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MIC 1162 HIGH/LOW LIMIT CONTROLLER INSTRUCTION MANUAL

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service parts: 1-800-473-7373
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international/main: 1-952-469-5424
fax: 1-952-469-4513
sales@despatch.com
www.despatch.com

8860 207th Street West
Minneapolis, MN 55044 USA

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TABLE OF CONTENTS

TABLE OF CONTENTS	i
SECTION 1: PRODUCT DESCRIPTION	1
1.1 General.....	1
1.2 Displays	1
1.3 Alarms	1
1.4 Process Variable/Setpoint Value Retransmission Output.....	2
SECTION 2: INSTALLATION AND WIRING.....	3
2.1 General Information.....	3
2.2 Wiring Guidelines	5
2.2.1 Installation Considerations	5
2.2.2 AC Power Wiring.....	6
2.2.3 Wire Isolation	6
2.2.4 Use Of Shielded Cable	7
2.2.5 Noise Suppression At The Source.....	7
2.3 Sensor Placement (Thermocouple or RTD)	9
2.4 Input Connections.....	10
2.5 Output Connections.....	13
SECTION 3: OPERATION	15
3.1 Power Up Procedure	15
3.2 Keypad Operation.....	15
3.3 Displays	16
3.3.1 Alarm Status Display.....	16
3.3.2 Over-Range/Under-Range Display	16
3.4 Front Panel Indicators	17
3.5 Exceeding Limit Setpoint	17
3.6 Annunciator	18
3.7 Remote Reset (Optional).....	18
SECTION 4: CONTROL MODE	19
SECTION 5: SETPOINT CHANGE MODE	21
SECTION 6: CONFIGURATION	22
SECTION 7: SET-UP MODE	25
SECTION 8: ENABLE MODE	28
SECTION 9: CALIBRATION	29
APPENDIX A: BOARD LAYOUT - JUMPER POSITIONING	32
APPENDIX B: HARDWARE DEFINITION CODE	35
APPENDIX C: INPUT RANGE CODES	37
APPENDIX D: SPECIFICATIONS.....	38
APPENDIX E: ORDER MATRIX	42
APPENDIX F: SOFTWARE REFERENCE SHEET	43

SECTION 1: PRODUCT DESCRIPTION

1.1 General

This instrument is a microprocessor based single loop controller capable of measuring and displaying temperature, pressure, flow, and level from a variety of inputs. The control is configurable to be either high-limit, low-limit, or both types.

Control functions, alarm settings and other parameters are easily entered through the front keypad. E² Technology (100 year life) protects against data loss during AC power outages.

The input is user configurable to directly connect to either thermocouple, RTD, mVDC, VDC or mADC inputs. The instrument can operate from either a 90-264 VAC, 50/60 HZ power supply, or optional 24V AC/DC power supply.

1.2 Displays

Each instrument is provided with dual displays and status indicators as shown in Figure 1 -1. Typically, the upper display displays the value of the process variable, while the lower display displays the setpoint value. Alternate displays can be selected in the Setup Mode.

1.3 Alarms

Alarm indication is standard on all instruments. Up to two alarm outputs are optional. Alarm type may be set as Process Direct or Reverse (high or low), Logical Combination of the two alarms, Annunciator Direct or Reverse, High Limit, or Low Limit. Alarm status is indicated by LED.

FIGURE 1-1 Keys and Indicators



1.4 Process Variable/Setpoint Value Retransmission Output

If the instrument is specified with this option, this output may be scaled over any desired range and re-transmitted, through optional Output 3.

SECTION 2: INSTALLATION AND WIRING

2.1 General Information

Electrical code requirements and safety standards should be observed and installation performed by qualified personnel.

The electronic components of the instrument may be removed from the housing during installation. To remove the components, grip the side edges of the front panel and pull the instrument forward. During re-installation, the vertically mounted circuit boards should be properly aligned in the housing.

Ensure that the instrument is correctly orientated. A stop will operate if an attempt is made to insert the instrument incorrectly.

Recommended panel opening sizes are illustrated in Figure 2-1. After the opening is properly cut, insert the instrument into the panel opening. Ensure that the panel gasket is not distorted and that the instrument is positioned squarely against the panel. Slide the mounting clamp into place on the instrument and push it forward until it is firmly in contact with the rear face of the mounting panel.

Note: The mounting clamp tongues may engage either on the sides or the top/bottom of the instrument housing. Therefore when installing several instruments side-by-side in one cut-out, use the ratchets on the top/bottom faces.

FIGURE 2-1
Panel Cut-Out Dimensions

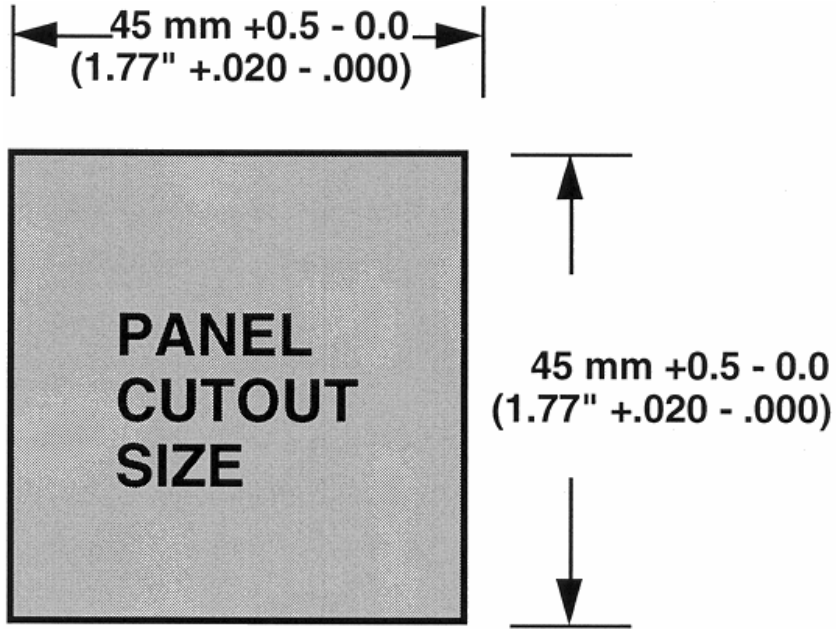


FIGURE 2-2
Main Dimensions

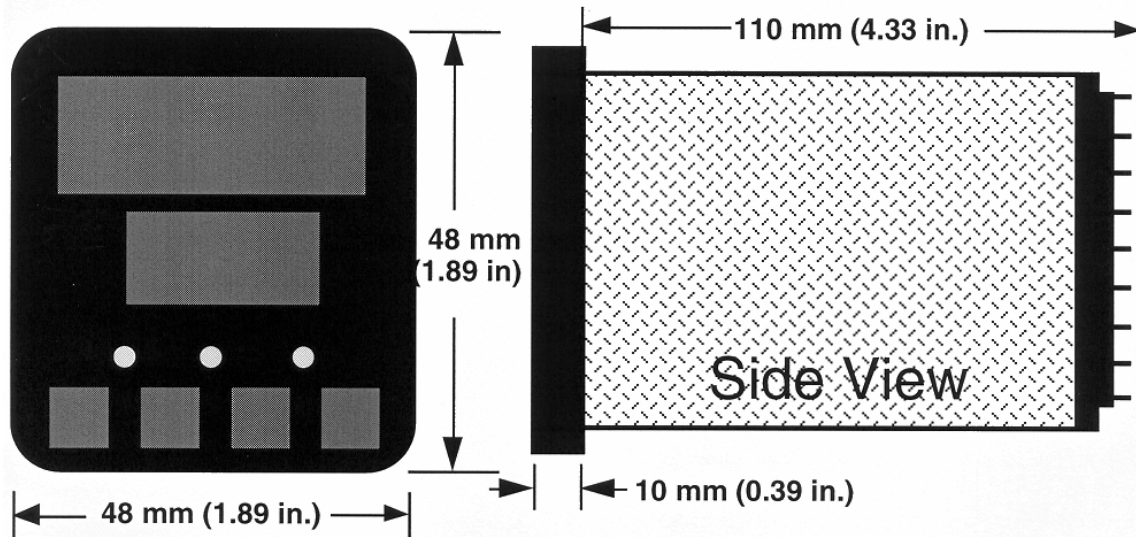
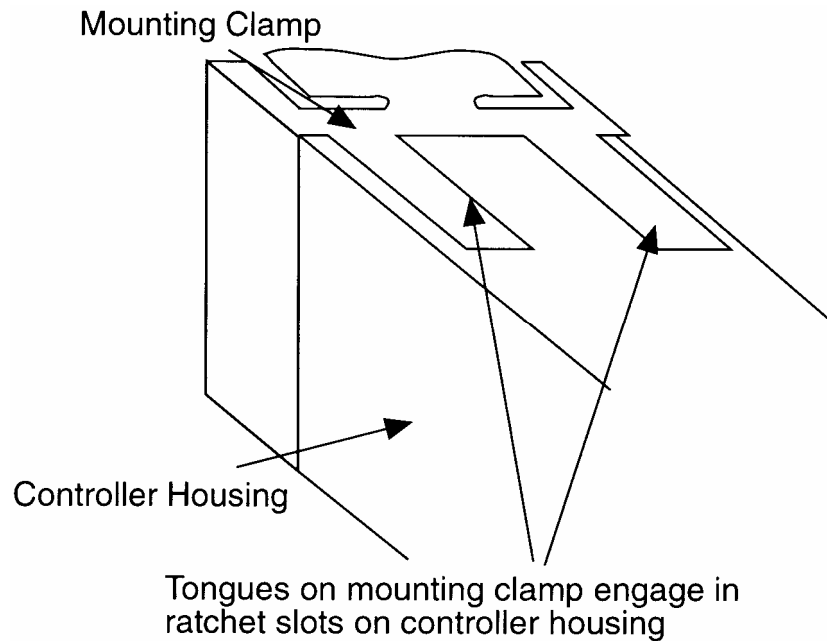


FIGURE 2-3
Panel Mounting the Controller



2.2 Wiring Guidelines

Electrical noise is a phenomenon typical of industrial environments. The following are guidelines that must be followed to minimize the effect of noise upon any instrumentation.

2.2.1 Installation Considerations

Listed below are some of the common sources of electrical noise in the industrial environment:

- Ignition Transformers
- Arc Welders
- Mechanical contact relay(s)
- Solenoids

Before using any instrument near the device listed, the instructions below should be followed:

1. If the instrument is to be mounted in the same panel as any of the listed devices, separate them by the largest distance possible. For maximum electrical noise reduction, the noise generating devices should be mounted in a separate enclosure.
2. If possible, eliminate mechanical contact relay(s) and replace with solid state relays. If a mechanical relay being powered by an instrument output device cannot be replaced, a solid state relay can be used to isolate the instrument.
3. A separate isolation transformer to feed only instrumentation should be considered. The transformer can isolate the instrument from noise found on the AC power input.
4. If the instrument is being installed on existing equipment, the wiring in the area should be checked to insure that good wiring practices have been followed.

2.2.2 AC Power Wiring

Neutral (For 115 VAC)

It is good practice to assure that the AC neutral is at or near ground potential. To verify this, a voltmeter check between neutral and ground should be done. On the AC range, the reading should not be more than 50 millivolts. If it is greater than this amount, the secondary of this AC transformer supplying the instrument should be checked by an electrician. A proper neutral will help ensure maximum performance from the instrument.

2.2.3 Wire Isolation

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

- Analog input or output (i.e. thermocouple, RTD, VDC, mVDC, or mADC)
- SPDT Relays
- AC power

The only wires that should run together are those of the same category. If they need to be run parallel with any of the other lines, maintain a minimum 6 inch space between the wires. If wires must cross each other, do so at 90 degrees. This will minimize the contact with each other and reduces "cross talk". "Cross Talk" is due to the EMF (Electro-Magnetic Flux) emitted by a wire as current passes through it. This EMF can be picked up by other wires running in the same bundle or conduit.

In applications where a High Voltage Transformer is used (i.e. ignition systems) the secondary of the transformer should be isolated from all other cables.

This instrument has been designed to operate in noisy environments, however, in some cases even with proper wiring it may be necessary to suppress the noise at its source.

2.2.4 Use Of Shielded Cable

Shielded cable helps eliminate electrical noise being induced on the wires. All analog signals should be run with shielded cable. Connection lead length should be kept as short as possible, keeping the wires protected by the shielding. The shield should be grounded at one end only. The preferred grounding location is the sensor, transmitter or transducer.

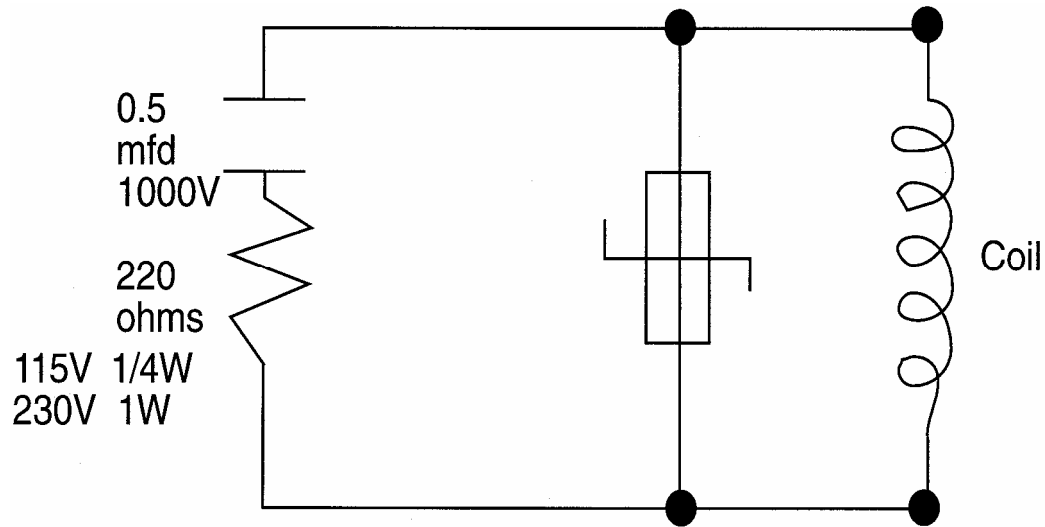
2.2.5 Noise Suppression At The Source

Usually when good wiring practices are followed no further noise protection is necessary. Sometimes in severe electrical environments, the amount of noise is so great that it has to be suppressed at the source. Many manufacturers of relays, contactors, etc. supply "surge suppressors" which mount on the noise source.

For those devices that do not have surge suppressors supplied, RC (resistance-capacitance) networks and/or MOV (metal oxide varistors) may be added.

Inductive Coils - MOV's are recommended for transient suppression in inductive coils connected in parallel and as close as possible to the coil. See Figure 2-4. Additional protection may be provided by adding an RC network across the MOV.

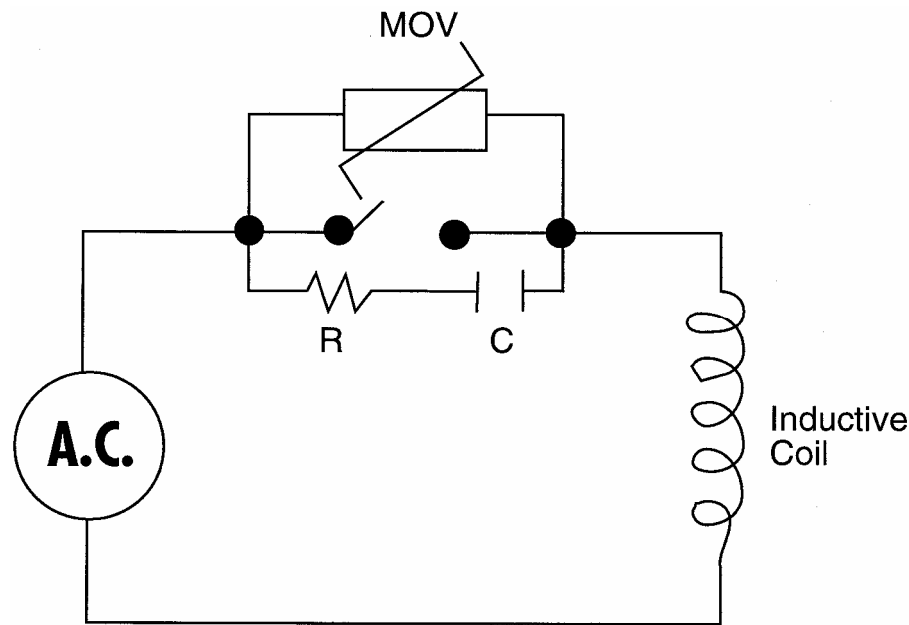
FIGURE 2-4



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

For circuits up to 3 amps, a combination of a 47 ohm resistor and 0.1 microfarad capacitor (1 000 volts) is recommended. For circuits from 3 to 5 amps, connect 2 of these in parallel. See Figure 2-5.

FIGURE 2-5



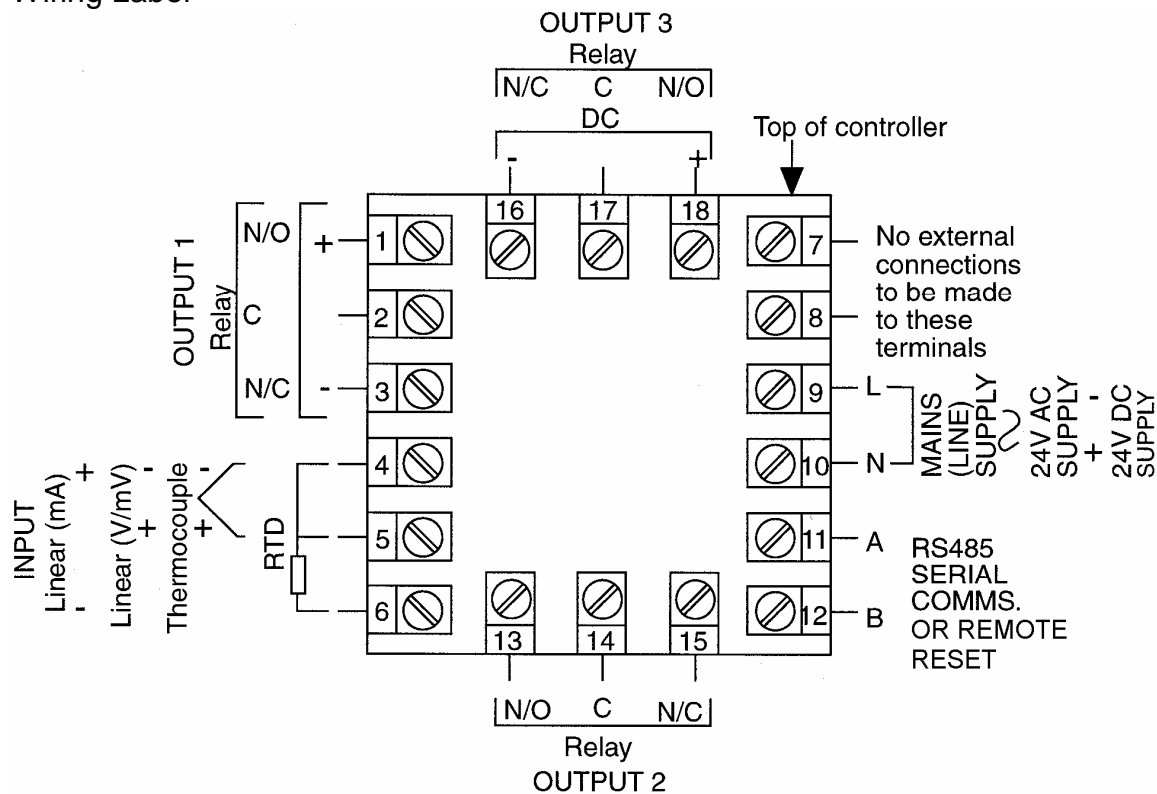
2.3 Sensor Placement (Thermocouple or RTD)

Two wire RTD's should be used only with lead lengths less than 10 feet.

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

- In liquid media - the most agitated area
- In air - the best circulated area

FIGURE 2-6
Wiring Label



2.4 Input Connections

In general, all wiring connections are made to the instrument after it is installed. Avoid electrical shock. AC power wiring must not be connected to the source distribution panel until all wiring connection procedures are completed.

FIGURE 2-7A

Main Supply

The instrument will operate on 90-264V AC 50/60Hz main supply. The power consumption is approximately 4 VA. Connect the line voltage, hot and neutral, to terminals 9 to 10 respectively as illustrated below.

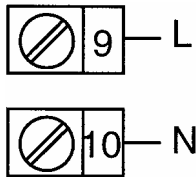


FIGURE 2-7B

24V (Nominal) AC/DC Supply

The supply connections for the 24V AC/DC versions of the instrument are shown below.

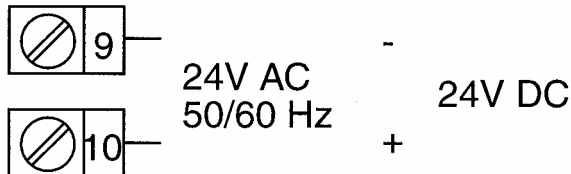


FIGURE 2-8

Thermocouple (T/C) Input

Make thermocouple connections as illustrated below. Connect the positive leg of the thermocouple to terminal 5 and the negative leg to terminal 4.

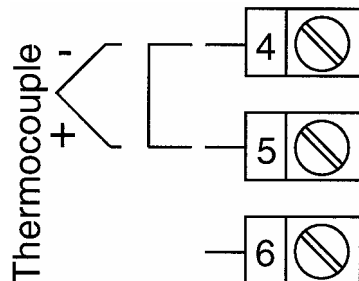


FIGURE 2-9

RTD Input

Make RTD connections as illustrated below. For a three wire RTD, connect the resistive leg of the RTD to terminal 6 and the common legs to terminals 4 and 5. For a two wire RTD, connect one leg to terminal 5 and the other leg to terminal 6 as shown below. A jumper wire supplied by the customer must be installed between terminals 4 and 5. Input conditioning jumper must be positioned correctly (see Appendix A) and Hardware Definition Code must be correct (see Appendix B).

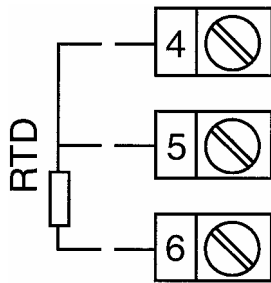


FIGURE 2-10

Volt, mV Input

Make volt and millivolt connections as shown below. Terminal 5 is positive and terminal 4 is negative. Input conditioning jumper must be positioned correctly (see Appendix A) and Hardware Definition Code must be correct (see Appendix B).

mADC Input

Make mADC connections as shown below. Terminal 4 is positive and terminal 6 is negative. Input conditioning jumper must be positioned correctly (see Appendix A) and Hardware Definition Code must be correct (see Appendix B).

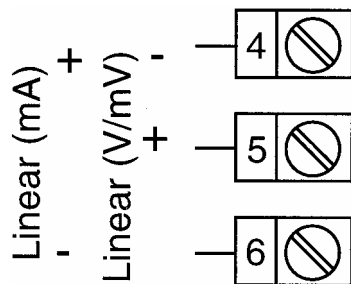


FIGURE 2-11

Remote Digital Communications - RS485

Make digital communication connections as illustrated below.

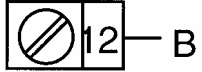
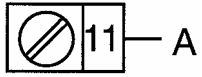
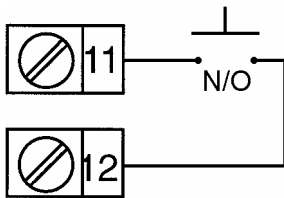


FIGURE 2-12

Remote Reset

Connections are made as illustrated below for remote reset.



2.5 Output Connections

FIGURE 2-13

Relay Output 1

Connections are made to Output 1 relay as illustrated below. The contacts are rated at 5 amp resistive, 120/240 VAC.

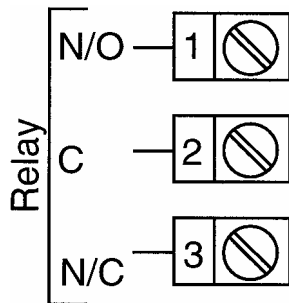


FIGURE 2-14

Relay Output 2 (Alarm or Annunciator)

Connections are made to Output 2 relay as illustrated below. The contacts are rated at 2 amp resistive, 120/240 VAC.

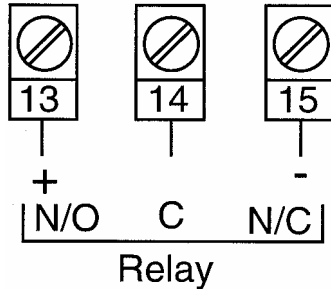


FIGURE 2-15

Relay Output 3 (Alarm or Annunciator)

Connections are made to Output 3 relay as illustrated below. The contacts are rated at 2 amp resistive, 120/240 VAC.

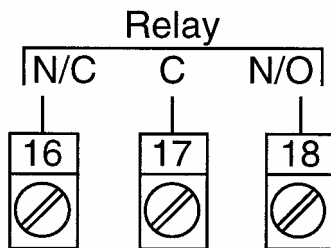
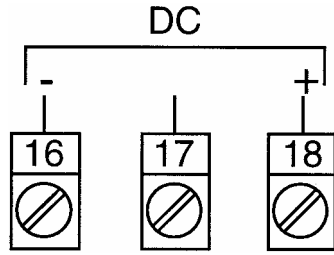


FIGURE 2-16

mADC Output 3 (Recorder Output Only)

Make connections for DC output 3 as illustrated below.



SECTION 3: OPERATION

3.1 Power Up Procedure

Verify all electrical connections have been properly made before applying power to the instrument.

During power up, a self-test procedure is initiated during which all LED segments in the two front panel displays appear and all LED indicators are ON. When the self-test procedure is complete, the instrument reverts to normal operation.

Note: When power is first applied, a delay of about 3 seconds will be seen before the LEDs will light.

3.2 Keypad Operation

RESET KEY

This key is used to:

1. Reset the limit condition after the process is within the limit
2. Acknowledge that the limit has been exceeded
3. Confirm entry in Configuration Mode

SCROLL KEY

This key is used to:

1. Select a parameter to be viewed or adjusted.
2. Display enabled modes of operation.
3. Display a mode parameter value.
4. Advance display from a parameter value to the next parameter code.
5. With the DOWN key to view the current Hardware Definition Code setting.

UP KEY

This key is used to:

1. Increase the displayed parameter value.
2. Increase setpoint.
3. Reset MAX/MIN HOLD and TIME EXCEED.

DOWN KEY

This key is used to:

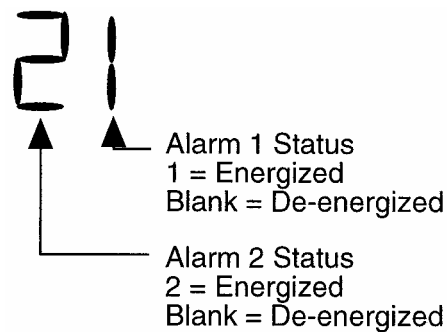
1. Decrease the displayed parameter value.
2. Decrease setpoint.
3. Reset MAX/MIN HOLD and TIME EXCEED.
4. With the SCROLL key to view the current Hardware Definition Code setting.

3.3 Displays

During configuration the upper display shows the parameter setting. The lower display shows the parameter code (tag name) for the currently selected parameter. During operation, the upper display shows the value of the process variable. The lower display shows the setpoint value. The operation display can be altered by the Display parameter in the Setup mode.

3.3.1 Alarm Status Display

The user may view the status of the instrument's alarm(s) by depressing the SCROLL key until the lower display shows the legend "ALSt" and the upper display shows the alarm status in the following format:



NOTE: This display is available only if one or more of the alarms is/are active.

3.3.2 Over-Range/Under-Range Display

If the process variable attains a value higher than the input scale maximum limit, the upper display will show:

CHHO

If the process variable attains a value lower than the input scale minimum, the upper display will show:

CLLo

If a break is detected in the sensor circuit, the upper display will show:

SnSr

3.4 Front Panel Indicators

OUT Indicates the status of the Limit Relay. When the indicator is on, the relay is de-energized, and when off, the relay is energized.

EXCEED This indicator is on when the process variable exceeds the limit setpoint (above for high limit, below for low limit). The indicator flashes if the error is not acknowledged (i.e. Reset key is not pressed). The indicator is on steady if the error has been acknowledged (i.e. Reset key has been pressed). Note: This LED action will occur even if the annunciator output is NOT selected in configuration.

ALM This indicator shows an alarm condition.

S Indicates when in Set-Up mode.

3.5 Exceeding Limit Setpoint

If the process value exceeds the limit setpoint, the limit relay will change state and latch. This is noted by the OUT indicator. The EXCEED indicator will also flash.

To acknowledge the limit condition, press the RESET key. If the process value exceeds the limit setpoint, the EXCEED indicator will change to a steady on condition. The EXCEED indicator will turn off once the process value no longer exceeds the limit setpoint.

In order to reset the limit relay, the process value must not exceed the limit setpoint. Pressing the RESET key with the control in this state will reset the limit relay, and the OUT indicator will turn off.

NOTE: The hysteresis limit value in the setup mode affects the value at which the control will reset. In the event of a high limit condition, the high limit setpoint must be higher than the sum of the process value and the hysteresis value. In the event of a low limit condition, the process value must be higher than the sum of the low limit setpoint and the hysteresis value.

3.6 Annunciator

An additional (optional) annunciator output is available. If selected in Program mode (either for USE2 or USE3) the annunciator output operates as follows:

If the limit is, or has been, exceeded AND the Reset key has NOT been pressed since the limit was exceeded, then the annunciator output will be active.

If the Reset key is pressed while the limit is exceeded, the annunciator output will be deactivated, even if the limit remains being exceeded.

3.7 Remote Reset (Optional)

The Remote Reset option allows a dry contact closure to substitute for the front panel Reset switch. Operation is as follows:

If the option "rrES" (remote reset) is selected then:

A contact closure will simulate the action of the front panel reset switch.

A contact opening will have no effect.

If the external contacts are left closed, only ONE reset operation will occur. If the instrument subsequently goes into a state where reset is required again, the contacts must be opened and closed again. The front panel Reset switch can still be used to activate a reset if required.

SECTION 4: CONTROL MODE

The Control mode allows viewing of the control status and process variables. Other modes can be accessed by pressing the SCROLL key until the appropriate mode is displayed, then pressing the DOWN key.

CONTROL	SETPOINT CHANGE	CONFIGURATION	SET-UP
(Ctrl)	(SPC)	(ConF)	(SEt)

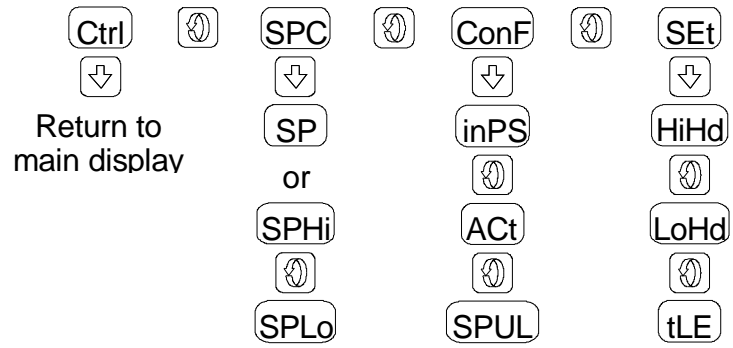
If a mode is not enabled it will be skipped over by the routine.

The Setpoint Change mode is used to adjust the limit setpoint(s).


The Configuration mode is used to configure or re-configure the instrument. The input and output selections are made in the Configuration mode (see Section 6). All possible parameters are illustrated in Table 6-1. Only those parameters that are applicable to the hardware options chosen will be displayed.

The Set-Up mode is used to adjust the displays, make alarm settings and retransmit scaling as needed for proper operation of the instrument. See Section 7 for the Set-up mode. Only those parameters that are applicable will be displayed.

The Enable mode provides a means of enabling or disabling access to the Program and Set-Up modes, and enables the Setpoint Change parameter. See Section 8 for Enable Mode operation.



 = SCROLL key

 = DOWN key

Press UP key with upper display blank to exit mode.

In Configuration Mode, the RESET key must be pressed to store any changed values.

SECTION 5: SETPOINT CHANGE MODE

To change the limit setpoint, the Setpoint Change Mode must be enabled (see Enable Mode). From the Control Mode, press the SCROLL key until **SPC** is displayed. Press the DOWN key to access Setpoint Change Mode.

To change the high limit setpoint, press the DOWN key until **SPHi*** is displayed in the lower display with the upper display blank. Press the SCROLL key and the current setpoint will be shown in the upper display. Use the UP and DOWN keys to adjust the setpoint. Press the SCROLL key.

To change the low limit setpoint, press the DOWN key until **SPLo*** is displayed in the lower display with the upper display blank. Press the SCROLL key and the current setpoint will be shown in the upper display. Use the UP and DOWN keys to adjust the setpoint. Press the SCROLL key.

To return to Control Mode, press the UP key when the upper display is blank. The control will accept the new setpoint(s) at this time.

The lower display will read **SPC**. Press the SCROLL key until **Ctrl** is displayed. Press the DOWN key.

If no keys are pressed within 20 seconds while in Setpoint Mode, the instrument will time out and return to Control Mode automatically.

NOTE: The instrument will not accept the new setpoint if the Setpoint Change Mode is allowed to time out.

* **SP** will be displayed if the instrument has been configured as either a high limit or a low limit control, but not both.

SECTION 6: CONFIGURATION

All configurable parameters are provided in Table 6-1. This table illustrates the display sequence, parameter adjustment and factory setting for each step.

Depression of the SCROLL key will cycle the display.

To enter the Configuration mode, press and release the SCROLL key until **ConF** is displayed. Use the DOWN key to enter the Configuration mode. Depress and release the SCROLL key to sequence through the parameters and their values, alternately showing the parameter code in the lower display with the upper display blank, then the parameter code with the parameter value in the upper display. Use the UP and DOWN keys to adjust the parameter values.

After adjusting a parameter, the upper display will flash, indicating that the new setting has yet to be confirmed. When the setting is as required, it may be confirmed by pressing the RESET key, and the upper display will stop flashing. After confirming a change, press the SCROLL key to proceed to the next parameter.

The DOWN key may also be used to advance to the next parameter when a parameter code is showing in the lower display and the upper display is blank. This is a faster way of scrolling through the parameter list.

To exit the Configuration mode, press the UP key whenever a parameter code is displayed in the lower display and the upper display is blank. The instrument will automatically exit the Configuration mode if no key is pressed in one minute.

DEFAULT PARAMETER INDICATION

If a parameter value, such as Input Select, was changed while in the Configuration mode, a decimal point after each digit will be lit when returning to the Control mode. This display indicates all Setup mode parameters have been set to their default condition. To clear this condition, enter the Setup mode and make a parameter value change and review each parameter for its proper setting.

Table 6-1 Configuration Mode Parameters

STEP	DESCRIPTION	DISPLAY CODE	AVAILABLE SETTINGS	FACTORY SETTING
1	Input Range Select	inPS	See App. C*	1420
2	Limit Action	ACt	Hi/Lo/Both	Hi
3	Limit Maximum	SPUL	+/- SPAN	Span max.
4	Limit Minimum	SPLL	+/- SPAN	Span min.
5	Alarm 1 Type	ALA1	nonE = No Alarm P_hi = Process High P_Lo = Process Low LiHi = High Limit LiLo = Low Limit	P_hi
6	Alarm 2 Type	ALA2	Same selection as ALA1	P_hi
7	Output 2 Usage ²	USE2	AL_d = Alm1 Direct LA_r = Annunc. Reverse LA_d = Annunc. Direct Ad_r = Rev Logic AND Ad_d = Dir Logic AND Or_r = Rev Logic OR Or_d = Dir Logic OR A2_r = Alm Rev A2_d = Alm Dir Al_r = Alm1 Rev	Al_d
8	Output 3 Usage ²	USE3	Al-d = Alm Dir rEcP = Rcdr Out P.V. LA_r = Annunc. Reverse LA_d = Annunc. Direct Ad_r = Rev Logic AND Ad_d = Dir Logic AND Or_r = Rev Logic OR Or_d = Dir Logic OR A2_r = Alm2Rev A2_d = Alm2Dir Al_r = Alm Rev	Al_d (rEcP when output 3 is retransmit)
9	Com Bit Rate ³	CbS	1200, 2400, 4800, 9600	4800
10	Com Parity ³	CPAr	nonE, EvEn, odd	nonE
11	Com Address ³	CAd	1 - 32	1
12	CJC Enable	CJC	EnAb diSA	EnAb

- 1 Does not appear unless Output 3 is configured as 4-20 mA.
- 2 Does not appear unless additional output has been selected.
- 3 Does not appear unless communications option has been selected.

*The Hardware Definition Code and input jumper configuration may need to be changed. See Appendices A and B.

LOGICAL COMBINATION OF ALARMS

Two alarms may be combined logically to create an AND/OR situation. They may be configured for Reverse-acting or Direct-acting. Either Output 2 or Output 3 may be assigned as Logical Outputs.

Example:

Logical OR of Alarm 1 with Alarm 2

Direct-Acting

AL1 OFF, AL2 OFF: Relay OFF

AL1 ON, AL2 OFF: Relay ON

AL1 OFF, AL2 ON: Relay ON

AL1 ON, AL2 ON: Relay ON

Reverse-Acting

AL1 OFF, AL2 OFF: Relay ON

AL1 ON, AL2 OFF: Relay OFF

AL1 OFF, AL2 ON: Relay OFF

AL1 ON, AL2 ON: Relay OFF

Example:

Logical AND of Alarm 1 with Alarm 2

Direct-Acting

AL1 OFF, AL2 OFF: Relay OFF

AL1 ON, AL2 OFF: Relay OFF

AL1 OFF, AL2 ON: Relay OFF

AL1 ON, AL2 ON: Relay ON

Reverse-Acting

AL1 OFF, AL2 OFF: Relay ON

AL1 ON, AL2 OFF: Relay ON

AL1 OFF, AL2 ON: Relay ON

AL1 ON, AL2 ON: Relay OFF

SECTION 7: SET-UP MODE

To enter the Set-Up mode, press and release the SCROLL key until **SEt** is displayed. Use the DOWN key to enter the Set-Up mode. The “S” LED will light. Depress and release the SCROLL key to sequence through the parameters and their values, alternately showing the parameter code in the lower display with the upper display blank, then the parameter code with the parameter values in the upper display. Use the UP and DOWN keys to adjust the parameter values. After adjusting a parameter, depress the SCROLL key to proceed to the next parameter. The DOWN key may also be used to advance to the next parameter when a parameter code is showing in the lower display and the upper display is blank.

To exit the Set-Up mode, press the UP key whenever a parameter code is displayed in the lower display and the upper display is blank.

Table 7-1 Set-Up Mode Parameters

STEP	DESCRIPTION	DISPLAY CODE	AVAILABLE SETTINGS	FACTORY SETTING
1	Alarm Status ³	ALSt		Read Only
2	Maximum Hold	HiHd		Read Only
3	Minimum Hold	LoHd		Read Only
4	Time Exceeded	tLE		Read Only
5	Input Correction	iCOR	+/-Span	0
6	Input Filter	Filt	0.0 to 100.0 seconds in .5 sec. Increments	2.0
7	Hysteresis Limit	HySt	0 to 10.0% of span	1
8	Process Output Upper	Pou	-1999 to 9999	Span Max.
9	Process Output Lower	PoL	- 1999 to 9999	Span. Min.
10	Process High Alarm 1 ¹	PHA1	± Span	Span Max.
11	Process Low Alarm 1 ¹	PLA1	± Span	Span Min.
12	Process High Alarm 2 ¹	PHA2	± Span	Span Max.
13	Process Low Alarm 2 ¹	PLA2	± Span	Span Min.
14	Decimal Position	dPoS	0, 1, 2, 3	1
15	Engineering Units ² Upper	Euu	-1999 to 9999	1000
16	Engineering Units ² Lower	EuL	- 1999 to 9999	0
17	Comm. Enable	CCon	0=Disable 1 =Enable	1

STEP	DESCRIPTION	DISPLAY CODE	AVAILABLE SETTINGS	FACTORY SETTING
18	Display Enable	diSP	1 = Display Setpoint* 2 = Display Process Variable 3 = Display Process Variable** and Setpoint 4 = Display Blank * If configured for both high and low limit ,the high limit setpoint will be in the upper display and the low limit in the lower display. ** If configured for both high and low limit, pressing the up key while in control mode will display high limit setpoint. Pressing the down key will display the low limit setpoint.	3

¹ Applies only if process alarm is selected in Configuration mode.

² Applies only if a linear input has been specified.

³ Only if an alarm is active.

NOTE: Euu and EuL parameters can not be adjusted within the range of the SPhi and SPlo parameters of the Setpoint Change Mode. SPhi and SPlo may need to be changed before properly setting Euu and EuL.

MAXIMUM/MINIMUM HOLD

A parameter is available that tracks and saves the maximum (high limit) or minimum (low limit) excursions of the process variable.

This parameter is a read only parameter and is viewed in the Set-Up mode, display code **HiHd** (maximum hold) and **LoHd** (minimum hold).

To reset this parameter, select the parameter and with the numeric value in the upper display, press and hold the UP or DOWN keys. After about 5 seconds, the upper display will indicate ---- for about another 2 seconds, then change to **0.00**. Release the key.

The value will be held through a supply power down/power up cycle.

TIME EXCEED

This parameter is available to measure the amount of time that the limit is exceeded.

This parameter is a read only parameter and is viewed in the Set-Up mode, display code **tLE**.

The parameter will time in minutes and seconds from 0 to 99 minutes and 59 seconds. After this time the display will change automatically to indicate minutes and tens of seconds from 100.0 to 999.5. For times greater than 999.5 the display will be **HH**.

The value viewed is the cumulative time that the instrument has been out of limit.

To reset this parameter, select the parameter and with the numeric value in the upper display, press and hold the UP or DOWN keys. After about 5 seconds, the upper display will indicate ---- for another 2 seconds, then change to **0.00**. Release the key.

The value will be held through a supply power down/power up cycle.

SECTION 8: ENABLE MODE

To enter the Enable mode, press and hold the SCROLL key. The display flashes for about 5 seconds, then returns to a normal display for about 5 more seconds, then displays **EnAb**. Release the keys, the display should show **ESP**. Pressing the DOWN key will display the Enable mode codes in the following sequence:

ESP – ECon – ESEt

Pressing the SCROLL key will display the Enable mode codes with the upper display blank. The next depression of the SCROLL key will add the Enable code status (**ON** or **OFF**) to the upper display. With the Enable code status displayed, use the UP key to change the status to **ON** and the DOWN key to change the status to **OFF**.

To exit the Enable mode, press the UP key with any Enable mode code displayed in the lower display and the upper display blank. The control will automatically return to Control mode if no key is pressed within one minute.

Table 8-1 Enable Mode Parameters

STEP	DESCRIPTION	DISPLAY CODE	AVAILABLE SETTINGS	FACTORY SETTING
1	Setpoint Mode	ESP	ON/OFF	ON
2	Configuration Mode	ECon	ON/OFF	ON
3	Set-Up Mode	ESEt	ON/OFF	ON

SECTION 9: CALIBRATION

NOTE: Calibration should be attempted only on instruments on which calibration errors have been encountered (see calibration check).

EQUIPMENT REQUIRED:

1. Input source with accuracy better than +/- 0.05% of reading.
 - a. Thermocouple: T/C simulator, K type with compensated leads
 - b. DC: 0 to 50 mV OR
0 to 10 V OR
0 to 20 mA
 - c. RTD: Decade resistance box with 3 wire input
2. MIC1162 case wired for appropriate input voltage supply (90 to 264 VAC, 50/60 Hz)

PROCEDURE:

1. Before applying power, position the input conditioning jumpers on the CPU PWA as appropriate. See Figure A-1 and A-2 in Appendix A.
2. Connect the appropriate input from the Input Source. Set the Input Source as follows:

INPUT TYPE	INPUT SOURCE
DC 0 - 50 mV	50 mVDC
DC 0 - 10 V	10 VDC
DC 0 - 20 mA	20 mADC
RTD	200 ohms
T/C (Type K)	0° C

3. Apply power to the instrument and leave powered for five (5) minutes for RTD and DC inputs OR thirty (30) minutes for T/C inputs, then power down.

4. Apply power to the instrument and within 30 seconds of power-up, press and hold the DOWN and SCROLL keys simultaneously for about 5 seconds. The upper display will show ip_1 and the lower display will show CAL.
5. Use the UP/DOWN keys as required to change the input type number as required:

CAL INPUT NO.	INPUT TYPE
1	DC 0 - 50 mv
2	DC 0 - 10 V
3	DC 0 - 20 mA
4	RTD
5	Thermocouple

NOTE: If required, only one input type may be calibrated. EXCEPTION: If it is required to calibrate the thermocouple input (Input Type 5), it is necessary to calibrate the DC 0 - 50 mV (Input Type 1) first.

6. Press the RESET key, the upper display will show _ _ _ _.
7. After a few seconds, the upper display will show ip_X, where X is the CAL INPUT No., if the calibration was successful. If the upper display shows FAIL, the calibration was not successful - check the jumper positions, wiring, CAL INPUT No. and try again.
8. To calibrate all inputs, repeat steps 2 through 7 for each of the other input types.
9. The calibration procedure is now complete. Disconnect power, remove input connections.

CALIBRATION CHECK

(See Configuration Mode, Appendix A, and Appendix B.)

1. Power up the instrument and allow to stabilize for at least 5 minutes (RTD and DC) or 30 minutes for T/C input.
2. After the stabilization period, connect the appropriate input device and check a number of input points.

APPENDIX A: BOARD LAYOUT - JUMPER POSITIONING

FIGURE A-1 Exploded View & Board Layout

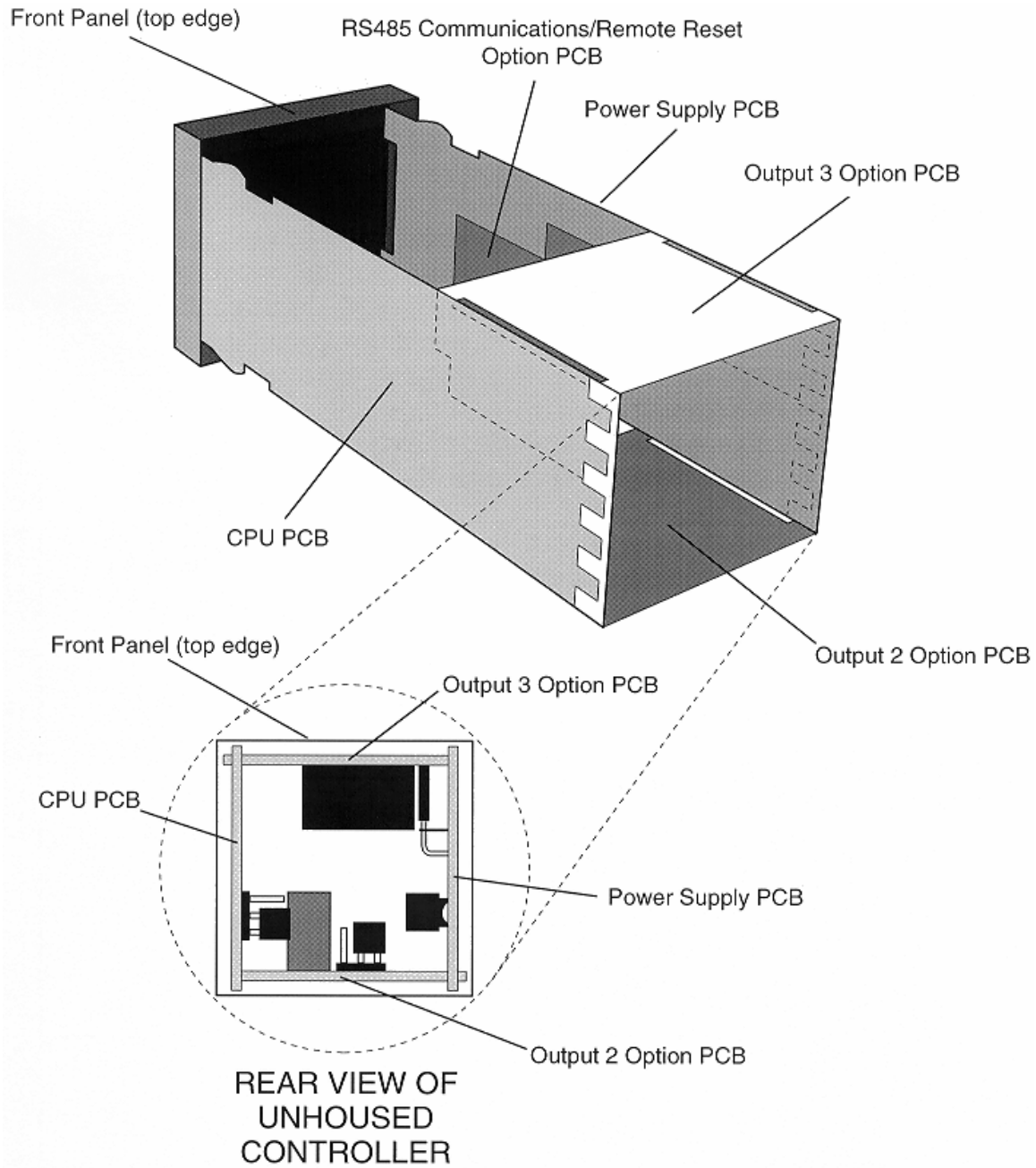
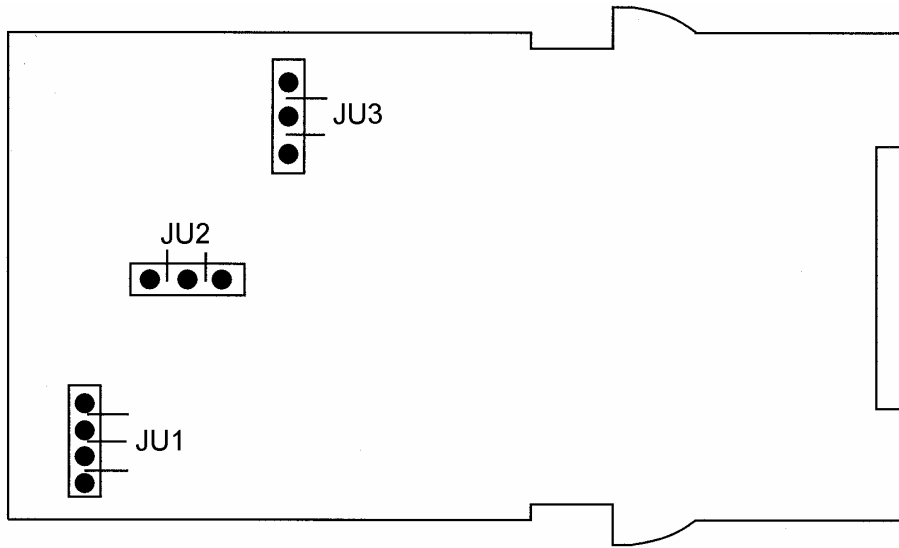


FIGURE A-2 CPU PWA



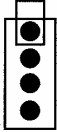

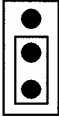
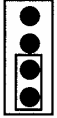
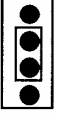
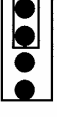
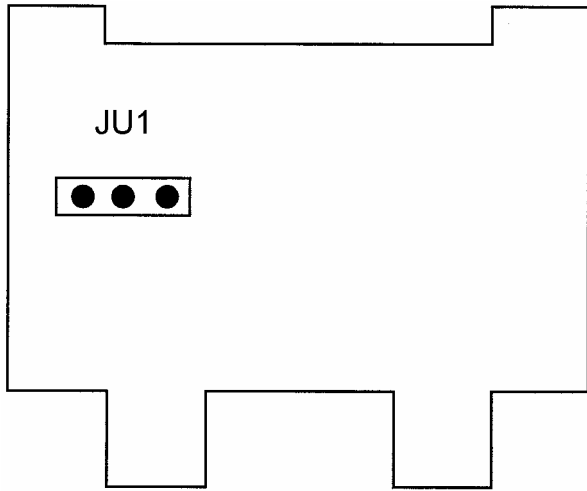
Input Type	JU1 Jumper Position	Output Type	JU2 Jumper Position	JU3 Jumper Position
RTD DC (mV)	 None Parked	Relay		
T/C				
DC (mA)				
DC (V)				

FIGURE A-3 OPTION PWA DC OUTPUT 2/OUTPUT 3



<u>Output Type</u>	<u>JU1 Jumper Position</u>
DC (0-10V)	
DC (0-20mA)	
DC (0-5V)	
DC (4-20mA)	

APPENDIX B: HARDWARE DEFINITION CODE

The Hardware Definition Code is used to represent the hardware installed (input type, Output 2 type and Output 3 type); this must be compatible with the hardware actually installed. It can be accessed, with the instrument in Configuration mode, by simultaneously depressing the DOWN and SCROLL keys. The displays will show **XXXX** (where X represents any number) in the upper display and **dEFn** in the lower display, where:

the first (left-most) digit is input type:

- 1 =RTD/Linear mV
- 2=Thermocouple
- 3=Linear DC mA
- 4=Linear DC V

the second digit is Output 1 type:

- 1=Relay

the third digit is Output 2 type:

- 0=Output 2 not installed
- 1 =Relay (Alarm Only)

the fourth digit is Output 3 type:

- 0=Output 3 not installed
- 1 =Relay (Alarm 1 only)
- 2=SSR (not available)
- 3=DC 0-10V (retransmit only)
- 4=DC 0-20mA (retransmit only)
- 5=DC 0-5V (retransmit only)
- 7=DC 4-20mA (retransmit only)

The displayed code may be incremented/decremented using the UP/ DOWN keys as required. The maximum setting available is 4117. For example, the code for a thermocouple input, Relay Output 1 and Relay Output 3 would be 2101. When the code is first altered, the code display will flash, until the desired value is displayed and confirmed by pressing the Reset key.

While the Hardware Definition Code is displayed, depressing the SCROLL key will cause the display to change to:

nonE	or	r485	or	rrES
OPtn		OPtn		OPtn

Where none indicates the absence of the communications option and the remote reset option, **r485** indicates the presence of the communications option, and **rrES** indicates the presence of the remote reset option.

The code may be changed by pressing the UP and DOWN keys. The RESET key must be pressed when the correct code is displayed.

NOTE: It is essential that this code is changed whenever there is a change to the instrument's hardware configuration (change of input/output type, alarm/retransmit output added/removed etc.). The instrument's software depends upon this code to ensure that the instrument operates correctly.

To exit from the Hardware Definition Code display, depress the DOWN and SCROLL keys simultaneously.

APPENDIX C: INPUT RANGE CODES

The input ranges available (selectable via the front panel) are:

TYPE	INPUT RANGE	DISPLAYED CODE
R	0 - 1650°C	1127
R	32 - 3002°F	1128
S	0 - 1649°C	1227
S	32 - 3000°F	1228
J	0.0 - 205.4°C	1415
J	32.0 - 401.7°F	1416
J	0 - 450°C	1417
J	32-842°F	1418
J	0 - 761°C	1419
J	32 - 1401 F	1420*
T	-200 - 262°C	1525
T	-328 - 503°F	1526
T	0.0 - 260.6°C	1541
T	32.0 - 501.0°F	1542
K	-200 - 760°C	6726

TYPE	INPUT RANGE	DISPLAYED CODE
K	-328 -1400°F	6727
K	-200 - 1373°C	6709
K	-328 - 2503°F	6710
L	0.0-205.7°C	1815
L	32.0-402.3°F	1816
L	0-450°C	1817
L	32.0-842°F	1818
L	0-762°C	1819
L	32-1404°F	1820
B	212-3315°F	1934
B	100-1824°C	1938
N	0 - 1399°C	5371
N	32 - 2550°F	5324

* Factory default

For RTD Inputs

Note: Input conditioning jumper JU1 needs to be changed, see Appendix A. Also, the Hardware Definition Code for the input type must be changed, see Appendix B.

INPUT RANGE	DISPLAYED CODE
0 - 800°C	7220
32-1471°F	7221
32-572°F	2229
-101.0-100.0°C	2230
-149.8-212.0°F	2231
0-300°C	2251

INPUT RANGE	DISPLAYED CODE
0.0-100.9°C	2295
32.0-213.6°F	2296
-200-206°C	2297
-328-403°F	2298
-101.0-537.3°C	7222
-149.8-999.1°F	7223

For DC Inputs

Note: Input conditioning jumper JU1 needs to be changed, see Appendix A. Also, the Hardware Definition Code for the input type must be changed, see Appendix B.

INPUT RANGE	DISPLAYED CODE
0-20mA	3413
4-20mA	3414
0-50mV	4443
10-50mV	4499

INPUT RANGE	DISPLAYED CODE
0-5V	4445
1-5V	4434
0-10V	4446
2-10V	4450

APPENDIX D: SPECIFICATIONS

INPUT SPECIFICATIONS

General

Input Sample Rate:	Four per second
Input Resolution:	14 bits approximately
Input Impedance:	Greater than 100M ohm resistive (except for DC mA and V inputs)
Isolation:	Universal input isolated from all outputs except SSR at 240 VAC.

Thermocouple

Types:	R, S, J, T, K, L, B and N
Calibration:	Complies with BS4937, NBS125 and IEC584.
Sensor Break Protection:	Break detected within 2 seconds. Limit Relay set to OFF; alarms operate as if the process variable has gone over-range.

RTD and DC mV

Type and Connection:	Three-wire Pt100
Calibration:	Complies with BS 1904 and DIN43760.
Lead Compensation:	Automatic
Sensor Break Protection:	Break detected within 2 seconds. Limit Relay set to OFF (0% power); alarms operate as if the process variable has gone under-range.

DC mA and DC V

Scale Range Maximum:	-1999 to 9999
Scale Range Minimum:	-1999 to 9999
Minimum Span:	1 display LSD
Sensor Break Protection:	Applicable to 4-20mA, 1-5V, and 2-10V ranges only. Break detected within 2 seconds. Limit Relay set to OFF; alarms operate as if the process variable has gone under-range.

Remote Reset

Type:	Voltage-free contact, closure required to reset.
-------	--

OUTPUT SPECIFICATIONS

OUTPUT 1 (Limit Relay)

Relay

Contact Type: SPDT
Rating: 5A resistive at 120/240V AC
Lifetime: > 100,000 operations at rated voltage/current
Isolation: Inherent

OUTPUT 2 (Alarm or Annunciator)

Relay

Contact Type: SPDT
Rating: 2A resistive at 120/240V AC
Lifetime: > 500,000 operations at rated voltage/current
Isolation: Inherent

OUTPUT 3 (Alarm, Annunciator, or Retransmit)

General

Types Available: Relay or DC linear (retransmit only)

Relay

Contact Type: SPDT
Rating: 2A resistive at 120/240V AC
Lifetime: > 500,000 operations at rated voltage/current
Isolation: Inherent

DC

Resolution: Eight bits in 250mS (10 bits in 1 second typical, >10 bits in >1 second typical).

Update Rate: 4 per second

Ranges: 0-20mA, 4-20mA, 0-10V, and 0-5V*

Load Impedance: 0-20mA: 500 ohm maximum
4-20mA: 500 ohm maximum
0- 10V: 500 ohm minimum
0-5V: 500 ohm minimum

Isolation: Isolated from all other inputs and outputs.

* Changes between V and mA ranges also require jumper movement.

Alarms

Maximum Number: Two "soft" alarms
Maximum # Outputs: Up to 2 outputs can be used for alarm purposes
Combination Alarms: Logical OR or AND of alarms to an individual hardware output is available.

PERFORMANCE

Reference Conditions

Ambient Temperature: $20^{\circ}\text{C} \pm 2^{\circ}\text{C}$
Relative Humidity: 60-70%
Supply Voltage: 90-264V AC 50Hz $\pm 1\%$
Source Resistance: <10 ohm for T/C input
Lead Resistance: <0.1 ohm/lead balanced (Pt100)
Common Mode Rejection: $>120\text{dB}$ at 50/60Hz giving negligible effect at up to 264V 50/60Hz
Series Mode Rejection: $>500\%$ of span (at 50/60Hz) causes negligible effect

DC Linear Inputs

Measurement Accuracy: $\pm 0.25\%$ of span ± -1 LSD

RTD/Thermocouple Inputs

Measurement Accuracy: $\pm 0.25\%$ of span ± -1 LSD

Note: Reduced performance with Type B T/C between $100-600^{\circ}\text{C}$ ($212 - 1112^{\circ}\text{F}$)

Linearization

Better than $\pm 0.2^{\circ}\text{C}$ any point, any 0.1°C range ($\pm 0.05^{\circ}\text{C}$ typical).
Better than $\pm 0.5^{\circ}\text{C}$ any point, any 1°C range.

Cold Junction Compensation: Better than $\pm 0.7^{\circ}\text{C}$

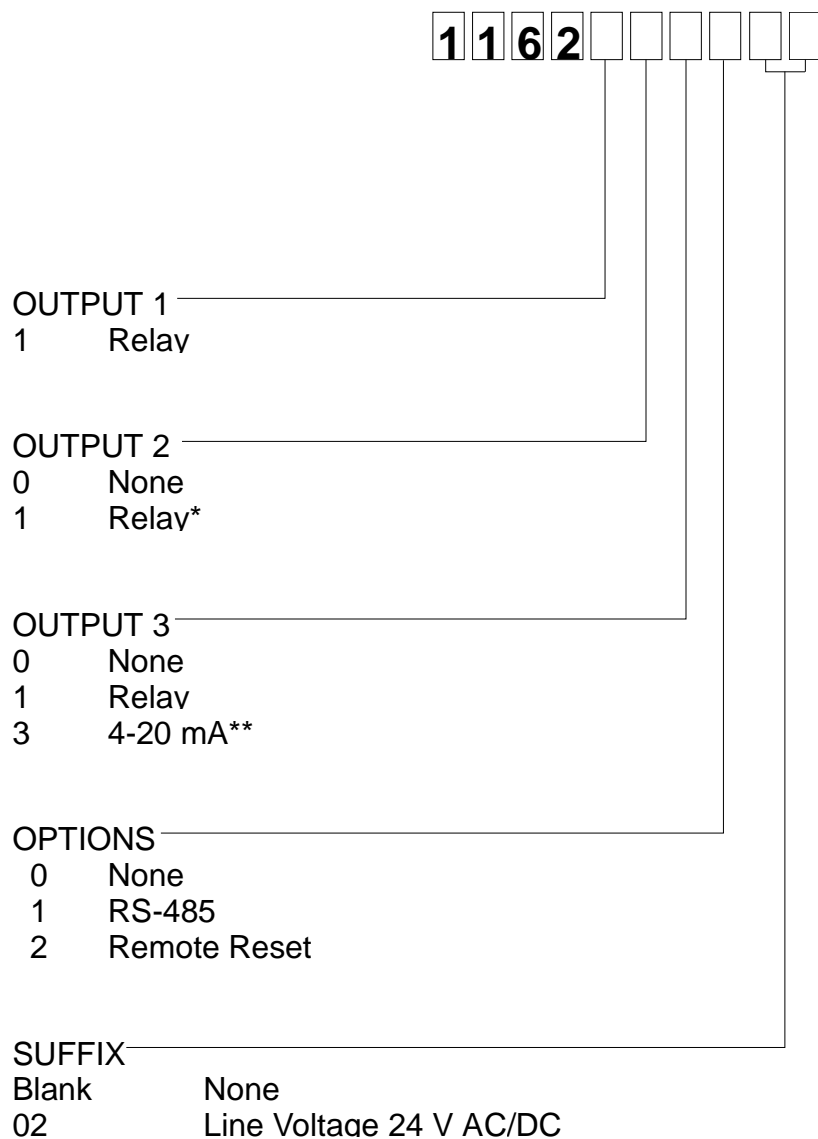
Operating Conditions

Ambient Operating Temperature:	0 to 55°C
Ambient Storage Temperature:	-20 to 80°C
Relative Humidity:	20% - 95% non-condensing
Supply Voltage:	90 - 264 VAC 50/60 Hz
Source Resistance:	1000 ohm maximum (thermocouple)
Lead Resistance:	50 ohm per lead maximum balanced (Pt 100)
Temperature Stability:	0.01% of Span/°C change in ambient

PHYSICAL

Dimensions:	1/16 DIN front panel (48mm x 48mm) 4.33 inches deep
Mounting:	Plug-in with panel mounting fixing strap. Panel cut-out 45mm x 45mm.
Terminals:	Screw type (combination head)
Power Consumption:	Approximately 4 watts
Weight:	8 ounces maximum
Front Panel Sealing:	IP65/NEMA4
Display Character Height:	Top - .36", bottom -.28"
Agency Approvals:	FM pending

APPENDIX E: ORDER MATRIX



* For alarm output only
 ** For retransmission only

APPENDIX F: SOFTWARE REFERENCE SHEET

Hardware Definition	Setting
HDW DEF	
OPTION	

Configuration Mode	Setting
inPS	
ACt	
SPUL	
SPLL	
ALA1	
ALA2	
USE2	
USE3	
CbS	
CPAr	
CAd	
CJC	

Enable Mode	Setting
ENAB	
ESP	
ECon	
ESEt	

Setup Mode	Setting
HiHd	
LoHd	
tLE	
iCOR	
Filt	
Hyst	
Pou	
PoL	
PHAI	
PLAI	
PHA2	
PLA2	
dPoS	
Euu	
EuL	
CCon	
diSP	

Setpoint Change Mode	Setting
SP	
SPHi	
SPLo	

Product Warranty

See separate warranty for Standard Products (Form BB7)

Parts, Materials and Labor

Seller warrants the equipment manufactured by Seller and not by others, to be free from defects in workmanship and material under normal use and service for a period of (1) year from the date of delivery or the period of two thousand (2,000) accumulated hours of use, whichever period is shorter. Use or service with corrosive or abrasive chemicals or materials is not deemed normal. The period of the forgoing warranty, in the case of furnaces, shall be ninety (90) days or five hundred twenty-five (525) accumulated hours of use, whichever period is shorter. Components manufactured by others including expendable items, are warranted only in accordance with the warranty, if any, issued by such other manufacturer.

Buyer shall give Seller written notice of any defects with 14 days after discovery thereof, specifying each particular defect discovered. If such notice is properly given, Seller will correct without charge any workmanship that is demonstrated to Seller's satisfaction to have been defective at the time of installation, and will repair or replace, at Seller's option, without charge, f.o.b. Seller's factory, parts covered by this warranty that upon inspection are found defective under normal use within the warranty period above stated. All work of removal and reinstallation, whether or not found defective, and shipping charges for defective or replacement parts shall be at the sole expense of Buyer.

The foregoing warranty shall not apply to (i) work done or materials furnished by others in connection with installation work performed without supervision by Seller's installation supervisors, or (ii) equipment repaired or altered by others unless such repairs or alterations were specifically agreed to in writing by an Officer of Seller. Seller shall not be liable for consequential damages of any kind which occur during the course of installation of equipment, or which result from the use or misuse by Buyer, its employees or others of the equipment supplied hereunder, and Buyer's sole and exclusive remedy against Seller for any breach of the foregoing warranty or otherwise shall be for the repair or replacement of the equipment or parts thereof affected by such breach.

The foregoing warranty shall be valid and binding upon Seller if and only if Buyer loads, operates and maintains the equipment supplied hereunder in accordance with the instruction manual to be provided upon delivery of the equipment. Seller does not guarantee the process of manufacture by Buyer or the quality of product to be produced by the equipment supplied hereunder, and Seller shall not be liable for prospective profits.

Despatch will repair or replace, at Despatch's option, FOB Despatch's factory, parts and materials covered by this warranty. Despatch is not responsible for parts or material failures resulting from misuse, abuse, inadequate preventative maintenance, acts of nature, or non-conforming utilities, including electrical, fuel supply, environmental and intake/exhaust provisions. This warranty also does not cover normal wear or routine maintenance parts and materials expressly designed as expendable/consumable and replaceable. (Note: Laboratory oven electric heaters are warranted for a period of five (5) years from date of shipment; three (3) years from date of shipment for Protocol Plus and DES 2000 temperature controllers).

Labor services for parts and materials replacement and repair to support this warranty are available at Despatch's normal service fees. This service is provided worldwide by a network of factory trained professionals.

Transportation Costs

All transportation costs to transport defective parts or materials to Despatch and to transport repaired or replacement parts or materials to Customer shall be the responsibility of the Customer.

Terms and Conditions

This Warranty shall be deemed valid and binding upon Despatch if and only if the Customer:

1. Installs, loads, operates and maintains the covered product supplied hereunder in accordance with the instruction manual provided upon delivery and product labeling affixed to the subject equipment;
2. If applicable, follows the Emergency Procedure set forth in this Warranty; and
3. Contacts Despatch's Helpline at 1-800-473-7373 for assistance in diagnosing and troubleshooting the problem immediately upon discovering any damage or malfunction. Despatch's reasonable determination as to whether a repair, replacement, or service is covered by this Warranty shall be final and binding.

Exclusions

This Warranty DOES NOT cover:

1. Damage or malfunctions, or expenses incurred in the process of diagnosing and/or repairing damage or malfunctions, resulting from any of the following: operator error, misuse, abuse, inadequate preventative maintenance, normal wear and tear, service or modifications by other than Despatch authorized technicians, use of the covered product that is inconsistent with the operation manual or labeling, acts of nature (including, without limitation, floods, fire, earthquake, or acts of war or civil emergency) internal or external corrosion, or non-conforming utilities (including, without limitation, electrical, fuel supply, environmental and intake/exhaust installations);
2. Repair or replacement of parts or materials designed and intended to be expendable or consumable; refrigerants, filters, lamps;
3. Routine maintenance; or
4. Labor costs incurred for troubleshooting, diagnostics or testing (except for testing required to verify that a covered defective part or material has been repaired).

Limitations of Liability

Despatch, shall not, in any event, be liable for indirect, special, consequential, incidental, or punitive damages or penalties of any kind, including, without limitation loss of revenue, profits or business opportunities resulting from interruption of process or production. In no event shall Despatch be liable for damages in excess of the amounts paid by Customer to Despatch with respect to the applicable product(s). This Warranty does not cover, and Despatch shall not be liable for any losses, costs, damages or expenses resulting from delays in diagnosing or repairing the products, supplying or obtaining replacement parts or materials, strikes, labor stoppages or shortages, fires, accidents, government acts or regulations, or any other causes beyond the control of Despatch.

Non-Compliance By Customer

Despatch reserves the right to suspend and withhold service under this Warranty in the event of non-compliance by the Customer to any terms and conditions of this Warranty or the applicable purchase order or invoice. Further, Despatch shall not be liable for any loss of production, expenses, and inconveniences incurred due to such suspension.

Customer Furnished Equipment Warranty Limitation

This Warranty does not cover diagnosis or repairs of defects in or caused by, lack of performance of, or fitness for purpose of customer-supplied parts or equipment unless specifically noted in the Despatch written order acceptance confirmation.

Performance Commitment

Despatch provides no guarantee of process performance or fitness for purpose, unless specifically noted otherwise in Despatch written order acceptance confirmation. Despatch is providing equipment with design parameters specific only to its equipment.

Procedure Upon Discovery of Defects and Emergencies

In the event Customer becomes aware of any defect in the applicable products, Customer must immediately: (a) shut off fuel or energy supply (gas and electricity), (b) call for emergency assistance, if needed, and (c) notify Despatch Service.

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Service

Worldwide Phone 952-469-8230; Worldwide Fax 952-469-8193; North American Phone 800-473-4373

e-mail service@despatch.com; www.despatch.com

Please see reverse side for other service offerings

Despatch Industries

Advantage Service Assurance Program (ASAP)

CONTACT: DESPATCH SERVICE AGREEMENTS SPECIALIST at 800-473-7373 or 952-469-8230
or e-mail: service@despatch.com

Despatch continues to deliver exceptional products backed by a strong sense of responsibility and drive for long term customer satisfaction. Your partnership with Despatch can offer even higher value through your subscription to one of Despatch's Advantage Service Assurance Program(ASAP).

Warranty

Despatch's exclusive, comprehensive service programs start with the 1 year parts only warranty which is described on the other side of this document. This warranty can be expanded immediately to meet your most stringent service needs. Despatch Service Products Group will be able to answer your service questions and provide a quotation for the immediate expansion of your product warranty. Call 800-473-7373 or 952-469-8230; or e-mail service@despatch.com.

Immediate Service Response

The key to an effective service program is response. Wherever your location, Despatch is only a phone call away. Our U.S. and Canadian customers can reach Despatch at 1-800-473-7373. Worldwide customers can call 1-952-469-8230 or FAX 1-952-469-8193. Our Customer Service Technicians have over 150 years combined experience and access to detailed design and manufacturing documentation specific to your Despatch unit(s). This exacting level of service is a benefit only Despatch can provide and means that you can expect speedy, accurate and the most cost effective response.

Field Service Network

A worldwide network of factory trained Service Professionals is available to support your Despatch equipment. From routine repair to certified instrument calibration, the Despatch service network is positioned to respond to your needs. As a manufacturer of custom equipment, our service programs are customized to meet your specific needs regarding:

1. Service scope
2. Response time
3. Preventive maintenance frequency and content
4. Payment method

Sustained Service Support

At Despatch, long term customer satisfaction means more than just responding quickly and effectively to our customers' service needs. It means offering comprehensive customer support well beyond the scope and duration of our initial warranty. Despatch offers two basic service packages which are customized to each individual customer's need. These service packages are titled Full Service and Preventive Maintenance Plus+ service agreement products. Each is unique in the industry and offer the following benefits:

1. Priority response for minimum production interruption
2. Preventive maintenance for longer product life
3. Discounts on parts and services
4. Various payment plans to ease budgeting and recording expenses
5. Reduce purchase ordering costs

Service

Worldwide Phone 952-469-8230; Worldwide Fax 952-469-8193; North American Phone 800-473-7373
e-mail service@despatch.com; www.despatch.com
