DRT SERIES

DUAL RATE / TOTALIZER
INSTALLATION & OPERATING INSTRUCTIONS

KEP

KESSLER-ELLIS PRODUCTS

10 Industrial Way East
Eatontown, NJ 07724
800-631-2165 • 732-935-1320
Fax 732-935-9344

kep•com

http://www.kep.com

WARNING

This instrument contains electronic components that are susceptible to damage by static electricity. Proper handling* procedures must be observed during the removal, installation or handling of internal circuit boards or devices.

*Handling Procedure

1. Power to unit must be removed.

2. Personnel must be grounded, via wrist strap or other safe, suitable means, before any printed circuit board or other internal device is installed, removed or adjusted.

3. Printed circuit boards must be transported in a conductive bag or other conductive container. Boards must not be removed from the protective enclosure until the immediate time of installation. Removed boards must be placed immedi-ately in a protective container for transport, storage or return to factory.

Comments:

This instrument is not unique in its content of EDS (electrostatic discharge) sensitive components. Most modern electronic designs contain components that utilize metal oxide technology (NMOS, CMOS, etc.). Experience has proven that even small amounts of static electricity can damage or destroy these devices. Damaged components, even though they appear to function properly, exhibit early failure.

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DESCRIPTION & SPECIFICATIONS

DESCRIPTION:
The DRT (Dual Rate Totalizer) is a dual 5 digit Ratemeter 6 digit Totalizer in a 1/8 DIN package. User selects 1 of 6 displays to show A,B or C rate and A,B or C total. Inputs A and B have separate scaling to read in engineering units.
A 4-20mA (0-20mA) output of the C rate or total is optional.
The user can press the VIEW button to see 6 separate items total A, total B, total C, rate A, rate B, rate C. Negative values are displayed with a negative symbol (- 12345). For the C value, the user can choose from the following combination of A&B inputs: TOTAL; with a choice of A+B or A-B; RATIO with choice of A÷B(x100) to show percent of A to B quantity or A÷[A+B(x100)] to show percent of A to total quantity.
Two independent presets are standard. User selects whether output A is activated by total or rate value of input A or selected C. Output B can be activated by total or rate value of input B or selected C. Outputs activated by A or B total can be set to latch or autorecycle with an adjustable output duration from 00.1 to 99.9 sec. For rate, ratio, or C total outputs pull in when value is equal or above the preset and drop out when value is below the preset minus the selected 0 to 999 hysteresis.

SPECIFICATIONS:

DISPLAY
6 digit, 0.55" High LED

INPUT POWER:
110 VAC ± 15% or 12 to 15 VDC
220 VAC ± 15% or 12 to 15 VDC
24 VAC ± 15% or 12 to 15 VDC

CURRENT:
250 mA DC max. or 6.5 VA AC

OUTPUT POWER (AC powered units only)
+12 VDC @ 50 mA, unregulated -10 + 50%

TEMPERATURE:
Operating:
+32°F (0°C) to +130 F (+54°C)
Storage:
-40 F (-40°C) to +200°F (93°C)

MEMORY
EEPROM stores data for 10 years if power is lost.

INPUTS:
3: High Impedance DC pulse input 4-30 VDC (high), Open or 0-1 VDC (low),10 KΩ imp. 10 kHz max. speed. Accepts simultaneous inputs. May be used with KEP 711 series or PD & D series sensors.
3M: Mag. Input, Input A only, accepts 30mV input (50 V max. P/P) signals 10 KΩ imp. 5 kHz max. (Input B, 4-30V)
3MB: Mag. Input, Inputs A & B, accepts 30mV input (50 V max. P/P) signals 10 KΩ imp. 5 kHz max.

NOTE: The Mag. inputs have filtering as follows: up to 300hz @30mV, 5KHz @ .25V to 50V max.

RESET:
Front Panel: Resets displayed value and control output

Remote: 4-30 VDC negative edge resets all counters, "A" counter or "B" counter (user selectable).

K FACTOR/SCALING
The DRT has two separate K-Factors that are used to convert the input pulses to engineering units. The 5 digit K-Factor dividers, with decimal keyed into any position, allow easy direct entry of any K-Factor from 0.0001 to 99999. Separate factors may be entered for the 2 separate input channels.

CONTROL OUTPUTS:
Relays:
2 each N.O. Relay; 10 Amps120/240 VAC or 28 VDC. (N.C. relay contacts and NPN transistor output available with solder jumpers. Transistor output is internally pulled up to 10 VDC through relay coil, sinks from 10 VDC to .5 V @ 100 mA)
Analog Output:
An optional 4-20mA (0-20mA) output is available for the DRT. The output can be programmed to track rate or total of the C display. This feature is available by adding suffix A to the part number. Connections are via a 2 terminal pluggable screw connector. Programming is accomplished by using the front panel in conjunction with rear dip switches.
Accuracy: 50uA worst case.
Compliance Voltage: 3 to 30 VDC non inductive.

RS232/RS422SERIAL INTERFACE
If the serial interface option is supplied, up to 99 units can be linked together. (The terminal addressing the unit must be capable of driving all loads in the loop.) Unit status and new set points can be communicated by serial communication. Mode changes, however, must always be made on the front panel. Data is transmitted at selected baud rates using standard seven bit ASCII characters and parity with two additional bits of "Start" and "Stop" to make up the standard ten bit character.
Data is received and transmitted over standard EIA RS232 or RS422 levels. Each 10 bit character is made up of a start bit, 7 bit ASCII code, parity bit and stop bit. Unit number, baud rate and parity are entered in the "Program Setting" set up mode and remain in memory even if power is off.
Note that the input impedance of RS232 is 3K or 7K Ohm worst case. The terminal addressing the unit must be capable of driving all loads in the loop. RS422 input impedance is much higher and there is usually no problem driving 25 units. Unit serial transmit line remains in a high impedance "OFF" state until addressed.

PRESETS
Two control outputs are provided. To set relay values, press "menu" button until "Relay" appears on the display, the A and B outputs can be assigned to the A,B or C displays. A 5 digit value can be entered for both presets and the decimal point location is the same as the counter. The outputs can be set to energize from 0.1 to 99.9 seconds or latch (0.0). If a value other than 0.0 is entered, the counters will auto reset at the preset (for A&B counters).

1

SPECIFICATIONS
(continued)

DECODING PART NUMBER

LOCKOUT

Unauthorized front panel changes can be prevented by entering a user selected 5 digit code. The front panel can be completely locked out or the presets can remain accessible.

RATEMETER

Accurate to 4 1/2 digits (±1 display digit). The ratemeter uses 1/tau with 8 digit math, can sample from 2 to 24 seconds maximum, and auto-range up to 5 digits of significant information. In the "RPS" mode, the ratemeter displays in units per second, and in the "scale" mode, units per hour or per minute. The unit will display the rate of the A&B Inputs.

COUNTER

The two 6-digit counters can count at 10Khz speed. Each has a seporate 5-digit dividing scale factor. The counters advance on the positive edge of each pulse. Besides being able to step through the total and rate values of A & B inputs, the user can see a selected combination of total or rate of A+B, A-B, A÷BX100 (percent of A to B), A÷A+BX100 (percent of A to total). A negative display will be veiwed as a 5 digit display with a negative symbol (- 12345).

Example: DRT A 3 A

Series:
DRT= 6 digits counter, 5 digit ratemeter with presets and scaling.

Operating Voltage:
A= 110 VAC ± 15% or 12 to 15 VDC
B= 220 VAC ± 15% or 12 to 15 VDC
C= 24 VAC ± 15% or 12 to 15 VDC

Count Inputs:
3 = Standard, 4-30 VDC simultaneous inputs.
3M = Mag. Input, Input A only, 30mV input (Input B, 4-30V)
3MB = Mag. Input, Inputs A & B, 30mV input

Options
1= RS232 Communications
2= RS422 Communications
A= Analog Output (4-20/0-20 mA)
CE = CE Approved Version
NOTE: RS232/RS422 & Analog Output options can not be combined

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HOW TO MOUNT THE UNIT

The unit is designed to be mounted with a gasket providing a water tight seal. Two mounting brackets are provided to secure the unit to the panel. A panel less than .1" may distort if the clamps are screwed too tightly.

Slide the body of the unit through the rubber gasket. Insert the unit into the panel. As shown in "FIG. A", slide the brackets up the groove to press against the back of the panel. Insert screws into rear of brackets and tighten them evenly and alternately. Do not over tighten! A normal level of torque is required. Maximum torque should be 3" pounds.

This product is designed to be panel mounted and is NEMA 4 rated if proper mounting procedures are followed and the required and supplied hardware is correctly used.

If the panel in which the unit is mounted is less than .125 of an inch thick, the possibility exists that there will be some flexing. Should this flexing occur, the resulting deformation of the panel could cause a loss of the water tight seal. In case this should occur, the use of silicone or other sealant would be recommended.

This product is designed to the NEMA 4 rated. However, the fact that we are unable to control either the location in which the device is installed or the actual installation itself requires that the company's liability shall extend only to the repair or replacement of a defective product.

We are prepared to offer additional assistance in those special situations where normal mounting methods do not seem to satisfy the customers needs. This assistance may be obtained by calling the factory and asking for Application Engineering.

FIG A
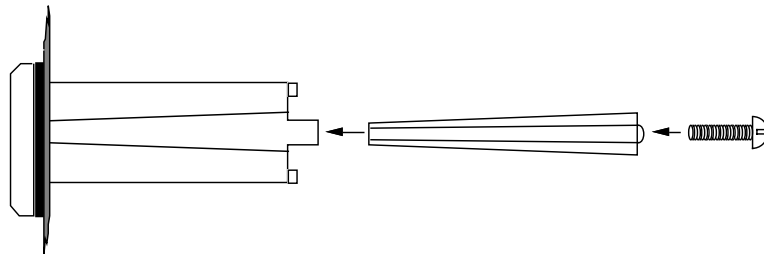
DIMENSIONS
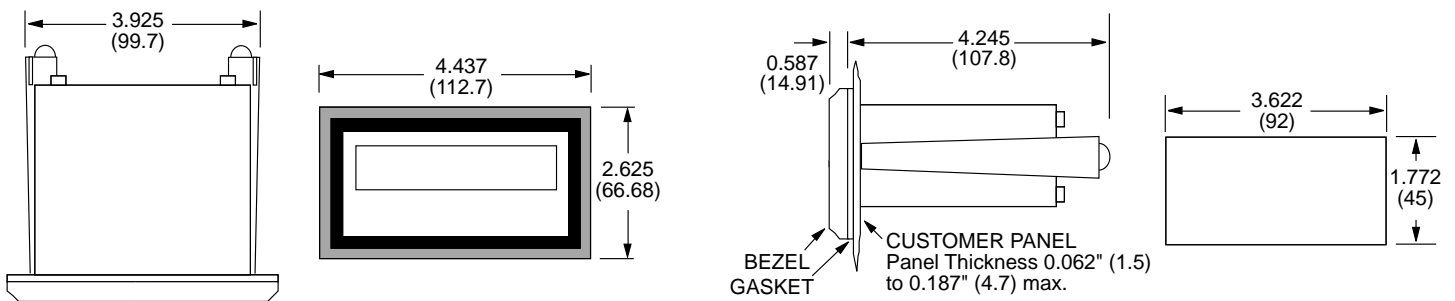
WIRING THE DRT

The rear terminal contains 12 screw terminals for connecting #14 to #28 gauge wire.

The unit is controlled by a microprocessor and, therefore, an electrically "noisy" environment could cause operating problems. The input power line should not be common to power lines for motors, pumps, contactors, etc.

The unit is designed to be immune from line or RF voltage interference. In some environments voltage spikes of over 100 volts, even 1000 volts, can occur. When common to a power line driving motors voltage fluctuations can be extreme and rapid. Lines driving DC or AC solenoids, relays, or actuators can also cause problems.

Four sources of noise can occur:

1) AC power line noise - If the unit cannot be connected to a clean power source, an inductive load suppressing device (MOV as GE # V130LA1 or Resistor Capacitor as Paktron # .2 uf/220 ohm @ 400V) can be installed. Although locating the suppressor across the AC supply at the unit should help, best results are obtained by connecting the suppressor across the leads of the "load" at the device causing the spike.

2) Input line noise -The noise is carried on the input and D.C. ground lines. Make sure the input wires are never run into the unit in a bundle with power input lines. Also, keep these input lines isolated from inductive lines from devices drawing heavy loads.   If there is a possibility of electrical noise, we recommend using shielded cable, with the shield being hooked to the D.C. ground terminal on the instrument, and to "earth" at one point in the circuit, preferably at the D.C. ground terminal of the unit.

3) Output lines - The unit has two relay outputs. When these outputs are used to run external relays or solenoids, spikes can be generated upon activation. This noise can spread through the instrument causing operating problems. If the source is a D.C. operated device, a general purpose diode (IN4004) placed across the solenoid prevents electrical noise spikes. Connect the cathode (banded side) to the more positive side of the coil. If the source is an A.C. operated device, use a MOV or Resistor Capacitor across the coil.

4) 12 VDC output supply - Noise can be generated on the 12 VDC output supply if it is used to drive inductive loads or if the current draw exceeds 50 mA. Insure that all inductive loads have a diode (such as IN4004) across the coil and that the current does not exceed 50 mA.
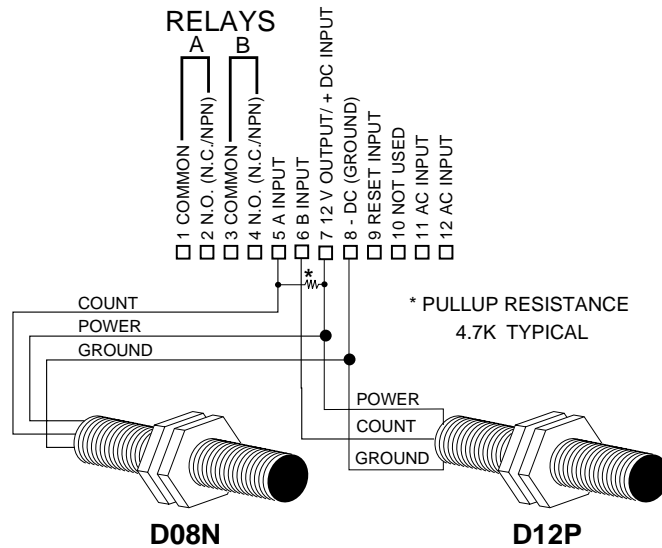
CONNECTING AC / DC POWER

NOTE: Connect power only after other connections are finished. Do not touch the live AC power terminals! The unit has been designed with an isolated AC input. Thus, polarity is not a concern for the AC input. The chassis is plastic, therefore earth ground is not used. For D.C. operation, connect + 12V to pin 7 and - D.C. to pin 8.
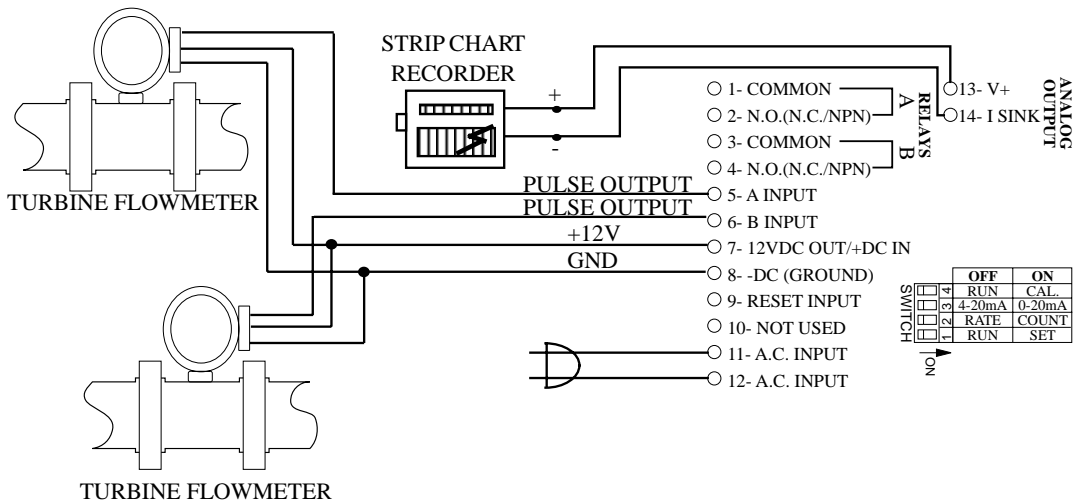
CONNECTING SENSOR INPUTS

These diagrams show how to hook typical input sensors to the unit. The unit supplies an unregulated 12 Volt (50mA) output to power these sensors (Pin 7).

A valid pulse is one which makes a transition from the off-state (0 to 1V) to the on-state (4 to 30V): a positive going edge. The input impedance is 10K Ohms to ground. The unit can be programmed from the front panel for slow switch closure inputs up to 40Hz (select "Lo CPS"), or solid state switches (select "hi CPS") up to 9.99KHz. No rear terminal jumpers are required. Use PNP (sourcing) type pulsers.

TYPICAL SENSOR HOOKUP

RELAYS
A   B

1 COMMON
2 N.O. (N.C./NPN)
3 COMMON
4 N.O. (N.C./NPN)
5 A INPUT
6 B INPUT
7 12 V OUTPUT/ + DC INPUT
8 - DC (GROUND)
9 RESET INPUT
10 NOT USED
11 AC INPUT
12 AC INPUT

COUNT
POWER
GROUND

* PULLUP RESISTANCE
4.7K TYPICAL

POWER
COUNT
GROUND

D08N   **D12P**

TYPICAL FLOW SENSOR HOOKUP

TURBINE FLOWMETER

STRIP CHART
RECORDER

+
-

PULSE OUTPUT
PULSE OUTPUT
+12V
GND

1- COMMON
2- N.O.(N.C./NPN)
3- COMMON
4- N.O.(N.C./NPN)
5- A INPUT
6- B INPUT
7- 12VDC OUT/+DC IN
8- -DC (GROUND)
9- RESET INPUT
10- NOT USED
11- A.C. INPUT
12- A.C. INPUT

RELAYS A B

13- V+
14- I SINK
ANALOG OUTPUT

TURBINE FLOWMETER

SWITCH	OFF	ON
4	RUN	CAL.
3	4-20mA	0-20mA
2	RATE	COUNT
1	RUN	SET

ON

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SELECTABLE COMBINATIONS

ꓮꓮdd b   - Scaled A input added to the Scaled B input.
ꓮ Sub b - Scaled A input subtracted by the Scaled B input.
ꓮ / b   - Scaled A input divided by the Scaled B input X 100 to show percent of A to B.
ꓮ / ꓮ + b - Scaled A input divided by the Scaled A input plus the scaled B input X 100 to show
            percent of A plus B.

WHAT CAN YOU VIEW?

By pressing the VIEW button one time the user can veiw the active display. By pressing the VIEW button more than once the user can step through all 6 displays to choose which display the user wishes to view.

tot ꓮ - Total of display A
tot b - Total of display B
tot C - Total of display C
rꓮtE ꓮ - Rate of display A
rꓮtE b - Rate of display B
rꓮtE C - Rate of display C

OUTPUT JUMPER SELECTIONS

| FUNCTION	MODIFICATION	
"A" RELAY N.C. OUTPUT	CUT AT "A"	JUMPER "B" TO "2"
"B" RELAY N.C. OUTPUT	CUT AT "D"	JUMPER "E" TO "4"
* "A" PRESET TRANSISTOR (NPN)	CUT AT "A"	JUMPER "C" TO "2"
* "B" PRESET TRANSISTOR (NPN)	CUT AT "D"	JUMPER "F" TO "4"

MILLIVOLT INPUT OPTION JUMPER SELECTIONS
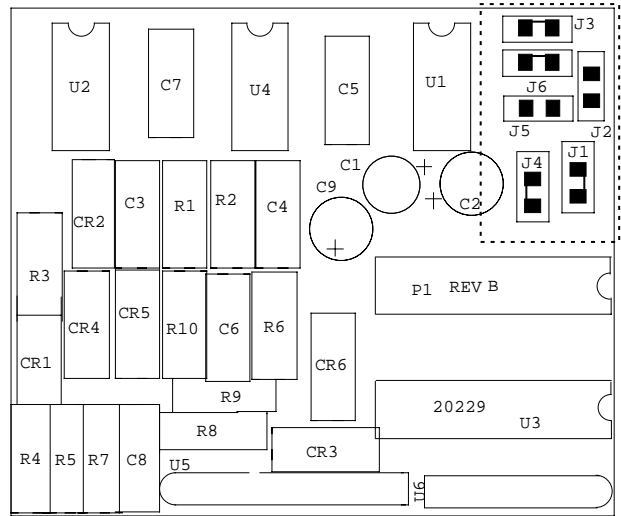
If the unit has the millivolt input bd.# 20229, A & B inputs can be separately solder jumper programmed to accept either a low millivolt or 4-30 V input. Each unit shipped is programmed according to part number. If solder jumpers are made, the part number should be modified to reflect the changes made.

C=CLOSE, O=OPEN

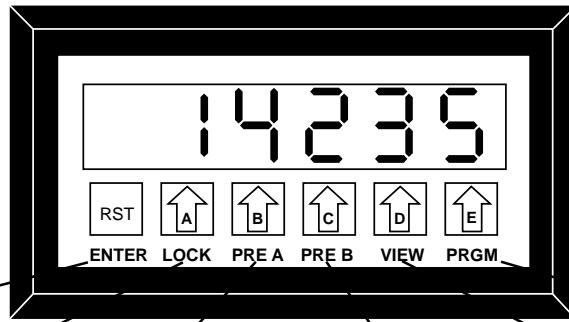|	**4-30V** INPUT	**Millivolt** INPUT
Input A	J1-O, J2-C, J3-O	J1-C, J2-O, J3-C
InputB	J4-O, J5-C, J6-O	J4-C, J5-O, J6-C

BOTTOM VIEW AT TERMINAL
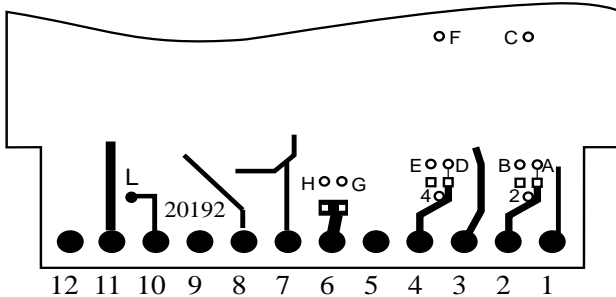
* The unit must be removed from the case to access jumpers C & F, all other jumpers can be accessed by removing the plastic extender.

NOTE: All three pads at jumpers 2 and 4 are connected.

OPERATING THE FRONT PANEL

Press to "reset" in operating mode. Press to "enter" in programming mode.

Press to enter lock code for panel lock.

Press to view or change preset A.

Press to view or change preset B.

Press to alternately view A,B,or C Rate / Total displays.

Press to cycle through PRO-GRAM choices. Press to toggle between choices in program mode.
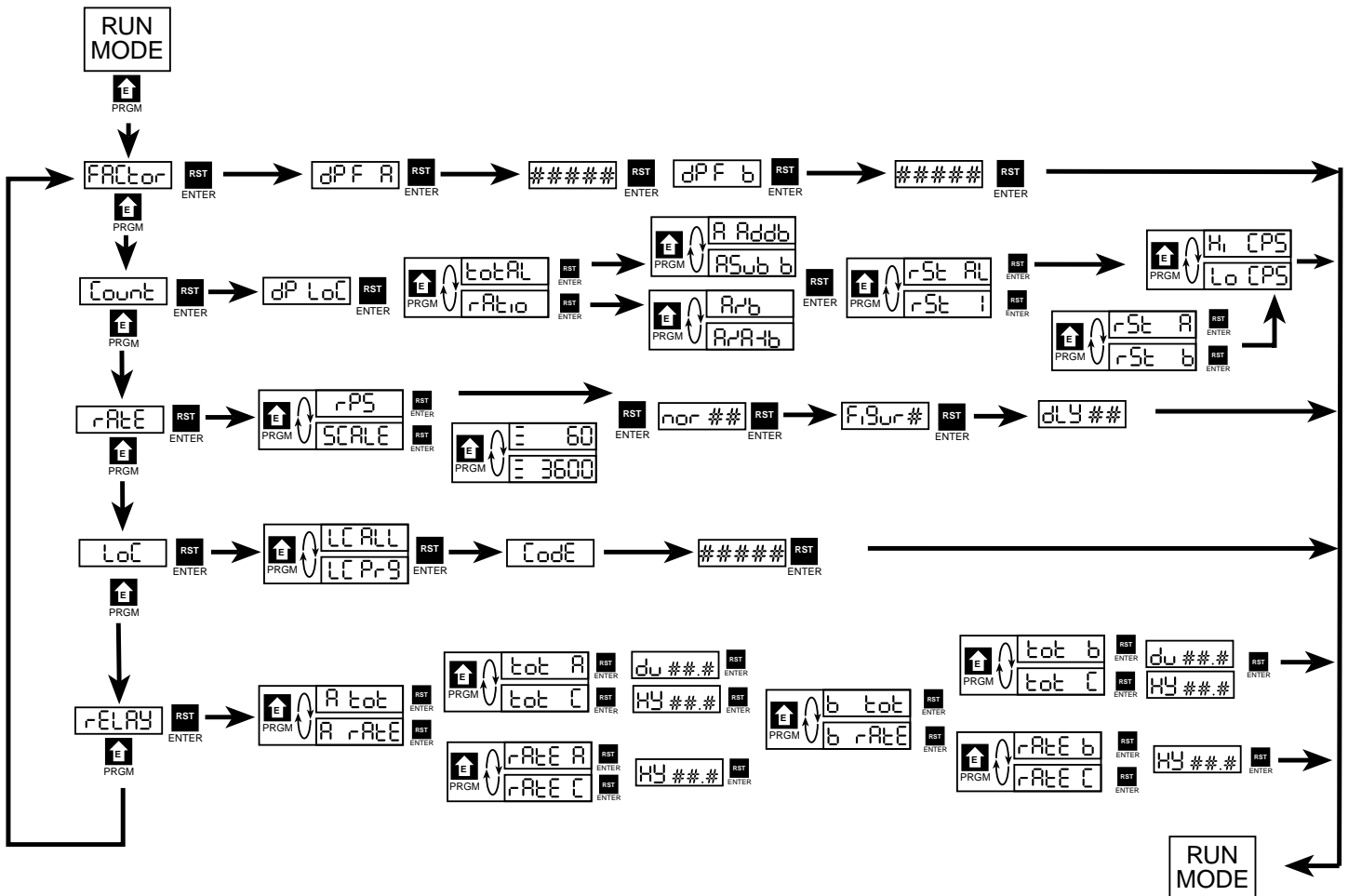
PROGRAMMING FLOWCHART

⬆ PRGM Press this key to step through menu choices.

RST ENTER Press this key to enter displayed value

The following is a list of abbreviations as they appear on the display and front panel of the unit.

ABBREVIATION   DESCRIPTION

FACtor   SCALING FACTOR - For A and B Inputs. Each input has a separate 5 digit dividing scale factor.

dPF A   DECIMAL POINT FOR FACTOR A - Enter location of decimal point for scaling Factor A by pressing the
            button under the digit where the decimal is desired.

dPF b   DECIMAL POINT FOR FACTOR B - Enter location of decimal point for scaling Factor B by pressing the
            button under the digit where the decimal is desired.

Count   PORTION OF MENU FOR SETTING COUNTER VARIABLES AND "C" DISPLAY COMBINATIONS.

dPLoC   DECIMAL POINT LOCATION - Enter desired location of decimal by pushing the button under the digit
            where the decimal is desired. Changing the decimal will change the decimal location in the A,B&C total
            as well as the rate displays.

totAL   TOTAL - Allows the unit to display A ADD B or A SUBTRACT B (A Add b or A Sub b)

rAtio   RATIO - Allows the unit to display A DIVIDED BY B X 100 to show percent of A to B or
            A DIVIDED BY A PLUS B X 100 to show percent of A to A + B. (Ar'b or Ar'A+b)

A Sub b   A SUBTRACT B - The number of scaled pulses from Input B are subtracted from the number of scaled
            pulses from Input A. (-99999 TO 999999)

A Add b   A ADD B - The number of scaled pulses from the A Input are added to the number of scaled pulses from the
            B Input.

Ar'b   A DIVIDED BY B - The number of scaled pulses of input A are divided by the number of scaled pulses of
            input B X 100 to give the percent ratio of A ÷ B.

Ar' A+b   A DIVIDED BY A PLUS B - The number of scaled pulses of input A divided by A plus the number of scaled
            pulses of input B X 100 to give the percent ratio of A ÷ A + B.

rSt AL   RESET ALL - When the remote reset is negative edged triggered, A,B, & C total displays are reset to 0.
            The reset button (rst) will only reset what is being displayed. If the C display is reset both A&B displays
             are reset as well.

rSt I   RESET ONE - Will give a chose between resetting the A or B total displays. If the A display is chosen and the
            remote reset is negative edged triggered, only the A display is reset. If B display is chosen the same applies.
            The C display will update accordingly. The reset button (rst) will only reset what is being displayed.
            If the C display is reset both the A&B displays are reset as well.

Hi CPS   HIGH COUNTS PER SECOND - This sets the unit to accept high count speeds (0-9.99KHz)

Lo CPS   LOW COUNTS PER SECOND – This sets the unit for contact debounce filtering (0-40Hz)

rAtE   PORTION OF MENU FOR SETTING RATE VARIABLES

rPS   RATE PER SECOND - The display will read in rate per second.

SCALE   SCALING - Allows unit to display rate per minute or rate per hour.

÷ 60   DIVIDE K FACTOR BY 60 - This sets the unit for rate per minute; equal to 60 times rate per second.

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⌐ 3600   DIVIDE K FACTOR BY 3600 - This sets the unit for rate per hour; equal to 3600 times rate per second.

nor ##   NORMALIZING FACTOR - Normalizes (averages) the data being received. Higher settings provide more normalizing (averaging) for a more stable display. Derived from the equation:

$$\frac{(\text{Old Data x "NOR" + New Data})}{(\text{"NOR" + 1})}$$

Fi9ur ##   SIGNIFICANT FIGURE - This sets the amount (1-5) of meaningful figures the unit will display. (RATE DISPLAY ONLY). FOR EXAMPLE: If "2" is set as the figure, a rate of 273.45 will be displayed as 270.

dLY##   DELAY FACTOR - The amount of time (02 to 24 sec.) the unit will "look" for valid data, before the display defaults to zero. (RATE DISPLAY ONLY)

LoC   LOCK - This portion of the menu allows you to:
1) lock the program (presets and front reset are still accessible)
2) lock all (presets, front reset, and program are locked).

LC Pr9   LOCK PROGRAM - This will lock the program, but allows the front reset and the presets to be changed when the unit is in the lock mode.

LC ALL   LOCK ALL - This will lock the program, reset and the presets when the unit is in the locked mode. The presets can be viewed, but not changed.

CodE   LOCK CODE - This message (code) will flash on display for approximately 3 seconds. It will be followed by a 5 digit number (xxxxx). The number you enter here will be the code to lock and unlock the unit.

rELAY   RELAY - This portion of the menu allows you to set your relay operation variables.

A tot   RELAY A FOR TOTALIZER - When this is selected the user has a choice of having Preset A follow the A (tot A) or C (tot C) display.

tot A   RELAY A FOR A TOTALIZER - If selected, the A output is activated by A total and user can select auto recycle with duration of 00.1 to 99.9 sec or latched till reset if 00.0 is programmed.

tot C   RELAY A FOR C TOTALIZER - If selected, the A output is activated when C total is equal or greater then preset A and drops out when C total goes below preset A by selected 0 - 99.9 hysteresis.

A rAtE   RELAY A FOR RATE - When this is selected, output A will activate when the Rate of either display A or display C (user selectable) equals or exceeds preset A. The relay will drop out when the selected rate falls below preset A by selected 0 - 99.9 hysteresis..

rAtE A   RELAY A FOR A RATE - If selected, the A output is activated when A rate is equal or greater than preset A and drops out when A rate goes below preset A by selected 0 - 99.9 hysteresis.

rAtE C   RELAY A FOR C RATE - If selected, output A is activated when C rate is equal or greater than preset A and drops out when the C rate goes below preset A by selected 0 -99.9 hysteresis.
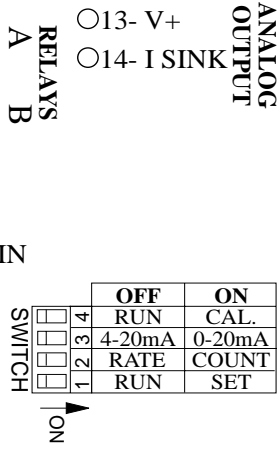
HY ##.#   HYSTERESIS OF RELAY - 0 - 99.9 value which user selects as difference between activation and drop out of output for rate and "C" value. Output activates when value is equal or above preset but only drops out when value is below preset by selected hysteresis value.

du ##.#   DURATION OF OUTPUT FOR A OR B TOTAL - If set 00.1 to 99.9 sec, selected counter autoresets at preset and output is active for selected time. If set 00.0 counter does not autoreset and output is active as long as count is equal or above preset.
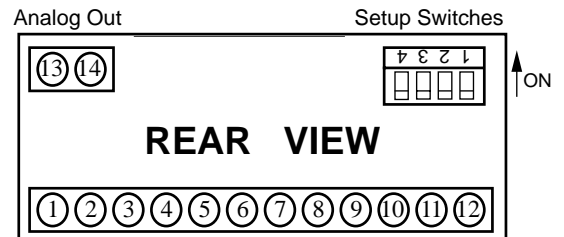
b tot   RELAY B FOR TOTALIZER - When this is selected, the user has a choice of having Preset B follow the B (tot b) or C (tot C) display.

tot b   RELAY B FOR B TOTALIZER - If selected, the B output is activated by B total and user can select auto recycle with duration of 00.1 to 99.9 sec or latched till reset if 00.0 is programmed.

tot C   RELAY B FOR C TOTALIZER - If selected, the B output is activated when C total is equal or greater then preset B and drops out when C total goes below preset B by selected 0 - 99.9 hysteresis.

b rAtE   RELAY B FOR RATE - When this is selected, output B will activate when the Rate of either display B or display C (user selectable) equals or exceeds preset B. The relay will drop out when the selected rate falls below preset B by selected 0 - 99.9 hysteresis..

rAtE b   RELAY B FOR B RATE - If selected, the B output is activated when B rate is equal or greater than preset B and drops out when B rate goes below preset B by selected 0 - 99.9 hysteresis.

TERMINATION:

○ 1- COMMON

○ 2- N.O.(N.C./NPN)

○ 3- COMMON

○ 4- N.O.(N.C./NPN)

RELAYS A / B

○ 13- V+

○ 14- I SINK

ANALOG OUTPUT

○ 5- A INPUT

○ 6- B INPUT

○ 7- 12VDC OUT/+DC IN

○ 8- -DC (GROUND)

○ 9- RESET INPUT

○ 10- NOT USED

○ 11- A.C. INPUT

○ 12- A.C. INPUT

SWITCH		OFF	ON
4		RUN	CAL.
3		4-20mA	0-20mA
2		RATE	COUNT
1		RUN	SET

ON

REAR VIEW

Analog Out   Setup Switches

⑬⑭

1 2 3 4
ON

REAR   VIEW

①②③④⑤⑥⑦⑧⑨⑩⑪⑫

CALCULATING SCALE FACTORS

There are two separate dividing scale factors, one for input "A" and one for input "B". The factor to enter is the number of pulses per the desired unit of measurement. The factor ranges from 0.0001 to 99999. The factor is the same for rate and count. Because the "units per second", "minute", or "hour" are field programmable from the keypad, scale factor calculations for the ratemeter are easy. Here are some examples:

SCALING FACTOR EXAMPLES:

UNIT COUNTING:
> You pick up a notch on a paper roll (1 pulse per shaft revolution). Each revolution equals 3 feet. To find the number of pulses per foot, simply divide "1 pulse" by "3 feet" (1 ÷ 3 = .3333).
> **Solution** - One foot equals 0.3333 pulses, enter this as the scale factor and the display will read in feet.

RATE:
> A conveyor carrying bottles must be controlled for bottle speed. For each revolution of the front roller, three bottles travel by. Thus, one revolution equals 3 bottles. A wheel with seven spokes is mounted on the roller. The user can't sense bottles because they are traveling through a washer, so a sensor is placed at the roller, sensing seven pulse per revolution of the shaft, which equals 3 bottles per revolution.
> To calculate the scale factor (7 ppr ÷ 3 bottles) = 2.3333 scale divider. Set rate per second, minute or hour as desired.

FLOW IN LITERS:
> A flow meter is generating 52.6 pulses per gallon. The desired readout is in liters. Since there are 3.785 liters per gallon, divide 52.6 by 3.785 to find the number of pulses per liter (52.6 ÷ 3.785 = 13.897).
> Enter 13.789 as the scale factor so the display will read in liters.

CUT TO LENGTH:
> An aluminum sheeting plant has a cut to length application to customer specification. A 100 pulse per revolution encoder with a 12" wheel is used to sense. The travel of aluminum sheets is in 0.1 inches. Thus, after 100 pulses, you want 12.0 to appear on the display. Note that decimal point is for display only. Factor must be calculated to show all desired units of measure. Thus, 100 ÷ 120 (total desired units of measure) = 0.8333. Enter 0.8333 as your scale factor. Set "dummy" decimal point location to 0.0 under Program Count section.

FLOW BOILER OR MOTOR "A-B":
> Fuel usage of a boiler can be monitored using the "A-B" option. Separate factors can be entered for Factors "A" and "B", but the time base must be the same for rate.

PROGRAMMING

STEP 1	PRESS	DISPLAY	REMARKS
SETTING SCALING FACTORS	□ PRGM	FACtor	This section of the menu is used to set up the scaling factors for inputs A & B.
	□ ENTER	dPF A	This sets the decimal for factor A. Press the arrow key under the digit where the decimal is desired. To clear the decimal, press the arrow key furthest to the right (PRGM) .
	□ ENTER	#####	This is the scaling factor for input A. To change, press the arrow key under the digit(s). Press ENTER to enter the displayed value.
	□ ENTER	dPF b	This sets the decimal for factor B. Press the arrow key under the digit where the decimal is desired. To clear the decimal, press the arrow key furthest to the right (PRGM) .
	□ ENTER	#####	This is the scaling factor for input B. To change, press the arrow key under the digit(s). Press ENTER to enter the displayed value.

PRESS	DISPLAY	REMARKS
□ **PRGM**	FACtor	This section of the menu sets up the counter and combination "C" information.
□ **PRGM**	Count	
□ **ENTER**	dPLoC	This sets the decimal location for the A,B&C counters. Press the arrow key under the desired digit location. To clear the decimal, press the arrow key furthest to the right. Press the ENTER key to enter the displayed location.
□ **ENTER**	totAL or rAtio	Press the program key to choose Total or Ratio. Press the ENTER key to enter the displayed choice.
□ **ENTER**	A Sub b or A Add b	This section will only appear if Total is selected. Choose A SUB B (A subtract B) or A ADD B. Press the ENTER key to enter the displayed choice.
□ **ENTER**	Arb or ArA+b	This section will only appear if RATIO is selected. Choose A÷B or A÷A+B. Press the ENTER key to enter the displayed choice.
□ **ENTER**	rSt AL or rSt 1	Press the PRGM key to choose RESET ALL (resetting A,B&C displays) or RESET 1 (resetting a choice of either A or B display) Press the ENTER key to enter the displayed choice.
□ **ENTER**	rSt A or rSt b	Press the PRGM key to choose RESET A or RESET B. Press the ENTER key to enter the displayed choice.
□ **ENTER**	Hi CPS or Lo CPS	Press the PRGM key to choose HIGH CPS (0-9.99KHz) or LOW CPS (0-40Hz). Press the ENTER key to enter the displayed choice.

STEP 2
SETTING THE COUNTER

	PRESS	**DISPLAY**	**REMARKS**

STEP 3

SETTING THE RATE

PRGM	FACtor	
PRGM	Count	
PRGM	rAtE	This section of the menu is used to set up the rate information.

ENTER	rPS or SCALE	Press the PRGM key to choose RPS (rate per second) or SCALE (RPM, RPH). Press ENTER to enter displayed choice.

ENTER	÷60 or ÷3600	Press PRGM to choose ÷60 (RPM) or ÷3600 (RPH). Press ENTER to enter displayed choice.

ENTER	nor ##	This sets the normalizing (averaging) factor. Press the arrow keys under the desired digits to change. Press ENTER to enter displayed value.

ENTER	Figur #	This sets the number of significant figures to be displayed. Press the arrow key under the digit to change. Press ENTER to enter displayed value.

ENTER	dLY #.#	This sets the delay time (2 to 24 sec.) that the unit will "look" for valid input data before the display falls to 0. Press the arrow key under the digits to change. Press ENTER to enter displayed value.

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	PRESS	DISPLAY	REMARKS
STEP 4 **SETTING LOCK**	☐ **PRGM**	FACtor	
	☐ **PRGM**	Count	
	☐ **PRGM**	rAtE	
	☐ **PRGM**	LoC	This section of the menu is used to set up the lockout type and code.
	☐ **ENTER**	LC PG or LC ALL	LC PG = Locks program but presets and reset are accessible. LC ALL= Locks entire keypad. Press the PRGM button to toggle between choices; Press ENTER to enter displayed choice.
	☐ **ENTER**	CodE Flashes followed by: #####	After CODE flashes the display will show the existing lock code. To change the code press the key under each digit to be changed. Press ENTER to enter displayed value.
LOCK AND UNLOCK UNIT	**PRESS** ☐ **LOCK**	CodE Flashes followed by: 0	When in the run mode press LOCK. After CODE goes out, key in the lock code (see programming step 4) by pressing the keys under the digits to be changed. Press the ENTER key to enter the displayed code.
	☐ **ENTER**	LoC or unLoC	After the code is entered the unit will display LOC (unit is locked) or UN LOC (unit is un-locked). This message will be displayed for approximately 3 seconds before the unit returns to the run mode.

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	PRESS	**DISPLAY**	**REMARKS**
STEP 5 **SETTING THE RELAYS**	☐ **PRGM**	FACtor	
	☐ **PRGM**	Count	
	☐ **PRGM**	rAtE	
	☐ **PRGM**	LoC	
	☐ **PRGM**	rELAY	This section sets up the relay information.
	☐ **ENTER**	A tot or A rAtE	Press the PRGM key to choose A TOT (A relay assigned to total) or A RATE (A relay assigned to rate). Press enter when the desired choice is displayed.
	☐ **ENTER**	tot A or tot C	This section will only appear if A tot is selected. Press the PRG button to choose tot A or tot C. Press the ENTER key to enter the displayed choice
	☐ **ENTER**	du ##.#	Set relay duration .1 to 99.9 sec. Counter autoresets and relay is energized for selected time. If 00.0 is selected counter does not autoreset. Output is active if counter is equal or above preset.
	☐ **ENTER**	HY ##.#	This is the hysteresis setpoint for relay A (00.0 to 99.9). This section will only appear if tot C is selected.
	☐ **ENTER**	rAtE A or rAtE C	This section will only appear if A rAtE is selected. Press the PRG. button to choose rAtE A or rAtE C. Press the ENTER key to enter the displayed choice.
	☐ **ENTER**	HY ##.#	This is the hysteresis setpoint for relay A (00.0 to 99.9).

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[ ] | **ENTER**	b tot or b rAtE	Press the PRGM key to choose B TOT (B relay assigned to total) or B RATE (B relay assigned to rate). Press enter when the desired choice is displayed.
[ ] | **ENTER**	tot b or tot b	This section will only appear if b tot is selected. Press the PRG button to choose tot b or tot C. Press the ENTER key to enter the displayed choice
[ ] | **ENTER**	du ##.#	Follow same procedures as A ##.#
[ ] | **ENTER**	HY ##.#	This is the hysteresis setpoint for relay A (00.0 to 99.9). This section will only appear if tot C is selected.
[ ] | **ENTER**	rAtE b or rAtE C	This section will only appear if b rAtE is selected. Press the PRG. button to choose rAtE b or rAtE C. Press the ENTER key to enter the displayed choice.
[ ] | **ENTER**	HY ##.#	This is the hysteresis setpoint for relay A (00.0 to 99.9).

SETTING THE PRESETS

PRESS

|		
[ ] **PRE A**	PrE A Followed by last PRE A entered	PRE A = Preset A (Final Preset); The set point at which output A will trigger. If the displayed value is not the desired preset, press the key(s) under the digit to be changed. Press ENTER to load Preset
[ ] **PRE B**	PrE b Followed by last PRE A entered	PRE B = Preset B (Prewarn); The set point at which output B will trigger. If the displayed value is not the desired preset, press the key(s) under the digit to be changed. Press ENT to load Preset

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OUTPUT WIRING

The following diagrams detail the connection of the relay and analog output options. Each relay consist of a form A contact (Normally Open). NPN transistor or Normally Closed contacts are available with solder jumpers (see Jumper Options).

SOLENOID (Single Stage)

Use Relay A (pins 1 & 2) for single stage preset. When the count or rate (selectable) reaches Preset A, Relay A will energize. When Relay A closes, current passes through the solenoid for activation. When operating AC solenoids, we recommend the use of an MOV to reduce inductive kickback (use a diode for DC solenoids).
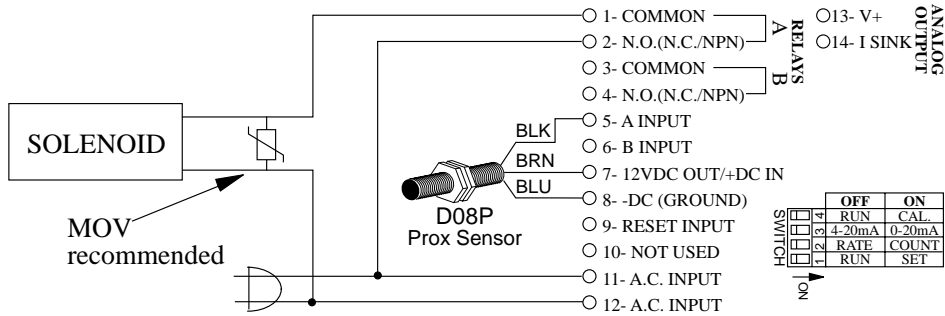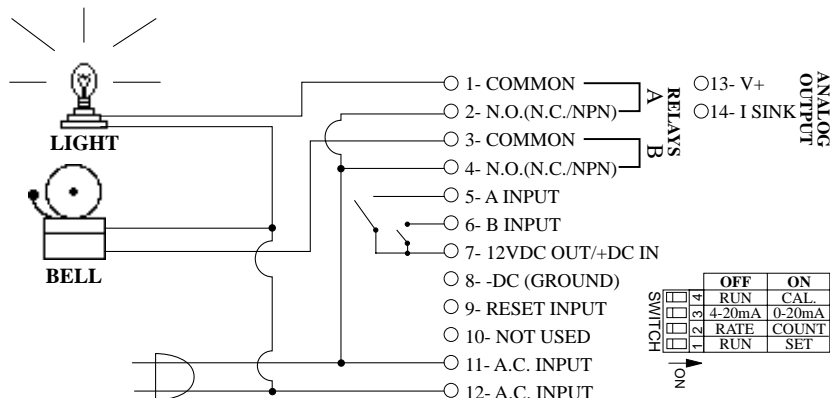

ANALOG OUTPUT

The analog output can be selected to output 4-20 mA or 0-20 mA and can be selected to track the rate or count of the C display. Pin 13 supplies 12 to 18V to power the current loop. Pin 14 supplies the current sinking driver. When connecting a strip chart recorder, make connections as follows:
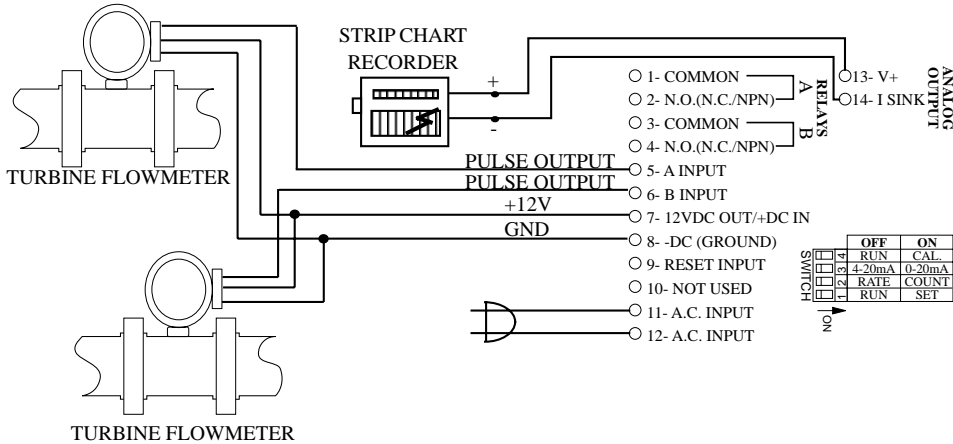
ALARMS

The relays can be used to trigger alarms which warn the operator that a batch is complete or the rate has exceeded a set speed. The outputs are programmable to be assigned to the A,B or C rate/count. When assigned to the count, the relays can have a user selectable on time (duration) or can be latched until reset.

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ANALOG OUTPUT OPTION

Description:
An optional 4-20mA (0-20mA) output has been added to the DRT series. The output can be programmed to track C rate or C total. This feature is available by adding suffix A to the part number. Connections are via a 2 terminal pluggable screw connector.

Connections: (see FIG. 1)
PIN13 supplies the 12 to 18 VDC to power the current loop.
PIN14 is the control sink driver

Accuracy:
50uA worst case

Compliance Voltage:
3 to 30 VDC non inductive

Setup:
The optional analog output feature uses 4 dip switches on the back for setup. These switches are used as follows:
SW1 - View or change "set low" and/or "set high" values
SW2 - Select output for rate or total
SW3 - Select 4-20mA or 0-20mA
SW4 - Calibrate the unit.
After the regular parameters shown in the programming flowchart have been set, locate the 4 switches on the back of the unit. (see FIG. 1)

Switch Settings:
SWITCH 1: Enter Analog Low & High (normally off)
Switch 1 is used to load in the low (4mA or 0mA) and/or the high (20mA) output settings. With power on, set switch 1 ON (up).

LOW SETTING is viewed or changed by pressing PRE A. If the displayed value is correct, press ENTER. If not, press buttons A through E to step to the desired value and press ENTER. (disregard the display which will show the last count reading).

HIGH SETTING is viewed or changed by pressing PRE B. If the displayed value is correct, press ENTER. If not, press buttons A through E to step to desired value and press ENTER.

Return switch 1 to OFF (down) position, PRE A and PRE B buttons now function to view or change relay trip values.

SWITCH 2: Select Count or Rate

      SW2 OFF (down): Analog output follows C rate
      SW2 ON (up): Analog output follows C count

**SWITCH 3:** Select 4-20mA or 0-20mA

      SW3 OFF (down): Selects 4-20mA output range
   SW3 ON (up): Selects 0-20mA output range

SWITCH 4: Calibrate (normally off)
Switch 4 is used for calibration. Calibration is done at the factory and should not be needed (see SWITCH 1 to enter high and low values). If recalibration is desired, a calibrated 20mA ammeter with 1uA resolution is needed. Attach the "+" lead of the meter to pin 13 and the "-" lead to pin 14. Set switch 4 ON (up). The unit will output approximately 20.000mA and a decimal will light in the third position. Read the output using the ammeter. Press PRE A. If the display is the same as the ammeter reading, press ENTER. If not, press buttons A through E to step to ammeter reading and ENTER. (Disregard display which now shows the last count reading with decimal point in third position) Return switch 4 to OFF (down) position.

FIG. 1

Typical Wiring:

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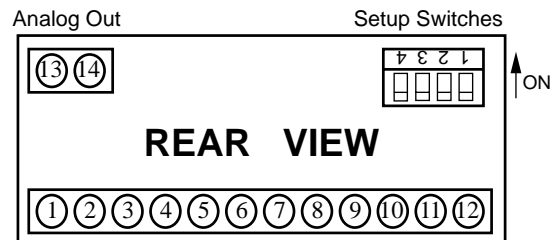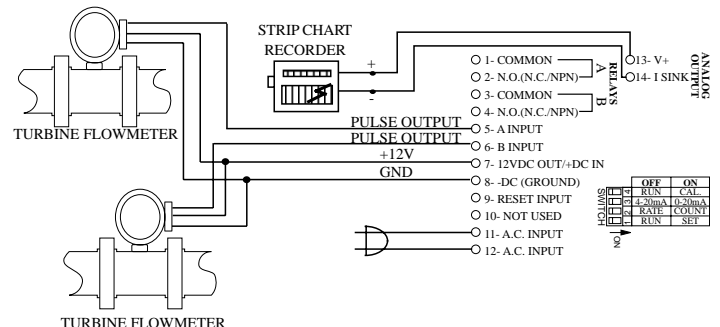
INTERFACE CARD RS 232/422 OPERATION

RS 232/422 SET-UP:
All serial communication mode changes must be done through serial communications. Mode changes cannot be done through the front panel.   To initialize the unit, place a jumper between pin 7(+12V)[bottom board] and pin 1(init) [DB -9 connector] on initial power up. The unit defaults to: 300 baud rate,"MARK" parity and device number 01. To enter the program mode you must set your terminal for 300 baud rate and "MARK" parity. Next, type D1(s), **(s)= space bar**. The unit will echo back "DEVICE #1:". Now type EP (enter program) and a carriage return (enter). The unit will echo back "PROGRAM SETTING". You are now in the programming mode.

SETUP PROCEDURE:
The following sections consist of the communications setup options as they appear in the menu. (If you wish to exit the program mode, at any time you can hit the "escape key" (Hex Code: 1B) and the unit will save the changes made but not effect the remaining data values.) When each section of the setup menu is displayed, the current data will appear in the < > signs. If you wish to change the data, type in the number of the desired choice and press return (enter). If you wish to keep the current data, simply press return.

DEVICE NUMBER:
Each unit in the hook-up must be assigned it's own device number (1 to 99). Zero is reserved for a dedicated hook-up to only one terminal, and it's transmit output line remains in an "on" active state.   The device number is entered in the program mode. The unit will prompt you:
DEVICE# <XX>?
 If XX is the desired device number press return (enter), if not enter the desired number after the question mark and press return (enter).

BAUD RATE:
The baud rate is the speed at which data is transmitted, expressed in bits per second. Baud rates of 300, 600, 1200, 2400, 4800 or 9600 are available. When in the baud rate section of the menu, the unit will list :
BAUD RATES:
1:300 2:600 3:1200
4:2400 5:4800 6:9600
then prompt you:
BAUD RATE <300>?
Press return (enter) if this is the desired baud rate or enter the assigned number of one of the six possible baud rates. If an invalid baud rate is entered the unit will prompt you to choose another baud rate. This will occur until a valid baud rate is entered or escape is pressed.

PARITY:
Parity is a bit of information that is inserted before the stop bit and is used to help check if the transmission is correct. When setting the parity you may select "ODD" (parity bit is logic 0 if total number of logic 1's in the first seven data bits is odd), "EVEN" (parity bit is logic 0 if total number of logic 1's in the first seven data bits is even), "MARK" (parity bit is always logic 1 - High / Mark) or "SPACE" (parity bit is always logic 0 - Low / Space). If a "MARK" parity is chosen, it will appear that two stop bits are used. Use the "MARK" parity with terminals using parity "OFF" or "NONE". These terminals ignore the parity. The unit does not check the parity but does transmit the parity chosen. When setting the parity, the unit will print:
PARITIES:
MARK-0 SPACE-1 EVEN-2 ODD-3
Then the unit will prompt you:
PARITY<MARK>?
If this is the desired parity press return (enter), if it isn't enter the number of the desired parity then press return (enter).

STROBE LIST:
The serial interface card is also equipped with a strobe line. When the strobe line is triggered, a chosen set of data will be transmitted to be displayed or printed. The selections for the display list are entered in the program mode. Enter "1" to add selections to the list and enter "0" to delete selections from the list. The seven available items for the strobe display list are: (1) Count B, (2) Count C, (3) Rate B, (4) Rate C, (5) Rate A, (6) Count A, (7) Reset A. If "Reset A" selected, the A counter is reset after other selected data is sent. This can be used to Print/Reset at preset by connecting Relay to strobe and +DC. Select "Reset All" and jumper strobe to pin 9 to reset both counters after print. **NOTE:** Due to cycle time of 2 sec @ 300 baud (0.4 sec @ 9600 baud), counts may be lost if received while cycling)

When setting the strobe list the unit will print :
ENTER STROBE LIST:
DO NOT DISPLAY-0   DISPLAY-1
The unit will prompt you:
COUNT B<DISPLAY>?
COUNT C<DISPLAY>?
RATE B<DISPLAY>?
RATE C<DISPLAY>?
RATE A<DISPLAY>?
COUNT A<DISPLAY>?
RESET A<DISPLAY>? (If selected, Resets Count A at end of selections)
If the above choices are entered, when the strobe line is triggered (3-30V positive pulse) the unit will transmit:
DEVICE# 1:
DB XXXXX
DCXXXXX
EBXXXXX
ECXXXXX
EAXXXXXX
DAXXXXXX
RA
(SEE COMMANDS BELOW FOR DESCRIPTION OF COM-MAND CODES).
Each time the strobe line gets triggered the unit will transmit this data unless the program mode is entered and the strobe list altered.

After these four items have been entered they will remain unaltered unless the program mode is entered again and the values changed. The unit is now set and must be addressed by it's device number to come on line again.

SERIAL INPUT COMMANDS:

To get a unit on line you must address it by it's device number. This is done by typing DXX(S), XX= device number. The unit comes on line and echoes back DEVICE# XX. Insure that "DEVICE# XX:" is received before requests are sent. The unit is now ready to receive a command or string of commands separated by a space. A carriage return (enter) will enter the commands and processing of requests begins. The carriage return (Hex Code "D") puts the unit "off line" after data is processed.

COMMANDS:

EP...........Unit will enter program mode.
DA..........Unit will display (transmit) Count A.
DB..........Unit will display (transmit) Count B.
DC..........Unit will display (transmit) Count C.
EA..........Unit will display (transmit) Rate A.
EB..........Unit will display (transmit) Rate B.
EC..........Unit will display (transmit) Rate C.
KA..........Unit will display K-factor A.
†*KA(S)XXXXX....Unit will load K-factor A
with entered number.
KB..........Unit will display K-factor B
†*KB(S)XXXXX....Unit will load K-factor B
with entered number.
PA...........Unit will display Preset A.
†PA(S)XXXXX....Unit will load Preset A with
entered number.
PB...........Unit will display Preset B
†PB(S)XXXXX....Unit will load Preset B with
entered number.
RA..........Reset Counter A and output
†*RA(S)XXXXXX...Unit will set Counter A to
entered number.
RB..........Reset Counter B and output
†*RB(S)XXXXXX...Unit will reset Counter B to
          entered number.

*THE UNIT WILL RECOGNIZE A DECIMAL IF ONE IS PLACED IN ANY OF THESE DATA VALUES.

†THE UNIT WILL ONLY RECOGNIZE THE LAST FIVE DIGITS ENTERED (SIX DIGITS FOR RA & RB).

The following is an example of requests and responses:

Transmit from terminal	Receive from unit
	(s)=Space
D5(s) [Unit #5 Activated]	DEVICE# 5:
PA(s)12345(s)PA	PA 12345 PA
KA(s)1576(s)KA	KA 1576 KA
KB(s)6751(s)KB	KB 6751 KB
RA(s)RB[RETURN]	RA RB

(UNIT PRESETS AND A & B K-FACTORS ARE SET AND BOTH COUNTERS ARE RESET)

          12345
          1576
          6751

SERIAL INTERFACE OPERATION:

Data is received and transmitted over standard EIA RS232 or RS422 levels. Each ten bit character is made up of a start bit, seven bit ASCII code, a parity bit and a stop bit. Device number, baud rate, parity and strobe list are entered in the program setup mode and will remain in memory even if power is lost.

The input impedance of RS232 is 3KΩ to 7KΩ worst case. The terminal addressing the unit must be capable of driving all loads in the loop. The input impedance of RS422 is much higher and there should be no problem driving as many as 99 units. The transmit line remains in a high impedance "off" state until addressed. Only one unit is to be on line at a time!!! More than one unit on line could damage the unit or destroy the transmitted data.

When the unit is active (on line) it will operate in a full duplex, echo back mode, so that data sent from the terminal will be transmitted back for verification. When the unit is "on line", use the proper serial transmit commands to request data or set a new value. Up to 80 characters of data can be linked together and transmitted to the unit in a string as long as there is a space between the commands. If an error is made, a correction can be made by back spacing and retyping correct data before the return (enter) is sent. Once a return (enter) is sent, the unit begins processing the data and will transmit the requested data on a non-priority basis over the data transmit line. A keypad entry or incoming data will halt the data communication cycle. Therefore, there should be a pause after data is requested to insure that all data has been transmitted before making another request or addressing another unit. If the unit is not busy, it should not take longer than 300 msec to process each request. To find the cycle time to process and transmit a request, calculate the bit transmit time by using this formula: $[(1 \div \text{baud rate}) \times (80) + .005] \times$ number of requests made. This time will be extended if the unit must service the front keypad. If transmission has not started within two seconds after data is requested, it can be assumed that there is a problem. The unit transmits a carriage return and line feed after each data value. Any new communication must be started with DXX(S) (device number and space).

RS232/RS422 - IBM-PC INTERFACE:

The following program is for IBM basic to set up RS232/RS422 on serial port (#1) at 300 baud. Run this program after connecting the serial interface connections.
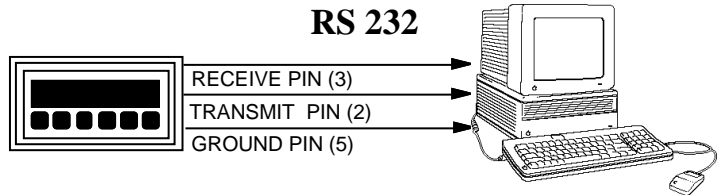
```
10 SCREEN 0,0:WIDTH 80

20 CLS:CLOSE

30 OPEN "COM1:300,n,7,1,CS,DS,CD" AS #1

40 ON ERROR GOTO 110

50 B$=INKEY$

60 IF B$< >"" THEN PRINT #1,B$;

70 IF EOF (1) THEN 50

80 A$=INPUT$  (LOC(1),#1)

90 PRINT A$;

100 GOTO 50

110 RESUME
```

RS232 / RS422 WIRING

COMPUTER HOOKUP:

RS 232: When connecting the unit to a computer with RS 232 communication, only three connections are needed. These connections are: Receive data, Transmit data and Ground. The connections should be made as follows:
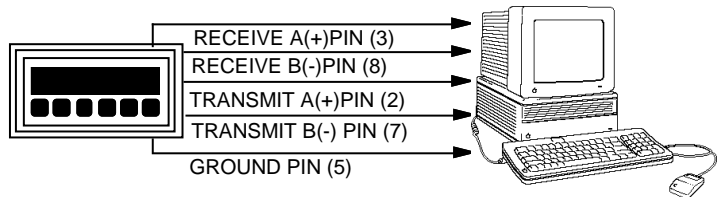
RS 232

RECEIVE PIN (3)
TRANSMIT PIN (2)
GROUND PIN (5)

RS 422

RECEIVE A(+)PIN (3)
RECEIVE B(-)PIN (8)
TRANSMIT A(+)PIN (2)
TRANSMIT B(-) PIN (7)
GROUND PIN (5)

DP -9 CONNECTOR	COMPUTER
Transmit data (pin 2)	Receive data
Receive data (pin 3)	Transmit data
Ground (pin 5)	Ground

RS 422: When connecting the unit to a computer with RS 422, five connections are needed. These connections are: Receive data A (+), Receive data B (-), Transmit data A (+), Transmit data B (-) and Ground. The connections should be made as follows:
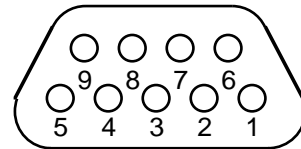
DB9 Male Connector

9 8 7 6
5 4 3 2 1

DP -9 CONNECTOR	COMPUTER
Transmit data A(+) (pin 2	Receive data A(+)
Transmit data B(-) (pin 7)	Receive data B(-)
Receive data A(+) (pin 3)	Transmit data A(+)
Receive data B(-) (pin 8)	Transmit data B(-)
Ground (pin 5)	Ground

RS 232	RS 422
1. INITIALIZE	1. INITIALIZE
2. TRANSMIT	2. TRANSMIT A (+)
3. RECEIVE	3. RECEIVE A (+)
4. N/C	4. N/C
5. GROUND	5. GROUND
6. STROBE	6. STROBE
7. N/C	7. TRANSMIT B (-)
8. N/C	8. RECEIVE B (-)
9. N/C	9. N/C

PRINTER HOOKUP:

When connecting the unit to a printer, you must first program the desired baud rate, parity and strobe list with a computer. After the unit is programmed it can be connected to the printer. Connect the transmit line(s) of the unit to the receive line(s) of the printer and be sure that both devices have common grounds. When the strobe line is triggered the unit will transmit the selected strobe list which you had previously programmed.

RS 232

STROBE PIN (6)
+12V PIN (7)
(BOTTOM BOARD)
TRANSMIT PIN (2)
GROUND PIN (5)

RS 422

STROBE PIN (6)
+12V PIN (7)
(BOTTOM BOARD)
TRANSMIT A (+) PIN (2)
TRANSMIT B (-) PIN (7)
GROUND PIN (5)
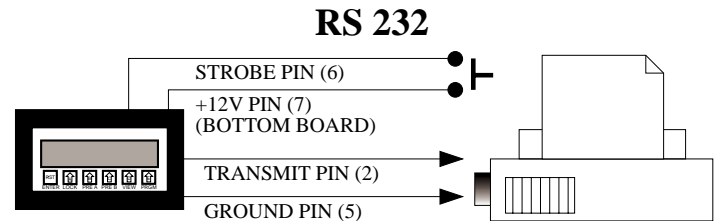
22
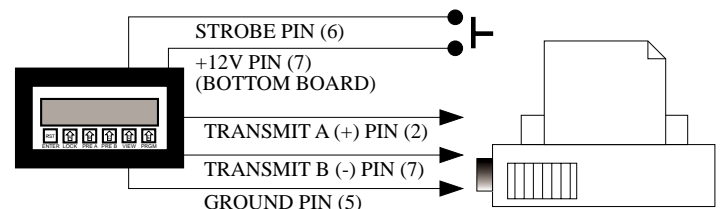
TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSES	SOLUTIONS
Power is applied to unit but the display does not light.	1. AC or DC power wiring is incorrect.	1. Recheck power wiring
Unit works, but occasionally the display freezes or skips counts.	1. Line noise is affecting the processor due to a current spike or surge.	1. Use a different power supply or install a surge suppressor.
Input signal is connected but the unit does not count or display rate.	1. Input wiring is incorrect. 2. Scale factors are incorrect. 3. Transmitting device is defective. 4. Wrong debounce filtering selected.	1. Recheck input wiring. 2. Recheck scale factors and factor calculations. 3. Replace transmitting device. 4. Recheck debounce filtering selection "hi cps" or "lo cps". 5. To confirm set scale factors at one and connect a wire to pin #7 and touch it to pin # 5 (input A). Each time pin #5 is touched counter A should count once. If not, call factory for RMA. (this test will not work on units with quadrature input)
Rate is displaying: r FFFFF.	1. The unit is trying to display a number which it can't (too small or too large). 2. Line noise affected unit on power up.	1. Check scaling factor, if it is correct, lower the number of significant figures. 2. Reprogram the unit and be sure to enter a decimal (enter one and re move it if a decimal is not desired).
Relays are not activating properly.	1. Wrong relay duration. 2. Relay set for wrong activation i.e. count instead of rate.	1. Recheck programmed relay duration. 2. Recheck programmed relay activation mode.
Counter resets before reaching 999999.	1. Relay duration is set at a value other than 00.0. This causes the counter to auto-reset at the preset.	1. If relay outputs are not being used, set the relays for rate. 2. Set the relay durations to 00.0.

NOTE TO OUR CUSTOMER

KEP is dedicated to providing complete customer service and customer satisfaction. If you have any comments or criticisms about how to improve this manual, please make a note of the problem/improvement and notify us. We are always open to new ideas and improvements. So please let us know your ideas and comments.

Call us toll free: 800-631-2165

WARRANTY

This product is warranted against defects in materials and workmanship for a period of two (2) years from the date of shipment to Buyer.

The Warranty is limited to repair or replacement of the defective unit at the option of the manufacturer. This warranty is void if the product has been altered, misused, dismantled, or otherwise abused.

ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, ARE EXCLUDED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.