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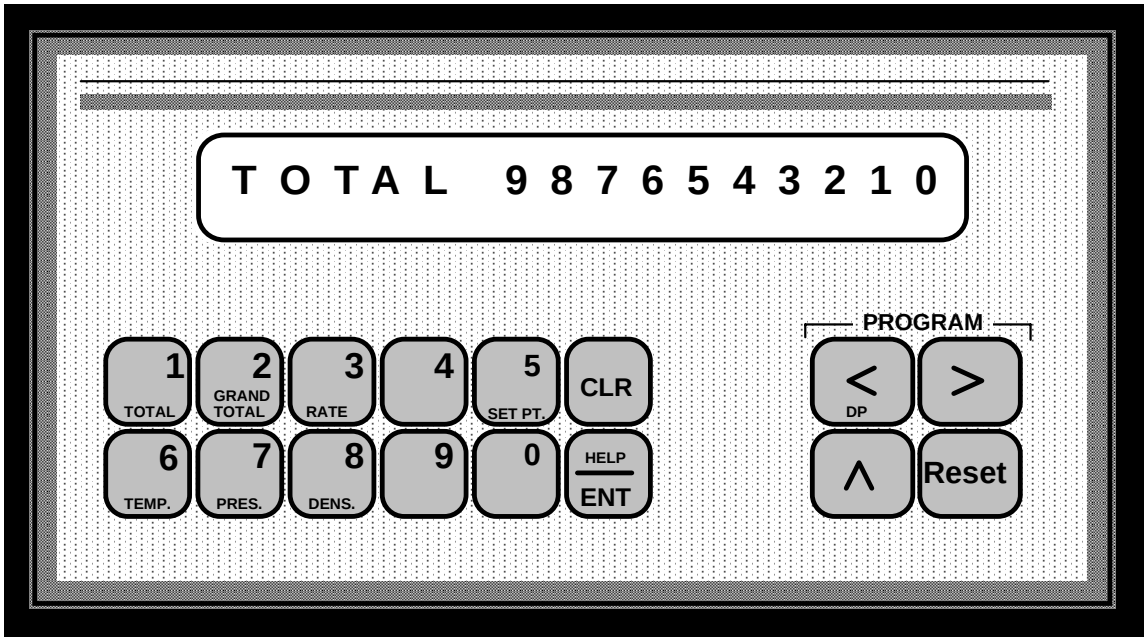
Operation Manual For Model

EA275-00

Mass Flow Computer



INTRODUCTION
FUNCTIONS

The Mass Flow Totalizer performs three basic functions:

- Totalizes actual, standardized or mass flow
- Displays Rate of flow
- Monitors rate, temperature and pressure and provides alarm outputs for up to five out of range conditions that may be assigned to Hi/Lo limits of flow rate, temperature, or pressure.

Modes

This unit may be configured to operate in two different ways; in linear mode or differential pressure mode. The linear mode accepts a linear 4 to 20 mA signal and the squared mode of operation will accept a linear signal from a 4 to 20mA source, and take and display the square root of the input signal.

TOTALIZERS

Operation

The unit is equipped with two totalizers, an 8 digit totalizer and a 10 digit totalizer. These totalizers can be programmed to display actual flow, standard flow, or mass flow. These totalizers are unidirectional and can only count up. The reset key can be programmed to reset the 8 digit totalizer.

Outputs

Transistor output number four provides a scaled output pulse for remote totalization. The pulse output duration can be programmed for Fast (125µ sec), Medium (2 msec.) or Slow (50 msec.). The Totalizer has a buffer capable of storing 255 scaled counts if the Totalizer count rate temporarily exceeds the scaled output rate. If the buffer capacity is exceeded, any Totalizer count attempting to cause the buffer to 256 will be lost from the scaled pulse output, and the message PULSE OVERFLOW will appear on the display. The contents of this buffer are saved if the power is removed from the unit before all of the counts have been put out. This buffer is reset when the totalizer is reset.

RATEMETER

Operation

This unit provides a 1/Tau ratemeter having 5 digits of display. Like the totalizers, this rate meter can be programmed to display actual, standardized, of mass flow rates. The rate is calculated approximately 3 times a second. The Reset key can be programmed to act on the Ratemeter.

Smoothing

It is possible to program the unit to average a number of rate updates to provided a smoothing effect. Up to 40 rate updates may be averaged. The smoothing function allows the ratemeter to average rate readings from 1.0 seconds to 7.5 seconds in .5 second steps. There is no smoothing when programmed for 0.5 seconds. The setpoints and analog outputs react to this average if they are programmed to the rate function.

Decimal Point and Units

The decimal point is programmed to provide the user with the desired resolution on the display. A six character identifier can be assigned to the rate meter function.

Set Points
This unit is equipped with five outputs, two relays (K1 and K2) and three transistors (T1, T2 and T3) that have setpoints associated with them. The setpoints can be independently programmed to follow the selected parameter, remain latched if the limit is ever exceeded, or time-out after the parameter is back within limits. These setpoints can also be locked from operator changes by the program mode. The setpoints can be programmed with an identification header to provide easier operator interface.

The setpoints are used to set values at which the rate output alarms turn on both transistor and relay outputs. The Hi output is turned on if the Rate is greater than the Hi setpoint, the Lo output is turned on if the rate is lower than the Lo setpoint. These outputs can be assigned to flow rate, temperature, or pressure. The setpoints are programmed by pressing the '5' key and using the ^ key to select the proper one. The outputs can be programmed to follow, time out, or to latch until a keyboard or input signal is received. In the follow mode of operation, the rate is compared to the Hi and Lo setpoints after each rate update. If an output is turned on, it remains on until the next rate update occurs and then the output is either left on or turned off depending on the comparison of the new rate reading with the setpoints. In the time out mode of operation, the outputs can be programmed to turn on for .01 to 99.99 seconds. Programming a value of 0.00 disables the timer and causes the outputs to latch until unlatched by a keyboard or input signal.

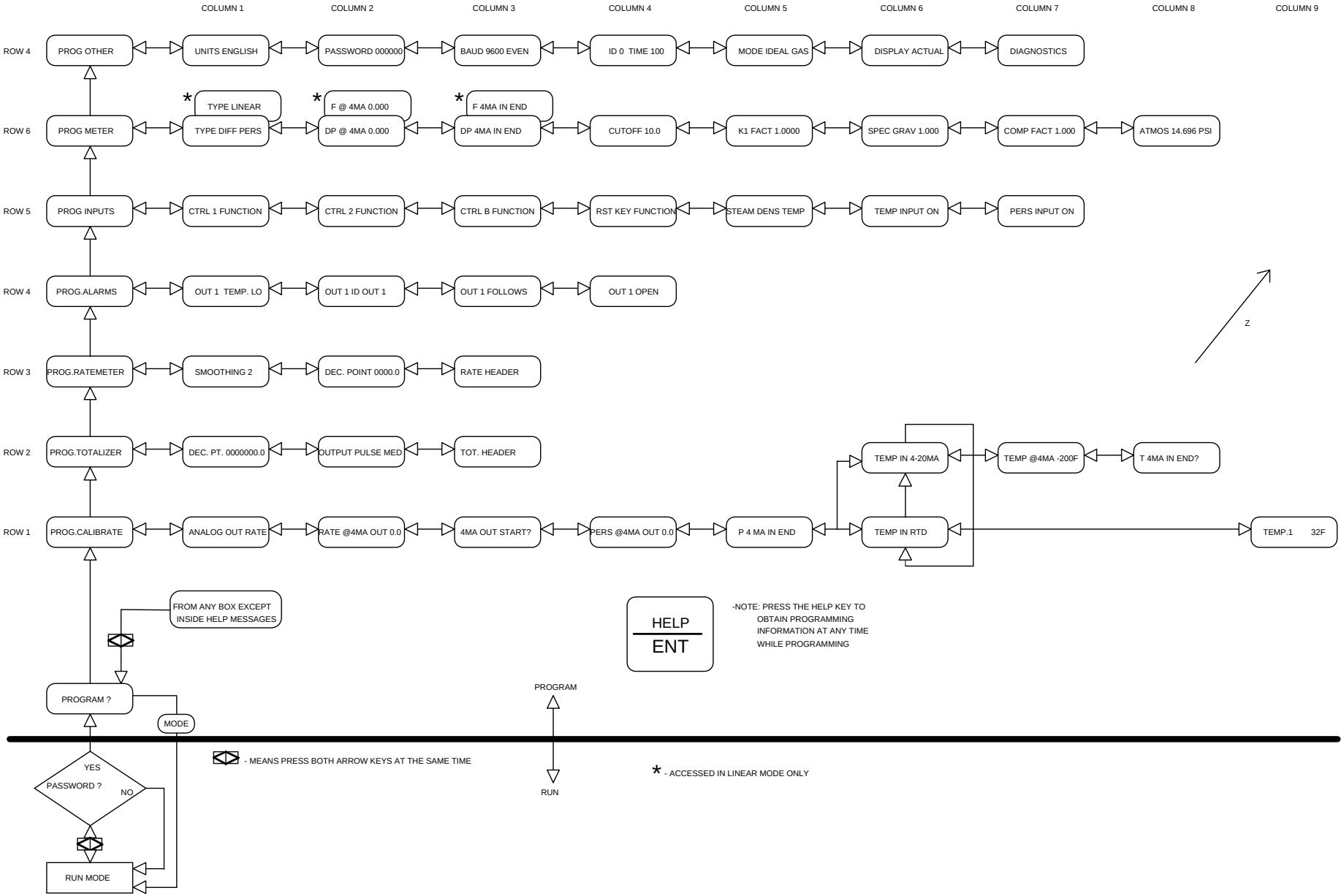
Rate at Zero
The Ratemeter displays zero rate when the time interval between input pulses exceed the programmed Rate Zero time. The timer can be set from 1 to 15 seconds.

Rate Header
The Rate units of measure (up to three characters) can be programmed into the unit and will be shown along with the rate value and rate setpoints on the display. If the Rate data exceeds four digits, the rate header will be shifted off the display in the split display mode.

Control Inputs
Control inputs 1 and 2 can be programmed to provide any combination of the following functions: reset the 8 digit totalizer, unlatch any of the setpoint outputs, or reset the 10 digit totalizer. Control input B can provided those same functions with the addition of count inhibit, When programmed as a count inhibit input , all other functions are not allowed. The Reset key can provide all of the functions of control inputs 1 and 1 except that it cannot reset the 10 digit totalizer.

PRESSURE AND TEMPERATURE
The unit is equipped with a 4 to 20 mA loop input for pressure and a 4 to 20 mA loop or RTD input for temperature. Either of these inputs can be turned off in the event of a sensor failure. A base temperature or pressure is then used. When in the saturated steam mode, only one of these inputs is required to determine this input. Calibration inputs are provided to insure the accuracy of these parameters.

RATE OUTPUT
Rate 4-20 mA Output
The analog rate output range can be programmed at both the 4 mA and 20 mA points. This permits analog rate indications from 0 to full scale rate or to select a portion of the rate range. The analog output can be digitally calibrated in the program mode. The analog output goes to a value of 4 mA when the unit is being programmed and during power-up diagnostic tests.


COLUMN 1
COLUMN 2
COLUMN 3
COLUMN 4
COLUMN 5
COLUMN 6
COLUMN 7
COLUMN 8
COLUMN 9
ROW 4
PROG OTHER
UNITS ENGLISH
PASSWORD 000000
BAUD 9600 EVEN
ID 0 TIME 100
MODE IDEAL GAS
DISPLAY ACTUAL
DIAGNOSTICS
ROW 6
PROG METER
* TYPE LINEAR
TYPE DIFF PERS
* F @ 4MA 0.000
DP @ 4MA 0.000
* F 4MA IN END
DP 4MA IN END
CUTOFF 10.0
K1 FACT 1.0000
SPEC GRAV 1.000
COMP FACT 1.000
ATMOS 14.696 PSI
ROW 5
PROG INPUTS
CTRL 1 FUNCTION
CTRL 2 FUNCTION
CTRL B FUNCTION
RST KEY FUNCTION
STEAM DENS TEMP
TEMP INPUT ON
PERS INPUT ON
ROW 4
PROG.ALARMS
OUT 1 TEMP. LO
OUT 1 ID OUT 1
OUT 1 FOLLOWS
OUT 1 OPEN
Z
ROW 3
PROG.RATEMETER
SMOOTHING 2
DEC. POINT 0000.0
RATE HEADER
ROW 2
PROG.TOTALIZER
DEC. PT. 0000000.0
OUTPUT PULSE MED
TOT. HEADER
TEMP IN 4-20MA
TEMP @4MA -200F
T 4MA IN END?
ROW 1
PROG.CALIBRATE
ANALOG OUT RATE
RATE @4MA OUT 0.0
4MA OUT START?
PERS @4MA OUT 0.0
P 4 MA IN END
TEMP IN RTD
TEMP.1 32F
FROM ANY BOX EXCEPT INSIDE HELP MESSAGES
HELP
ENT
-NOTE: PRESS THE HELP KEY TO OBTAIN PROGRAMMING INFORMATION AT ANY TIME WHILE PROGRAMMING
PROGRAM ?
MODE
PROGRAM
RUN
YES
PASSWORD ?
NO
RUN MODE
- MEANS PRESS BOTH ARROW KEYS AT THE SAME TIME
* - ACCESSED IN LINEAR MODE ONLY

PROGRAM MODE

Except for the alarm setpoint values, all parameters and calibrations are performed in the program mode. All totalizing , rate, and output functions are disabled when in the program mode.

Accessing Programming Mode
Pressing the < and > keys down at the same time causes the display to prompt the user for a PASSWORD. When the correct password is entered, the unit enters into the program mode and displays the message PROGRAM?. The password is not displayed but an underscore is shown for each digit entered. Note: The unit comes from the factory with the Password of 000000. When the password is set to zeros, the unit enters the program mode directly after pressing the < and > keys.

From the program mode entry/exit display, access to submenu items can be obtained in two ways.

PROGRAM ?

1. A. Press the ^ (up) key to scroll through the main menu items (row X).

   B. Press the < or > key to scroll through the submenu items (column Y).

2. From the program menu chart, identify the row (x) and column (y) of the submenu desired. Access is gained without scrolling with the arrow keys.

In some cases, submenus are "layered" (Z-axis). Access is gained from the "top" layer of the submenu by pressing the appropriate front panel key. All submenus are mapped out in detail with their definitions in the pages following the Program Menus chart. The HELP key will provide programming information when pressed at any time during programming.

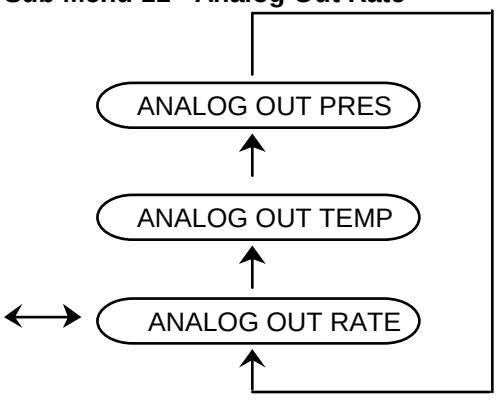
In any submenu of the program mode, pressing the < and > keys at the same time returns the unit to the program mode entry/exit display.

PROGRAM ?

Pressing the Reset key at this time causes the unit to go to the run mode.

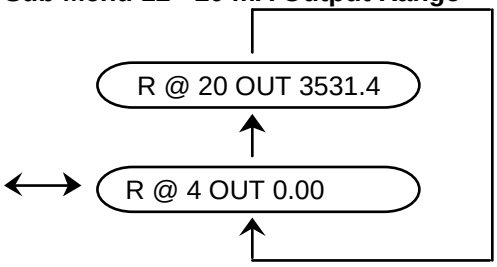
PROG. CALIBRATE

Sub Menu 11 - Analog Out Rate



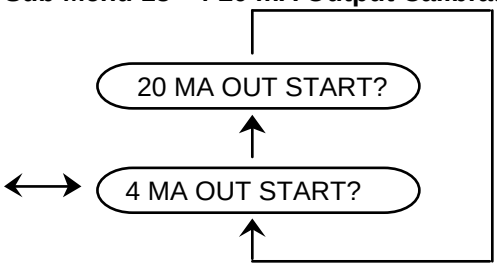
Use the ^ key to select the analog out. It may be set to rate, temperature of pressure.

Sub Menu 12 - 20 mA Output Range



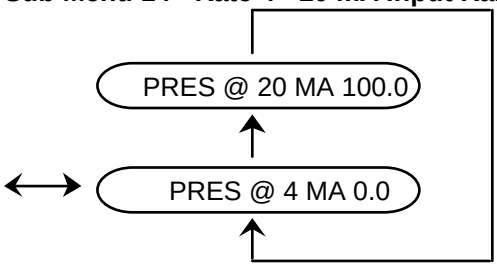
Depending on which parameter was selected for the analog out, the user must enter the range for that parameter, Use the ^ key to select the 4 or 20 mA analog output point. Press the Clr key to enable new key entry. Use the 0 - 9 and enter keys to enter a new value.

Sub Menu 13 - 4-20 mA Output Calibration



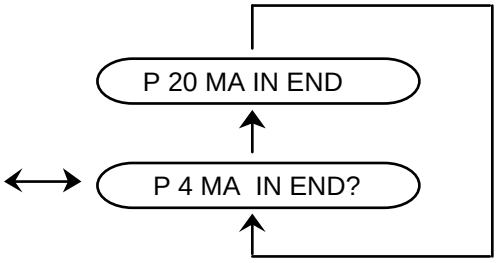
To calibrate the analog output signal, first turn off all power and then connect the analog output "+" terminal and the 24VDC ground terminal to a current meter. Turn power back on and select menu 13. Press the CLR key to start the calibration process and use the left < and > right arrow keys to adjust the current to 4 mA, then press the ENT key to enter the 4 mA calibration point. Use the up arrow key to select the 20 mA setpoint. Press the CLR key to start the calibration process and use the < and > arrow keys to adjust the current to 20 mA, then press the ENT key to enter the 20 mA calibration point. To calibrate the analog inputs using the output, connect the output "-" terminal through the meter to the selected analog input instead of ground. After adjusting the output, press the reset key and the 1 key to calibrate the pressure input or the 2 key to calibrate the 4 to 20 mA temperature 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 20 mA.

Sub Menu 14 - Rate 4 - 20 mA Input Range



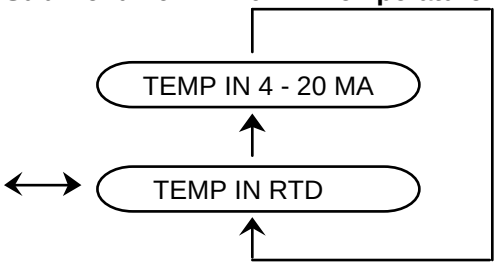
Use the up arrow key to select the 4 or 20 mA setpoints and then use the CLR, NUMBER and ENT keys to enter a new value.

Sub Menu 15 - Rate 4 - 20 mA Pressure Input Calibration



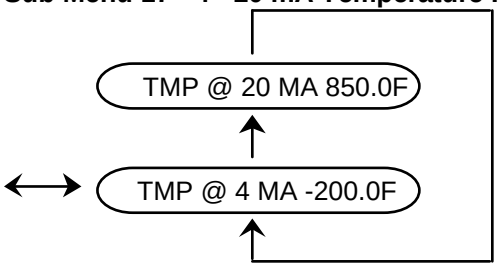
To calibrate the pressure analog input using a current source, set the input current to exactly 4 mA and press the Reset key. The display will blank momentarily to indicate the calibration for that level is complete. Use the up arrow key to select the 20 mA flow inputs and then use the CLR, NUMBER and ENT keys to enter a new value.

Sub Menu 16 - 4 - 20 mA Temperature Input Select



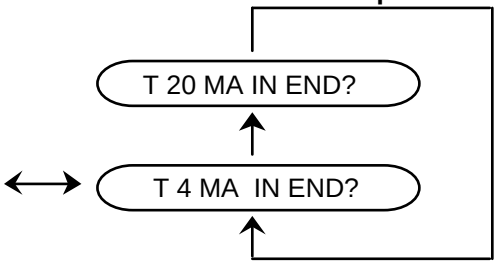
The temperature input may be either 4 to 20 mA or RTD. Use the ^ key to select the input type for temperature. If the RTD input is selected, sub menus 17 and 18 will be skipped over when using the < and> keys to scroll between the sub menus. If the 4 to 20 mA input is selected, sub menu 19 will be skipped. However, these sub menus may still be direct accessed by the number keys.

Sub Menu 17 - 4 - 20 mA Temperature Range



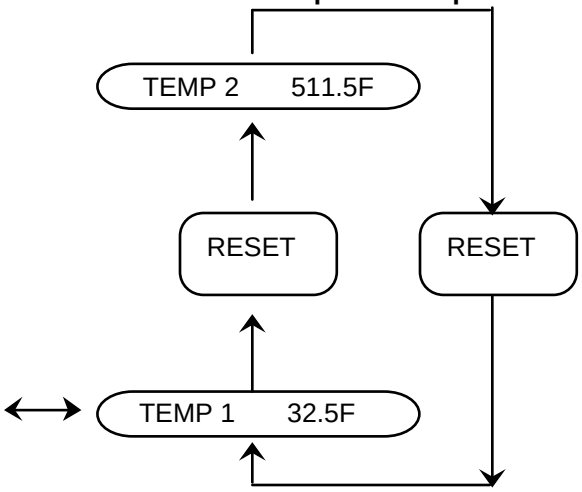
Use the up arrow key to select the 4 or 20 mA setpoints and then use the CLR, NUMBER and ENT keys to enter a new value.

Sub Menu 18 - 4 - 20 mA Temperature Calibration



To calibrate the temperature analog input using a current source, set the input current to exactly 4 mA and press the Reset key. The display will blank momentarily to indicate the calibration for that level is complete. Use the up arrow key to select the 20 mA flow inputs and then use the CLR, NUMBER and ENT keys to enter a new value.

Sub Menu 19 - RTD Temperature Input Calibration



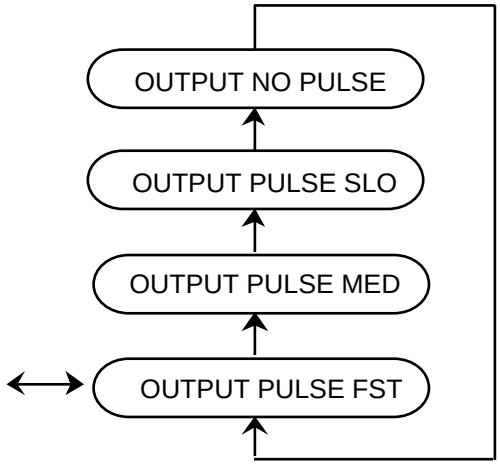
To calibrate the RTD input, connect a known precision resistance value to the RTD input. Press the 'CLR' key to enable a new entry and use the 0 - 9 and 'Enter' keys to enter the temperature at that resistance. Connect a second known precision resistance value to the RTD input and repeat the process. The display will return to the first temperature to indicate that the calibration is complete.

PROG. TOTALIZER

Sub Menu 25- Totalizer Decimal Key

Use the 0 - 4 keys to select the decimal point location for the totalizer. The location of the decimal point determines the resolution of the totalizer displays.

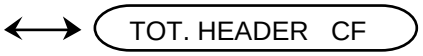
Sub Menu 22 - Totalizer Scaled Pulse Output



The totalizer pulse output transistor can be programmed for fast, medium, or slow pulse widths. It can also be programmed to not output pulses.

Fast - 125 µsec on, 125 µsec off
Medium - 2 msec on, 2 msec off
Slow - 50 msec on, 50 msec off

Sub Menu 37 - Totalizer Header



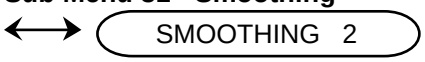
Range A to Z or blank

The default units of measure in English for the totalizers are CF (cubic feet) for actual and standardized displays ands LBM (pounds mass) for the mass display. In metric they are CM (cubic meters) and KG (kilograms). If the user desires a different header for the totalizers the units of measure (up to three characters) can be programmed into the unit. If any characters are programmed in this sub menu, they will be displayed with the totalizer regardless of what units of measure are programmed in sub menu 61.

Use the < and > keys to cause the selected character to blink. Then use the ^ key to scroll through the alphabet. Blank (no character) is between Z and A.

PROG. RATEMETER

Sub Menu 31 - Smoothing



The rate smoothing factor determines how many rate updates are to be averaged. The rate is calculated approximately 3 times a second. The calculated rates are buffered in a FIFO list and averaged pre the smoothing factor. This averaged rate is used for the analog out value and the output alarms if so programmed. Press the CLR key to enable a new entry, and use the 0 - 9 and ENTER keys to enter the number of rate calculations to average from 1 to 40.

Sub Menu 32 - Ratemeter Decimal Point

Use the 0 - 4 keys to select the decimal point location for the ratemeter.

Sub Menu 33 - Ratemeter Header

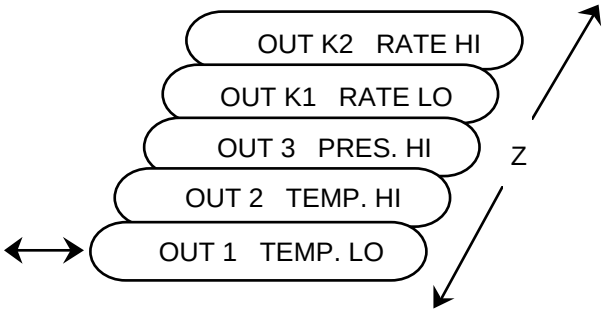
Range A to Z or blank

The default units of measure in English for the ratemeter is ACFM (actual cubic feet per minute), SCFM (standardized cubic feet per minute), and LBM/HR (pounds mass per hour). In metric they are ACMM (actual cubic meters pre minute), SCMM (standardized cubic meters per minute), and KG/HR (kilograms per hour). If the user desires a different header for the ratemeter the units of measure (up to three characters) can be programmed into the unit. If any characters are programmed in this sub menu, they will be displayed with the totalizer regardless of what units of measure are programmed in sub menu 61.

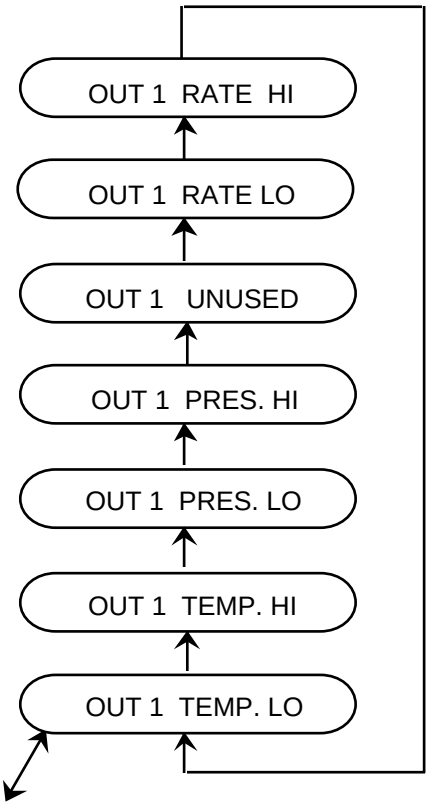
Use the < and > keys to cause the selected character to blink. Then use the ^ key to scroll through the alphabet. Blank (no character) is between Z and A.

PROG. ALARMS

Sub Menu 41 - Output Assignments



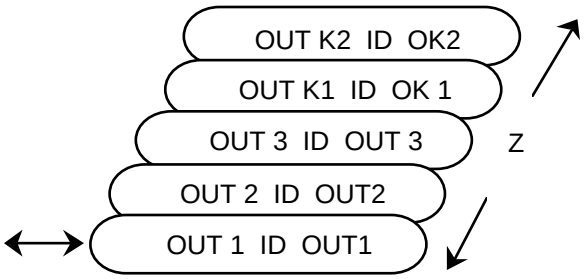
Pres 1 through 5 to access transistor outputs 1, 2, 3 and relay outputs K1 and K2 respectively.



Same selections for output 2, output 3, K1 and K2

The three transistor outputs and two relays may be assigned to any of 6 parameters - rate Lo, rate Hi, temperature Lo, temperature Hi, Pressure Lo, Pressure Hi. they may also be programmed to be unused. 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.

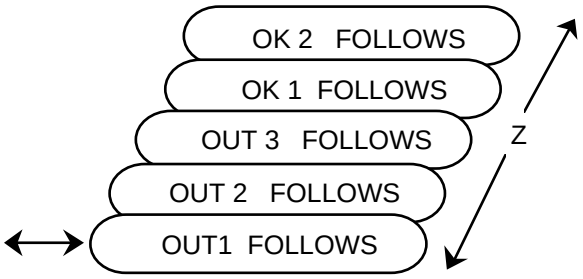
Sub Menu 42 - Output ID



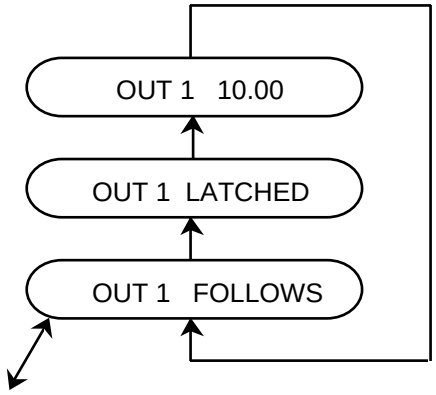
Press 1 thorugh 5 to access transistor outputs 1, 2, 3 and relay outputs K1 and K2 respectively.

An ID may be programmed for each of the outputs to help identify the function. 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.

Sub Menu 43 - Output Operation



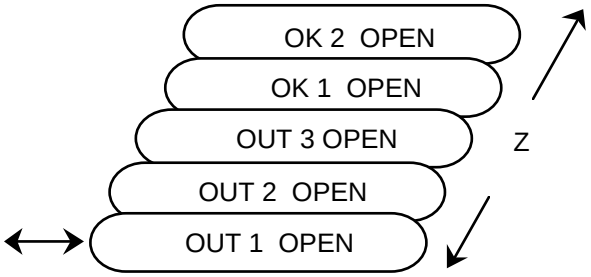
Press 1 thorugh 5 to access transistor outputs 1, 2, 3 and relay outputs K1 and K2 respectively.



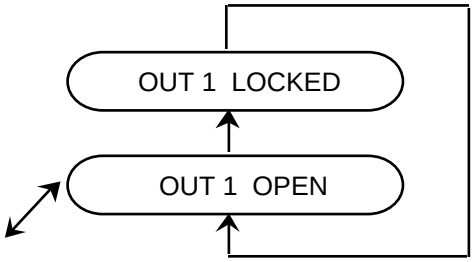
Same selections for output 2, output 3, K1 and K2.

The outputs can be programmed to be latched, timed, or follow the selected parameter. 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 and use the 0 - 9 and Enter keys to enter a new output time.

Sub Menu 44 - Setpoint Locks



Press 1 thorugh 5 to access transistor outputs 1, 2, 3 and relay outputs K1 and K2 respectively.



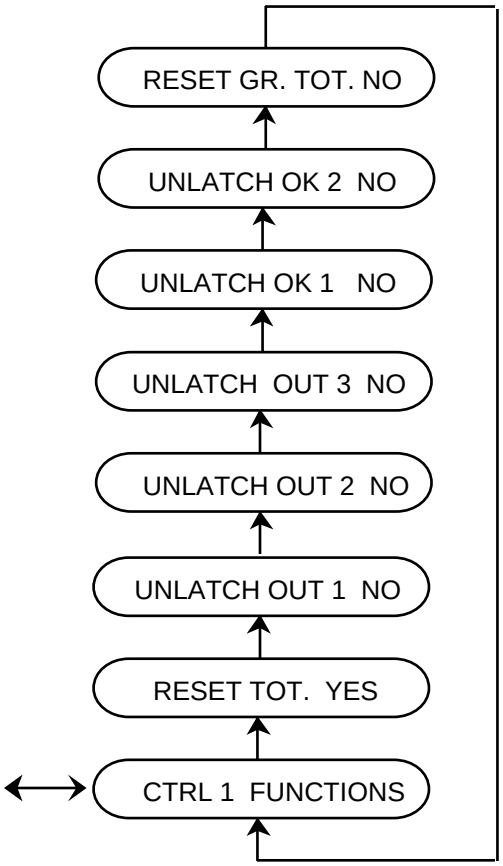
Same selections for output 2, output 3, K1 and K2.

The setpoints associated with the 5 outputs may be selectively locked to their current value. Use the 1 - 3 keys to select outputs 1 to 3 , the 4 key t select the K1 output, or the 5 key to select the K2 output. Use the ^key to select whether the setpoint associated with this output is open of locked.

Lit # 24528-00 Rev. 1.1/05-05

PROG. INPUTS

Sub Menu 51 - Control Input 1 Function
Sub Menu 52 - Control Input 2 Function

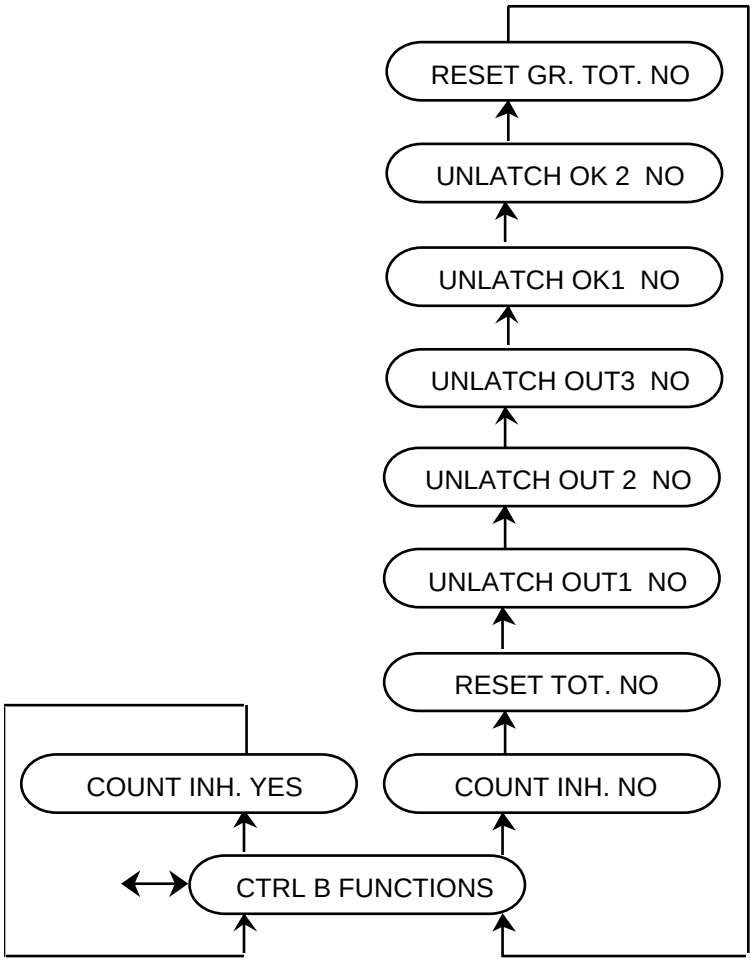


Same selections repeated for control input 2 in sub menu 46. Note, however, the default setting for input 2 reset grand total is yes.

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

Lit # 24528-00 Rev. 1.1/05-05

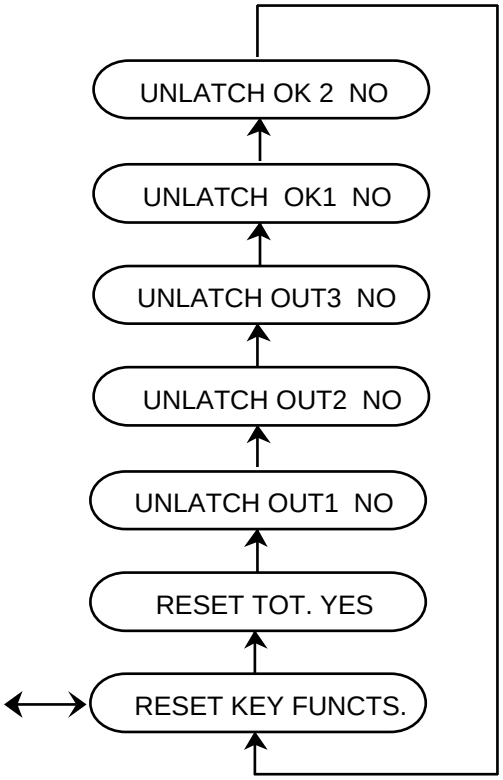
Sub Menu 53 - Control Input B Function



Input B can be used as a count inhibit. If input B is programmed as count inhibit, all other functions are not allowed. Use the ^ key to select the function of the control B input. Press the 1 key to enable that function of the 0 key to disable that function.

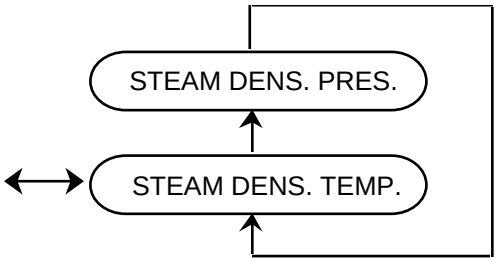
Lit # 24528-00 Rev. 1.1/05-05

Sub Menu 54 - Reset Key Functions



The reset key cannot be programmed to reset the grand total. Use the ^ key to select the function of the reset key. Press the 1 key to enable that function of the o key to disable that function.

Sub Menu 55 - Steam Density Input

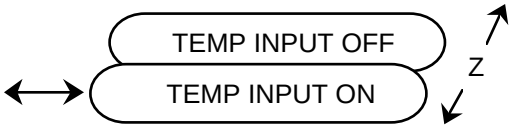


Controls type of input to steam table - Pres. or Temp.

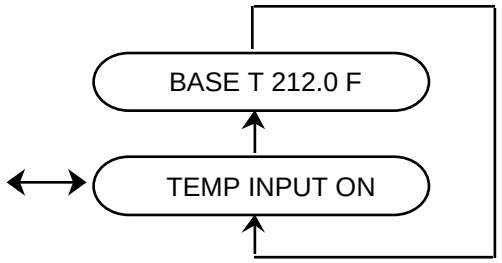
Use the ^ key to select either the pressure input or the temperature input as the source for the saturated steam density calculation.

Lit # 24528-00 Rev. 1.1/05-05

Sub Menu 56 - Temperature Input Enable



Press 0 for Temp. Input off, 1 for Temp. Input On

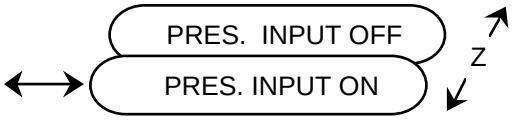


Same Selection for Temp. Input Off

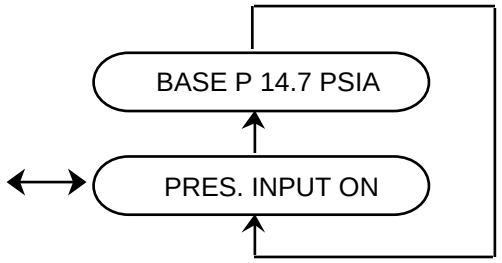
The temperature input may be disabled by pressing the 0 key, or enabled by pressing the 1 key. If the temperature input is disabled, the base temperature programmed in this sub menu is used for the flow calculation. Disabling the temperature input also causes the run mode temperate display to read TEMP.INPUT ERROR, and any output assigned to temperature Hi or temperature Lo will be on continuously.

Use the 0 and 1 keys to disable of enable the temperature input. Use the CLR key to enable a new base temperature entry and the 0 - 9 and ENTER keys to enter a new base temperature.

Sub Menu 57 - Pressure Input Enable



Press 0 for Pressure Input Off, 1 for Pressure Input On



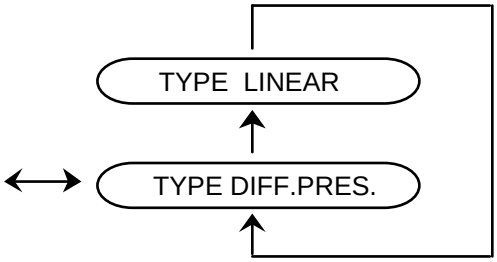
Same Selection for Presl Input Off

The pressure input may be disabled by pressing the 0 key, or enabled by pressing the 1 key. If the pressure input is disabled, the base pressure programmed in this sub menu is used for the flow calculation. Disabling the pressure input also causes the run mode temperature display to read TEMP.INPUT ERROR, and any output assigned to pressure Hi or pressure Lo will be on continuously.

Use the 0 and 1 keys to disable of enable the pressure input. Use the CLR key to enable a new base pressure entry and the 0 - 9 and ENTER keys to enter a new base pressure.

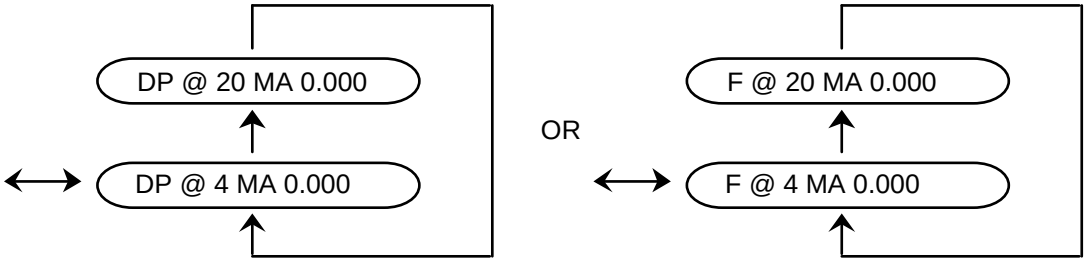
PROG. METER

Sub Menu 61 - Differental Pressure or Linear



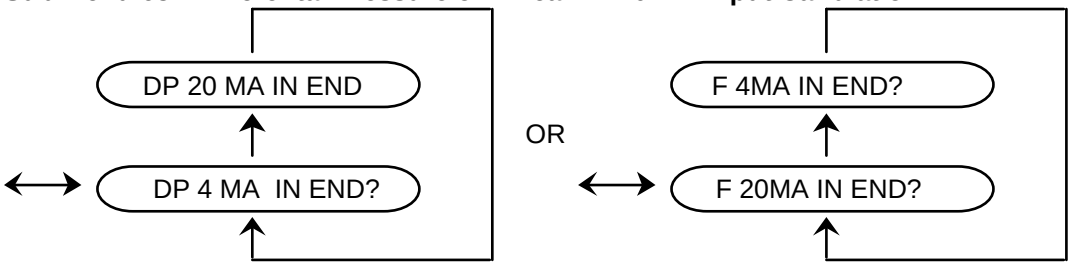
The linear mode displays the input analog signal in a linear form, the squared mode will take the square root of the signal then display the result. To select the linear or squared modes use the ^ key to toggle between them.

Sub Menu 62 - Differental Pressure or linear for 4 and 20 mA



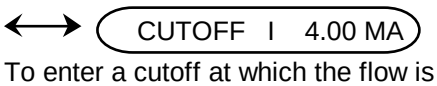
Depending on which parameter was selected for the analog input, the user must enter the differential pressure (DP) or the flow (LINEAR) expected at the 4 and 20 mA levels. Use the ^ key to select the 4 or 20 mA analog output point. Press the Clr key to enable new key entry. Use the 0 - 9 and enter keys to enter a new value.

Sub Menu 63 - Differental Pressure or Linear 4 - 20 mA Input Calibration



To calibrate the differential pressure or linear analog input using a current source, set the input current to exactly 4 mA and press the Reset key. The display will blank momentarily to indicate the calibration for that level is complete. Use the up arrow key to select the 20 mA flow inputs and then use the CLR, NUMBER and ENT keys to enter a new value.

Sub Menu 64 - Cutoff Current



To enter a cutoff at which the flow is considered to be zero use the CLR key to enable a new current. Use the 0 - 9 keys and ENT keys to enter a new value.

Sub Menu 65 - K1 Factor

The K1 factor is a constant that is multiplied by the square root of the differential pressure to scale the displayed differential pressure.

Lit # 24528-00 Rev. 1.1/05-05

Sub Menu 66 - Specific Gravity

Range 0.001 - 9.999

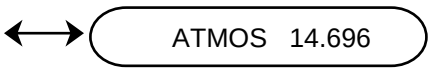
Use the CLR key to enable a new entry, and use the 0 - 9 DP, and ENTER keys to enter a new specific gravity.

Sub Menu 67 - Compressibility Factor

Range 0.0000 - 999999

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

Sub Menu 68 - Atmospheric Pressure

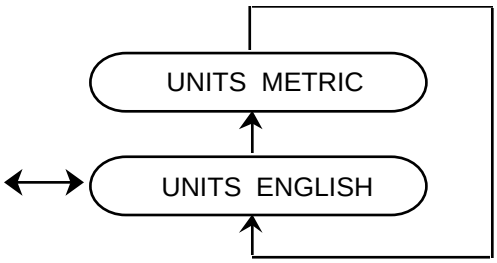


Range 0.000 - 999.999

Use the CLR key to enable a new entry, and use the 0 - 9 DP, and ENTER keys to enter a new atmospheric pressure.

PROG.OTHER

Sub Menu 71 - Units Of Measure



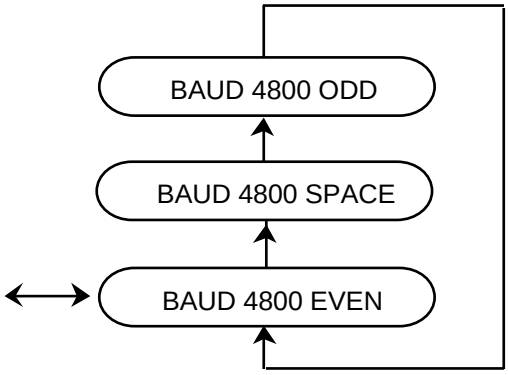
This parameter determines the units of measure for all of the totalizers, ratemeter, pressure, temperature, density and setpoint displays. Use the ^ key to select whether the unit of measure is English or metric.

Sub Menu 72 - Password

Range 0 to 999999

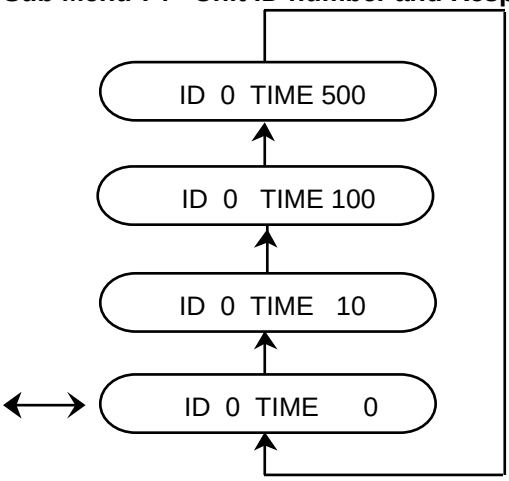
A password can be programmed into the unit to provide password access to the program mode. The unit as it comes from the factory does not require the entry of a password to gain access to the program mode. This is accomplished by programming all zeros into the password data field. Entering a number from 1 to 6 digits in length into the password data field activates the password access to the program mode.

Sub Menu 73 - Communication Baud Rate and Parity



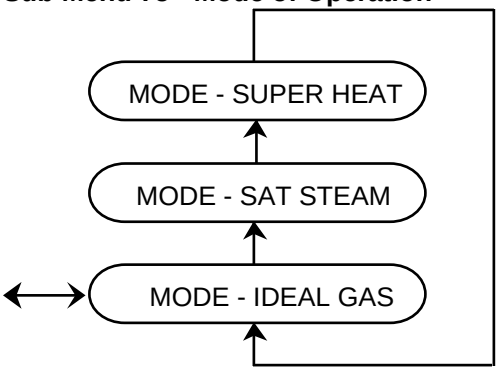
The baud rate and parity are set in this menu. Enter a baud rate of 300, 600, 1200, 2400, 4800, 9600 or 19200 by using the CLR, NUMBER and ENT keys. Enter EVEN, ODD or SPACE parity by using the up arrow key.

Sub Menu 74 - Unit ID number and Response Delay Time



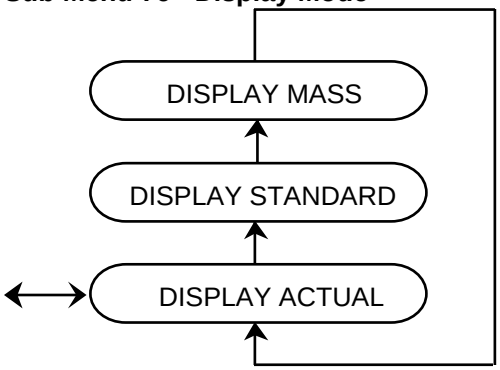
The unit identification number is set in this menu. Each unit on the communication bus must have a unique identifying number, 1 through 255. Enter the units ID by using the CLR, NUMBER and ENT keys. The length of time before the control response to communication requests can set to accommodate various types of computer equipment. Delay times of 0, 10, 100 and 500 milliseconds can be selected by using the up arrow key.

Sub Menu 75 - Mode of Operation



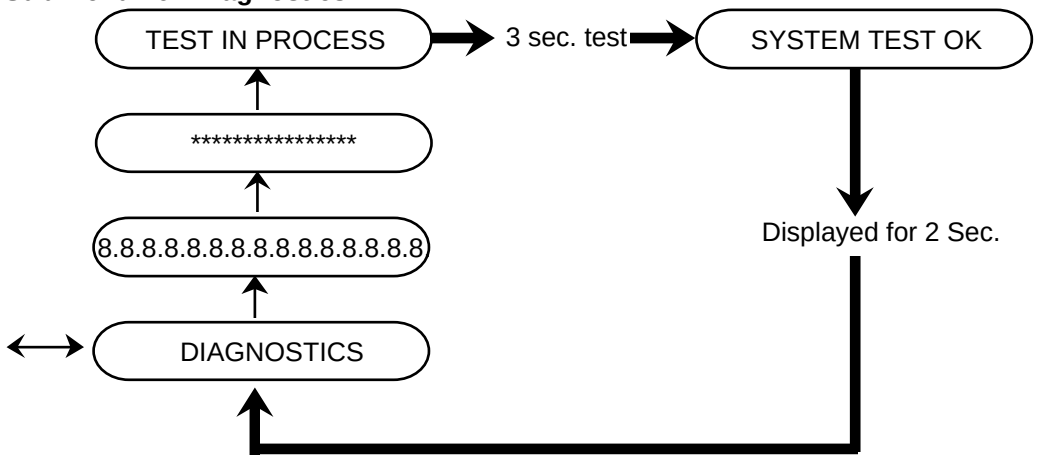
Use the ^ key to select the mode of operation of the unit, either ideal gas, steam, or superheat.

Sub Menu 76 - Display Mode



This parameter determines what totalizer and rate meter is to be displayed. Use the ^ key to select the display and output parameter.

Sub Menu 46 - Diagnostics



The diagnostics allow the user to test the control's display and internal memory. Press the up arrow key for display test 1. Each of the display's 16 characters will go to 8 with the decimal point lit. Press the up arrow key for display test 2. Each character will go to *. Press the up arrow key for the internal memory test. The display will read "TEST IN PROCESS" for three seconds while the tests are being run. The display will read "SYSTEM TEST OK" for two seconds, and then go back to "DIAGNOSTICS" if no memory errors were detected. If the unit detects a memory error, the display will hold an error message. The error messages are:

ROM FAILURE
INT. RAM FAILURE
EXT. RAM FAILURE

These errors are non-recoverable. It is possible that electrical noise caused the diagnostic failure, so the power to the unit should be cycled (turned off and then turned back on). The memory tests are always performed at power up. If the same test fails at power up, the unit likely needs repair. If a different test fails, or if the unit powers up normally, it is likely that the unit is experiencing electrical noise problems.

The power up diagnostics include two other tests that are not run during program mode diagnostics. These check the validity of the data stored in non-volatile memory when the unit is powered down. These errors are recoverable, but stored information or data will be lost during the recovery.

The first test is the run data test. If the stored checksum of the total, setpoints and pulse output does not match the calculated checksum at power up, the display will read:

RUN DATA ERROR

Pressing the reset key will change the display to:

RUN DATA CLEARED

The total, grand total, and pulse output register data will be lost. The setpoints for the alarm outputs will also be lost and must be reprogrammed.

The second test is the program data test. It is also a checksum test comparing the checksum of the programming data at power down with the calculated checksum at power up. If the checksums do not match, the display will read:

REPROGRAM UNIT

Pressing the reset key will cause the unit to revert to factory default programming and the display will read:

DEFAULTS LOADED

The unit must be reprogrammed at this point.

RUN MODE

KEYS

Viewing Data
Press the following keys in any order to display the data contained in the control.

Key Pressed	Shown on Display (example)
TOTAL	TOT 68148.0 CF
G TOTAL	T 4277977.0 CF
SET PT.	OUT1 100.0 ACFM
RATE	RAT 115 ACFM
TEMP	TEMP. 107 F
PRES	PRES. 15.2 PSIA
DENS	D 0.0003 LB/CF

Entering Setpoints

To change the value for any used setpoint, press the set pt. key and then press the ^ key until that setpoint appears on the display. Use the CLR, 0 - 9 ands ENTER keys to enter a new setpoint value. Setpoints can be locked in the program mode such that they cannot be changed in the run mode.

Reset Key Functions
The reset key is programmable to reset the totalizer and/or unlatch any combination of transistor outputs 1,2 and 3 and relay outputs 1 and 2. The reset key cannot be programmed to reset the grand total. Use the chart below to record the functions of the reset key.

Control Inputs
The mass flow computer contains three rear terminal inputs which may be assigned to do a number of functions. Control inputs 1 ands 2 can be programmed to reset totalizer ands/or unlatch any combination of outputs. Control input B may either be a count inhibit or may be used to reset totalizers ands/or unlatch outputs. The following table may be used to record the functions of the control inputs.

Function	Reset Key	Control Input 1	Control Input 2	Control Input B	
Reset Totalizer				NA	
Unlatch Output 1				NA	
Unlatch Output 2				NA	
Unlatch Output 3				NA	
Unlatch OK1				NA	
Unlatch OK2				NA	
Reset Grand Total	NA			NA	
Count Inhibit	NA	NA	NA		NA

TRANSISTOR OUTPUTS

T1 Scaled pulse output transistor. As a scaled pulse output, this transistor provides a count pulse out to a second counter while that totalizer is counting.

T2 Totalizer setpoint. This transistor turns on when the Totalizer setpoint is reached.

T3 Rate high alarm output transistor. This transistor turns on at the rate update if the calculated rate is greater than the high rate setpoint.

T4 Rate low alarm output transistor. This transistor turns on at the rate update if the calculated rate is less than the low rate setpoint.

RELAY OUTPUTS

K1 Scaled switch output. As a scaled switch output, this relay provides a switch closure or opening as programmed to the rate setpoint.

K2 Scaled switch output. As a scaled switch output, this relay provides a switch closure or opening as programmed to the rate setpoint.

MESSAGES

A number of messages are available for display during the run mode or while the unit is entering the run mode from a power up or exit from program mode condition. Diagnostic messages may also be displayed while the unit is running self-test.

Run Mode Messages
INV - Invalid Key

ANA OUTPUT ERROR - The 4 mA output rate is greater than the 20 mA output rate.

OVERFLOW - If the calculated rate is greater than 999999, the word OVERFLOW will appear in the rate display.

FLOW INPUT ERROR - If the unit has not been calibrated than the words FLOW INPUT ERROR will appear in the display.

SERIAL COMMUNICATIONS

INTRODUCTION TO SERIAL COMMUNICATIONS

PURPOSE

The Mass Flow Rate Computer is equipped with an RS-485 serial communication port for the purpose of allowing a computer to:

1. Issue control commands such as reset.

2. Ad..cc (acknowledge with data, d...., and checksum of the data, cc)

3. Nee (not acknowledge with a two digit error code, ee).

4. Query and program all program mode sub menus except numbers 13, 15, 42, 43 & 44.

The serial format follows the Opto 22 Optomux protocol. This consists of a start character (>), a two character unit ID number, a three character command, data for the command, if applicable, a two character checksum and a termination character.

Each character is ten bits. The first bit is the start bit, followed by seven data bits (ASCII code), followed by the parity bit and the tenth bit is the stop bit. If the unit is programmed to space parity, the unit ignores the received parity and transmits space parity. The unit ID number and the checksum are in ASCII hexadecimal and have a rage of 00 to FF. The checksum id the two least significant hex digits of the sum of the ASCII values of the unit ID number, the command and the data. All hex characters A through F must be in upper case. All leading zeros in data field must be sent. Decimal points within the data field are indicated by and ASCII comma. Commas within the data fields sent to the control are ignored. The termination character may by an ASCII carriage of an ASCII decimal point.

Responses by the control consist of three possibilities:

1. A(acknowledge)

2. Ad..co(acknowledge with data, d..., and checksum of the data, cc)

3. Nee (not acknowledge with two digit error code, ee)

Example:

Command sent to control - >01RST18B.

Where;
> is the start character,
01 is the unit ID number,
RST is the three character command (reset),
1 is applicable data (reset option - reset only),
8B is the two least significant digits of the hexadecimal checksum,

0	1	R	S	T	1

30+31+52+53+54+31 = 18B hexadecimal

Error Codes

ERROR CODES CONSIST OF THE FOLLOWING:

01 Invalid Command
02 Communication Checksum Error
03 Buffer Overrun Error
05 Data Format Error
08 Parity or Framing Error
10 In Run Mode, Command not Allowed
12 In Program Mode, Command not Allowed
13 Mode Already Active. Command not Allowed
21 Data out of Range

CLASSIFICATIONS

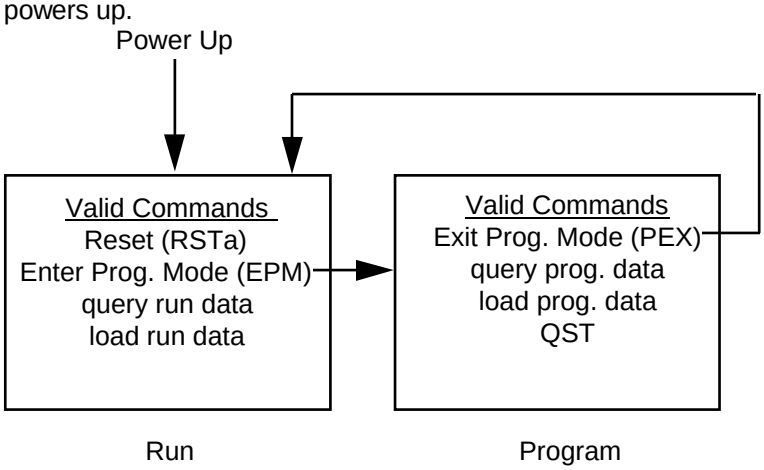
All serial commands fall into one of five classifications. These classifications are:

1. Control Commands
2. Query Run Data
3. Load Run Data
4. Query Program Data
5. Load Program Data

The control has two modes of operation; run mode and program mode. The control will respond to specific commands only if the command is valid for the mode of operation the control is in when the command is received. Command validity is addressed in the following section and all specific commands are described in detail in the following tables.

Control Commands

There are three control commands. Two of them, Enter Program Mode and Exit Program Mode are used to change the control's mode of operation. The following flow chart illustrates the validity and function of each control command and the validity of the other four command classification in each mode of operation. Note that the control goes into the run mode when it powers up.



The third control command, reset, does not change the control's mode of operation, but merely performs a reset and/or unlatch function while leaving the control in the run mode. The Rest control command is suffixed by one digit (a) which allows for secondary functions to occur along

with the Reset function. All secondary functions are listed in the following control command table.

All commands in the following tables are preceded by the start character (>) and unit number and succeeded by the two character checksum and carriage return.

The following control commands are supported by this control:

Command	Response	Description
RSTabcde	A	RESET COMMAND Where "abcde" determine functions to be performed
Digit "a"	0	Do not reset either actual flow Totalizer
	1	Reset actual flow Totalizer
	2	Reset actual flow grand total
	3	Reset both actual flow totalizers
Digit "b"	0	Do not reset either standardized flow Totalizer
	1	Reset standardized flow Totalizer
	2	Reset standardized flow grand total
	3	Reset both standardized flow totalizers
Digit "c"	0	Do not reset either mass flow Totalizer
	1	Reset mass flow Totalizer
	2	Reset mass flow grand total
	3	Reset both mass flow totalizers
Digit "d"	0	Do not unlatch outputs 1, 2, or 3
	1	Unlatch output 1
	2	Unlatch output 2
	3	Unlatch outputs 1 and 2
	4	Unlatch output 3
	5	Unlatch outputs 1 and 3
	6	Unlatch outputs 2 and 3
	7	Unlatch outputs 1, 2 and 3
Digit "e"	0	Do not unlatch relays K1,or K2
	1	Unlatch relays K1
	2	Unlatch relays K2
	3	Unlatch relays K1 and K2
EPM	A	ENTER PROGRAM MODE
PEX	A	EXIT PROGRAM MODE

QUERY RUN DATA COMMANDS

This classification of commands allows the computer to read run data information such as status, count, rate, setpoint, etc. These commands are valid in run mode only, except for QST (query status), which is valid in all modes of operation.

The following Query Run Data commands are supported:

Command	Response	Description
QOS	AOS abcdef	QUERY OUTPUT STATUS Where a = Current Mode R - Run Mode P - Program Mode b = Output 1 Status A - Output On N - Output Off c = Output 2 Status A - Alarm On N - No Alarm d = Output 3 Status A - Alarm On N - No alarm e = K1 output Status A - Alarm On N - No alarm f = K2 output Status A - Alarm On N - No alarm
QRT	ART aaaaa	Query Flow Rate where aaaaa = Rate
QAT	AAT aaaaaaaa	QUERY ACTUALTOTAL where aaaaaaaa = Totalizer Count
QAG	AAG aaaaaaaaaa	QUERY ACTUAL GRAND TOTAL where aaaaaaaaaa = Totalizer Count
QST	AST aaaaaaaa	QUERY STANDARDIZED TOTAL where aaaaaaaa = Totalizer Count
QSG	ASG aaaaaaaaaa	QUERY STANDARDIZED GRAND TOTAL where aaaaaaaaaa = Totalizer Count. (totalizer mode)
QMT	AMTaaaaaaaa	QUERY MASS TOTAL where aaaaaaaaa... = Totalizer Count
QMG	AMGaaaaaaaaaa	QUERY MASS GRAND TOTAL where aaaaaaaaaa = Totalizer Count
QSA	ASAsaaaaa	QUERY OUTPUT 1 SETPOINT where aaaaa = Output 1 setpoint s = sign (space or -)
QSB	ASBsaaaaa	QUERY OUTPUT 2 SETPOINT where aaaaa = Output 2 setpoint s = sign (space or -)
QSC	ASCsaaaaa	QUERY OUTPUT 3 SETPOINT where aaaaa = Output 2 setpoint s = sign (space or -)

QSD	ASDsaaaaa	QUERY RELAY K1 SETPOINT where aaaaa = Relay 1 setpoint s = sign (space or -)
QSE	ASEsaaaaa	QUERY RELAY K2 SETPOINT where aaaaa = Relay 2 setpoint s = sign (space or -)
QTP	ATPsaaaaa	QUERY CURRENT TEMPERATURE where aaaaa = Current temperature s = sign (space or -)
QPR	APRsaaaaa	QUERY CURRENT ABSOLUTE PRESSURE where aaaaa = Current Pressure s = sign (space or -)
QDN	ADNsaaaaa	QUERY CURRENT ABSOLUTE PRESSURE where aaaaa = Current Pressure s = sign (space or -)
QMD	Aa..	QUERY MENU DATA where a = Data specified in current menu
QAP	Aab c...ab c... ...	QUERY ALL PREGRAM DATA where a = Program menu row b = Program menu column c = Applicable data

LOAD RUN DATA COMMANDS

This classification of commands allows the computer to write setpoints to the control and specify the control's response to the QMD command. These commands are valid only in the run mode.

The following Load Run Data Commands are supported:

Command	Response	Description
LSAsaaaaa	A	LOAD SETPOINT 1 where aaaaa = Setpoint 1 s = sign (space or -)
LSBsaaaaa	A	LOAD SETPOINT 2 where aaaaa = Setpoint 2 s = sign (space or -)
LSCsaaaaa	A	LOAD SETPOINT 3 where aaaaa = Setpoint 3 s = sign (space or -)
LSDsaaaaa	A	LOAD SETPOINT 4 where aaaaa = Setpoint 4 s = sign (space or -)
LSEsaaaaa	A	LOAD SETPOINT 5 where aaaaa = Setpoint 5 s = sign (space or -)
LCMabcd	A	LOAD COMMUNICATION MENU where abcd determine the information that will be sent by the control when it is issued a QMD command. The following table illustrates the bit assignments for the available data. Setting the appropriate bits will cause that data to be sent.
Digit "a"	Bit 0	Status
(0-F)	Bit 1	Flow Rate
	Bit 2	Actual Total
	Bit 3	Actual Grand Total
Digit "b"	Bit 0	Standardized Total
(0-F)	Bit 1	Standardized Grand Total
	Bit 2	Mass Total
	Bit 3	Mass Grand Total
Digit "c"	Bit 0	Setpoint for Output 1
(0-F)	Bit 1	Setpoint for Output 2
	Bit 2	Setpoint for Output 3
	Bit 3	Setpoint for Relay K1
Digit "d"	Bit 0	Setpoint for Relay K2
(0-F)	Bit 1	Current Temperature
	Bit 2	Current Absolute Pressure
	Bit 3	Current Density

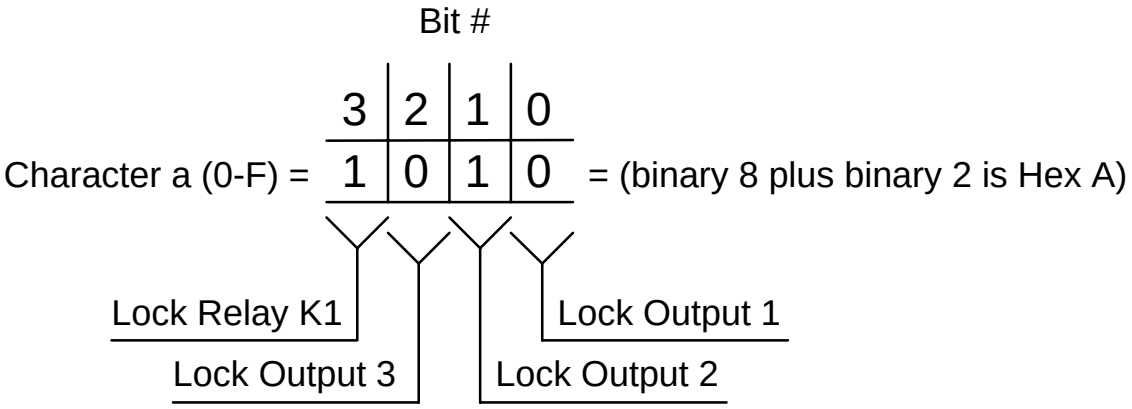
QUERY PROGRAM DATA/LOAD PROGRAM DATA COMMANDS

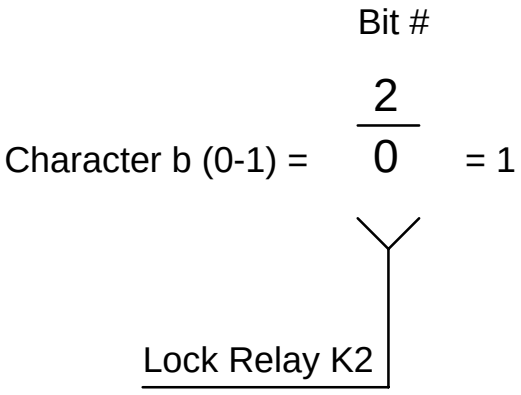
Query commands allow an external computer to read program data from the totalizer and load commands allow the computer to write program data to the totalizer. Each command consists of an L (load) or a Q (query) and a two digit submenu number from the programming matrix illustrated on page 13. All program mode sub menus are serially accessible except numbers 12 through 19 inclusive, 62, 63, and 64. Program data commands are valid only in the program mode.

Note: Load and query commands for submenus 44, 45, 46, 47, and 48 will contain data which is bit mapped. The set condition is a binary "1" for that bit. One to four bits are required for each character of data. Four bit characters are in hexadecimal.

Example: Load command to lock output 2 and relays K1 and K2 setpoints.

L44ab where a and b are derived from the following tables.





The command and data for this example would be:
L44A1

The following program mode commands are supported by this totalizer. Decimal points are not required by the command except for those program blocks which allow for a floating decimal point. All other program blocks will insert the decimal point in the correct location.

L11 a	A	Load Analog Output Select

		where a= 0 - Flow Rate = 1 - Temperature = 2 - Pressure
Q11 a	A11 a	Query Analog Output Select where a = 0 - Flow Rate = 1 - Temperature = 2 - Pressure
L21 a	A	Load Totalizer D.P. Location where a = 0 - No Dec. Pt. = 1 - XXXXXXXXX.X = 2 - XXXXXXXX.XX = 3 - XXXXXXX.XXX = 4 - XXXXXX.XXXX
Q21	A21 a	Query Totalizer D.P. Location where a = 0 - No Dec. Pt. = 1 - XXXXXXXXX.X = 2 - XXXXXXXX.XX = 3 - XXXXXXX.XXX = 4 - XXXXXX.XXXX
L22 a	A	Load Totalizer Pulse Output Speed where a = 0 - Pulse Fast = 1 - Pulse Medium = 2 - Pulse Slow
Q22	A22 a	Query Totalizer Pulse Output Speed where a = 0 - Pulse Fast = 1 - Pulse Medium = 2 - Pulse Slow
L23 aaa	A	Load Totalizer Display Header where aaa = Totalizer Display Header
Q23	A23 aaaa	Query Totalizer Display Header where aaa = Totalizer Display Header
L31 aa	A	Load Ratemeter Smoothing where aa = Smoothing Fact. (1 - 40)
Q31	A31 aa	Query Ratemeter Smoothing where aa = Smoothing Factory
Q31	A31 aa	Query Ratemeter Smoothing
L32 a	A	Load Ratemeter D.P. Location where a = 0 - No Dec. Pt. = 1 - XXXX.X = 2 - XXX.XX = 3 - XX.XXX = 4 - X.XXXX

Q32	A32 a	Query Ratemeter D.P. Location where a = 0 - No Dec. Pt. = 1 - XXXX.X = 2 - XXX.XX = 3 - XX.XXX = 4 - X.XXXX
L33 aa	A	Load Zero Rate Time where aa = Zero Time (01 - 15)
Q33	A33 aa	Query Zero Rate Time where aa = Zero Time
L34 aaaaaa	A	Load Rate Display Header where aaaaaa = Rate Display Header
Q34	A34 aaaaaa	Query Rate Display Header where aaa = Rate Display Header
L41 abcde	A	Load Output Setpoint Functions where a = Output 1 Setpoint Function b = Output 2 Setpoint Function c = Output 3 Setpoint Function d = Relay K1 Setpoint Function e e = Relay K2 Setpoint Function where 0 = Unused Setpoint 1 = Rate Lo Setpoint 2 = Rate Hi Setpoint 3 = Temperature Lo Setpoint 4 = Temperature Hi Setpoint 5 = Pressure Lo Setpoint 6 = Pressure Hi Setpoint

Q41	A41 abcde	Query Output Setpoint Functions where a = Output 1 Setpoint Function b= Output 2 Setpoint Function c= Output 3 Setpoint Function d= Relay K1 Setpoint Function e= Relay K2 Setpoint Function where 0 = Unused Setpoint 1= Rate Lo Setpoint 2= Rate Hi Setpoint 3= Temperature Lo Setpoint 4= Temperature Hi Setpoint 5= Pressure Lo Setpoint 6= Pressure Hi Setpoint
L42 aaaa bbbb cccc dddd eeee	A	Load Output Setpoint Identifier where aaaa = Output 1 Setpoint ID bbbb= Output 2 Setpoint ID cccc= Output 3 Setpoint ID dddd= Relay K1 Setpoint ID eeee= Relay K2 Setpoint ID
Q42	A42 aaaa bbbb cccc dddd eeee	Query Output Setpoint Identifier where aaaa = Output 1 Setpoint ID bbbb = Output 2 Setpoint ID cccc = Output 3 Setpoint ID dddd = Relay K1 Setpoint ID eeee= Relay K2 Setpoint ID

L43 a b c d e	A	Load Output Characteristic where a = Characteristic of Output 1 b = Characteristic of Output 2 c= Characteristic of Output 3 d= Characteristic of Relay K1 e = Characteristic of Relay K2 where 0 = Output Follows 1= Output Latched XXXX = Output Time Note: A space must follow each piece of data.
Q43	A43 a b c d e	Query Output Characteristic where a = Characteristic of Output 1 b = Characteristic of Output 2 c = Characteristic of Output 3 d = Characteristic of Relay K1 e= Characteristic of Relay K2 where 0 = Output Follows 1= Output Latched XXXX = Output Time Note: A space must follow each piece of data.
L44 ab	A	Load Output Setpoint Locks Where ab determine which Setpoints are locked. Setting the appropriate bit will lock that setpoint.
Digit "a" (0-F)	Bit 0 Bit 1 Bit 2 Bit 3	Lock Output 1 Setpoint Lock Output 2 Setpoint Lock Output 3 Setpoint Lock Relay K1 Setpoint
Digit "b" (0-1)	Bit 0	Lock Relay K2 Setpoint
Q44	A44 ab	Query Output Setpoint Locks where ab determine which Setpoints are locked.
Digit "a" (0-F)	Bit 0 Bit 1 Bit 3	Output 1 Setpoint Locked Output 2 Setpoint Locked Relay K1 Setpoint Locked
Digit "b" (0-1)	Bit 0	Relay K2 Setpoint Locked

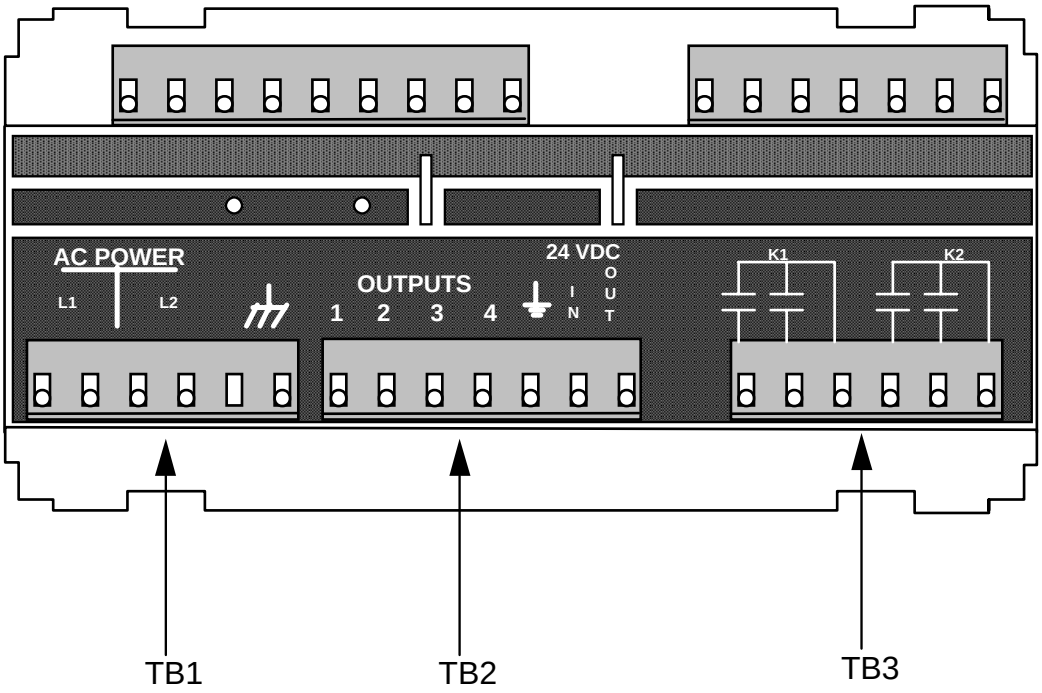
L51 ab	A	Load Control Input 1 Functions where ab determine the functions of Control Input 1. Setting the appropriate bit will enable that function.
Digit "a"	Bit 0	Reset Totalizer
(0-F)	Bit 1	Unlatch Output 1
	Bit 2	Unlatch Output 2
	Bit 3	Unlatch Output 3
Digit "b"	Bit 0	Unlatch K1 Relay
(0-7)	Bit 1	Unlatch K2 Relay
	Bit 2	Reset Grand Total
Q51	A51 ab	Query Control Input 1 Functions where ab determine the functions of Control Input 1.
Digit "a"	Bit 0	Reset Totalizer
(0-F)	Bit 1	Unlatch Output 1
	Bit 3	Unlatch Output 3
Digit "b"	Bit 0	Unlatch K1 Relay
(0-7)	Bit 1	Unlatch K2 Relay
	Bit 2	Reset Grand Total
L52 ab	A	Load Control Input 2 Functions where ab determine the functions of Control Input 2. Setting the appropriate bit will enable that function.
Digit "a"	Bit 0	Reset Totalizer
(0-F)	Bit 1	Unlatch Output 1
	Bit 2	Unlatch Output 2
	Bit 3	Unlatch Output 3
Digit "b"	Bit 0	Unlatch K1 Relay
(0-7)	Bit 1	Unlatch K2 Relay
	Bit 2	Reset Grand Total
Q52	A52 ab	Query Control Input 2 Functions where ab determine the functions of Control Input 2.
Digit "a"	Bit 0	Reset Totalizer
(0-F)	Bit 1	Unlatch Output 1
	Bit 2	Unlatch Ouptut 2
	Bit 3	Unlatch Output 3
Digit "b"	Bit 0	Unlatch K1 Relay
(0-7)	Bit 1	Unlatch K2 Relay
	Bit 2	Reset Grand Total
L53 ab	A	Load Control Input B Functions where ab determine the functions of Control Input B. Setting the appropriate bit will enable that function. If Count Inhibit is enabled, all other functions must be disabled.
Digit "a"	Bit 0	Reset Totalizer

(0-F)	Bit 1	Unlatch Output 1
	Bit 2	Unlatch Output 2
	Bit 3	Unlatch Output 3
Digit "b"	Bit 0	Unlatch K1 Relay
(0-8)	Bit 1	Unlatch K2 Relay
	Bit 2	Reset Grand Total
	Bit 3	Count Inhibit
Q53	A53 ab	Query Control Input B Functions where ab determine the functions of Control Input B.
Digit "a"	Bit 0	Reset Totalizer
(0-F)	Bit 1	Unlatch Output 1
	Bit 2	Unlatch Output 2
	Bit 3	Unlatch Output 3
Digit "b"	Bit 0	Unlatch K1 Relay
(0-8)	Bit 1	Unlatch K2 Relay
	Bit 2	Reset Grand Total
	Bit 3	Count Inhibit
L54 ab	A	Load Reset Key Functions where ab determine the functions of the Reset Key. Setting the appropriate bit will enable that function.
Digit "a"	Bit 0	Reset Totalizer
(0-F)	Bit 1	Unlatch Output 1
	Bit 3	Unlatch Output 3
Digit "b"	Bit 0	Unlatch K1 Relay
	Bit 1	Unlatch K2 Relay
Q54	A54 ab	Query Reset Key Functions where ab determine the functions of the Reset Key.
Digit "a"	Bit 0	Reset Totalizer
(0-F)	Bit 1	Unlatch Output 1
	Bit 2	Unlatch Output 2
	Bit 3	Unlatch Output 3
Digit "b"	Bit 0	Unlatch K1 Relay
(0-3)	Bit 1	Unlatch K2 Relay
L65 aaaaaa	A	Load K Factor where aaaaaa = K Factor (D.P. valid)
Q65	A65 aaaaaa	Query K Factor where aaaaaa = K Factor
L66 aaaa	A	Load Specific Gravity where aaaa = Specific Gravity
Q66	A66 aaaa	Query Specific Gravity where aaaa = Specific Gravity
L67 aaaaaa	A	Load Compressibility Factor where aaaaaa = Comp. Factor (D.P. valid)
Q67	A67 aaaaaa	Query Compressibility Factor where aaaaaa = Comp. Factor

L68 aaaaaa	A	Load Atmospheric Pressure where aaaaaa = Atmos. Pressure
Q68	A68 aaaaaa	Query Atmospheric Pressure where aaaaaa = Atmos. Pressure
L55 a	A	Load Steam Density Input where a = 0 - Temperature Input = 1 - Pressure Input
Q55	A55 a	Query Steam Density Input where a = 0 - Temperature Input = 1 - Pressure Input
L56 a sbbbbb	A	Load Temperature Input On/Off and Standard Temp. where a = 0 - Temp. Input Disabled = 1 - Temp. Input Enabled s= Sign (- or Space) bbbbb = Standard Temperature
Q56	A56 a sbbbbb	Query Temperature Input On/Off and Standard Temp. where a = 0 - Temp. Input Disabled = 1 - Temp. Input Enabled s = Sign (- or Space) bbbbb = Standard Temperature
L57 a bbbbb	A	Load Pressure Input On/Off and Standard Pressure where a = 0 - Pres. Input Disabled = 1 - Pres. Input Enabled bbbbb = Standard Pressure
Q57	A57 a bbbbb	Query Pressure Input On/Off and Standard Pressure where a = 0 - Pres. Input Disabled = 1 - Pres. Input Enabled bbbbb = Standard Pressure
L71 a	A	Load Units of Measure where a = 0 - English = 1 - Metric
Q71	A71 a	Query Units of Measure where a = 0 - English = 1 - Metric

L75 a	A	Load Mode of Operation where a = 0 - Ideal Gas = 1 - Saturated Steam = 2 - Superheated Steam
Q75	A75 a	Query Mode of Operation where a = 0 - Ideal Gas = 1 - Saturated Steam = 2 - Superheated Steam
L76 a	A	Load Display Parameter where a = 0 - Actual Flow = 1 - Standardized Flow = 2 - Mass Flow
Q76	A76 a	Query Display Parameter where a = 0 - Actual Flow = 1 - Standardized Flow = 2 - Mass Flow

I/O TERMINAL DESCRIPTION



TB1 AC POWER INPUT

AC POWER L1, L2, L3, L4 Terminal connection for 120 or 240 VAC.

⏚ Chassis ground. This terminal should be connected to earth ground.

TB2 TRANSISTOR OUTPUTS, 24 and 12 VDC POWER

OUTPUT 1, 2, 3 Alarm outputs assignable to hi and lo limits for flow temperature or pressure.

OUTPUT 4 Remote totalizer pulse output.

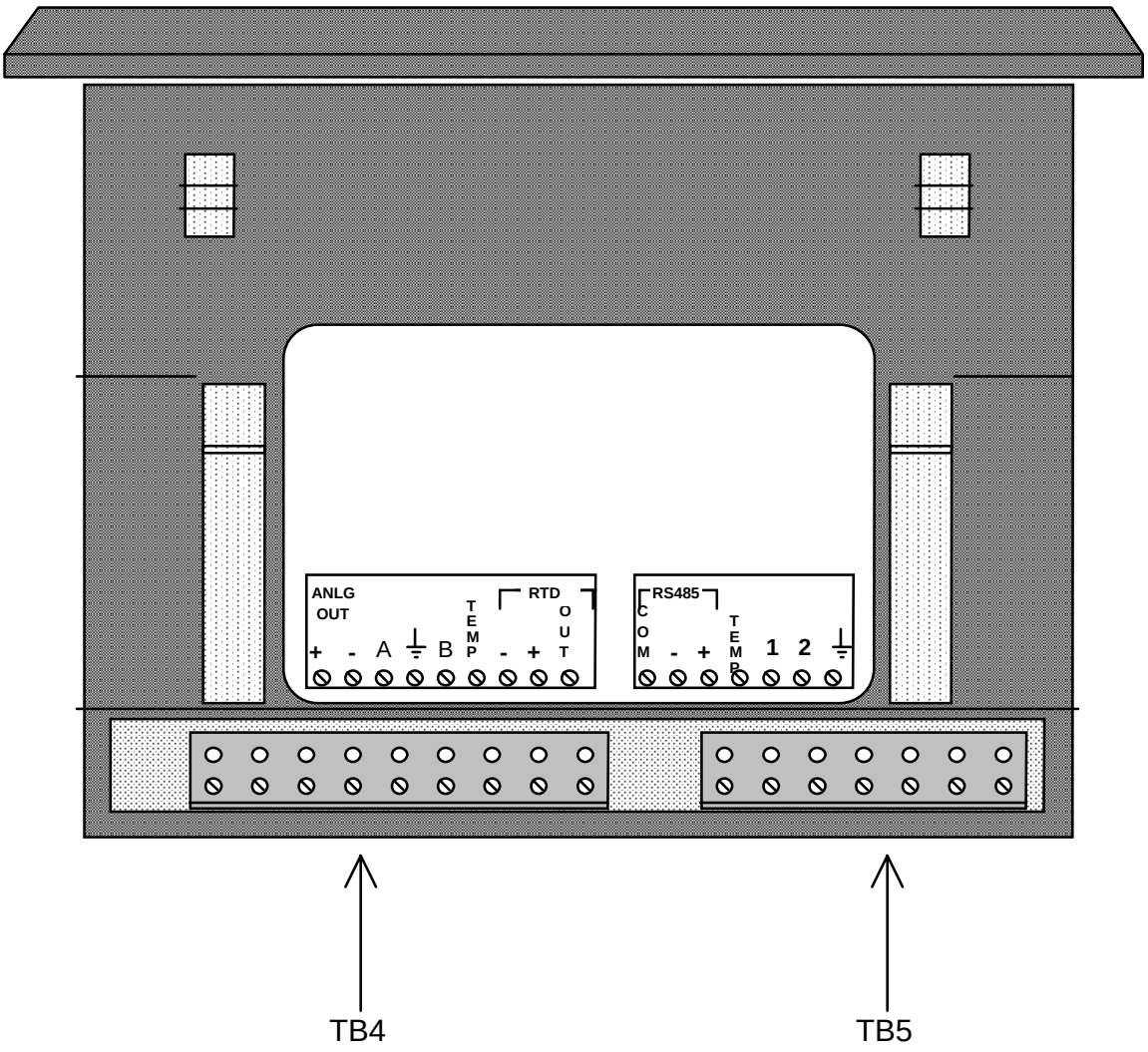
24 VDC ⏚ DC common. When unit is powered by DC, connect minus side of 18 - 27 VDC power supply to this terminal. When unit is supplies 24 VDC power for accessories, connect accessory DC common to this terminal.

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

24 VDC OUT Plus 24 VDC accessory power. Connect this terminal to the accessory plus 24 VDC input. Accessory power is available only if the unit is powered by AC.

RELAY OUTPUTS

K1, K2 Terminals are symbolically designated by contacts in the relays de-energised state. K1 and K2 are relay alarm outputs assignable to high and low limits for flow, temperature, or pressure.



TB4 ANALOG OUTPUT, FLOWMETER INPUT, COMMUNICATIONS OUTPUT

ANLG OUT +	The analog output positive terminal is connected to the analog circuit power supply positive or the 24 VDC out terminal on TB2. Maximum voltage applied to ANLG OUT + IS 27 VDC. MINIMUM VOLTAGE IS 12 VDC + LOAD DROP @ 20 MA.
ANLG OUT -	The analog output negative terminal is connected to the analog load positive terminal. The 4 - 20 mA signal with respect to common is put out at the ANLG OUT - terminal.
A	This is the flowmeter input.
⏚	DC common. Dc common is the reference level for the flowmeter and control inputs and transistor outputs conduct to DC common when in the 'on' state. DC common is connected to chassis ground through a capacitor.
B	Control input B. Input may be programmed as a count inhibit or as an unlatch/reset input.

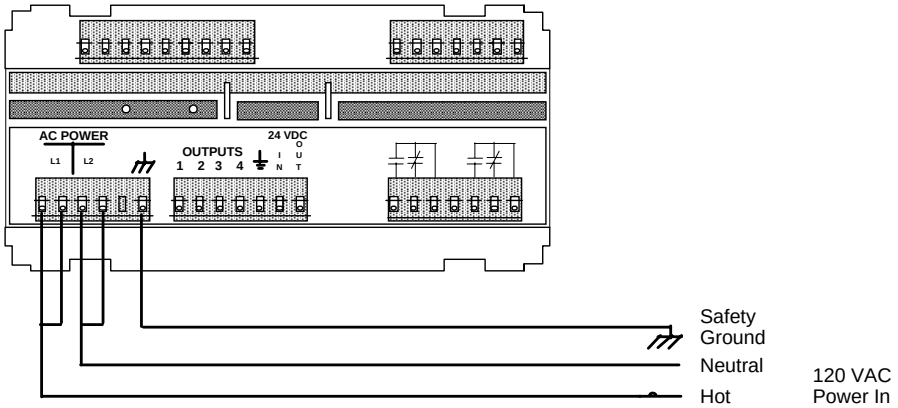
TEMP.	This is the positive terminal for the 4 - 20 mA temperature input.
RTD-	This terminal is the RTD negative sense input. It is connected to the same side of the RTD as RTD OUT (excitation positive).
RTD+	This terminal is the RTD positive sense input. It is connected to the same side of the RTD as RTD OUT (excitation positive).
RTD OUT	This terminal provides a + 2mA DC output (with respect to DC common) for RTD excitation.

TB5 COMMUNICATIONS OUTPUT PRESSURE INPUT, CONTROL INPUT

RS 485 COM	Communications common terminal. Connected to DC common by a 100 internal resistor.
RS 485-/RS 485+	Communications differential signal input/output.
CONTROL INPUTS ⏚	DC Common. Control inputs are active when connected to DC common.
CONTROL INPUTS 1, 2	Programmable inputs which may be assigned to various functions as explained in the program mode.

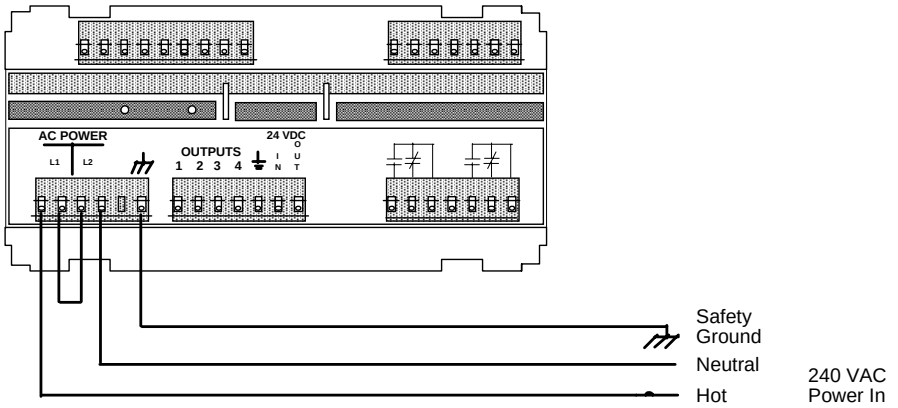
WIRING

120 VAC Power Input



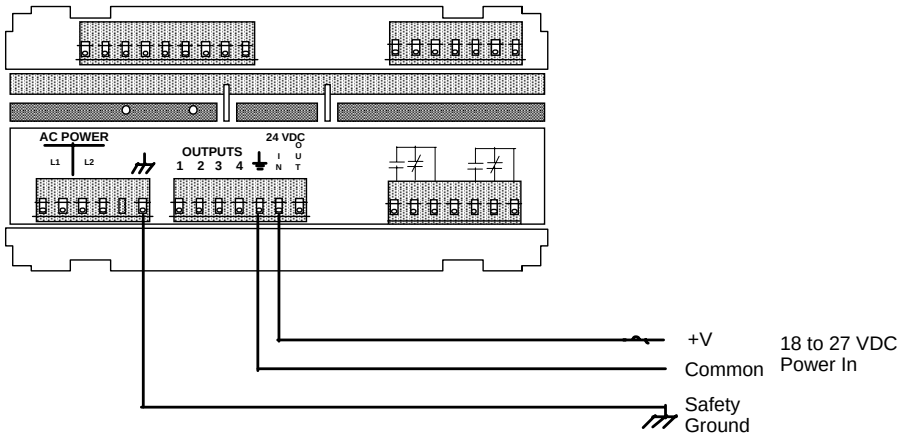
1. Fuse: .2A Slow-Blow

240 VAC Power Input



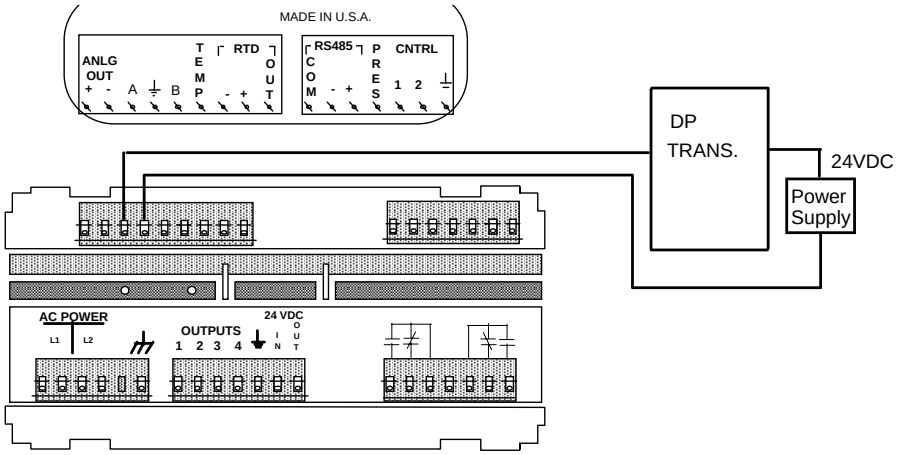
1. Fuse: .1A Slow-Blow

DC Power Input

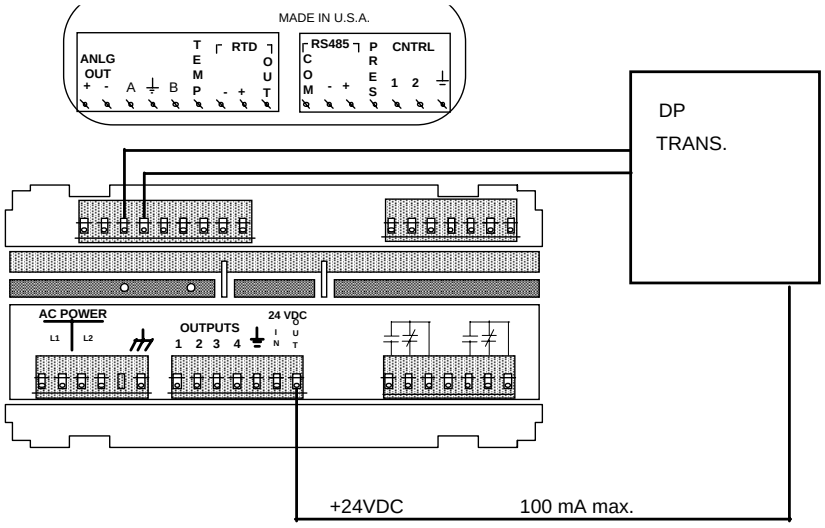


1. Fuse: .5A Slow-Blow
2. Safety ground optional, only required if relays are switching AC Power.

Flow Input Sensor with External Power Supply

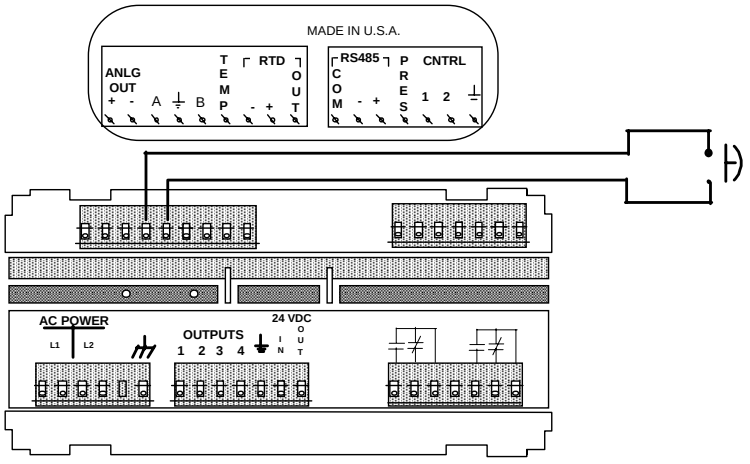


Flow Input Sensor with Control Power Supply



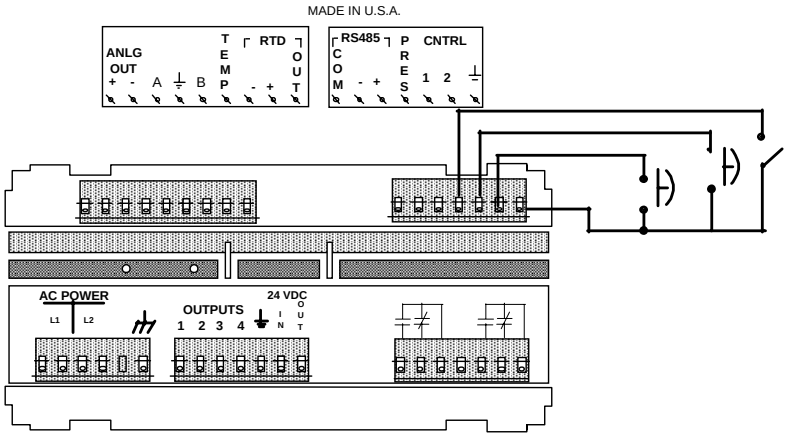
Do not connect the 24VDC out terminal to the sensor if the sensor is powered from another source.

Inhibit Input



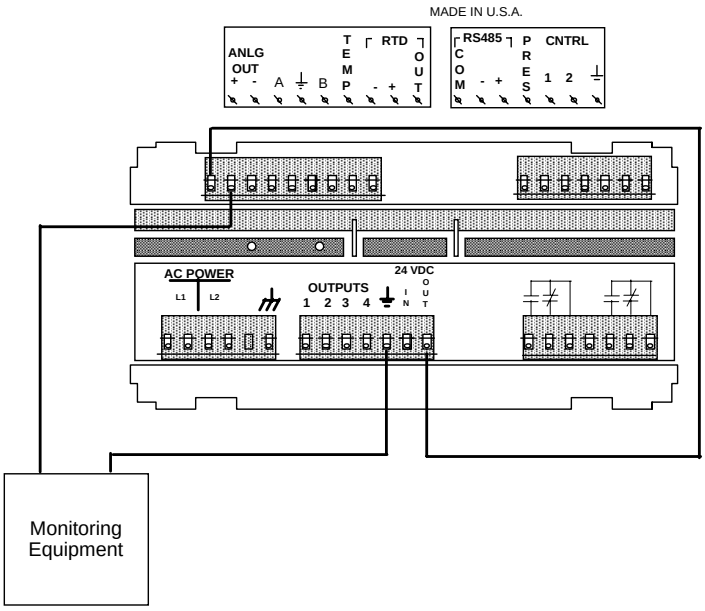
1. Inhibit input device may be a switch or an NPN transistor.

Wiring Control Inputs

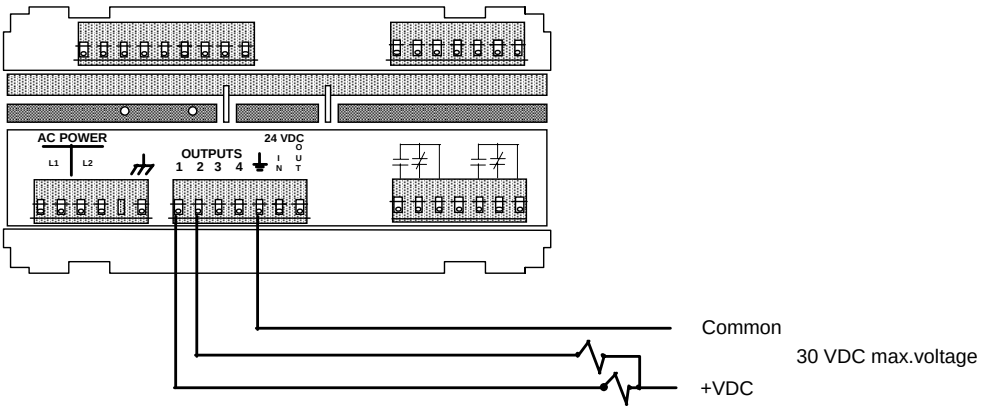


1. Control input device may be a switch or an NPN transistor.
2. Control inputs 1 and 2 wired in a similar manner.

Analog Rate Output (Non-Isolated)

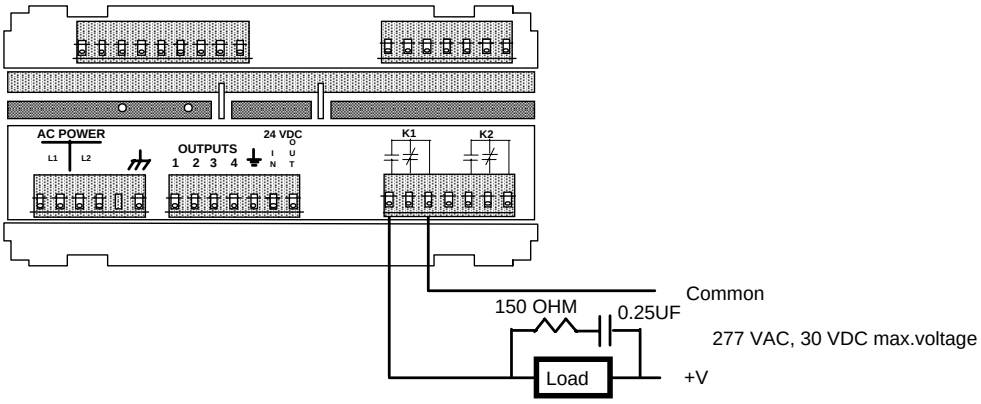


Wiring DC Loads
To Transistor Outputs



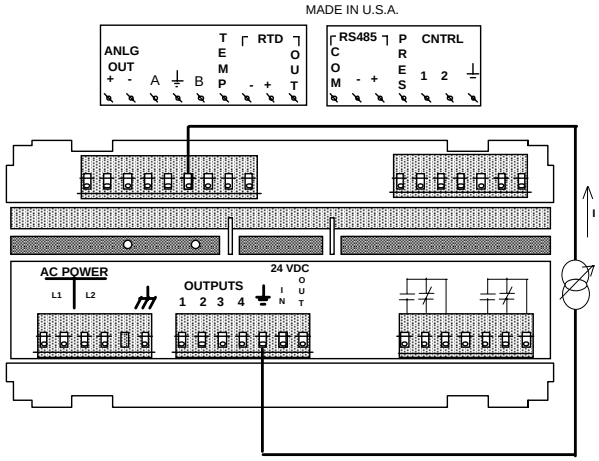
1. The load must not draw more than 150 mA of current.
2. Outputs 3 and 4 wired in the same manner as outputs 1 and 2.

Wiring Loads
To Relay Outputs

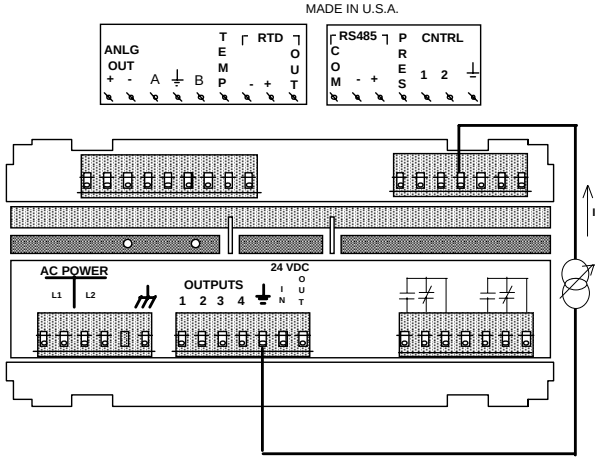


1. The load must not draw more than 10 A of current.
2. K2 relay is wired in the same manner as output K1.
3. Load is shown for normally open operation, if normally closed operation is desired, connect to other terminal.

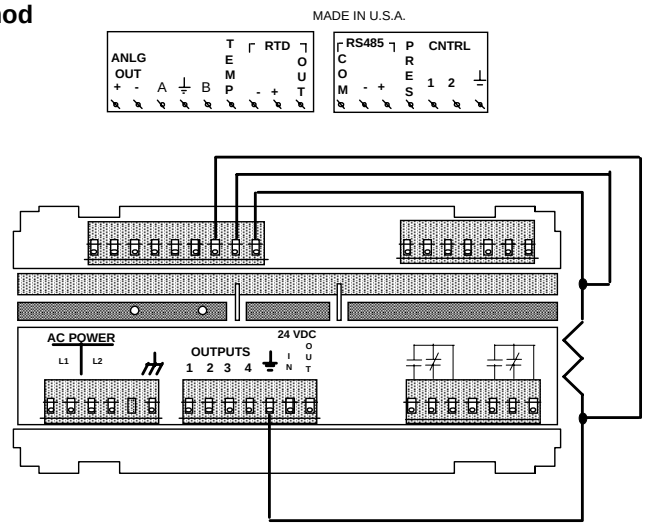
4 TO 20 Ma Temperature Input



4 TO 20 Ma Pressure Input



RTD Temperature Input
4 Wire Ohms Method



SPECIFICATIONS

ENVIRONMENTAL

Temp:	Operating 0 to 55 C Storage -40 to 70 C
Humidity:	0 to 85% RH non-condensing
Front Panel:	Sealed to Nema 4X

INPUTS

Power:	120/240 VAC+10%, -15%, 50/60 Hz @ 0.2 amps or 18 to 27 VDC @ .4 amps max. 5 watts max.
Control Inputs:	
Number:	1&2
Type:	Requires current sinking device such as contact closure to ground or NPN transistor to ground.
Impedance:	5.8k to +5 VDC
Voltage:	High 3.5 To 24 VDC Low 0.0 to 1.3 VDC
Response	Min Low 30 ms., min. high 30 ms.
Control Input B:	
Number:	1
Type:	Requires current sinking device such as contact closure to ground or NPN transistor to ground.
Impedance:	5.8k to +5 VDC
Voltage:	High 3.5 To 24 VDC Low 0.0 to 1.3 VDC
Response	Min Low 30 ms., min. high 30 ms.
Flow Input:	
Identification:	A
Type:	4-20mA, Adj. range 3.75-20.25 mA.
Impedance:	100 Ω
Voltage:	5 Volts max. sustained input voltage
Response	2 Hz
Resolution	11 bits.
Accuracy	± 0.1% @ 25° C, ±0.25 % over temp.
Temperature Input (only one of the following inputs can be used at a time):	
Identification:	TEMP
Type:	4-20mA, Adj. range 3.75-20.25 mA.
Impedance:	100 Ω
Voltage:	5 Volts max. sustained input voltage
Response	2 Hz
Resolution	14 bits.
Accuracy	± 0.1% @ 25° C, ±0.25 % over temp.
Temperature Input:	
Identification:	TEMP
Type:	4 wire RTD, Platinum to European Alpha 3850 curve
Impedance:	100 Ω
Response	2 Hz
Resolution	14 bits.
Accuracy	± 0.1% @ 25° C, ±0.25 % over temp.
Range:	-320° to 850°F in 0.1°F (Span definable)
Pressure Input:	
Identification:	PRES
Type:	4-20mA, Adj. range 3.75-20.25 mA.
Impedance:	100 Ω

Voltage:	5 Volts max. sustained input voltage
Response	2 Hz
Resolution	12 bits.
Accuracy	± 0.1% @ 25° C, ±0.25 % over temp.
Range:	0 - 3500 psia in 0.1 psia (span definable)

OUTPUTS

Accessory Power:	24 VDC±5%, 100 mA max.
Alarms (Relay):	
Type:	2 relays assignable to Hi/Lo flow, temp., of pressure
Rating:	Each relay has 1 for C contact rated 240 VAC, 10 amps resistive or 30 VDC, 10 amps resistive.
Operation:	Follows Latched or timed from 00..1 to 99.99 seconds
Alarms (Transistor):	
Type:	3 NPN transistors assignable to Hi/ Lo limits for flow, temperature or pressure.
Rating:	150 mA maximum 30 VDC blocking maximum
Operation:	Follows, latched or timed from 00.01 to 99.99 seconds
Pulse Output:	
Type:	1 NPN transistor for remote totalizing
Rating:	150 mA maximum,, 30 VDC blocking maximum.
Operation:	Outputs pulse for every increment of the internal totalizer. Output pulse width selectable from: Fast - 125 µsec. pulse width, 1.5 kHz max. frequency Med - 2 msec. pulse width 200 Hz max. frequency. Slow - 50 msec. pulse width, 10 Hz max. frequency.
Analog Output:	
Type:	4-20 mA current loop, optically isolated.
Voltage:	Compliance voltage 12 - 27 VDC
Response:	2 Hz.
Accuracy:	± 1% @ 25 C, ±.25% over temp.
Resolution:	11 bits
Operation:	Assignable to Flow, Temperature or Pressure.

RATEMETER

Type:	1/Tau.
Display:	5 digits with 6 character units of measure identifier.
Accuracy:	±.05%
Rate Multiplier:	.00001 to 999999.
Rate Smoothing:	.5 to 7.5 sec. in .5 sec steps.

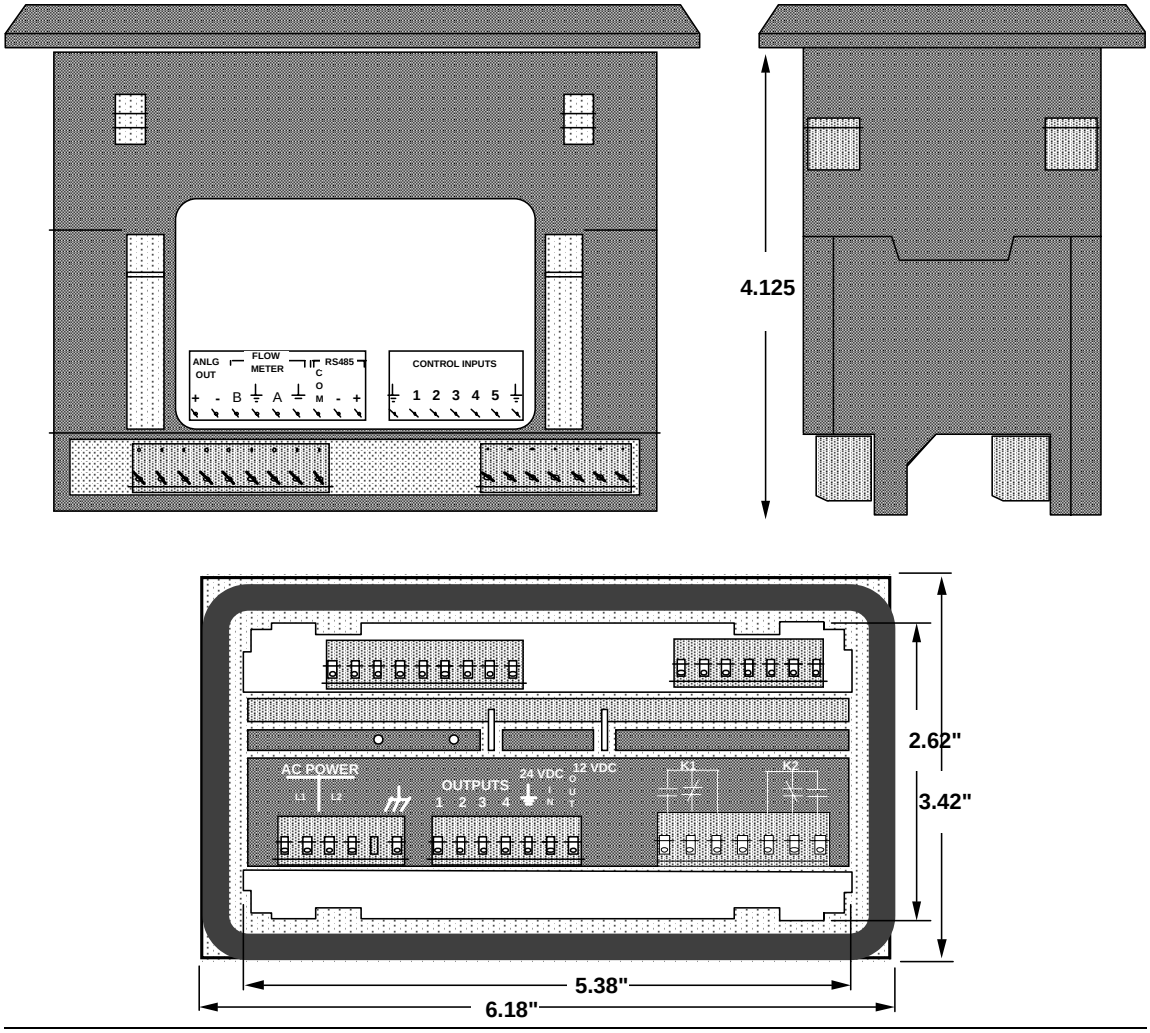
CONSTANT

Range:	.0001 to 99999.

COMMUNICATIONS

Type:	RS-485 multidrop.
Baud Rate:	300, 600, 1200, 2400, 4800, 9600, 19200.
Parity:	Space, Even, Odd
Protocol:	Opto-22 compatible.
Operation:	Can be configured to send persecuted data to printer.

DIMENSIONS



Lit # 24528-00 Rev. 1.1/05-05

OTHER McCROMETER PRODUCTS INCLUDE:

Magnetic Flowmeters

Propeller Meters

Propeller Meters

Differential Pressure Flowmeters

Differential Pressure Flowmeters

Differential Pressure Flowmeters

Variable Area Meters

Electronic Instrumentation for Remote Display and Control

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U.S. Patents 4638672, 4812049, 5363699, 4944190 and 5,814,738
Canadian Patent 1325113 European Patent 0277121 Japan patent 1,858,116 Other U.S. and Foreign patents pending
Lit# 24528-00 Rev 1.1/05-05 Printed in U.S.A.