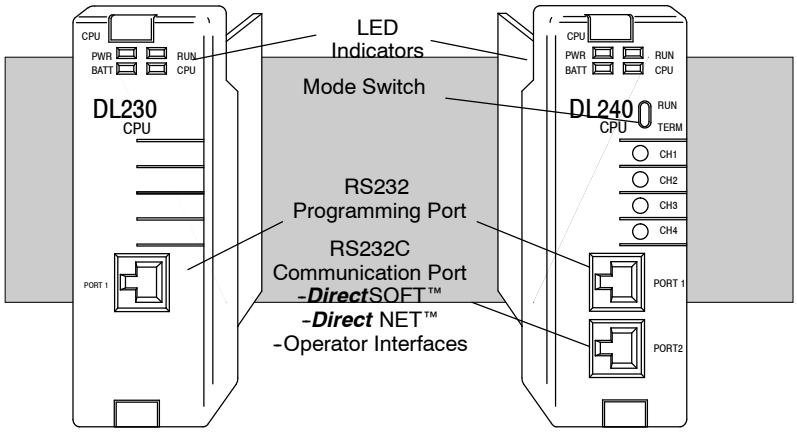


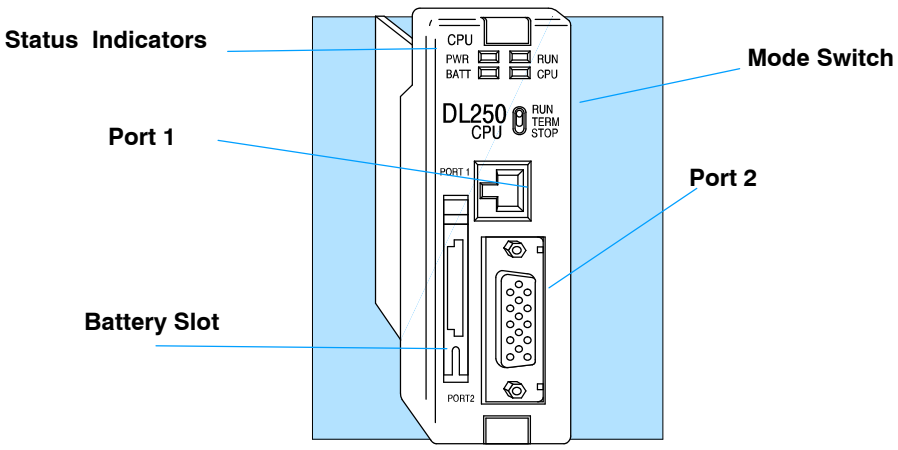
WARNING: Do not attempt to recharge the battery or dispose of an old battery by fire. The battery may explode or release hazardous materials.

CPU Indicators

The DL205 CPUs have indicators on the front to help you diagnose problems with the system. The table below gives a quick reference of potential problems associated with each status indicator. Following the table will be a detailed analysis of each of these indicator problems.

Indicator Status	Potential Problems
PWR (off)	1. System voltage incorrect. 2. Power supply/CPU is faulty 3. Other component such an I/O module has power supply shorted 4. Power budget exceeded for the base being used
RUN (will not come on)	1. CPU programming error 2. Switch in TERM position 3. Switch in STOP position (DL250 only)
CPU (on)	1. Electrical noise interference 2. CPU defective
BATT (on)	1. CPU battery low 2. CPU battery missing, or disconnected





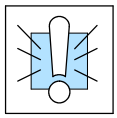
PWR Indicator

There are four general reasons for the CPU power status LED (PWR) to be OFF:

1. Power to the base is incorrect or is not applied.
2. Base power supply is faulty.
3. Other component(s) have the power supply shut down.
4. Power budget for the base has been exceeded.

Incorrect Base Power

If the voltage to the power supply is not correct, the CPU and/or base may not operate properly or may not operate at all. Use the following guidelines to correct the problem.



WARNING: To minimize the risk of electrical shock, always disconnect the system power before inspecting the physical wiring.

1. First, disconnect the system power and check all incoming wiring for loose connections.
2. If you are using a separate termination panel, check those connections to make sure the wiring is connected to the proper location.
3. If the connections are acceptable, reconnect the system power and measure the voltage at the base terminal strip to insure it is within specification. If the voltage is not correct shut down the system and correct the problem.
4. If all wiring is connected correctly and the incoming power is within the specifications required, the base power supply should be returned for repair.

Faulty CPU

There is not a good check to test for a faulty CPU other than substituting a known good one to see if this corrects the problem. If you have experienced major power surges, it is possible the CPU and power supply have been damaged. If you suspect this is the cause of the power supply damage, a line conditioner which removes damaging voltage spikes should be used in the future.

Device or Module causing the Power Supply to Shutdown

It is possible a faulty module or external device using the system 5V can shut down the power supply. This 5V can be coming from the base or from the CPU communication ports.

To test for a device causing this problem:

1. Turn off power to the CPU.
2. Disconnect all external devices (i.e., communication cables) from the CPU.
3. Reapply power to the system.

If the power supply operates normally you may have either a shorted device or a shorted cable. If the power supply does not operate normally then test for a module causing the problem by following the steps below:

If the PWR LED operates normally the problem could be in one of the modules. To isolate which module is causing the problem, disconnect the system power and remove one module at a time until the PWR LED operates normally.

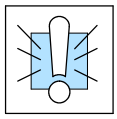
Follow the procedure below:

- Turn off power to the base.
- Remove a module from the base.
- Reapply power to the base.

Bent base connector pins on the module can cause this problem. Check to see the connector is not the problem.

Power Budget Exceeded

If the machine had been operating correctly for a considerable amount of time prior to the indicator going off, the power budget is not likely to be the problem. Power budgeting problems usually occur during system start-up when the PLC is under operation and the inputs/outputs are requiring more current than the base power supply can provide.



WARNING: The PLC may reset if the power budget is exceeded. If there is any doubt about the system power budget please check it at this time. Exceeding the power budget can cause unpredictable results which can cause damage and injury. Verify the modules in the base operate within the power budget for the chosen base. You can find these tables in Chapter 4, Bases and I/O Configuration.

RUN Indicator

If the CPU will not enter the Run mode (the RUN indicator is off), the problem is usually in the application program, unless the CPU has a fatal error. If a fatal error has occurred, the CPU LED should be on. (You can use a programming device to determine the cause of the error.)

If you are using a DL240 or DL250 and you are trying to change the modes with a programming device, make sure the mode switch is in the TERM position.

Both of the programming devices, Handheld Programmer and ***Direct***SOFT™, will return a error message describing the problem. Depending on the error, there may also be an AUX function you can use to help diagnose the problem. The most common programming error is "Missing END Statement". All application programs require an END statement for proper termination. A complete list of error codes can be found in Appendix B.

CPU Indicator

If the CPU indicator is on, a fatal error has occurred in the CPU. Generally, this is not a programming problem but an actual hardware failure. You can power cycle the system to clear the error. If the error clears, you should monitor the system and determine what caused the problem. You will find this problem is sometimes caused by high frequency electrical noise introduced into the CPU from an outside source. Check your system grounding and install electrical noise filters if the grounding is suspected. If power cycling the system does not reset the error, or if the problem returns, you should replace the CPU.

BATT Indicator

If the BATT indicator is on, the CPU battery is either disconnected or needs replacing. The battery voltage is continuously monitored while the system voltage is being supplied.

Communications Problems

If you cannot establish communications with the CPU, check these items.

- The cable is disconnected.
- The cable has a broken wire or has been wired incorrectly.
- The cable is improperly terminated or grounded.
- The device connected is not operating at the correct baud rate (9600 baud for the top port. Use AUX 56 to select the baud rate for the bottom port on a DL240 and DL250).
- The device connected to the port is sending data incorrectly.
- A grounding difference exists between the two devices.
- Electrical noise is causing intermittent errors
- The CPU has a bad communication port and the CPU should be replaced.

If an error occurs the indicator will come on and stay on until a successful communication has been completed.

Noise Troubleshooting

Electrical Noise Problems

Noise is one of the most difficult problems to diagnose. Electrical noise can enter a system in many different ways and fall into one of two categories, conducted or radiated. It may be difficult to determine how the noise is entering the system but the corrective actions for either of the types of noise problems are similar.

- Conducted noise is when the electrical interference is introduced into the system by way of a attached wire, panel connection ,etc. It may enter through an I/O module, a power supply connection, the communication ground connection, or the chassis ground connection.
- Radiated noise is when the electrical interference is introduced into the system without a direct electrical connection, much in the same manner as radio waves.

Reducing Electrical Noise

While electrical noise cannot be eliminated it can be reduced to a level that will not affect the system.

- Most noise problems result from improper grounding of the system. A good earth ground can be the single most effective way to correct noise problems. If a ground is not available, install a ground rod as close to the system as possible. Insure all ground wires are single point grounds and are not daisy chained from one device to another. Ground metal enclosures around the system. A loose wire is no more than a large antenna waiting to introduce noise into the system; therefore, you should tighten all connections in your system. Loose ground wires are more susceptible to noise than the other wires in your system. Review Chapter 2 Installation, Wiring, and Specifications if you have questions regarding how to ground your system.
- Electrical noise can enter the system through the power source for the CPU and I/O. Installing a isolation transformer for all AC sources can correct this problem. DC sources should be well grounded good quality supplies. Switching DC power supplies commonly generate more noise than linear supplies.
- Separate input wiring from output wiring. Never run I/O wiring close to high voltage wiring.

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WARRANTY REGISTRATION

Please copy the information from the data sheet supplied with your manual.

Type of Equipment: _____ Serial Number: _____

ASDI Sales Order #: _____ Order Date: _____

Purchased By: _____

_____

_____

To help us provide better service to you, please fill out this warranty registration form and return it to us. Keep a copy for your records.

This will register your recent purchase and aide us in tracking the performance of your equipment. Please help us with a small amount of information about your company and about how you are using the equipment. Contact us via phone, fax, or email if you have a question, problem, or concern about your equipment. Please have the type of equipment and serial number available so we can give you accurate information.

End Customer/Company Name: _____

Address: _____ Tel: _____

City: _____ State: _____ Zip: _____ Fax: _____

Name of individual to contact for follow up information: _____

When was the equipment put in service? ____/____/____

Usage - Circle one:	Base Load	Standby System		
	Peak Shaving	Other please specify: _____		
Application - Circle one:	**Agriculture:**	Poultry	Livestock	Grain drying
	Commercial:	Restaurant	Hospital	School
	Industrial:	Construction	Automotive	Glass/ceramics
	Other:	Please specify: _____		

Note: If you have more than one piece of our equipment, fill out one warranty sheet and staple the others to it, well do the rest.

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