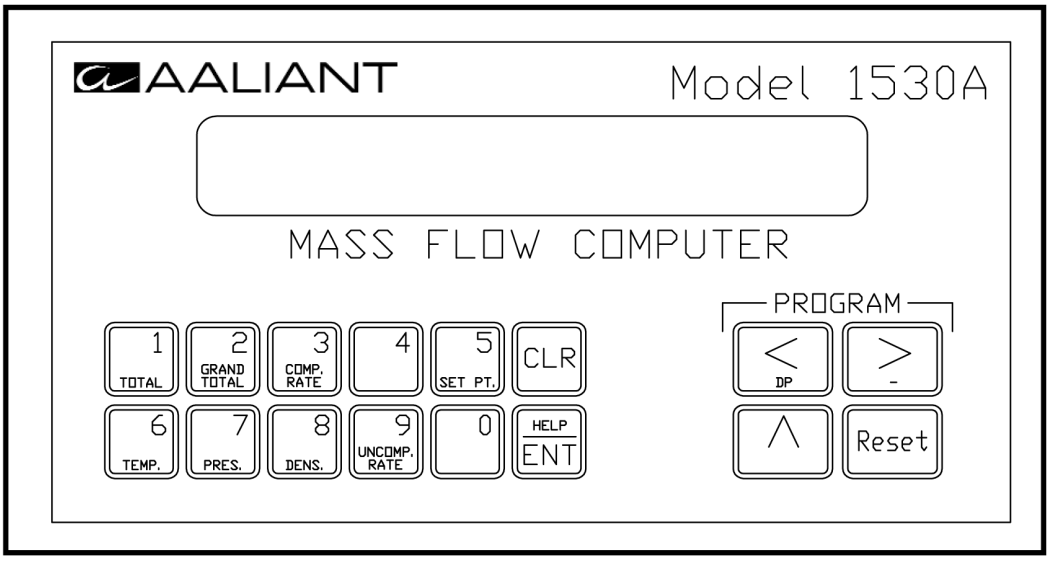
AALIANT

M542A Rev. F

MODEL 1530A
Mass Flow Computer



INSTALLATION, OPERATION & MAINTENANCE MANUAL

SAFETY INFORMATION

Before installing the Model 1530A Mass Flow Computer, please read these instructions and familiarize yourself fully with the requirements and functions. Ensure that all personnel involved with operating this device are suitably qualified. Observe all local and national electrical codes for the wiring of this device.

If any questions or problems arise during installation of this equipment, please contact the Aaliant Applications Department at 800-778-9251 or 864-574-3327.

NOTE: Manufacturer's instructions and the National Electrical Code (ANSI/NFPA 70) must be followed when installing this equipment. Tampering or replacement with non-factory components may adversely affect the safe use of the system.

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GENERAL

The Model 1530A Mass Flow Computer — designed for use with ideal gas, saturated steam, or superheated steam — indicates mass rate, mass totalization, temperature, pressure, and density. Each of these functions may be displayed quickly and easily by pressing a single key on the front panel. The unit may be used with a target flowmeter or any linear output flowmeter such as a turbine or vortex.

User options make the Model 1530A especially versatile. Field programmability is possible through a user-friendly menu system which leads the programmer to each new step.

Temperature and pressure inputs may be overridden. RS-485 serial communication may be used for computerized process monitoring.

Inherent in the Model 1530A's technology are many features. There are two totalizers — total and grand total. Five alarm outputs monitor high or low conditions of rate, temperature, and pressure. The front panel reset key may be programmed to reset any of the outputs manually. In case of a power failure, the memory is backed up so that program settings and totals are saved.

SPECIFICATIONS

Process Inputs

Flow

Type: 4-20mA current loop
Impedance: 100Ω
Voltage: 5 VDC
Response: 3 Hz
Resolution: 11 bits
Accuracy: ±0.1% at 25°C; ±0.25% over temperature range

Temperature

Type: 4-wire RTD or current loop
RTD: Platinum to European alpha 3850 curve
Current loop: 4-20mA with 5V maximum sustained voltage and an adjustable range from 3.75 to 20.25mA
Impedance: 100Ω
Resolution: 14 bits
Range: –9999.9°F to 9999.9°F in 0.1° increments (programmable)
Steam tables for temperatures from 140°F to 1150°F
Accuracy: ±0.1% at 25°C; ±0.25% over temperature range
Response: 2 Hz

Pressure

Type: 4-20 mA current loop; 5V maximum sustained voltage; adjustable range from 3.75 to 20.25mA
Impedance: 100Ω
Resolution: 12 bits
Range: 0.0 - 9999.9 psi (programmable)
Steam tables for pressures from 3 to 2400 psia
Accuracy: ±0.1% at 25°C; ±0.25% over temperature range
Response: 2 Hz

Other Inputs

Power

115/230 VAC +10%, –15%, 50/60 Hz, 0.2/0.1 amps; or 18 - 27 VDC, 0.4 amps maximum, 6 watts maximum

Control inputs 1 and 2

Type: Current sinking device such as contact closure or npn transistor to ground (electronic pulse)
Impedance: 5.8 KΩ pull-up resistor to +5 VDC
Logical voltages: High, 3.5 - 24 VDC; low, 0.0 - 1.0 VDC
Response: 30 msec input
Use: Reset logical alarm outputs and/or totals

Control input B
Type: Current sinking device such as contact closure or npn transistor to ground (electronic pulse)
Impedance: 5.8 KΩ pull-up resistor to +5 VDC
Logical voltages: High, 2.8 - 24 VDC; low, 0.0 - 1.3 VDC
Response: 30 msec input
Use: Reset logical alarm outputs and/or totals; or inhibit recognition of flow input A (programmable)

Reset key
Type: Front panel pushbutton
Use: Reset logical alarm output and/or total (programmable); cannot reset grand total

Outputs

Accessory power
Available only when unit is AC powered
Voltage: 24 VDC ±5%
Current: **100 mA maximum**

Alarm relays (2)
Type: Assignable to hi/lo limits for rate, temperature, or pressure
Contacts: Form C rated at 240 VAC and 5 amps resistive or 24 VDC and 10 amps resistive
Operation: Programmable; may follow condition, latch, or time-out from 0.01 - 99.99 sec

Alarm transistors (3)
Type: Open-collector npn transistors assignable to hi/lo limits for rate, temperature, or pressure
Rating: 150mA maximum, 30 VDC blocking maximum
Operation: Programmable; may follow condition, latch, or time-out from 0.01 - 99.99 sec
Use: Logic input to computer system, external relay, or indicator

Pulse output
Type: Open-collector npn transistor for remote totalization
Rating: 150mA maximum, 30 VDC blocking maximum
Operation: Follows totalizer; pulse width may be selected from

- 125 µsec with 4K Hz max. (fast)
- 2 msec with 250 Hz max. (medium)
- 50 msec with 10 Hz max. (slow)

Analog output
Type: 4-20mA current loop (optically isolated)
Voltage: Compliance voltage 12V to 27 VDC
Response: 2 Hz
Accuracy: ±0.1% at 25°C; ±0.25% over temperature range
Resolution: 11 bits
Operation: Assignable to rate, temperature, or pressure

Communications
Type: RS-485 multidrop
Baud: 300, 600, 1200, 2400, 4800, 9600, or 19200
Parity: space, even, or odd
Protocol: Opto-22 compatible

Environment

Temperature
Operating: 32°F to 131°F (0°C to 55°C)
Storage: –40°F to 158°F (–40°C to 70°C)

Humidity
0 - 85% relative, non-condensing

Front panel
Sealed to NEMA 4X with included O-ring gasket

Wall mount enclosure
Sealed to NEMA 4X

Wiring Terminals
14 AWG maximum; detachable

Warranty
Standard 2 year

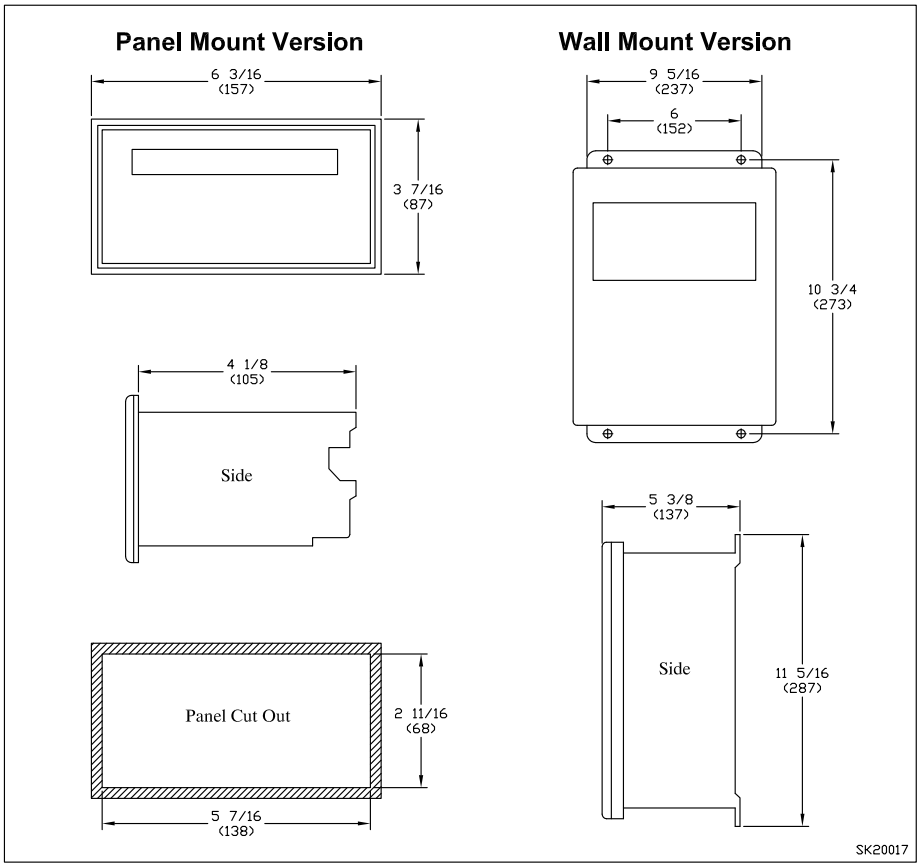


Figure 1. Dimensions **in (mm)**

INSTALLATION

For panel mount units, refer to the panel cut-out dimensions in Figure 1. Completely install and secure the unit into the panel before wiring.

For wall mount units, refer to the dimensions in Figure 1 and mount the enclosure to the wall. The recommended minimum clearance from each side of the enclosure is 4". Wires should be 18" long inside the enclosure from entry to termination. This will provide ample length so the hinged door will swing freely and allow access to the wiring terminals. After installing either version of the Model 1530A, place the adhesive cable clamps (included in the shipment) on the bottom of the unit near the wiring terminals as needed. Loop the cable ties through the clamps and around the wires to transfer the strain from the terminal blocks to the clamps.

General Wiring

Remember:
- All connections should be made to the unit with the power off.
- Improper wiring may cause damage to the Model 1530A. Double-check all connections before powering.
- Do not exceed the power ratings of the components. See specifications for these ratings.
- An in-line fuse should be installed in the input power supply line. See the section on applications wiring.
- Sensor, control, and power lines should not be routed in the same conduit.
- When connecting inductive loads to the control outputs, provide diode protection.
- Do not exceed the voltage and current specifications of the relays. To prevent surge damage, provide protection when connecting loads to the relay outputs. Consult a qualified electrician for applicable protection methods.
- If powering the Model 1530A with a DC supply while switching AC power through the relays, connect the safety ground. If switching DC power, the safety ground is not required.

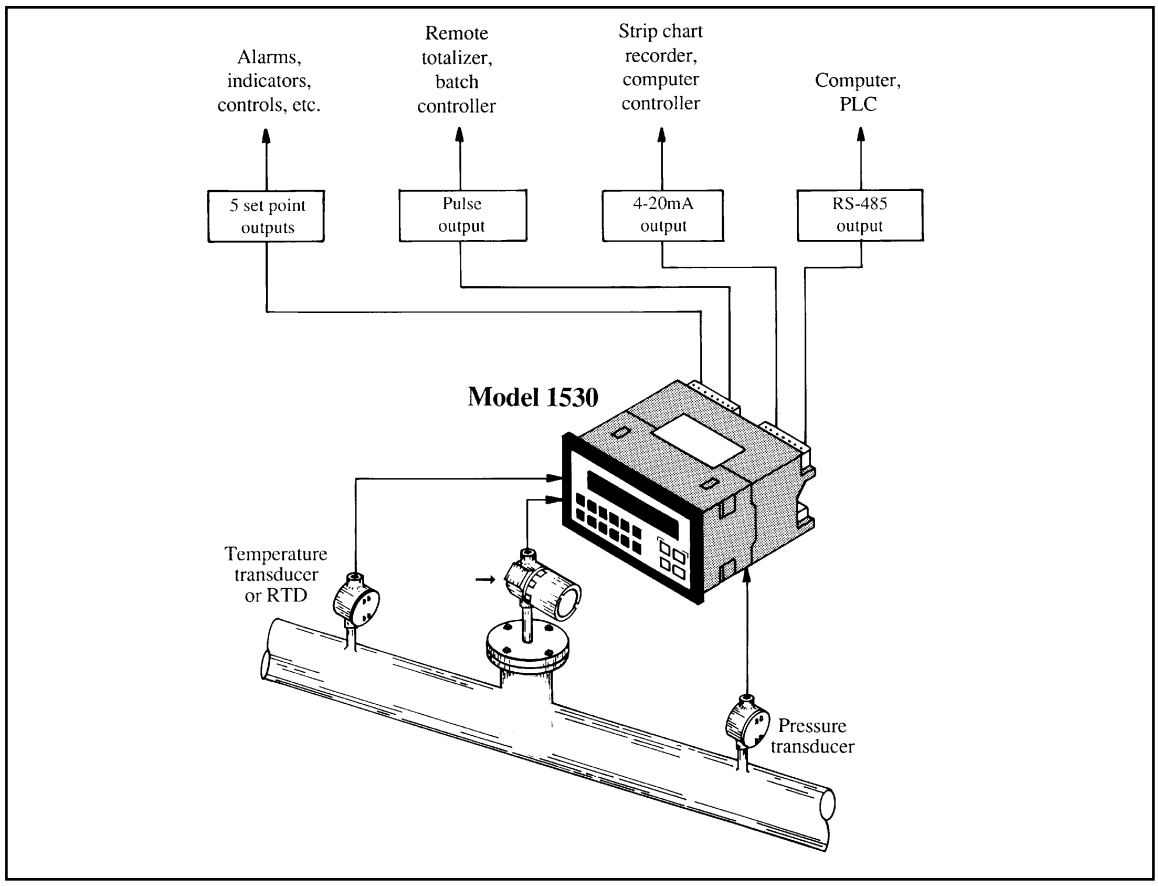


Figure 2. Operational Diagram

Terminal block 1 (TB1) (See connection diagrams on pages 9-14.)
AC power input

L1, L2 Terminals L1 and L2 are used for connecting the 115V or 230 VAC power input. L1 uses the two left terminals. L2 uses the next two terminals to the right.

115 VAC connection
To connect 115 VAC power, join the fused hot lead to both of the L1 terminals and the neutral lead to both of the L2 terminals.

230 VAC connection
To connect 230 VAC power, the left-most L1 terminal and the right-most L2 terminal should be connected to the two incoming power lines while a wire jumper connects the right-most L1 terminal and the left-most L2 terminal. One of the incoming leads should be fused.

⏚ This chassis ground terminal should be connected to earth ground. This connection is optional only if the unit is powered by 24 VDC, and the relays are not used to switch AC power.

Terminal block 2 (TB2) (See connection diagrams on pages 9-14.)
Transistor outputs, 24 VDC power

Outputs 1, 2, 3 Open-collector npn transistor outputs assignable to high and low limits for rate, temperature, or pressure

Output 4 Open-collector npn transistor output for remote totalizer.

24 VDC⏚ DC common. When unit is powered by a DC supply, connect to this terminal the minus side of the 18V - 27 VDC power supply.

24 VDC IN DC power input. When unit is powered by DC, connect the plus side of the 18V - 27 VDC power supply to this terminal.

24 VDC OUT DC power output. For powering accessories only when unit is powered by AC. Connect this terminal to the accessory's 24 VDC input (100 mA maximum).

Terminal block 3 (TB3) (See connection diagrams on pages 9-14.)

Relay contacts

K1, K2 Terminals symbolically show the normally open, normally closed, and common contacts for relays K1 and K2. The two relays may function as alarm outputs that are assignable to high and low set points for rate, temperature, and pressure.

Terminal block 4 (TB4) (See connection diagrams on pages 9-14.)

Analog output, flowmeter input, temperature input, and control input B

ANLG OUT + The analog output positive terminal, if used, should be connected to the analog circuit power supply positive or the 24 VDC out terminal on terminal block 2. Maximum voltage applied to this terminal is 27 VDC. The minimum voltage is 12 VDC plus the load drop at 20mA.

ANLG OUT – The analog output negative terminal is connected to the analog load positive terminal. The 4-20mA signal with respect to the common is put out at this terminal.

A This is the positive terminal for the 4-20mA flow input.

⏚ DC common. This is the reference level for the flowmeter and control inputs. (Control inputs are active when connected to DC common). DC common is connected to chassis ground through a capacitor.

B Control input B. May be programmed as a count inhibit, as an input to unlatch alarm outputs, or to reset totals. The input is active when pulled down to DC common.

TEMP This is the positive terminal for the 4-20mA temperature input.

RTD – This terminal is the RTD negative sense input. It is connected to the same side of the RTD as DC common (excitation negative).

RTD + RTD positive sense input. It is connected to the same side of the RTD as RTD OUT (excitation positive).

RTD OUT This terminal provides a 2mA DC output (with respect to DC common) for RTD excitation.

Terminal block 5 (TB5) (See connection diagrams on pages 9-14.)

Communications, pressure input, and control inputs 1 & 2

RS-485 COM Communications common terminal. Not the same as DC common. Internally connected to DC common by a 100Ω resistor.

RS-485 – and RS-485 + Communications differential signal input and output.

PRES Positive terminal for the 4-20mA pressure input.

CNTRL INPUTS 1 & 2 These inputs are active when pulled down to DC common.

⏚ DC common. Same as DC common at terminal blocks 2 and 4.

Applications Wiring

On pages 9-16, find the diagram(s) relating to your application and wire accordingly.

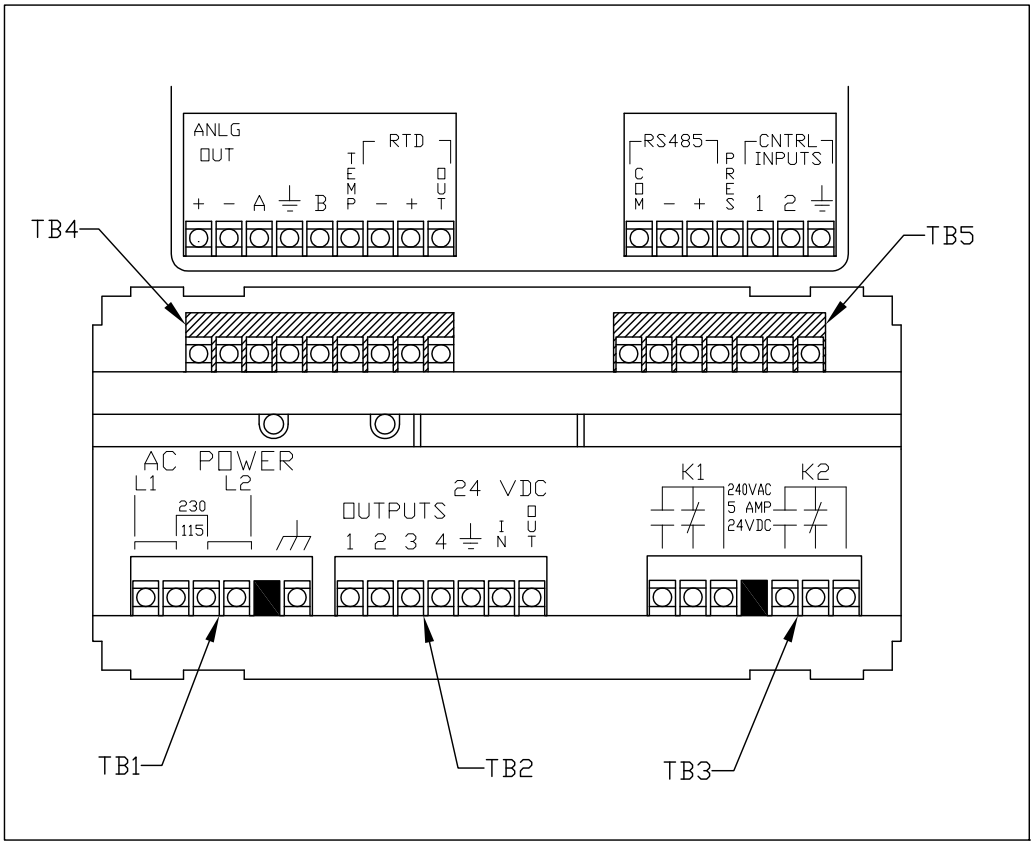
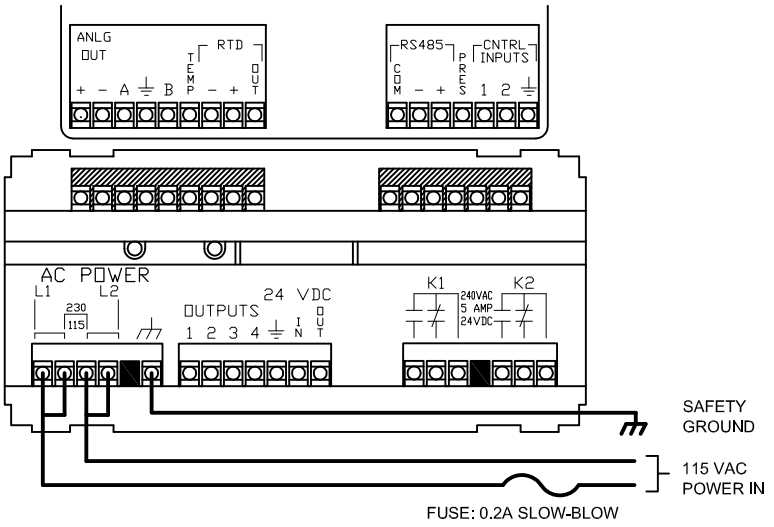


Figure 3. Wiring Terminal

115 VAC Power Input



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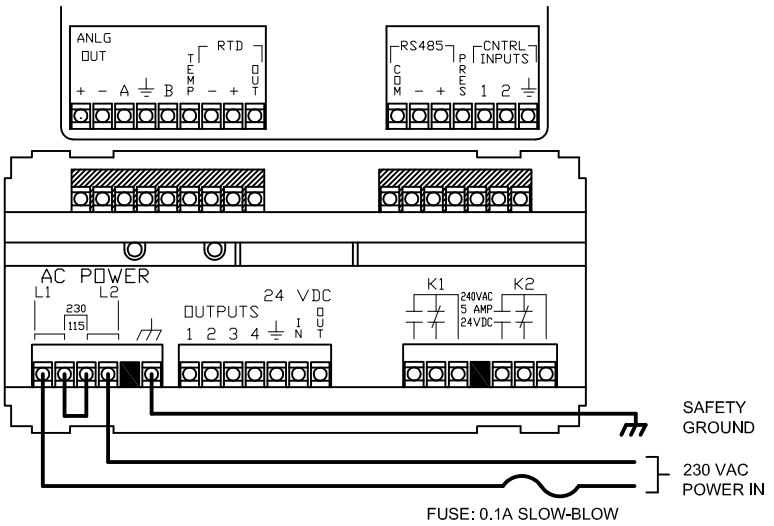
230 VAC Power Input



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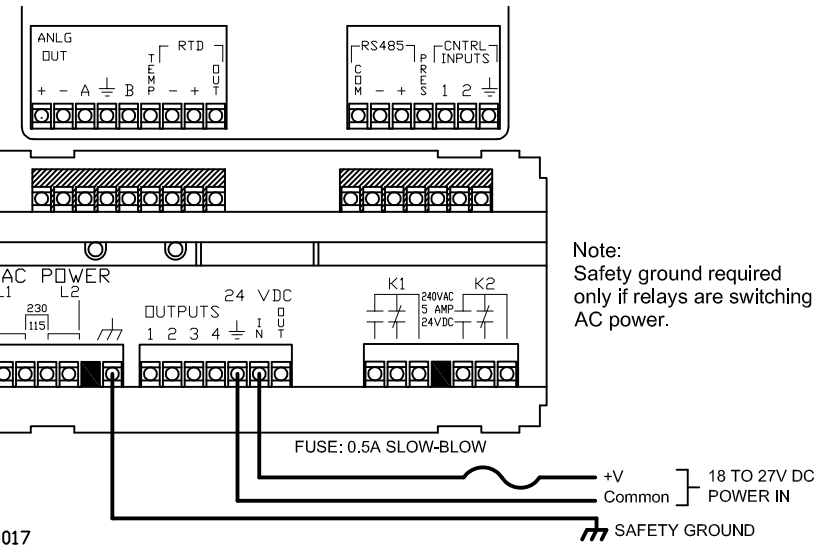
DC Power Input



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Flow Input Sensor with External Power Supply

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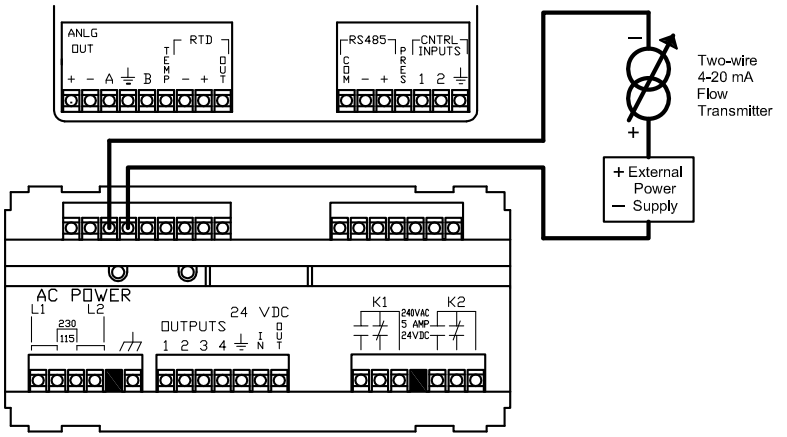
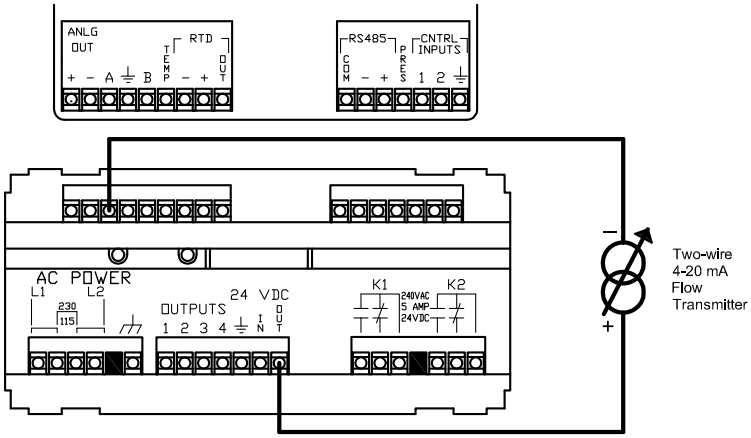


Do not connect the 24 VDC OUT terminal to the sensor if powered from another source.
The DC power required for the transmitter may be optionally obtained from an external power source or the 24 VDC OUT terminal of the Model 1530A. Be certain not to exceed the total current output capability of the 24 VDC OUT terminal (100 mA).
If using an external DC supply, connect the minus side of the supply to the DC common of the Model 1530A.

Flow Input Sensor with Control Power Supply (1530A powered)



The DC power required for the transmitter may be optionally obtained from an external power source or the 24 VDC OUT terminal of the Model 1530A. Be certain not to exceed the total current output capability of the 24 VDC OUT terminal (100 mA).

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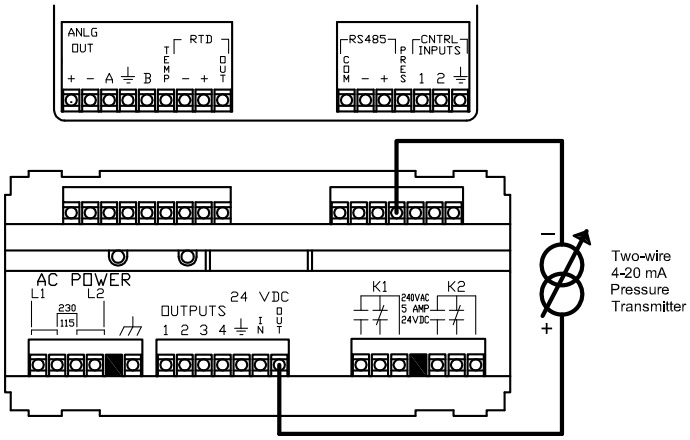
4-20 mA Pressure Input with Two-Wire Transmitter (1530A powered)



The DC power required for the transmitter may be optionally obtained from an external power source or the 24 VDC OUT terminal of the Model 1530A. Be certain not to exceed the total current output capability of the 24 VDC OUT terminal (100 mA).

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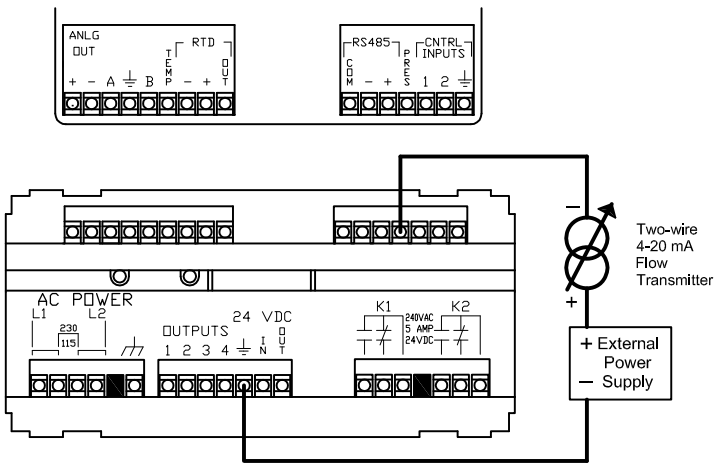
4-20 mA Pressure Input with Two-Wire Transmitter (Externally powered)



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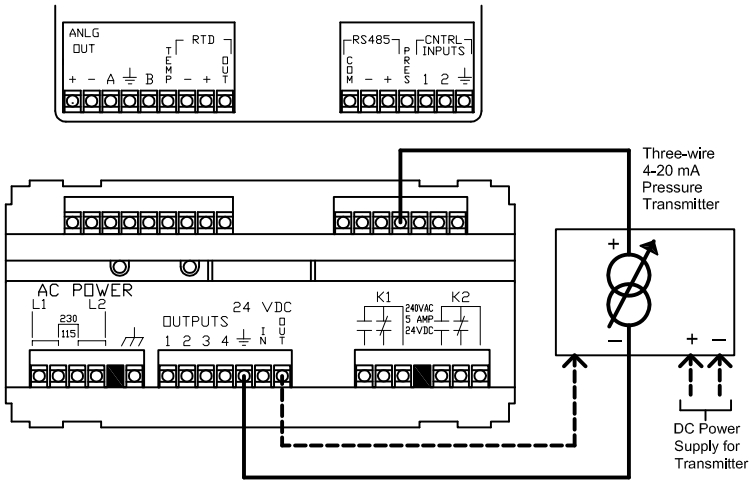
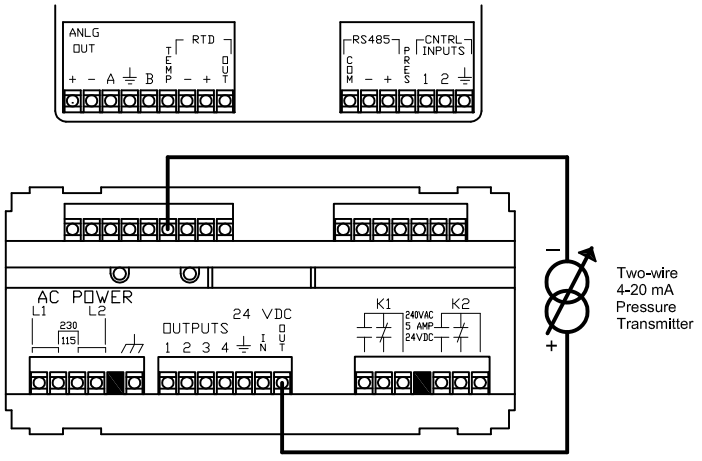
4-20 mA Pressure Input with Three-Wire Transmitter



The DC power required for the transmitter may be optionally obtained from an external power source or the 24 VDC OUT terminal of the Model 1530A. Be certain not to exceed the total current output capability of the 24 VDC OUT terminal (100 mA).
If using an external DC supply, connect the minus side of the supply to the DC common of the Model 1530A.

SK20017

4-20 mA Temperature Input with Two-Wire Transmitter (1530A powered)



The DC power required for the transmitter may be optionally obtained from an external power source or the 24 VDC OUT terminal of the Model 1530A. Be certain not to exceed the total current output capability of the 24 VDC OUT terminal (100 mA).

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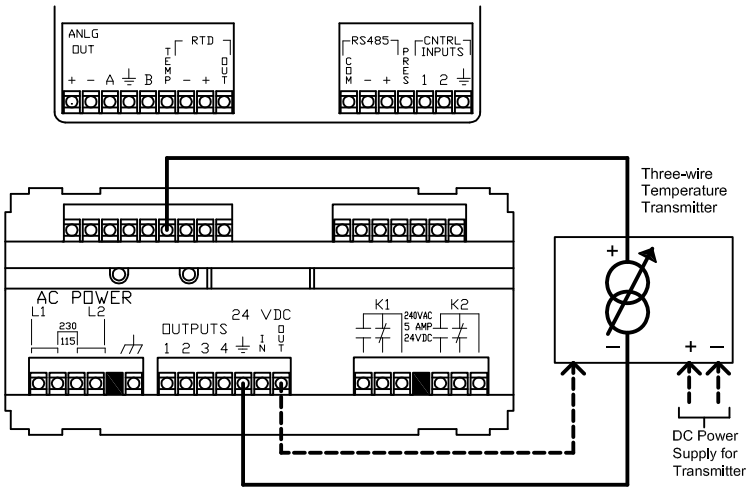
4-20 mA Temperature Input with Three-Wire Transmitter



The DC power required for the transmitter may be optionally obtained from an external power source or the 24 VDC OUT terminal of the Model 1530A. Be certain not to exceed the total current output capability of the 24 VDC OUT terminal (100 mA).
If using an external DC supply, connect the minus side of the supply to the DC common of the Model 1530A.

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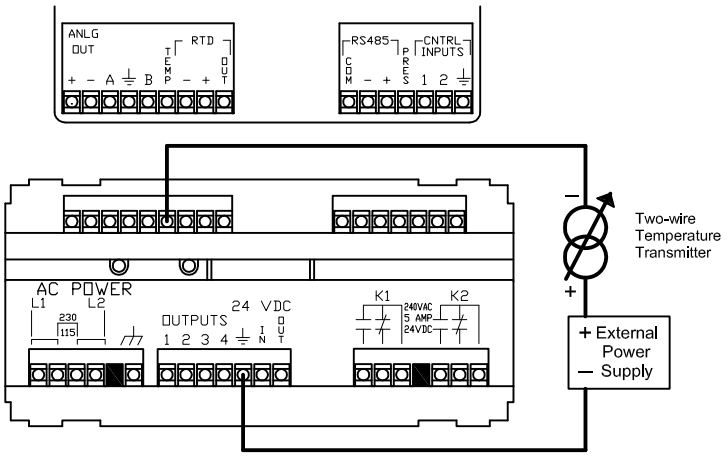
4-20 mA Temperature Input with Two-Wire Transmitter (Externally powered)



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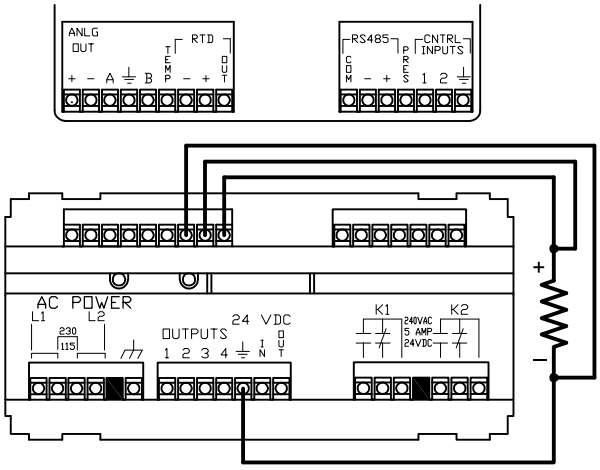
RTD Temperature Input



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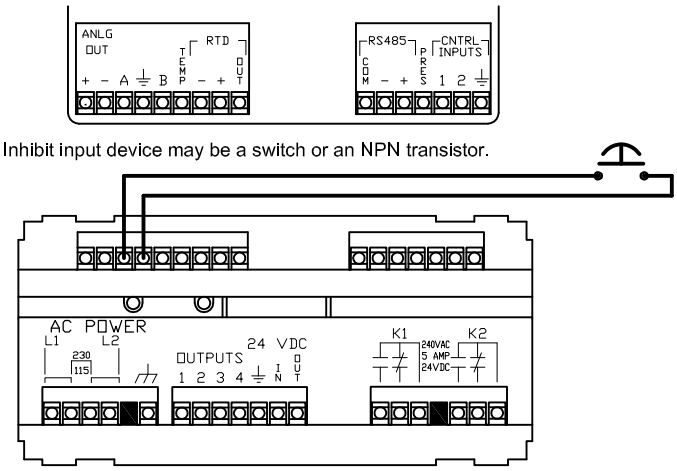
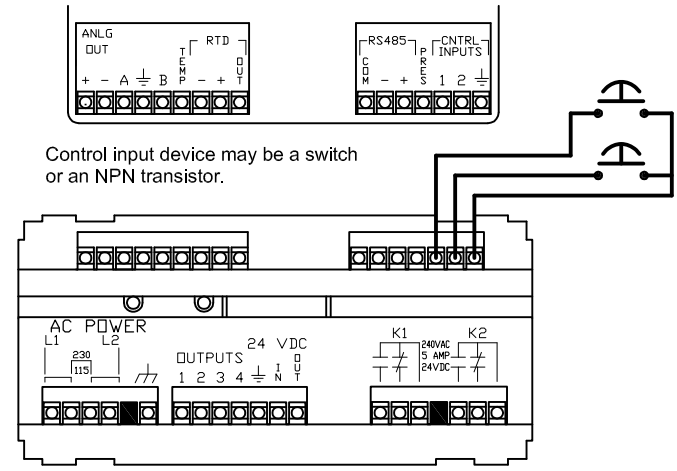
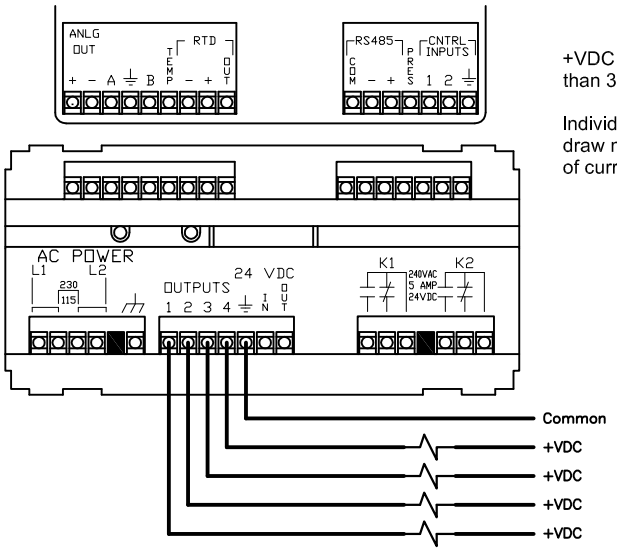
Control Input B (Inhibit input if so programmed)



Control Inputs 1 & 2



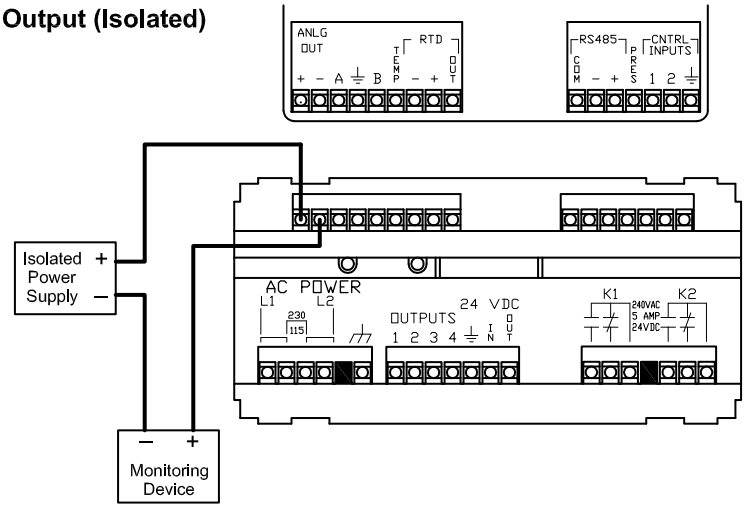
Transistor Outputs



+VDC may be no more than 30 VDC.

Individual loads must be not draw more than 150 mA of current.

Analog Output (Isolated)



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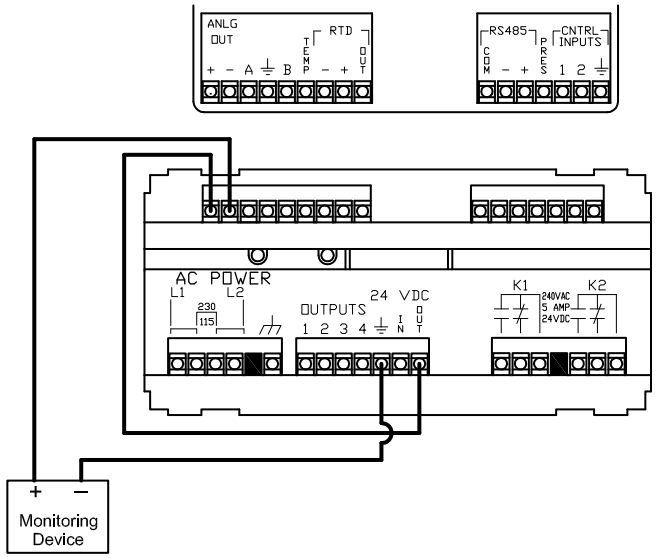
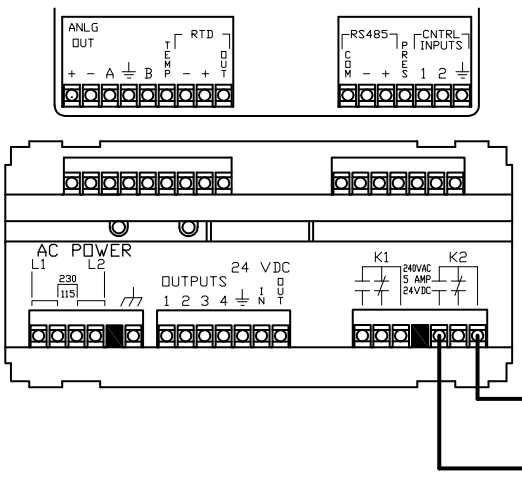
Analog Output (Non-Isolated)



The DC power required for the transmitter may be optionally obtained from an external power source or the 24 VDC OUT terminal of the Model 1530A. Be certain not to exceed the total current output capability of the 24 VDC OUT terminal (100 mA).

SK20017

Output Relay Contacts



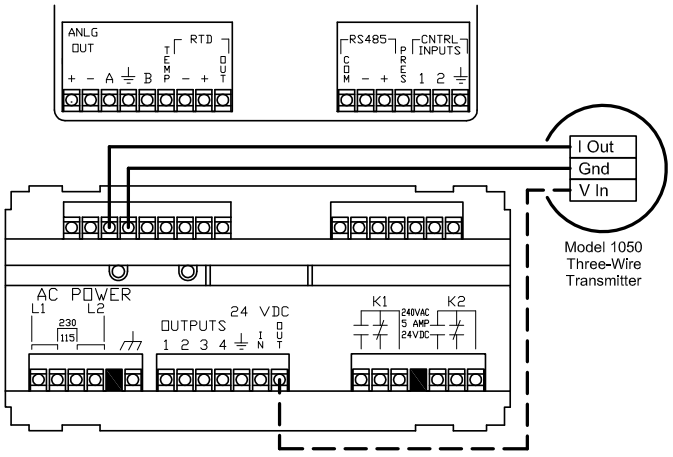
AC or DC for load
230 VAC or 30 VDC max.

Relay K1 wired in the same manner as relay K2.

An RC surge suppressor is recommended to place across the load to minimize transient voltages and extend relay contact life.

SK20017

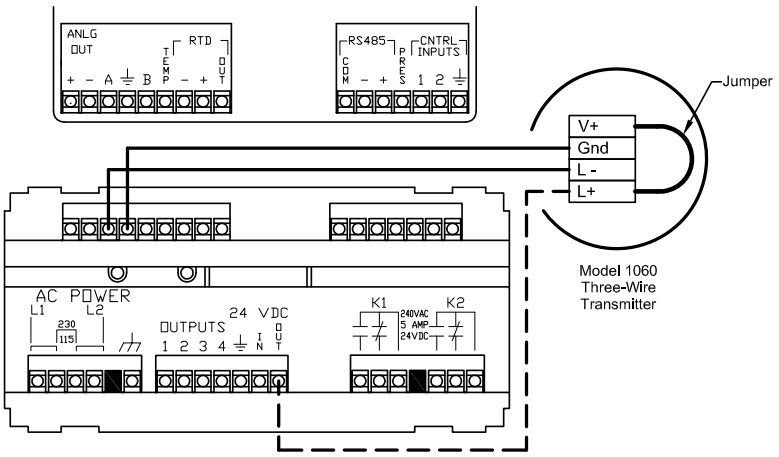
Connecting the Model 1050 (For use with strain gage target meter)



Do not connect the 24 VDC OUT terminal to the Model 1050 if Model 1050 is powered from another source.
Do not connect any other devices to the 24 VDC OUT when using the Model 1050.

SK20008

Connecting the Model 1060 (For use with strain gage target meter)



Do not connect the 24 VDC OUT terminal to the Model 1060 if Model 1060 is powered from another source.
Do not connect any other devices to the 24 VDC OUT when using the Model 1060.

SK20009

Note: If the Model 1530A was pre-programmed at the factory, do not complete the following steps unless you wish to change the programming.

The chart on pages 16 and 17 shows all the programming possibilities. Throughout the programming process, it is used as a map to find particular functions.

Entering the Programming Mode

Simultaneously press the < and > keys. If the unit has not been programmed with a password, the display will produce PROGRAM ?, and you may move directly into programming. The Model 1530A is always shipped from the factory without an assigned password.

If the display produces PASSWORD ?, you must enter the password by pressing the number keys that correspond to the programmed password. Press the ENT (enter) key. If the password is correct, PROGRAM ? will appear and you may proceed with programming.

If the password is incorrect, INVALID PASSWORD will appear and the unit will return to its normal running display mode. To try again, repeat pressing the < and > keys and enter the password. If a correct password is unavailable, call Aaliant to obtain a default password for the unit. There is also a separate default password that will wipe out all programmed information — but this would be like starting with a brand new Model 1530A in which all pertinent program parameters must be reentered.

During the password procedure the Model 1530A will remain in the run mode, continuing with computing functions. Once PROGRAM? is displayed, process monitoring will cease until the programming mode is exited.

Exiting the Programming Mode

Simultaneously press the < and > keys to obtain the PROGRAM ? display. Then press RESET to return the unit to its running mode.

Choosing a Programming Method

The Model 1530A may be programmed by either of two methods or a combination of both. The **sequential menu method** is the simplest and, in most cases, preferred. Once into the programming mode (indicated on the display by PROGRAM ?), main menu items are selected by pressing the ^ key, using the programming chart if necessary to locate the desired function. (All the main menu items begin with the lettering PROG.) Once the desired menu line is displayed, functions within that item are reached by successively pressing either the < or > key. Eventually the main menu line (containing PROG) will return, allowing access again to other main menu functions by pressing ^.

The **rapid access method** allows immediate access to a particular function by entering its row and column numbers shown on the programming chart. Another function may be accessed by first pressing < and > simultaneously, then entering the appropriate row and column numbers.

The sequential menu and rapid access programming methods may be used interchangeably during a programming session. They are simply different ways of accessing a program function.

On-Line Help Feature

When the display shows any submenu item, the HELP key may be pressed to produce information on how to enter data for that particular program function. The message will scroll across the display and automatically disappear at its completion, allowing the submenu item to return. If you do not need to read the entire message, pressing any key will return the submenu item to the display.

Programming Notes

- The < and > keys may be pressed simultaneously at any time during a programming session to return to the PROGRAM ? display. You may then proceed with programming or exit.
- Scrolling through the function menus will not change programmed data. The entry sequence required for a particular function must be performed in order to change the data. (These sequences are described later in this section.)
- If a certain function has multiple layers (see the programming chart), embedded layers are sometimes accessed by pressing the ^ key. In some cases, a step must be performed at the surface layer function before embedded layers may be accessed. Use the HELP key while programming a particular function to obtain details on function entry.
- A program settings chart (Figures 4 and 5) is included with every Model 1530A. This chart contains available program functions and their default settings. If your unit was preprogrammed at the factory, values that are different from the default values are shown in the "Programmed Setting" column.

PROG CALIBRATE

ANALOG OUT RATE

Set the mode for the analog output. The 4-20mA output may be used for rate, temperature, or pressure.

Help message: Use the ^ key to select the function of the analog output.

R @ 4 OUT 0.0

Dependent upon the mode (R, T, or P) selected in the step above, the active range of the analog output may be specified.

Help message: Use the ^ key to select the 4 or 20mA analog output point. Use the CLR key to enable a new entry. Use the 0-9 and ENTER keys to enter a new value.

4 MA OUT START ?

This step is used to calibrate the analog output. After the output is calibrated, it may be used to calibrate the analog inputs.

Help message: To calibrate the analog output, connect the analog output "+" terminal to the +24 VDC out. Connect the analog output "–" terminal to ground through a current meter. Press the CLR key. Use the < and > keys to adjust the output current to 4mA and then press the ENTER key to calibrate the output current to 4mA and then press the ENTER key. Use the ^ key to select the 20mA level and repeat the process. To calibrate the analog inputs using the output — connect the output "–" terminal thru the meter selected analog input instead of ground. After adjusting the output, press the RESET key and the 1 or 2 key to calibrate the input. The display will blank momentarily to indicate that the analog input has been calibrated. Press the ENTER key to calibrate the output and then repeat the process for 4 to 20mA.

P @ 4 MA 0.0PSI

This step is used to set the pressure range represented by the pressure analog input.

Help message: Use the ^ key to select the 4 or 20mA pressure analog input. Use the CLR key to enable a new entry. Use the 0-9 and ENTER keys to enter a new value.

P 4 MA IN END?

This step is used to calibrate the pressure input.

Help message: To calibrate the pressure analog input using a current source, set the input current to exactly 4mA and press RESET. The display will blank momentarily to indicate calibration for that level has been completed. Use the ^ key to select the 20mA level and repeat the process.

TEMP IN RTD

The temperature input may be either directly from an RTD or from a 4-20mA temperature transmitter. One of the two modes is selected in this step.

Help message: Use the ^ key to select whether the temperature input is 4-20mA or an RTD.

TEMP 1 32.0F

Note: This step is used only if the temperature input in the previous step was selected to be an RTD.

This step is used to calibrate the RTD input by using two precision resistors to represent an RTD at two different temperatures.

Help message: To calibrate the RTD input, connect a known precision resistance value to the RTD input. Use the CLR key to enable a new entry. Use the 0-9 and ENTER keys to enter the temperature at that resistance. Press RESET to scroll to the second temperature. Connect a second known precision resistance value to the RTD input. Use the CLR key to enable a new entry. Use the 0-9 and ENTER keys to enter the temperature at that resistance. Press RESET to complete calibration and return to the first temperature.

Note: The > key may be used to enter a negative (minus) sign.

TEMP @ 4 MA –200.0F

Note: This step is used only if the temperature input mode was selected to be 4-20mA.

This step is used to set the temperature range for the temperature input if the 4-20mA mode has been selected.

Help message: Use the ^ key to select the 4 or 20mA temperature analog input. Use the CLR key to enable a new entry. Use the 0-9 and ENTER keys to enter a new value.

T 4 MA IN END ?

Note: This step is used only if the temperature input mode was selected to be 4-20mA.

This step is used to calibrate the temperature input in the 4-20mA mode.

Help message: To calibrate the temperature analog input using a current source, set the input current to exactly 4mA and press RESET. The display will blank momentarily to indicate that calibration for that level is completed. Use the ^ key to select the 20mA level and repeat the process.

PROG TOTALIZER

DEC PT 0000000.0

This step is used to place a decimal point in the totalizer.

Help message: Use the 0-4 keys to select the decimal point location for the totalizer.

OUTPUT PULSE MED

The totalizer output pulse width may be selected from slow (SLO), medium (MED), and fast (FST). Note that a slower pulse width necessitates slower totalizer counting. The slow pulse width has a duration of 50 milliseconds; the medium, 2 milliseconds; and the fast, 125 microseconds.

Help message: Use the ^ key to select the speed of the totalizer pulse output.

T HEADER

Engineering units for the totalizer may be assigned using up to 3 alphanumeric characters.

Help message: Use the < and > keys to select which location to program. Use the ^ key to select the character for that location.

PROG RATEMETER

SMOOTHING 2

Rate readings may be dynamically averaged to make rate indication more stable and easier to read. Up to 40 readings may be averaged at a time. When smoothing is used, the response time of the rate indication is slowed. The analog output, which follows the rate indicator, is also smoothed.

Help message: Use the CLR key to enable a new entry. Use the 0-9 and ENTER keys to enter the number of rate calculations to average.

DEC PT 00000.0

The decimal point may be placed in the rate display with this step.

Help message: Use the 0-5 keys to select the decimal point location for the ratemeter.

R HEADER
The rate header may be specified in engineering units using up to 6 alpha-numeric characters. The available characters are: (blank), ", $, /, 0 through 9, and A through Z.

Help message: Use the < and > keys to select which location to program. Use the ^ key to select the character for that location.

PR0G I/O
OUT 1 TEMP LO
There are 5 outputs from the Model 1530A that may individually act upon 1 of 6 programmable conditions (or none). Three of the outputs are open-collector npn transistor type, designated as OUT 1, OUT 2, and OUT 3. Two of the outputs are SPDT (form C) relays, designated as K1 and K2. The 6 conditions that may be signaled as outputs from the Model 1530A are: rate low, rate high, temperature low, temperature high, pressure low, and pressure high. The output may also be programmed to be unused.

Help message: Use the 1-3 keys to select outputs 1 to 3, the 4 key to select the K1 output, or the 5 key to select the K2 output. Use the ^ key to select the function associated with the selected output.

OUT 1 ID OUT1
Each of the 5 outputs may have an associated label that may be customized with 4 alphanumeric characters for the purpose of function clarity. For example, for an output that is designated as a low pressure set point, instead of the label OUT 3, why not use P_LO? This way, some functional significance is given to the label.

Help message: Use the 1-3 keys to select outputs 1 to 3, the 4 key to select the K1 output, or the 5 key to select the K2 output. Use the < and > keys to select which location to program. Use the ^ key to select the character for that location.

OUT1 FOLLOWS
Each of the 5 outputs may be programmed to activate and deactivate by 3 different methods. These methods are called “follows,” “latched,” and “timed.” An output selected to act by the “follows” method will activate when a condition occurs and will deactivate itself when the condition ceases. A “latched” output will activate when the specified condition occurs, but will not deactivate until it is given a reset signal (either from the front panel or through a wired control input connection). When a “timed” condition occurs, the output will activate and remain activated for a certain period after the condition ceases or until a reset signal is received. The period is programmable from 0.01 to 99.99 seconds.

Note: To unlatch a “latched” or “timed” relay, the Model 1530A must receive an unlatch signal. This may occur from the RESET key of the front panel or by use of the wired control inputs (1, 2, or B). With either method, the function of the input must be programmed to unlatch that particular output. (See the CTRL FUNCTIONS below.)

Help message: Use the 1-3 keys to select outputs 1 to 3, the 4 key to select the K1 output, or the 5 key to select the K2 output. Use the ^ key to select the characteristic of the output. If timed, use the CLR key to enable a new entry. Use the 0-9 and ENTER keys to enter a new output time.

OUT1 OPEN
The setpoints may be changed from the front panel for each condition (such as rate high and low, pressure high and low, and temperature high and low). The front panel may be locked to prevent changing of these setpoints through programming. Each of the 5 output setpoints may be independently open or locked.

Help message: Use the 1-3 keys to select outputs 1 to 3, the 4 key to select the K1 output, or the 5 key to select the K2 output. Use the ^ key to select whether the setpoint associated with the output is open or locked.

CTRL 1 FUNCTIONS
Control input 1 allows external access to reset the totalizers or the setpoint outputs. Each function may be independently selected to reset or not upon activation of the control input. The functions that may take place are: reset the small totalizer, unlatch output 1, unlatch output 2, unlatch output 3, unlatch K1 relay output, unlatch K2 relay output, and reset the grand totalizer. See the control inputs section on page 29 for more details on use.

Help message: Use the ^ key to select the function of control input 1. Press the 1 key to enable that function or the 0 key to disable that function.

CTRL 2 FUNCTIONS
Control input 2 allows external access to reset the totalizers or the setpoint outputs. Each function may be independently selected to reset or not upon activation of the control input. The functions that may take place are: reset the small totalizer, unlatch output 1, unlatch output 2, unlatch output 3, unlatch K1 relay output, unlatch K2 relay output, and reset the grand totalizer. See the control inputs section on page 29 for more details on use.

Help message: Use the ^ key to select the function of control input 2. Press the 1 key to enable that function or the 0 key to disable that function.

CTRL B FUNCTIONS
Input B may act as a count inhibit input for the flowmeter or it may act as a control input (exactly like control inputs 1 and 2). Each function may be independently selected to reset or not upon activation of the control input. The functions that may take place are: reset the small totalizer, unlatch output 1, unlatch output 2, unlatch output 3, unlatch K1 relay output, unlatch K2 relay output, and reset the grand totalizer. See the control inputs section on page 29 for more details on use.

Help message: Use the ^ key to select the function of input B. Use the 1 key to enable or the 0 key to disable input B as count inhibit. If input B is disabled as count inhibit, use the ^ key to select the function of input B. Press the 1 key to enable that function or the 0 key to disable that function. If input B is enabled as count inhibit, all other functions are disabled.

RESET KEY FUNCTIONS
The front panel RESET key allows manual access to reset the small totalizer or the setpoint outputs. Each function may be independently selected to reset or not upon pressing the RESET key. The functions that may take place are: reset the small totalizer, unlatch output 1, unlatch output 2, unlatch output 3, unlatch K1 relay output, and unlatch K2 relay output. Resetting the grand totalizer is not a function available to this key.

Help message: Use the ^ key to select the function of the RESET key. Press the 1 key to enable that function or the 0 key to disable that function.

PRES ABSOLUTE
Pressure may be displayed in either absolute (psia) or gauge (psig) units. The units selection of the 2 is made at this step.

Help message: Use the ^ key to select the units of the pressure display and output functions, either gauge or absolute.

PROG METER
FLO @ 4 mA
This step is used to set the flow range represented by the flow analog input.

Help message: Use the ^ key to select the 4 or 20mA analog flow input. Use the CLR key to enable a new entry. Use the 0-9 and ENTER keys to enter a new value.

F 4 mA IN END ?
This step is used to calibrate the flow input.

Help message: To calibrate the flow analog input using a current source, set the input current to exactly 4mA and press the RESET key. The display will black momentarily to indicate that calibration for that level is completed. Use the ^ key to select the 20mA and repeat the process. (See Figure 6 for FLO @ 20mA calculations.)

CUTOFF I 4.00 mA
This step is used to set the low-flow current cutoff.

Help message: Use the CLR key to enable a new entry. Use the 0-9 and ENTER keys to enter a new cutoff current.

MODE IDEAL GAS
The Model 1530A can monitor mass flow of ideal gas, saturated steam, and superheated steam. The correct mode must be set so that the Model 1530A uses the proper equations during its operation.

Note: If the process mode is selected for ideal gas, then the display mode (see DISPLAY ACTUAL on page 25) may be selected as mass, actual, or standard. However, if the process mode is selected as saturated or superheated steam, then the display mode can only be mass.

Help message: Use the ^ key to select the mode of operation for the unit. If in steam mode, unit is locked in mass display mode.

SPEC GRAV 1.000

The specific gravity of the flow medium should be entered. This value should be that of the medium at standard temperature and pressure (.¹., 20° Centigrade, and 14.696 psi). If the steam mode is selected, the specific gravity of 1.000 will be used regardless of the value entered into this menu item. The menu item value will be used in the ideal gas mode only.

Help message: Use the CLR key to enable a new entry. Use the 0-9 and ENTER keys to enter a new specific gravity.

1. Refer to the table below to find the number of the equation to use for your application.

	Ideal Gas			Saturated or Superheated Steam
	Standard	**Actual**	**Mass**	**Mass**
Target meter	1	3	5	7
Linear meter	2	4	6	8

2. Use the appropriate equation and values below to calculate your FLO @ 20 mA.

Equation 1

$$\text{FLO @ 20 mA} = \frac{S_{cfm}}{\sqrt{F1}}$$

Equation 2

$$\text{FLO @ 20 mA} = \frac{S_{cfm}}{F1}$$

Equation 3

$$\text{FLO @ 20 mA} = (A_{cfm})(\sqrt{F1})$$

Equation 1

$$\text{FLO @ 20 mA} = A_{cfm}$$

Equation 5

$$\text{FLO @ 20 mA} = \frac{(P_{ph})(\sqrt{F1})}{(60)\,D_G}$$

Equation 6

$$\text{FLO @ 20 mA} = \frac{P_{ph}}{(60)(D_G)}$$

Equation 7

$$\text{FLO @ 20 mA} = \frac{P_{ph}}{(14.99145)(\sqrt{D_s})}$$

Equation 8

$$\text{FLO @ 20 mA} = \frac{P_{ph}}{(60)(D_s)}$$

A_{cfm} = full scale actual cubic feet per minute of the flowmeter
S_{cfm} = full scale standard cubic feet per minute of the flowmeter
D_s = density; i.e., 1 ÷ specific volume
P_{ph} = full scale flow rate in pounds per hour

$$F1 = \frac{519.67 \times P_A}{14.696 \times T \times C}$$

$$D_G = \frac{2.698825 \times \text{spec. grav.} \times P_A}{C \times T}$$

where: P_A = absolute pressure; i.e., gauge pressure + 14.696
T = temperature in °F + 459.67
C = 1 for target meters or the compressibility factor for linear meters

*If necessary to convert from acutal conditions to standard conditions or vice versa, see “Correction Factors” box on next page.

Figure 6. Calculating the FLO @ 20mA

Correction Factors for Volumetric Gas Flow Rate

A flowmeter calibrated for use with a specified gas at given conditions of temperature and pressure can often be used to measure the flow rate when the operating conditions are changed. A change to a different gas can often be accommodated also. There are three limitations:

1. Do not apply higher pressures and/or higher temperatures that are beyond the limits of the flowmeter's internal design and the end connections' ratings. Check the flowmeter data sheet.
2. When the operating gas pressures exceed 100 psig, the ideal gas lows do not apply, and the equations below must be modified by a super-compressibility compression factor. Refer to standard handbooks covering gas flows or call the factory.
3. The new operating conditions must not cause the indicated flow rate to go beyond the original flow range. If it would, check with the factory to have the flowmeter rearranged.

Gas flow rates (at a given operating temperature and pressure) can be expressed in either standard cubic feet per minute (Scfm) or actual cubic feet per minute (Acfm). Scfm is a standard reference and indicates the flow rate in cubic feet per minute if the same weight of gas had been flowing at the "standard" conditions of 14.696 psia and 60°F (or 519.67°R)*.

When the flow being measured uses a different gas or the operating conditions are changed, the indicated flow rate must be multiplied by a correction factor to get the new flow rate. Choose the correction factor from the equations below, depending on the units used in the original calibrations and the units desired for the new flow rate.

Original in S_{cfm}, new in S_{cfm}:

$$V_2 = V_1\sqrt{(G_1 \div G_2)(P_2 \div P_1)(T_1 \div T_2)(Z_1 \div Z_2)}$$

Original in A_{cfm}, new in A_{cfm}:

$$V_2 = V_1\sqrt{(G_1 \div G_2)(P_1 \div P_2)(T_2 \div T_1)(Z_2 \div Z_1)}$$

Original in S_{cfm}, new in A_{cfm}:

$$V_2 = V_1\ (14.696 \div 519.67)\sqrt{(G_1 \div G_2)(T_1 \div P_1)(T_2 \div P_2)(Z_1 Z_2)}$$

Original in S_{cfm}, new in A_{cfm}:

$$V_2 = V_1\ (519.67 \div 14.696)\sqrt{(G_1 \div G_2)(P_1 \div T_1)(P_2 \div T_2)(1 \div Z_1 Z_2)}$$

V_1 = Indicated volumetric flow rate (equal to true flow rate at original calibration)
V_2 = Volumetric flow rate at new conditions
G_1 = Specific gravity of original gas
G_2 = Specific gravity of new gas
P_1 = Original pressure of gas at operating conditions (psia)
P_2 = New pressure of gas at operating conditions (psia)
T_1 = Original temperature of gas at operating conditions (°R)*
T_2 = New temperature of gas at operating conditions (°R)*
Z_1 = Original compressibility factor
Z_2 = New compressibility factor

* °R = degrees Rankin = °F + 460

COMP FACT 1.0000

The gas compressibility factor (also known as the Z factor) of 1.0000 may be entered if the expected operating pressure is less than 100 psi. This constant, which may range from 0.0001 to 100000, is used only in calculations for gases. It is not used for steam. When needed, the factor is normally provided by the factory and is based upon the particular gas, temperature and the pressure operating ranges.

Note: If the Model 1530A has been programmed to compute the mass of saturated or superheated steam, the compressibility factor is not used in calculations, and any value entered will be ignored.

Help message: Use the CLR key to enable a new entry. Use the 0-9, DP, and ENTER keys to enter a new compressibility factor.

ATMOS 14.696 PSI

The standard atmospheric pressure should be entered. At sea level this value is 14.696 psi. This pressure may be changed, depending upon location.

Help message: Use the CLR key to enable a new entry. Use the 0-9 and ENTER keys to enter a new atmospheric pressure.

STEAM DENS TEMP

For saturated steam, it is not absolutely necessary to have both temperature and pressure inputs. The steam density will be taken from steam tables based upon either the pressure or temperature. TEMP or PRES should be selected for this menu item based upon which input is actually present. For superheated steam, you must have both temperature and pressure inputs for accurate readings. This menu item will be ignored if ideal gas mode has been selected.

Help message: Use the ^ key to select whether steam density is calculated from the temperature input or the pressure input.

TEMP INPUT ON

It is not absolutely necessary to have a temperature transducer input if the temperature of a system is constant. In the case that no temperature sensor is present or a sensor has failed and has not been replaced, disable the temperature input by selecting “0” and input a “base” temperature by selecting “^”. This temperature will be used by the Model 1530A in all required calculations. In the case that no temperature transducer is required or the temperature transducer has failed, the Model 1530A should be programmed to have a 4-20mA input and the temperature input should be turned off. The normal operating temperature must be entered as the base temperature. This functionality is also useful for simulating a temperature condition for verification purposes. Also, when no temperature input is connected, a temperature error will be reported unless this TEMP INPUT is turned off.

Help message: Use the “1” key to enable the temperature input or the “0” key to disable the input. Use the “^” key to program a base temperature to use when the input is disabled. Use the “CLR” key to enable a new entry. Use the “0 - 9” and “Enter” keys to enter a new base temperature.

PRES INPUT ON

It is not absolutely necessary to have a pressure transmitter input if the pressure of a system is constant. In the case that no pressure transmitter is present or a sensor has failed and has not been replaced, disable the pressure input by selecting “0” and input a “base” pressure by selecting “^”. This pressure will be used by the Model 1530A in all required calculations. In the case that no pressure transducer is required or the pressure transducer has failed, the Model 1530A should be programmed to have a 4-20mA input and the pressure input should be turned off. The normal operating pressure must be entered as the base pressure. This functionality is also useful for simulating a pressure condition for verification purposes. Also, when no pressure input is connected, a pressure error will be reported unless this PRES INPUT is turned off.

Help message: Use the “1” key to enable the pressure input or the “0” key to disable the input. Use the “^” key to program a base pressure to use when the input is disabled. Use the “CLR” key to enable a new entry. Use the “0 - 9” and “Enter” keys to enter a new base pressure.

PROG OTHER

UNITS ENGLISH

Select whether the desired engineering units displayed are English or metric. During programming, this step may be used several times (depending upon the units of the input parameters) to enter parameters without having to calculate English-to-metric or metric-to-English conversions.

Help message: Use the ^ key to select whether the unit of measure is English or metric.

PASSWORD 000000

The Model 1530A may be secured so that programmed information cannot be changed unless a password is entered before a programming session. The default password of 000000 will allow programming mode entry without requesting a password.

Note: If a programmed password has been forgotten, a special “backdoor” password has been reserved. Consult your Aaliant representative or the factory if this password is needed.

Help message: Use the CLR key to enable entry. Use the 0-9 and ENTER keys to enter a new password.

BAUD 9600 EVEN

Communication information necessary for the RS-485 link may be programmed in this step and the next. The baud rate may be 300, 600, 1200, 4800, 9600, or 19200. Parity may be even, odd, or “space” (none).

Help message: Use the CLR key to enable entry. Use the 0-9 and ENTER keys to enter the communication baud rate. Use the ^ key to select odd, even, or space parity.

ID 0 TIME 100

The remaining communication information necessary for the RS-485 link may be programmed in this step. Each unit on the communication line must have a unique identification number from 0 to 255. The response time must also be specified as 0, 10, 100, or 500 milliseconds (“10” represents one-hundredth of a second, “100” represents one-tenth of a second, and “500” represents one-half of a second). Choose the response time according to the desired urgency in reporting.

Help message: Use the CLR key to enable entry. Use the 0-9 and ENTER keys to enter the unit identity number from 0 to 255. Each unit on the communication link must have a unique number. Use the ^ key to select the minimum communication response time.

MODE - SAT STEAM

The calculation mode may be selected to use saturated steam, superheated steam, or ideal gas law equations.

Help message: Use the ^ key to select the mode of operation of the unit.

DISPLAY ACTUAL

The flow rate displayed may be the actual rate, the standard rate (relative to an equivalent rate at standard temperature and pressure), or the mass flow rate (pounds or kilograms per unit time) for ideal gases. If the unit is set up for saturated steam or superheated steam, only mass rate can be displayed.

Help message: Use the ^ key to select the display and output parameter. If unit is in steam mode, then it is locked in mass display mode.

A metering factor based on the meter type (target or linear), flow medium (ideal gas, saturated steam, or superheated steam), and display mode (actual, standard, or mass) must be used when programming meter functions. This factor is typically called the K factor, but in the case of the Model 1530A, it is referred to as FLO @ 20mA. If the factory has not calculated the FLO @ 20 mA for you — or if you plan to reprogram the meter type — turn to Figure 6 and calculate this value. The correct FLO @ 20 mA must be at hand while programming meter functions.

METER LINEAR

Flowmeter type may be linear or target. Select target for use with our strain gage target meter. Select linear for use with a turbine or vortex shedding meter. Also select linear for a square-root-extracted signal from an orifice plate meter.

Note: The help message cautions the changing of meter type. To avoid problems, always select the meter type first, then program the FLO @ 20 mA. If the meter type has been changed, check the FLO @ 20 mA to make sure it is still correct.

Help message: Use the ^ key to select the type of flowmeter used.

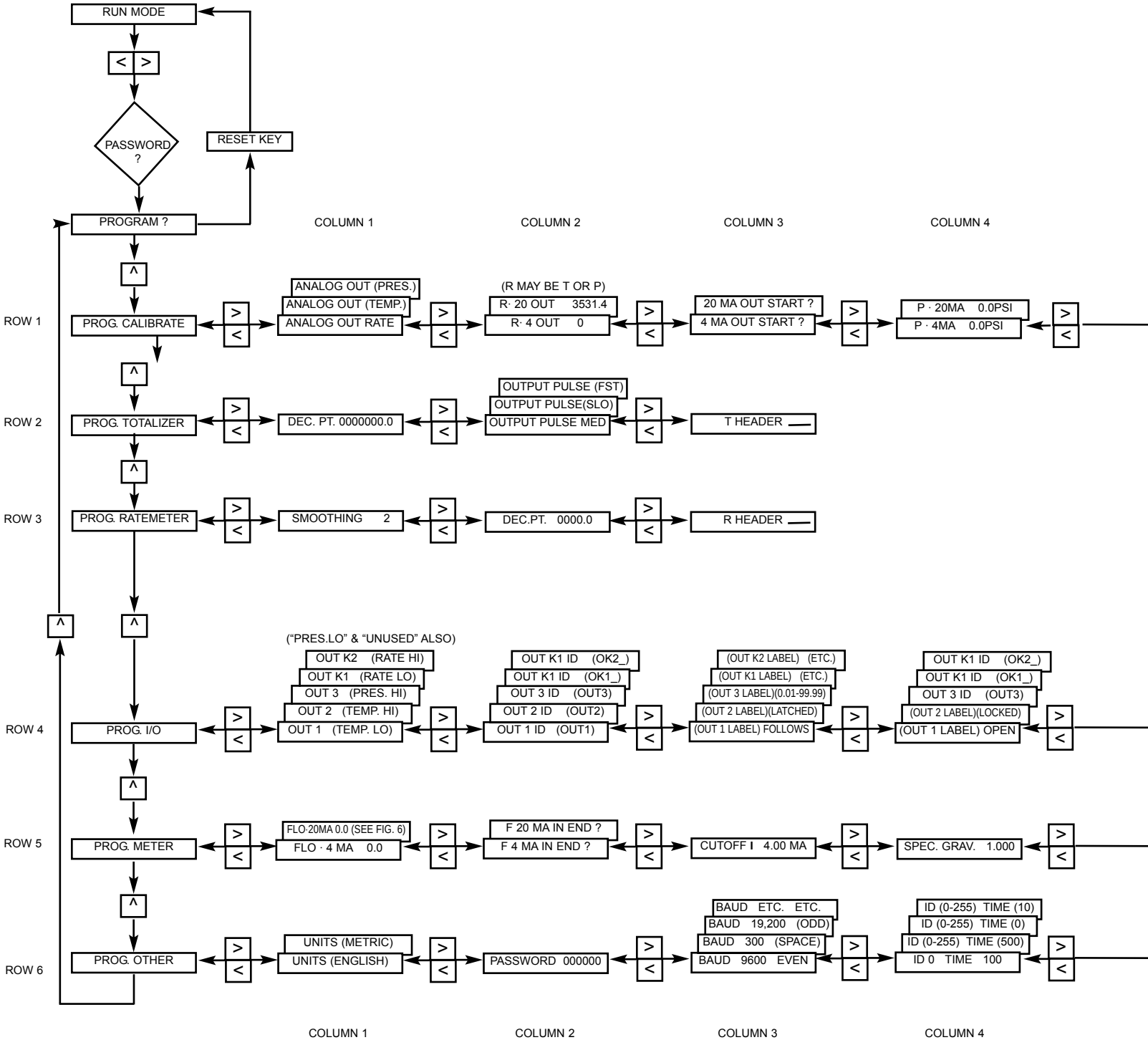
Warning — *changing the meter type may change the FLO @ 20 mA value.*

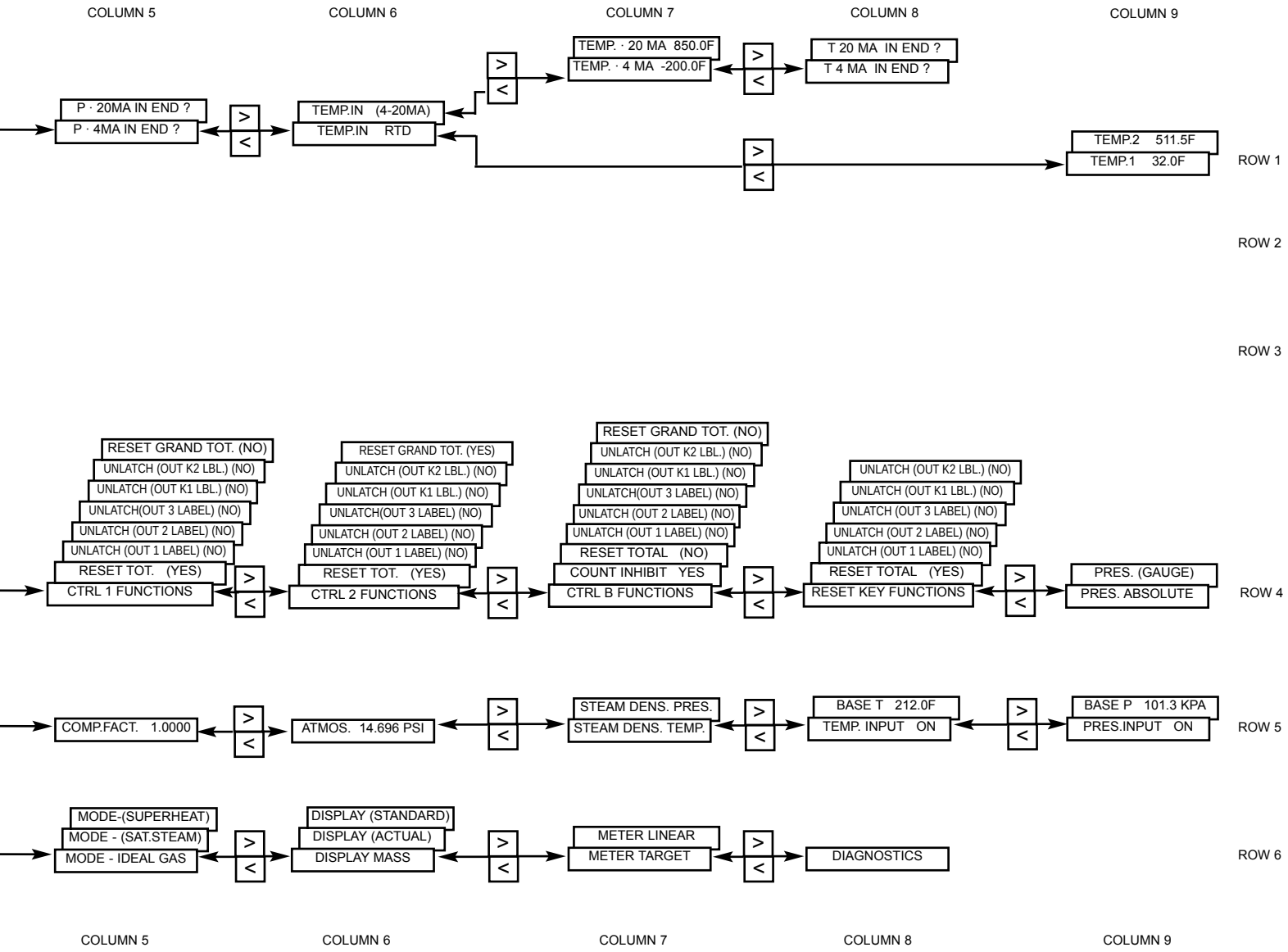
DIAGNOSTICS

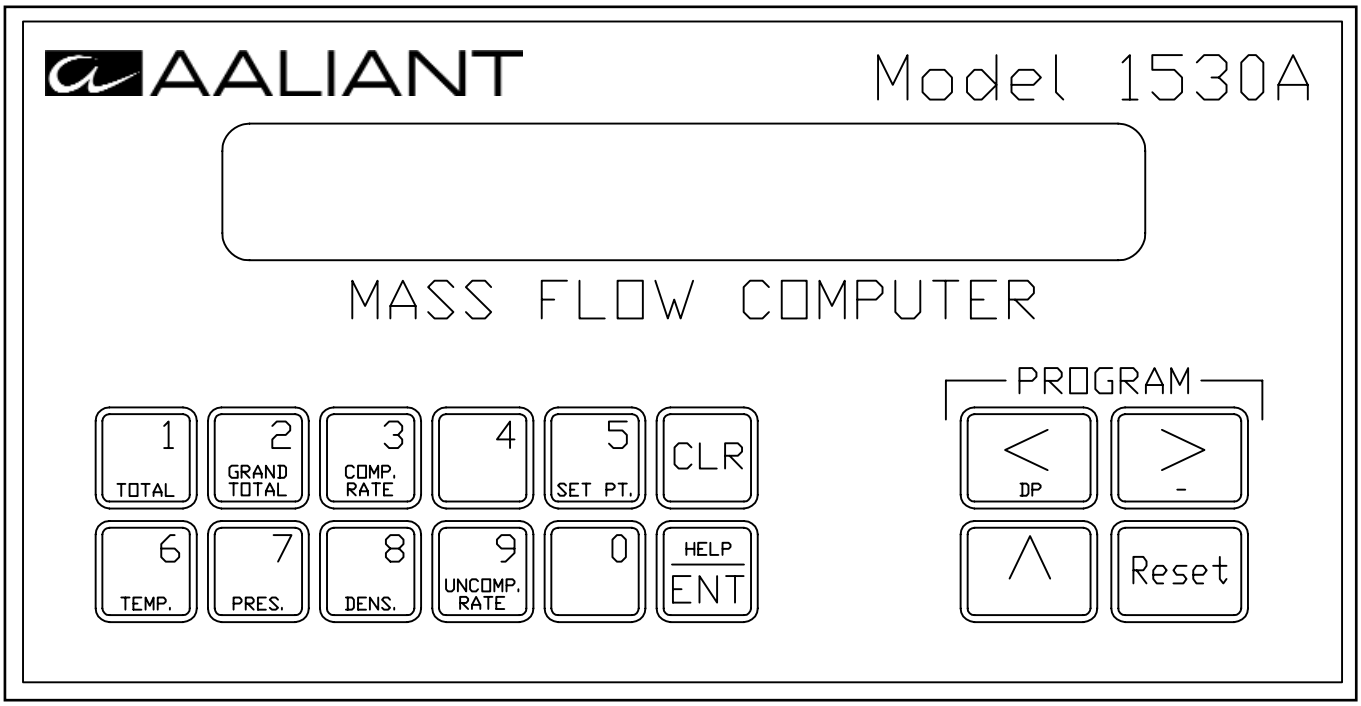
Diagnostics may be used to check the software version and the display and circuits of the microprocessor inside the Model 1530A. The first step checks the software version. The second and third steps — respectively displaying all 8’s and decimal points, then all asterisks — check the vacuum-florescent display to make sure no segments are missing. The fourth step, displaying TEST IN PROGRESS, checks the microprocessor circuits. The display will read SYSTEM TEST OK if the circuit test is successful, automatically returning to DIAGNOSTICS at the conclusion of testing.

Help message: Press the ^ key 4 times to sequence through the display tests and start the diagnostic routine.

Programming Chart




COLUMN 5
COLUMN 6
COLUMN 7
COLUMN 8
COLUMN 9
P · 20MA IN END ?
P · 4MA IN END ?
TEMP.IN (4-20MA)
TEMP.IN RTD
TEMP. · 20 MA 850.0F
TEMP. · 4 MA -200.0F
T 20 MA IN END ?
T 4 MA IN END ?
TEMP.2 511.5F
TEMP.1 32.0F
ROW 1
ROW 2
ROW 3
RESET GRAND TOT. (NO)
UNLATCH (OUT K2 LBL.) (NO)
UNLATCH (OUT K1 LBL.) (NO)
UNLATCH(OUT 3 LABEL) (NO)
UNLATCH (OUT 2 LABEL) (NO)
UNLATCH (OUT 1 LABEL) (NO)
RESET TOT. (YES)
CTRL 1 FUNCTIONS
RESET GRAND TOT. (YES)
UNLATCH (OUT K2 LBL.) (NO)
UNLATCH (OUT K1 LBL.) (NO)
UNLATCH(OUT 3 LABEL) (NO)
UNLATCH (OUT 2 LABEL) (NO)
UNLATCH (OUT 1 LABEL) (NO)
RESET TOT. (YES)
CTRL 2 FUNCTIONS
RESET GRAND TOT. (NO)
UNLATCH (OUT K2 LBL.) (NO)
UNLATCH (OUT K1 LBL.) (NO)
UNLATCH(OUT 3 LABEL) (NO)
UNLATCH (OUT 2 LABEL) (NO)
UNLATCH (OUT 1 LABEL) (NO)
RESET TOTAL (NO)
COUNT INHIBIT YES
CTRL B FUNCTIONS
UNLATCH (OUT K2 LBL.) (NO)
UNLATCH (OUT K1 LBL.) (NO)
UNLATCH (OUT 3 LABEL) (NO)
UNLATCH (OUT 2 LABEL) (NO)
UNLATCH (OUT 1 LABEL) (NO)
RESET TOTAL (YES)
RESET KEY FUNCTIONS
PRES. (GAUGE)
PRES. ABSOLUTE
ROW 4
COMP.FACT. 1.0000
ATMOS. 14.696 PSI
STEAM DENS. PRES.
STEAM DENS. TEMP.
BASE T 212.0F
TEMP. INPUT ON
BASE P 101.3 KPA
PRES.INPUT ON
ROW 5
MODE-(SUPERHEAT)
MODE - (SAT.STEAM)
MODE - IDEAL GAS
DISPLAY (STANDARD)
DISPLAY (ACTUAL)
DISPLAY MASS
METER LINEAR
METER TARGET
DIAGNOSTICS
ROW 6
COLUMN 5
COLUMN 6
COLUMN 7
COLUMN 8
COLUMN 9



TOTAL (Key 1)
Displays the small total. The display shows “TOT,” up to eight (8) digits of totalization, and the three (3) characters of the programmed header for totalization. This total may be reset from the front panel or by use of the control inputs if programmed to do so.

GRAND TOTAL (Key 2)
Displays the grand total. The display shows “T,” up to ten (10) digits of totalization, and the three (3) characters of the programmed header for totalization. The grand total may not be reset from the front panel, but only by use of the control inputs if programmed to do so.

COMP. RATE (Key 3)
Displays the compensated flow rate. Compensated means that the flow rate indicated takes into consideration the effects of temperature and/or pressure. The display shows “RAT,” up to six (6) digits of rate indication, and up to six (6) characters of the programmed rate header. The rate indication may be smoothed for erratic flow conditions.

SET PT. (Key 5)
Used to view the set points for the three (3) transistor outputs and the two (2) relay outputs. Pressing this key will initially show the set point for output transistor 1. To scroll through the set points for the other four (4) outputs, simply press the ^ key repeatedly. Displayed will be the four (4) character label (if programmed) for that output, the set point value, and the applicable units for the set point. (The default label will be displayed if a descriptive label has not been programmed.)

Each set point may be programmed to be “open” or “locked” to front panel value changing. If the set point has been programmed to be open, the value may be changed by first pressing the set point key. Then, scroll to the desired set point by pressing the ^ key. Press the CLR key. Enter the new set point with the “0” through “9,” the “DP” key (decimal point key), and the “-” key (minus sign key under program). Then press the ENT key (enter key) to end the set point entry process.

TEMP. (Key 6)
Displays the current process temperature, the programmed default temperature, or the relative process temperature from the steam tables if no temperature input is present. The display will show the “TEMP.” header, the temperature up to 9999.9 with a negative sign (if applicable), and “F” or “C” dependent whether English or metric display units have been chosen.

PRES. (Key 7)
Displays the current process pressure, the programmed default pressure, or the relative process pressure from the steam tables if no pressure input is present. The display will show the “PRES.” header, the pressure up to 9999.9, and units of absolute or gauge pressure.

DENS. (Key 8)
Displays the computed density of the flow medium based upon the process temperature and/or pressure. Displayed is a header of “D,” the density with 4 decimal digits of precision, and English or metric units (“LB/CF” or KG/CM”).

CLR
Clear key. Used when entering set point values in the run mode or many other values in the program mode. Before entering a numeric value in either mode, pressing the CLR key will begin an entry sequence. This is usually followed by the entry of combinations of numbers, decimal point, negative sign, and finally, the ENT key.

HELP/ENT
Help and/or Enter key. Used as the ENT (enter) key when entering set point values in the run mode or other values in the program mode. Used to complete an entry sequence.

In the programming mode, if help is needed on how to program a certain value, pressing the HELP key will cause a message to scroll across the display with information on programming the function. The display will return to the function after the message has completed or the message can be preempted by pressing HELP again before message completion.

RESET
The function of the RESET key may be programmed to perform a variety of resets or to have no function at all. It may be programmed to reset the small totalizer, or to unlatch any of the set point output alarms. It cannot be used to reset the grand total. RESET may be used to perform a single or any combination of these functions.

“<” and “>”
When in the run mode, < and > will do nothing by themselves. By pressing < and > simultaneously, the program mode will be entered. If a password has been programmed, it must be entered correctly before proceeding in the program mode. < and > are used for scrolling through the programming menus in the program mode.

“^”
When in the run mode, ^ does nothing unless you have selected SET POINTS for display, in which case ^ will scroll through the set point values. In the program mode, ^ is used for scrolling through the programming menus and selecting certain program parameters.

Process Inputs

Flow
The input signal from the flowmeter must be a 4-20mA current loop. The signal must be sent to the Model 1530A from a strain gage target flowmeter or a linear meter.

Pressure
The pressure input signal must be a 4-20mA current loop. It may be from an “absolute” or “gauge” pressure transmitter. The pressure range represented by the 4 and 20mA signals must be known. The pressure input is actually optional. That is, if the pressure of a process is constant, then the pressure value may be programmed into the Model 1530A, and no pressure transmitter will be required.

Temperature
The temperature input signal may be a 4-20mA current loop or an RTD. If a current transmitter is used, then the temperature represented by the 4 and 20mA signals must be known. If an RTD is used, then two (2) resistors of known value must be used to calibrate the unit to the sensor. The temperature input is optional, also. If the temperature of a process is constant, then the temperature value may be programmed in to the Model 1530A and no temperature sensor or transmitter will be required.

Control Inputs
There are 3 control inputs that may be wired to perform various reset functions in the Model 1530A. These may function similarly to the RESET key on the front panel. These control inputs are internally pulled high with a 5.8 Ký resistor to +5 VDC. To activate the inputs, the terminals must be pulled down to DC common by a switch to ground or electronically (npn transistor to ground).

Control Inputs “1” and “2” operate similarly. They may be used to reset the small totalizer, reset the grand total, or unlatch set point alarm outputs. Note that if a set point alarm output is unlatched, it will relatch immediately if the alarm condition persists. Control outputs cannot be used as “silence” controls. The control inputs may be programmed to reset or unlatch any combination of the counts or the alarm outputs or to perform no function at all.

Control Input “B” may be used similarly to Control Inputs 1 and 2 with a special qualifier added. Control Input B may be used to inhibit the Model 1530A from counting the flow signal it receives at Input A. If the count inhibit feature is selected, then that is all Control Input B may be used for. If Control Input B is not used as count inhibit, then it may be programmed to perform all functions similar to Control Inputs 1 and 2.

Set Point Alarm Outputs
There are 3 transistorized outputs (outputs 1, 2 and 3) and 2 relay outputs (relays K1 and K2) that may be programmed to operate dependent upon process conditions. The menu of process conditions includes flow rate low, flow rate high, temperature low, temperature high, pressure low, and pressure high. They may also be programmed to perform no function at all. All five of the outputs have 4-character header that may be altered to read a meaningful label such as “T LO” for low temperature or “R HI” for rate high.

The outputs may be individually programmed to turn on and off in any of the three different manners. They may “follow” the process condition — turning on and off automatically as the process condition changes. They may “latch” or turn on until a control unlatch occurs (through the control inputs or the reset key). This may be handy as an indicator that some maximum temperature, pressure, or flow rate has been exceeded. The third manner is to operate as “time latched.” With this method, a turn on time is selected from 0.01 to 99.99 seconds. When an alarm condition occurs, the output will activate. When the condition ceases, the output will remain latched for the present amount of time unless a control unlatch occurs. The three transistor outputs are open-collector npn transistors that are tied to DC common through the emitter. They may switch any DC voltage up to 27 VDC. They may be used to operate external relays, turn on lights or audible annunciators, or send a logic signal to a computer.

The two relay outputs are single-pole-double-throw (SPDT) (form C) contacts. They may be used to switch AC or DC voltages within their operating specifications.

Entering Set Points
To change the value for any used setpoint, providing it has not been locked by programming, press the SET PT key and then press the key until that setpoint appears on the display. Use the CLR, “-” (minus), 0 through 9, DP (decimal point), and ENT keys to enter a new setpoint value. Set points may be locked in the Program Mode so they cannot be changed in the Run Mode.

Totalizer Pulse Output
Output 4 is a totalizer pulse output that may be used for remote totalization or as input to another computer. The output is an open-collector npn transistor like the control outputs. The output pulse width may be programmed to be 120 µsec, 2 msec, or 50 msec, with maximum frequencies of 4000 Hz, 250 Hz, and 10 Hz, respectively. A pulse is output for every count that appears on the totalizer.

Analog Output
The Model 1530A has an analog output in the form of 4-20mA current loop. This output may be programmed to follow rate, temperature, or pressure. The process variable maximum and minimum limits are programmed to suit the user. Calibration of the analog output is performed through the front panel. There are no potentiometers to turn or hardware jumpers to move. The analog output is optically isolated. It may be driven by the 24 VDC OUTPUT (see accessory power below) or by an external source. Using the 24 VDC OUTPUT deisolates the loop.

Accessory Power

If the Model 1530A is powered with an ac supply, 24 VDC will be generated and available at the 24 VDC OUT terminal for powering accessories. The 24 VDC supply is regulated at ±5%. The current limit is 100mA. Caution should be used when powering a flow transmitter, a temperature transmitter, and a pressure transmitter from this supply. There may be little or no power left for other accessories such as those that may be controlled by the alarm set point outputs (transistors and relays), the pulse output, or the analog output.

150 Venture Boulevard
Spartanburg, SC 29306
Phone: (864) 574-8060, Fax: (864) 574-8063
Customer Care: (800) 778-9251
Internet: http://www.aaliant.com
email: sales@aaliant.com

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