MRT

INSTALLATION & OPERATING INSTRUCTIONS

KOBOLD Instruments Inc.

1801 Parkway View Drive
Pittsburgh, PA 15205
Telephone: (412) 788-2830
Toll Free: (800) 998-1020
Fax: (412) 788-4890

Proprietary Notice

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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 immediately 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

The MRT is a dual input (channel A and B) counter/ratemeter, each with its own 5 digit dividing scale factor. The two 10AMP preset relay outputs can be programmed by the user to apply to the "A" total counter, the "A" ratemeter, or the "B" counter or the net total of A and B inputs. The user can view the Net Total of "A+B", the Net Total of "A-B", the rate of A, or A and B counters separately. The "MRT-1000" version shows rate and total (as described above). The "MRT-2000" is exclusively a counter and the "MRT-3000" is exclusively a ratemeter.

SPECIFICATIONS

DISPLAY: 6 digit, 0.55" High LED
INPUT POWER:
          110 VAC ± 15% or 11 to 15 VDC
          220 VAC ± 15% or 11 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 Open or 0-1 VDC (low), 4-30 VDC (high), 10 KOhm imp. 10 KHz max. speed. Accepts simultaneous inputs.
  5: 4-30 V Count pulses on Input A, 4-30 V Direction Control input (level) on Input B.
  9: Quadrature, accepts 4-30 V pulses with 90°phase shift for direction detection.
RESET:
  Front Panel: Resets displayed value and control output
  Remote: 4-30 VDC negative edge resets COUNTER "A" and control output.

K FACTOR/SCALING

In the standard unit a fixed K-Factor is 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 0.5 V @ 100 mA)
Analog Output:
    An optional 4-20mA (0-20mA) output is available for the MRT series. The output can be programmed to track rate or total. This feature is available by adding suffix 3 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 ratemeter (high/low), one preset for rate and one for total, or two presets (2 stage shutoff) on the A and B counters. 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 . In the A-B or A+B versions, the relays will be assigned to either net total or A rate.

LOCKOUT

Unauthorized front panel changes can be prevented by entering a user selected 5 digit code, in the "LOC" , . mode. The front panel can be completed locked out or the presets can remain accessable.

RATEMETER

Accurate to 4 1/2 digits (±1 display digit). The rate meter can be programmed to accept almost any number of pulses per unit of measurement, 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 Input only.

COUNTER

The two 6-digit counters can count at 10Khz speed. Each can have a 6-digit dividing scale factor. The counter advances on the positive edge of each pulse. Count up or down modes available, as are quadrature inputs from encoders for position or length measurement. The unit can be programmed to view the net value of "A+B" or "A-B", or A and B as separate counters.

MRT Part Number Table

MRT	W=Function	X=Operating Voltage	Y=Count Input	Z=Options
	W=1 : Rate & Total	X=1 : 220 VAC or 11-15 VDC	Y=3: Standard, 4-30 VDC simultaneous inputs.	Z=0 : None
	W=2 : Total Only	X=5 : 110 VAC or 11-15 VDC	Y=5: 4-30 V pulses on Input A, 4-30 V Direction Control input (level) on Input B.	Z=1 : RS232 interface
	W=3 : Rate Only		Y=9: Quadrature, accepts 4-30 V pulses	Z=2 : RS422 interface
				Z=3: 0(4)-20 mA output

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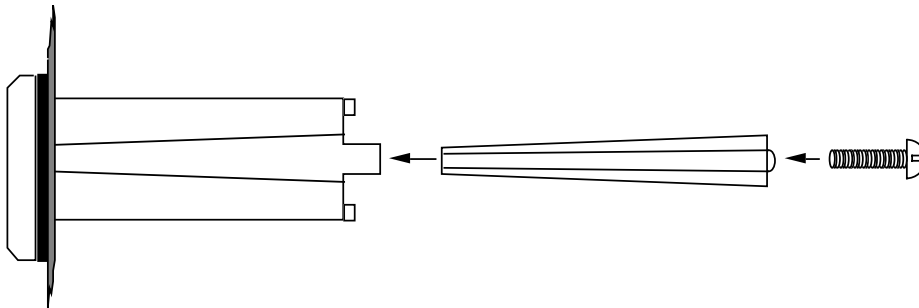
This product is designed to be panel mounted and is NEMA 4 rated if proper mounting procedures are followed and the required and supplied hardware is correctly used.

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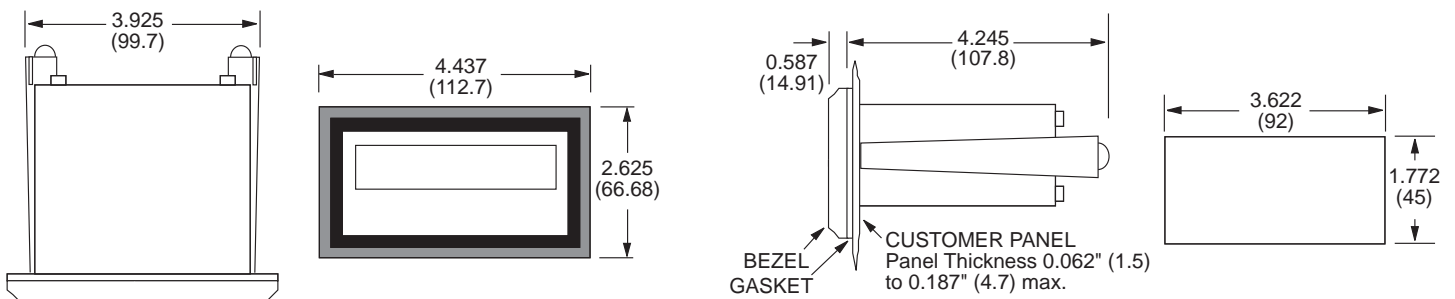
This product is designed to the NEMA 4 rated. However, the fact that we are unable to control either the location in which the device is installed or the actual installation itself requires that the company's liability shall extend only to the repair or replacement of a defective product.

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

3.925 (99.7)

4.437 (112.7)

2.625 (66.68)

0.587 (14.91)

4.245 (107.8)

3.622 (92)

1.772 (45)

BEZEL
GASKET

CUSTOMER PANEL
Panel Thickness 0.062" (1.5)
to 0.187" (4.7) max.

WIRING MRT

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 # 0.2 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.o p e r - ated 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.

UP/DOWN CONTROL AND QUADRATURE INPUTS

QUADRATURE INPUT:
While programming the counter section for quadrature input, you must set the unit for A net B and A sub B (see step 2 in programming section). This insures proper operation. The rate can only be viewed in one direction. If the unit is a ratemeter only (MRT-3000), connect only one of the quadrature channels to Input A (pin 5).

UP/DOWN CONTROL:
When using the up/down control option, Input A (pin 5) is the count input and Input B (pin 6) is the up/down control (direction) input. The counter must be set for A net B and A sub B (see step 2 in programming section).
When the direction input is high (4-30VDC) the count inputs will count up, when the direction input is low (open or less than 1VDC) the count inputs will count down. The direction input must precede the count input by 1 msec when the unit is set for low CPS and 1 usec when set for high CPS.

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

TYPICAL QUADRATURE HOOKUP

When the unit has the quadrature input, the counter must be set at:

A net B, A sub B (for "set to preset", A add B) and the scaling factors for A & B must be of equal value.
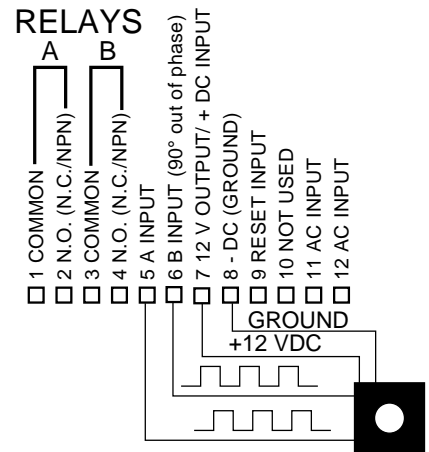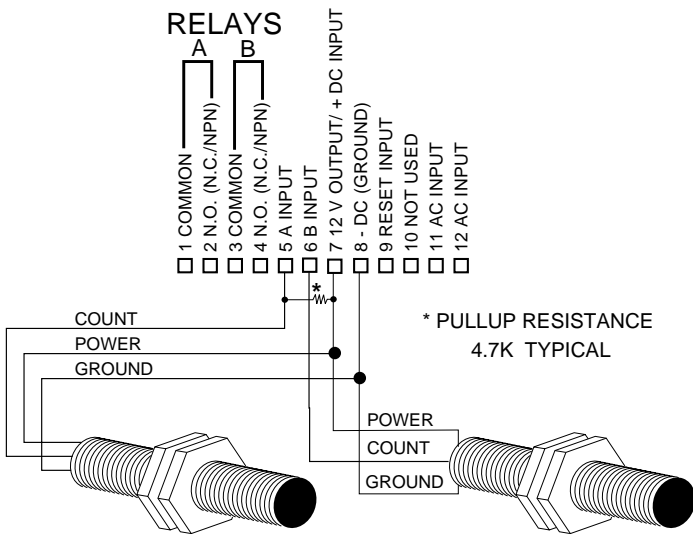
WHAT CAN YOU VIEW?

1) "A sub B" - If you have selected the "A sub B" mode, pressing "view" shows:
   A) The net result of subtracting input B from input A. Pulses on input B will subtract (count down). Pulses on input A will add (count up) if "reset to 0" is selected, if "set to preset" is selected, input A will subtract (count down).
   B) The rate of input A.

2) "A add B" - If you have selected "A add B" mode, pressing "view" shows:
   A) The net result of adding "A" and "B" inputs. Pulses on input B will add (count up). Pulses on input A will add (count up) if "reset to 0" is selected, if "set to preset" is selected input A will subtract (count down).
   B) The rate of input A.

3) "A sep B" - If you have selected " A sep B" mode, pressing "view" shows:
   A) The total counts of input A. If "reset to 0" is selected A counts up, if "set to preset" is selected A will count down.
   B) The rate of input A.
   C)* The total counts of input B. B will always count up.

NOTE: In "A sep B" mode, B can be used in 3 ways:
   1) As a separate totalizing counter
   2)** As a Batch Total Counter for input A
   3)** As a Grand Total Counter for input A
NOTE:
  * All decimal points are inverted when "B total" is being displayed.
** See below on how to modify for Batch Count and "B" as a Grand Total Counter.

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"
	"B" AS BATCH COUNTER	SELECT "A SEP B"	JUMPER "H" TO "G"
	"B" AS GRAND TOTAL COUNTER	SELECT "A SEP B"	CONNECT PULSES TO "A" & "B"

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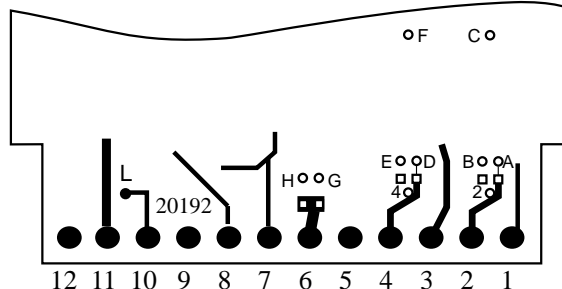
* The unit must be removed from the case to access jumpers C & F, all
   other jumpers can be accessed by removing the plastic extender.

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

6

OPERATING THE FRONT PANEL


```
6 5 4 3 2 1
```

RST	⬆	⬆	⬆	⬆	⬆
ENTER	LOCK	PRE A	PRE B	VIEW	PRGM
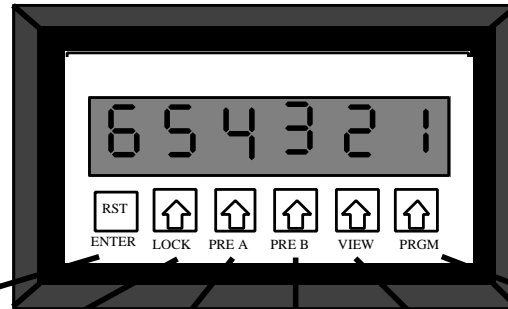
Press to "reset" in operating mode. Press to "enter" in programming mode.

Press to enter lock code for panel lock.

Press to view or change preset A.

Press to view or change preset B.

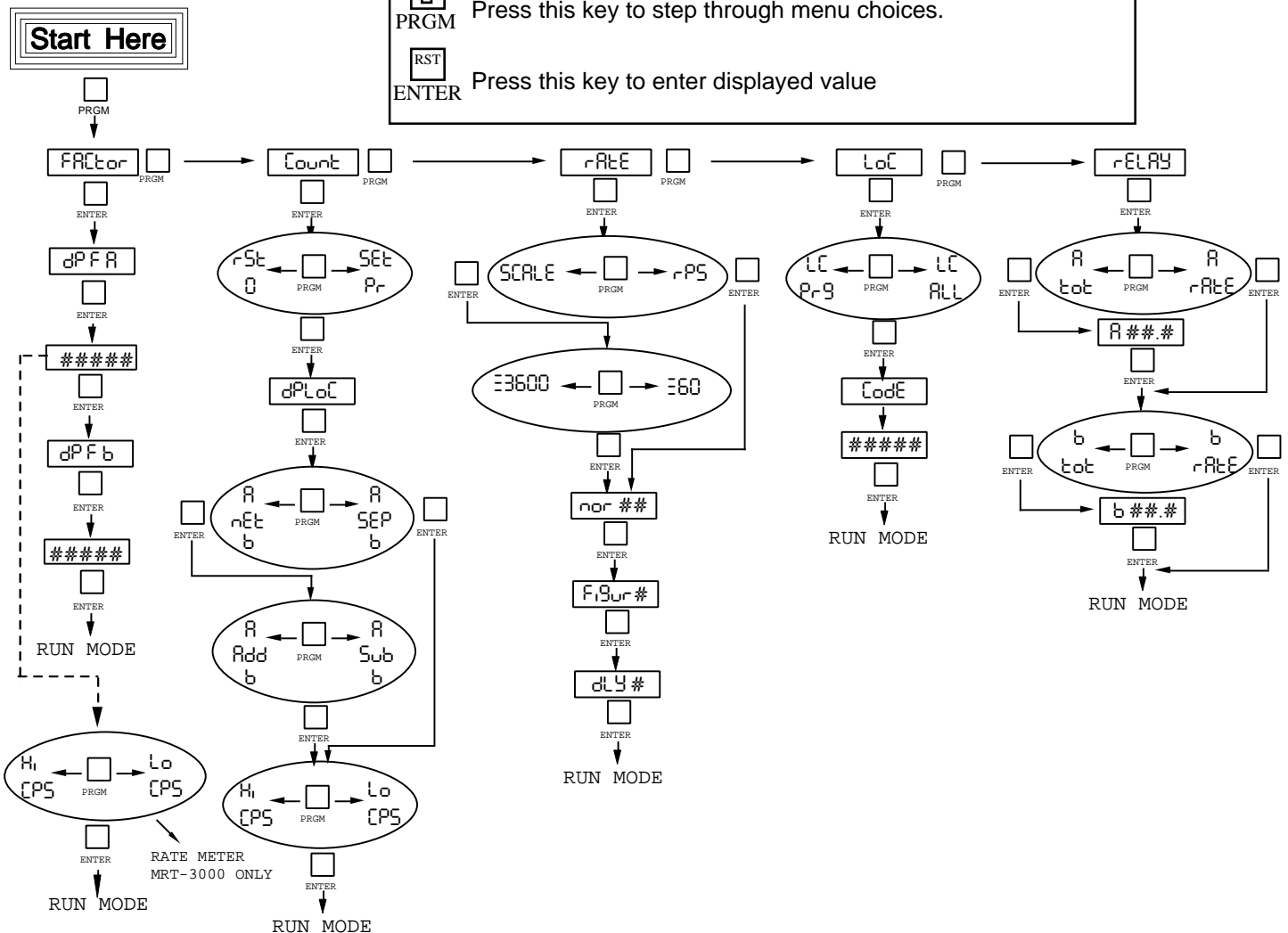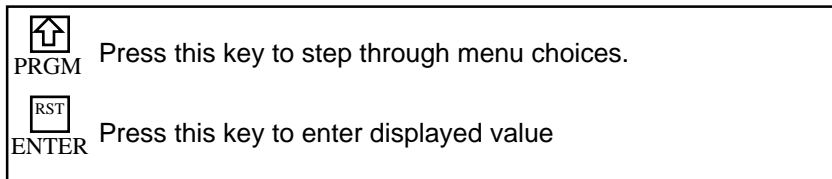Press to alternately view A rate & net total or A rate, A total & B total.

Press to cycle through PROGRAM choices. Press to toggle between choices in program mode.

PROGRAMMING FLOWCHART

NOTE: Serveral programming selections will not appear with MRT-2000 and MRT-3000 units.

⬆ PRGM Press this key to step through menu choices.

RST ENTER Press this key to enter displayed value

Start Here

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.

dPFA   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.

dPFb   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

rSt0   RESET TO 0 - Counter will reset to 0. Input A will count up from 0. Input B will subtract (count down) in A Sub B mode. Input B will add (count up) in A Add B mode.

SEt Pr   SET TO PRESET - Counter will reset to preset A. Input A will count down from preset A. Input B will count up (add) in "A add B" mode and input B will count down (subtract) in "A sub B" mode.

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 counters as well as the rate display.

AnEtb   NET RESULT OF ADDING OR SUBTRACTING A & B INPUTS

ASEPb   A & B INPUTS ARE SEPARATE - A & B are not added or subtracted.

ASubb   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)

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

HiCPS   HIGH COUNTS PER SECOND - This sets the unit for high count speeds (0-9.99KHz)

LoCPS   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.

÷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:

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

FiGur ##   SIGNIFICANT FIGURE - This sets the amount (1-5) of meaningful figures the unit will display. (RATE DIS PLAY 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 are still accessible)
                2) lock all (presets and program are locked).

LCPr9   LOCK PROGRAM - This will lock the program and allow the presets to be changed when the unit is in the lock mode.

LC ALL   LOCK ALL - This will lock the program 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 relay A will activate when the net total has reached Preset A ("A NET B" Mode). Relay A will activate when the total of input A reaches preset A ("A SEP B" Mode).

A rAtE   RELAY A FOR RATE - When this is selected relay A will activate when the Rate of input A equals or exceeds preset A when in "A NET B" or "A SEP B" mode. The relay will drop out when the rate of A falls below preset A.
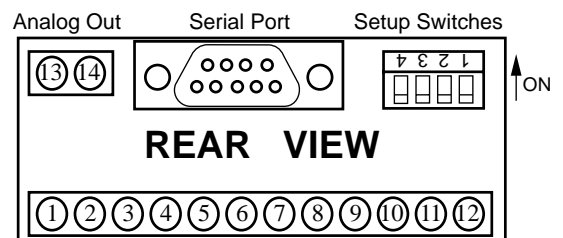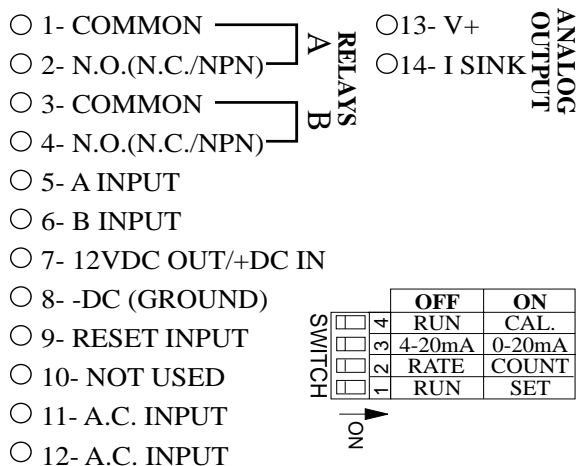
A##.#   RELAY A   DURATION - This message will appear when "A TOT" is selected. It is the duration which the relay will remain energized (00.1 to 99.9 sec).   If 00.0 is selected, the relay will latch until reset. When the duration is not at 00.0, the unit will autorecycle.

b tot   RELAY B FOR TOTALIZER - When this is selected relay B will activate when the net total has reached preset B ("A NET B" Mode). Relay B will activate when the total of input B has reached preset B ("A SEP B" Mode).

b rAtE   RELAY B FOR RATE - When this is selected relay B will activate when the rate of input A equals or exceeds preset B when in"A NET B" or "A SEP B" mode. The relay will drop out when the rate of A falls below preset B.

b##.#   RELAY B DURATION - Follow same procedure as A ##.#.

MRT TERMINATIONS

○ 1- COMMON   **RELAYS A**   ○13- V+   **ANALOG OUTPUT**
○ 2- N.O.(N.C./NPN)   ○14- I SINK
○ 3- COMMON   **B**
○ 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

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

ON

Analog Out   Serial Port   Setup Switches

⑬⑭   ○ ⬡ ○   1 2 3 4   ↑ON

REAR   VIEW

①②③④⑤⑥⑦⑧⑨⑩⑪⑫

CALCULATING SCALE FACTORS

Scale factors are the internal "fudge factors" that allow the end-user to customize the MRT to display engineering units rather than pulse or frequency gibberish. The MRT uses a dividing scale factor. That is to say, the unit will divide the count by the scale factor to display the required engineering units.

In practice the "dividing scale factor" is used as follows: Choose the engineering unit you want to use (feet, gallons, inches, boxes, bottles, liters, or whatever). Next, determine the number of pulses your sensor counts per engineering unit. This number is also your scale factor.

Example: Frank and Ed are lumberjacks (and they're OK). They are working in a stand of trees where they know that 30 trees are equivalent to 2.91 "cords" (don't let this lumberjack jargon scare you - in layman's terms a cord is a volume of 4 ft x 4 ft x 8 ft). They want to know how many cords of wood have been cut by the end of each day without measurement. Luckily for these woodsmen, they called Kobold and bought an MRT totallizer. They then hooked the MRT up to their trusty Trees-R-Us "Timber" detector (the Timber detector, as you probably know, contains a microphone which emits a pulse every time it hears the word "TIMBER !"). Frank and Ed, of course, dutifully yell "TIMBER !" every time they fell a tree.
Frank's and Ed's scale factor is 30 trees per 2.91 cords = 30 / 2.91 = 10.3. They program their MRT, and live happily ever after.

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 on input "A". 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 other examples:

OTHER SCALING FACTOR EXAMPLES:

BATCHING: You want to count the number of batches, of 10 boxes each, being loaded onto a pallet. Your detector counts individual boxes.
Solution: Dial in a scale factor of 10 boxes per batch = 10/1 = 10

UNIT COUNTING: You detect the passage of a notch on a paper roller (1 pulse per shaft revolution). Each revolution equals 3 feet. The number of feet of paper passing over the roller is the number wanted by the operator.
Solution: To find the number of pulses per foot, simply divide "1 pulse" by "3 feet" (1÷ 3 = 0.3333). One foot equals 0.3333 pulses, enter this as the scale factor and the display will read in feet.

RATE: The shaft of a motor has a flywheel with 10 spokes. A proximity switch is mounted to sense 10 pulses per revolution. RPM of the shaft is the desired readout.
Solution: Enter a Factor of 10 pulses for every 1 revolution (10 / 1 = 10). The number "1" will appear on the display. Set rate per second, minute or hour as desired.

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.
Solution: To calculate the scale factor 7 ppr ÷ 3 bottles = 2.3333 scale divider. Set rate per second, minute or hour as desired.

RATE: A flow meter is generating 52.6 pulses per gallon. The desired readout is in liters.
Solution: Since there are 3.785 liters per gallon, we reason that there are 52.6 pulses per 3.785 liters. The scale factor needed to display flow in liters is 52.6 ÷ 3.785 = 13.897.

RATE: An aluminum sheeting plant has an application to cut to sheet length according to customer specification. A ten pulse per revolution encoder is used with a 12" measuring wheel to sense length of travel of the aluminum sheeting. The desired units of measurement are inches.
Solution: After 10 pulses, you want the number "12" (that is, 10 pulses per 12 inches) to appear on the display. Thus, 10 pulses ÷ 12 inches = 0.8333. Enter 0.8333 as your scale factor.

PROGRAMMING

STEP 1 SETTING SCALING FACTORS	PRESS	DISPLAY	REMARKS
	☐ 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) to change. press ENTER to enter the displayed value.
THIS SECTION WILL ONLY APPEAR IN THE RATE METER ONLY VERSION	☐ ENTER	HiCPS or LoCPS	This section will only appear in theRATE only version. 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.
	☐ 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) to change. Press ENTER to enter the displayed value.

	PRESS	DISPLAY	REMARKS

STEP 2
SETTING THE COUNTER

PRESS	DISPLAY	REMARKS
☐ **PRGM**	FACtor	
☐ **PRGM**	Count	This section of the menu sets up the counter information.
☐ **ENTER**	rSt 0 or SEt Pr	Press the PRGM key to choose RST 0 (reset to 0, count up) or SET PR (set to preset, count down), press the ENTER key to enter the displayed choice.
☐ **ENTER**	dPLoC	This sets the decimal location for the A & B 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**	A nEt b or A SEP b	Press the program key to choose A NET B (add or subtract A & B) or A SEP B (view A & B as separate counters). Press the ENTER key to enter the displayed choice.
☐ **ENTER**	A Sub b or A Add b	This section will only appear if A NET B was selected. Choose A SUB B (A subtact B) or A ADD 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.

PRESS	**DISPLAY**	**REMARKS**

<table>
<tr>
<td rowspan="7">

STEP
3
SETTING
THE
RATE
</td>
</tr>
</table>

PRESS	DISPLAY	REMARKS
☐ **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**	Fi�r #	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) 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.

PRESS	DISPLAY	REMARKS

STEP 4
SETTING LOCK CODE

PRESS	DISPLAY	REMARKS
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 accessable. 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.

SETTING THE LOCK STATUS

PRESS	DISPLAY	REMARKS
LOCK	CodE Flashes followed by: 0	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 unlocked). This message will be displayed for approximately 3 seconds before the unit returns to the run mode.

| 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	Atot or A rAtE	Press the PRGM key to choose A TOT (A assigned to total) or A RATE (A assigned to rate). Press enter when the desired choice is displayed.
□ ENTER	A ##.#	This is the duration (0.1 to 99.9 sec) that relay A will remain energized. If 00.0 is selected, the relay will latch until reset
□ ENTER	btot or b rAtE	Press the PRGM key to choose B TOT (B assigned to total) or B RATE (B assigned to rate). Press enter when the desired choice is displayed.
□ ENTER	b ##.#	This is the duration (0.1 to 99.9 sec) that relay B will remain energized. If 00.0 is selected, the relay will latch until reset
SETTING THE PRESETS		
□ 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.
□ 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.

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).
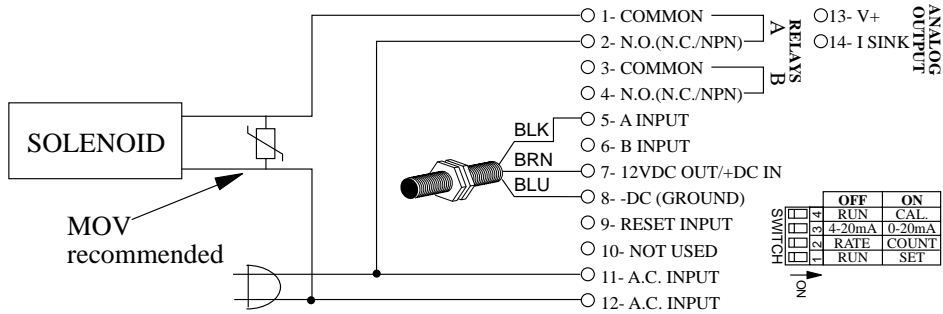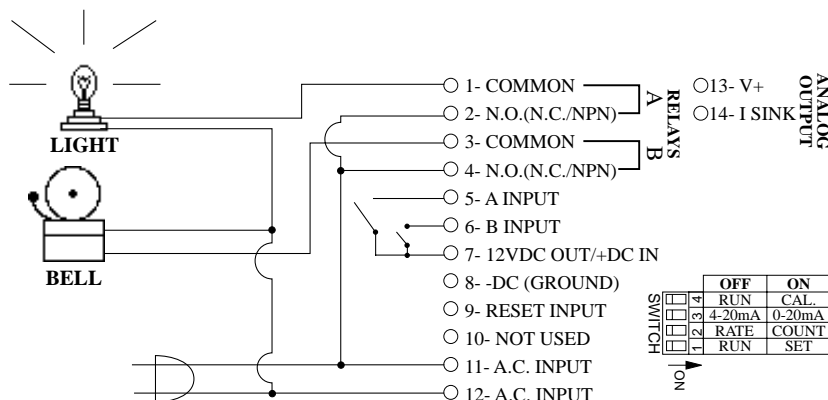

ANALOG OUTPUT

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.

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:
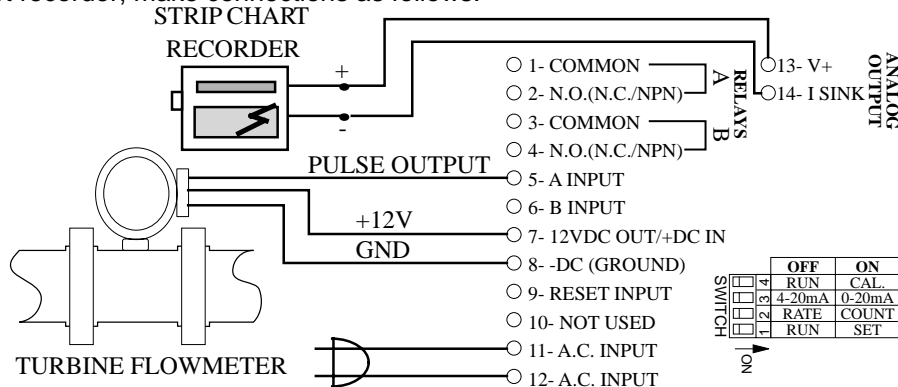
ALARMS

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 for rate or count. When assigned to the count, the relays can have a user selectable on time (duration) or can be latched until reset.

ANALOG OUTPUT OPTION

Description:

An optional 4-20mA (0-20mA) output has been added to the MRT series. The output can be programmed to track rate or total. This feature is available by adding suffix 3 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 conductive

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 flow-chart 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 rate
SW2 ON (up): Analog output follows 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
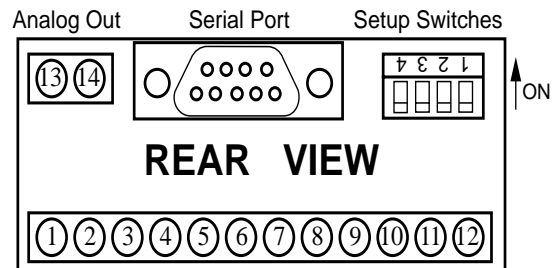
and low values). If recalibration is desired, a calibrated 20mA ammeter with 1uA resolution is needed. Attach the "+" lead of the meter to pin 13 and the "-" lead to pin 14. Set switch 4 ON (up). The unit will output approximately 20.000mA and a decimal will light in the third position. Read the output 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 amme-ter 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.
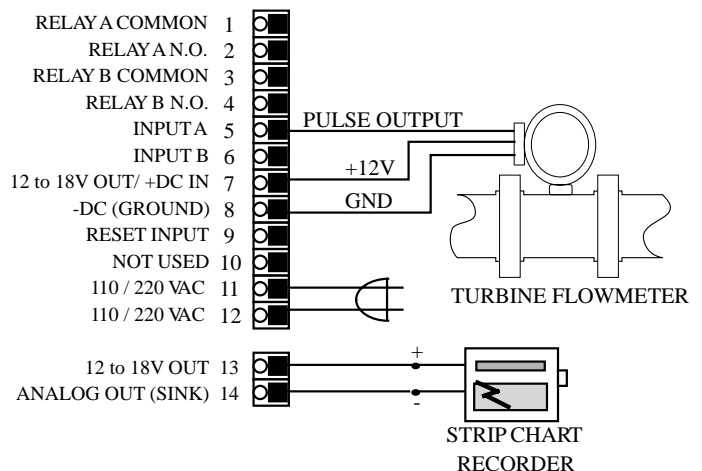
RS232 & RS 422 Operation:

If the unit is supplied with RS232 or RS422, the analog output "low" and "high" settings can be accessed and changed through the serial port. The codes are as follows:

AL:	Unit will display (transmit) analog out "low" value.
AL(S)XXXXX:	Unit will load analog out "low" with entered number. (S) = space
AH:	Unit will display (transmit) analog out "high" value.
AH(S)XXXXX:	Unit will load analog out "high" with entered number. (S) = space

FIG. 1

Analog Out   Serial Port   Setup Switches

REAR VIEW

Typical Wiring:

RELAY A COMMON	1
RELAY A N.O.	2
RELAY B COMMON	3
RELAY B N.O.	4
INPUT A	5
INPUT B	6
12 to 18V OUT/ +DC IN	7
-DC (GROUND)	8
RESET INPUT	9
NOT USED	10
110 / 220 VAC	11
110 / 220 VAC	12
12 to 18V OUT	13
ANALOG OUT (SINK)	14

PULSE OUTPUT
+12V
GND
TURBINE FLOWMETER

STRIP CHART RECORDER

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 equiped 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) Preset A, (2) Preset B, (3) K-Factor A, (4) K-Factor B, (5) Rate of A, (6) Count A, (7) Count B. In the "A net B" mode Count A will display the Net Count and Count B is an invalid command and the unit will transmit useless data.   When setting the strobe list the unit will print :

        ENTER STROBE LIST:
        DO NOT DISPLAY-0   DISPLAY-1
    The unit will prompt you:
        PRESET A<DISPLAY>?
        PRESET B<DISPLAY>?
        K-FACTOR A<DISPLAY>?
        K-FACTOR B<DISPLAY>?
        RATE<DISPLAY>?
        COUNT A<DISPLAY>?
        COUNT B<DISPLAY>?

If the above choices are entered, when the strobe line is triggered (3-30V positive pulse) the unit will transmit:

        DEVICE# 1:
        PA XXXXX
        PB XXXXX
        KA XXXXX
        KB XXXXX
        DR XXXXXX
        DA XXXXXX
        DB XXXXXX
    (SEE COMMANDS BELOW FOR DESCRIPTION OF COMMAND CODES).

Each time the strobe line is 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 echos 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 seperated 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.
DR..........Unit will display (transmit) rate A.
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..........Counter A will reset
    †*RA(S)XXXXXX...Unit will set Counter A to entered number.
RB..........Counter B will reset.
    †*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

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: $[(1 \div$ baud rate) x (80) + 0.005] x 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.
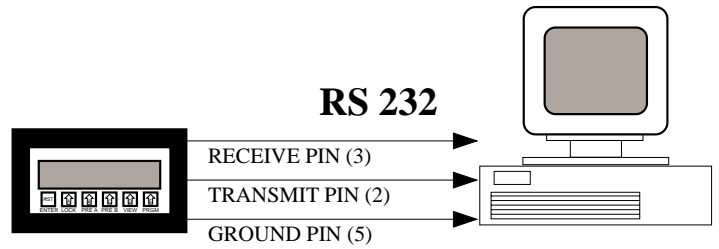
```
10  SCREEN 0,0:WIDTH 80
20  CLS:CLOSE
30  OPEN "COM1:300,n,7,1,CS,DS,CD" AS #1
40  ON ERROR GOTO 110
50  B$=INKEY$
60  IF B$< >"" THEN PRINT #1,B$;
70  IF EOF (1) THEN 50
80  A$=INPUT$  (LOC(1),#1)
90  PRINT A$;
100 GOTO 50
110 RESUME
```

RS232 / RS422 WIRING

RS 232

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

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:
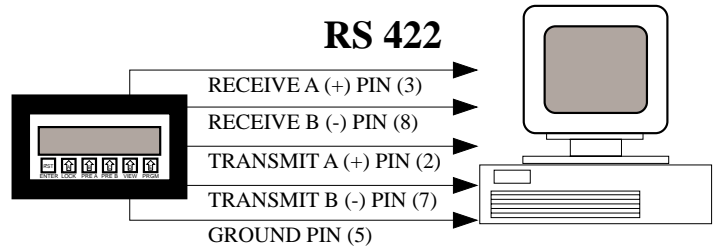
RS 422

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
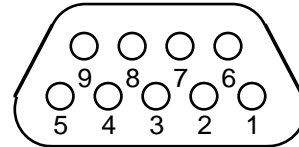Receive data (pin 3)   Transmit data
Ground (pin 5)   Ground

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:

```
    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

RS 232

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

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 422

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

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. 5. MRT is defective.	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 (MRT only). 2. Set the relay durations to 00.0.
Various menu items are not being displayed.	1. The menu flow chart and the setup steps show the setup for the units with rate and total (MRT1000). When using a unit which has only count (MRT2000) or only rate (MRT3000), several menu items will not be displayed.	1. The menu items which do not appear are not used for the models without the ratemeter (MRT2000) or without the counter (MRT3000). Therefore, disregard any menu items which appear on the flowchart and setup steps, but do not appear on the unit's display.

NOTE TO OUR CUSTOMER

WE HOPE YOU WILL BE PLEASED WITH OUR PRODUCT. IF YOU HAVE ANY QUESTIONS CONCERNING OUR WARRANTY, REPAIR OR RETURN GOODS PROCESS PLEASE CONTACT YOUR LOCAL DISTRIBUTOR.

Kobold Instruments Inc.
1801 Parkway View Drive
Pittsburgh, PA 15205
(412) 788-2830
(800) 998-1020

MRT-4000

INSTALLATION & OPERATING INSTRUCTIONS

KOBOLD Instruments Inc.

1801 Parkway View Drive
Pittsburgh, PA 15205
Telephone: (412) 788-2830
Toll Free:　(800) 998-1020
Fax:　　　(412) 788-4890

TABLE OF CONTENTS

SPECIFICATIONS

Features

- 5 Digit Scaling Factor

- Display Rate, Batch Size and
  (Batch Total or Grand Total)

- Second B Relay Programmable for Output at
  Prewarn or selected Batch/Grand Total

- Pulse Input - 10 kHz Max.

- Security Lockout

- RS422/RS232 Serial Communication

- NEMA 4X / IP65 Front Panel

- 30mV Magnetic Pickup Inputs

- 4-20mA or 0-20mA Analog Output

Application:
This miniature batcher is ideal for all batching applications. The display will show Batch Amount, Rate and Batch/Grand Total at the push of a button. The Start and Stop buttons make batching simple.

Description:
The MRT-4000 is a 6 digit totalizer and 4.5 digit ratemeter with two relay outputs. One output is dedicated to the batch amount (Preset A), the other can be activated for Prewarn or Batch/Grand Total. The unit can count up to the preset (reset to 0) or down from the preset (set to preset). Start, Stop and Reset functions can be activated from the front panel or remote inputs.
An analog output (assignable for Rate or Batch Amount) is available for data logging.
Up to 99 units can communicate to a host computer on a single RS232 or RS422 loop.

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)
Humidity: 0-90% Noncondensing
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.
3M: Mag. Input, accepts 30mV input (50 V max.) signals 10 KΩ imp. 5 kHz max.
Stop / Reset:
Front Panel:
    STOP/RST button stops batch if batch is running, Resets displayed value and control output if batch is stopped.
Remote:
    4-30 VDC, positive edge: stops batch if batch is running, Resets batch amount if batch is stopped.
NOTE: Hold either front or remote reset active to inhibit any start inputs.
Start:
Front Panel:
    START button Starts batch by energizing Relay A (and Relay B if Prewarn selected).
Remote:
    4-30 VDC, positive edge: Starts batch by energizing Relay A (and Relay B if Prewarn selected).
Scaling Factor (K-Factor)**:** A user programmable K-Factor is used to convert the input pulses to engineering units. The 5 digit K-Factor divider, with decimal keyed into any position, allows easy direct entry of any K-Factor from 0.0001 to 99999.
Presets: Two control outputs are provided. A 5 digit value can be entered for both presets. The decimal point location is the same as the counter (No decimal in Batch Total counter).
PRESET A:
    The preset A output is dedicated to the batch amount. When START is activated, Relay A will energize and remain on until the batch is complete or the batch is stopped.
PRESET B:
    The preset B output can be programmed to activate as a Prewarn (for two stage batch control) or activate on Batch Total or Grand Total (selectable).
    When set for PREWARN, Relay B will energize when START is activated and drop out at Prewarn number before preset.
    When set for Batch Total or Grand Total, Relay B will activate when the batch total or grand total counts up to preset B amount. The output ON time can be set for a duration (0.01 to 99.99 sec.) or latched (0.00 setting). If a value other than 0.00 is set for the duration, the batch total or grand total will auto-reset at preset B.
Control Outputs:
Relays:
    2 each N.O. Relay; 10 Amps 120/240 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 0.5 V @ 100 mA)
Analog Output:
    An optional 4-20mA (0-20mA) output is available for the Mini-Batch series. The output can be programmed to track rate or batch amount. Connections are via a 2 terminal pluggable screw connector. Programming is accomplished by using the front panel in conjunction with rear dip switches. Accuracy: ±.25% FS worst case. Compliance Voltage: 3 to 30 VDC non inductive.
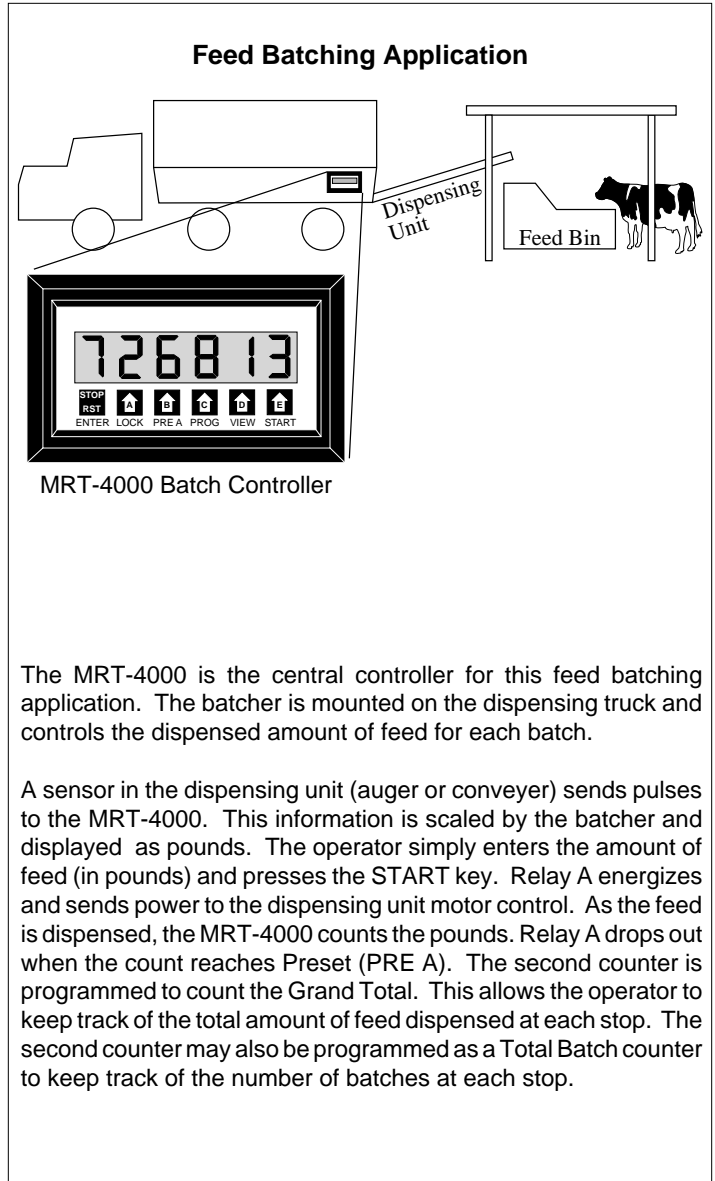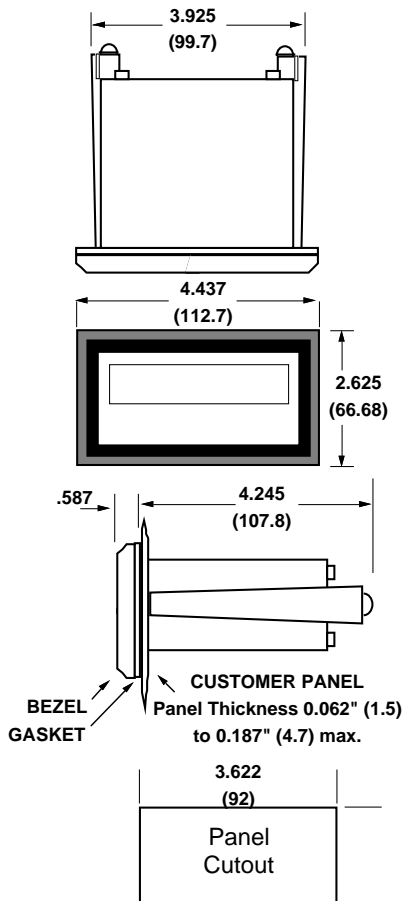
SPECIFICATIONS
(continued)

Lockout: Unauthorized front panel changes can be prevented by entering a user selected 5 digit code. The front panel can be completely locked out (except Start & Stop) or the preset can remain accessible.

Ratemeter: Accurate to 4 1/2 digits (±1 display digit). The rate display updates once per second. The rate meter can be programmed to sample from 2 to 24 seconds maximum, and auto-range up to 5 digits of significant information. The ratemeter displays in units per second, minute or hour.

Batch or Grand Totalizer: In addition to viewing the batch amount, a second counter can be viewed. This counter is programmable to count either the number of batches (Batch Total) or the grand total count (Grand Total).

RS232/RS422 Serial 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.

Dimensions:

Feed Batching Application

MRT-4000 Batch Controller

The MRT-4000 is the central controller for this feed batching application. The batcher is mounted on the dispensing truck and controls the dispensed amount of feed for each batch.

A sensor in the dispensing unit (auger or conveyer) sends pulses to the MRT-4000. This information is scaled by the batcher and displayed as pounds. The operator simply enters the amount of feed (in pounds) and presses the START key. Relay A energizes and sends power to the dispensing unit motor control. As the feed is dispensed, the MRT-4000 counts the pounds. Relay A drops out when the count reaches Preset (PRE A). The second counter is programmed to count the Grand Total. This allows the operator to keep track of the total amount of feed dispensed at each stop. The second counter may also be programmed as a Total Batch counter to keep track of the number of batches at each stop.

2

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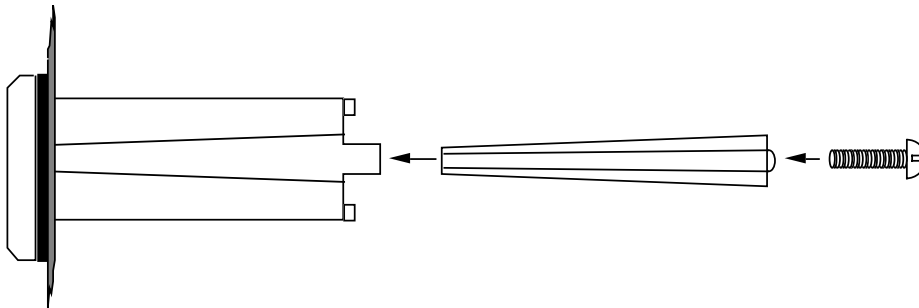
This product is designed to be panel mounted and is NEMA 4 rated if proper mounting procedures are followed and the required and supplied hardware is correctly used.

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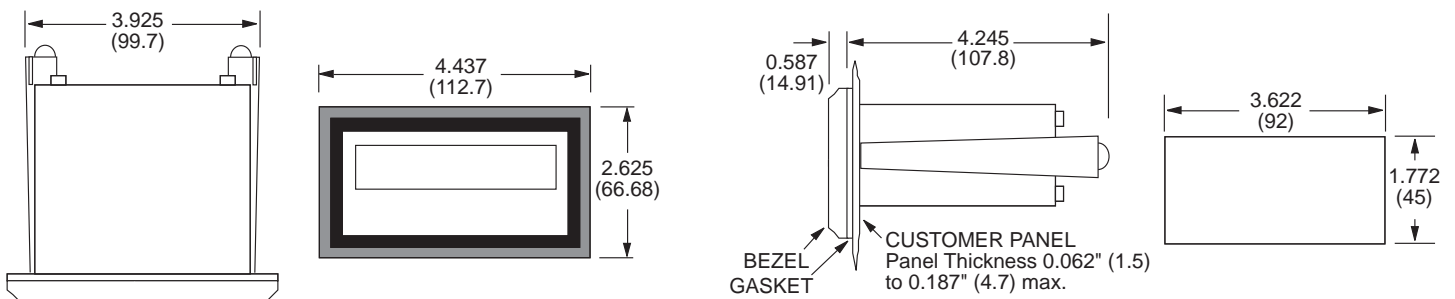
This product is designed to the NEMA 4 rated. However, the fact that we are unable to control either the location in which the device is installed or the actual installation itself requires that the company's liability shall extend only to the repair or replacement of a defective product.

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

3.925 (99.7)

4.437 (112.7)

2.625 (66.68)

0.587 (14.91)

4.245 (107.8)

3.622 (92)

1.772 (45)

BEZEL
GASKET

CUSTOMER PANEL
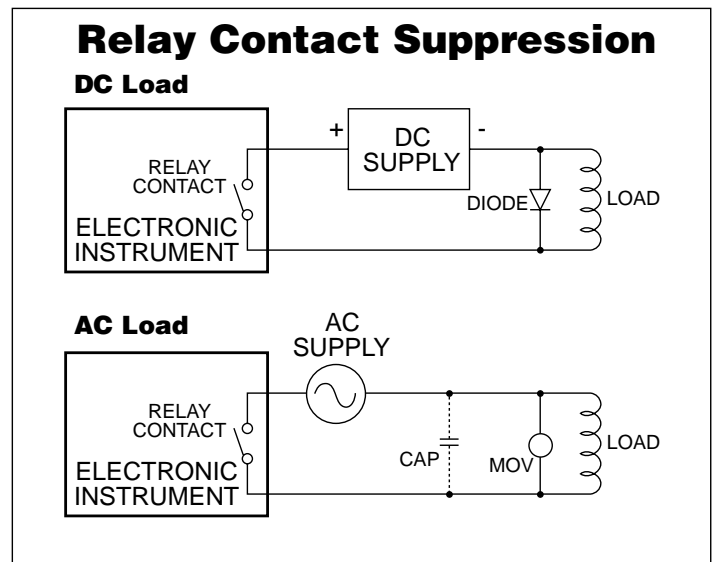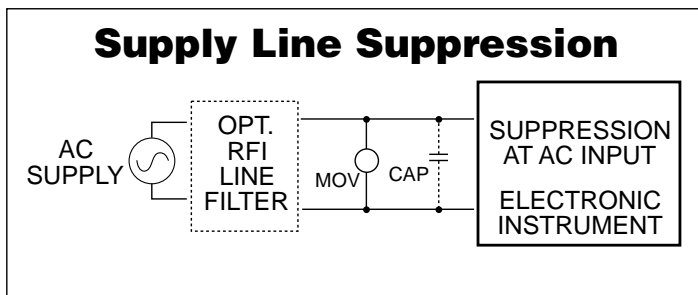Panel Thickness 0.062" (1.5)
to 0.187" (4.7) max.

WIRING

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.

Supply Line Suppression

Relay Contact Suppression

WIRING
(continued)

AC / DC Power Connections
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. Connect AC power to pins 11 and 12. 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.
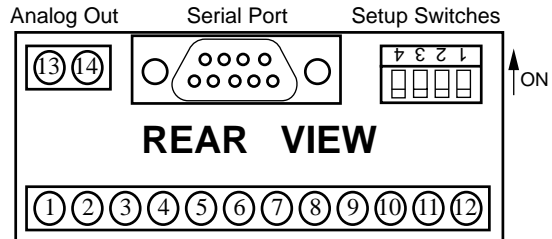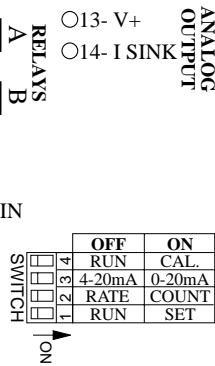
Sensor Connections
These diagrams show how to hook typical input sensors to the unit. The unit supplies an unregulated 12 Volt (50mA) output to power these sensors (Pin 7).
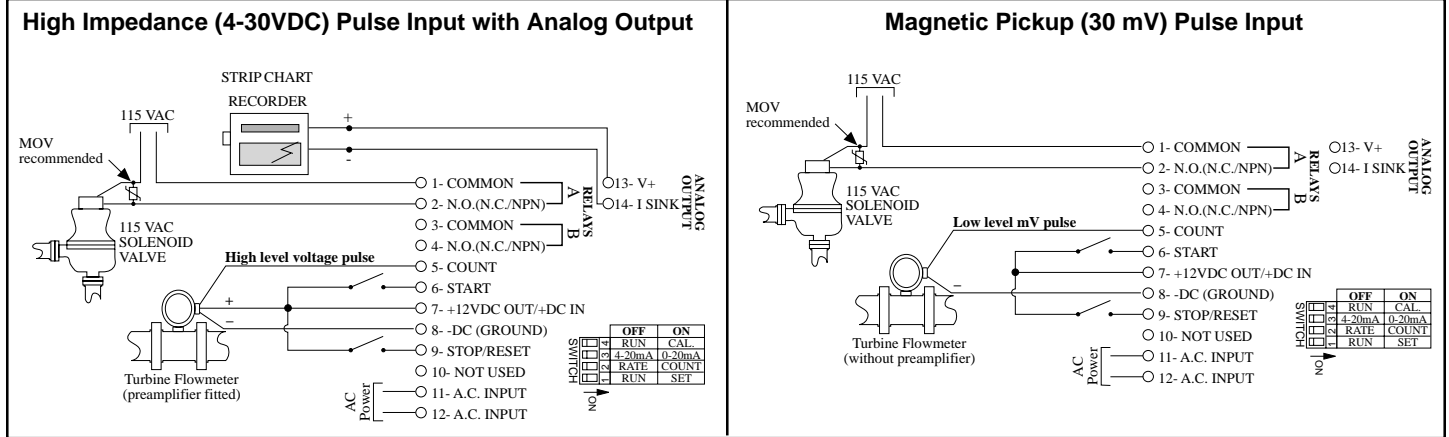
A valid pulse is one which makes a transition from the off-state (0 to 1V) to the on-state (4 to 30V): a positive going edge. The input impedance is 10K Ohms to ground. The unit can be programmed from the front panel for slow switch closure inputs up to 40Hz (select "Lo CPS"), or solid state switches (select "hi CPS") up to 9.99KHz. No rear terminal jumpers are required. Use PNP (sourcing) type pulsers.

Wiring Terminations:

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

Typical Flowmeter Connections

High Impedance (4-30VDC) Pulse Input with Analog Output

Magnetic Pickup (30 mV) Pulse Input

Typical Sensor Connections

Inductive Proximity Sensor Input

* Use Pull-Up Resistor For NPN Outputs 4.7KΩ Typical

Contact Closure Input

5
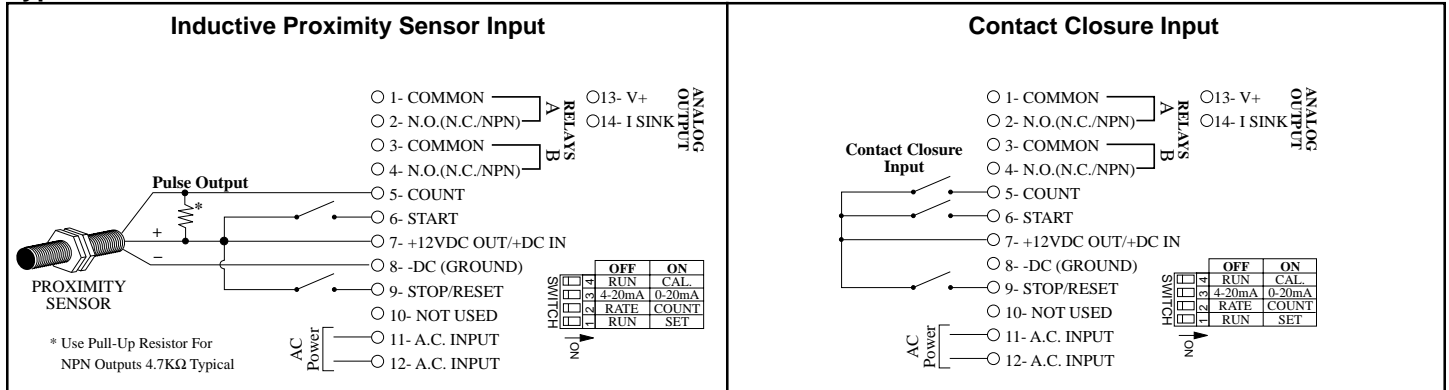
THEORY OF OPERATION

Batching

After the batcher has been programmed, it will operate as follows:

The unit will reset to "0" (count up mode) or load Preset A (count down mode) when RESET/STOP is activated. (front button or rear input)

When Start (front button or rear input) is activated, Relay A (and Relay B if Prewarn is selected) will energize and the right decimal will light. The unit will count in engineering units corresponding to the input scaling.

If Prewarn is selected for Relay B, Relay B will drop out when the count is at the selected number (Preset B) before final Preset A. When Preset A (or "0") is reached, Relay A drops out and the right decimal turns off. (The right decimal turns on whenever Relay A is energized). At the end of the batch the display is immediately loaded with "P" and Preset A number. At this point you can:

> Press START to reset and start another batch
> Press PRE A to change Preset A
> Press VIEW to view count (over-run)
> Press RESET/STOP to reset to "0" (Preset A)

If RESET/STOP is activated while the unit is started, Relay A (and Relay B if Prewarn) will drop out and the last count will remain on the display. Press START to continue the batch or RESET/STOP to abort the batch. All starts are inhibited if RESET/STOP is held active.

Grand Total or Batch Counter

The second counter (displayed with inverted decimals) can be programmed as a Grand Total or Batch counter. The Grand counter counts the grand total, the Batch counter counts the total number of complete batches. These counters can only be reset from the front panel while viewing them. To reset, press the VIEW key until the displays shows a number with all decimals lit. Press RESET/STOP to reset.

Relay B Operation

Relay B can be programmed as a prewarn relay or grand total/batch counter alarm.

When Relay B is set for Prewarn, Relay B will energized when the batcher is started. Relay B will drop out when the count is at the selected number (Preset B) before final Preset A. This is often used for slow down (2 stage batching).

When Relay B is set for total (Batch or Grand Total), Relay B will energize for the selected time duration when the Batch/Grand Total reaches Preset B. If the Relay is set to latch, it can be reset by resetting the Batch/Grand Total. (as described above).

Relay B as Scaled Pulse Output

To use output B as a scaled output proceed as follows:
1) Select ℌr tot under Count section of menu.
2) Select tot under rELAY section of menu.
3) Enter the desired duration for the B Relay.
4) Set PrE b at desired scaling (PrE b is a divider).
   Maximum output frequency is 15 pulses/second.

Presets

Preset A can be viewed and changed by pressing the "PRE A" button. The present Preset A will appear. Press buttons "A" through "E" to load in desired Preset A. Press the ENTER button once to enter.

Preset B can be viewed and changed by entering the program menu. Press the PRGM button. PRE B will appear. Press ENTER. The present Preset B will appear. Press buttons "A" through "E" to load in desired Preset B. Press the ENTER button once to enter.

VIEW Button

The VIEW button allows you to alternately view:

> 1. Count of "A" (Batch)
> 2. Rate of "A" (Batching speed)
> 3.* A) Grand Total if "ℌr tot" is selected
>   B) Number of Batches if "bA tot" is selected

* All decimal points are inverted when Grand/Batch Total is being displayed.
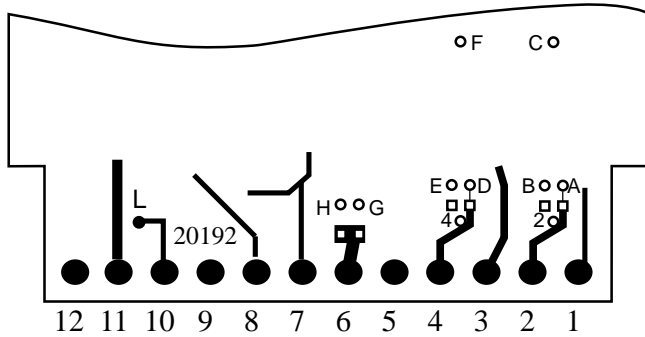
INPUT & OUTPUT JUMPER SELECTIONS

Output Jumper Selections

Output Jumper Selections
Before making any board modifications, be sure power is disconnected and locate the plastic extender to the case at the rear of the unit. To remove the extender locate and remove the two screws which hold it in place. After the extender is removed the PC board will be exposed.
The unit must be removed from the case to access jumpers C & F, all other jumbers can be accessed by removing the plastic extender.

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"

BOTTOM VIEW AT TERMINAL

Millivolt Input Option Jumper Selections
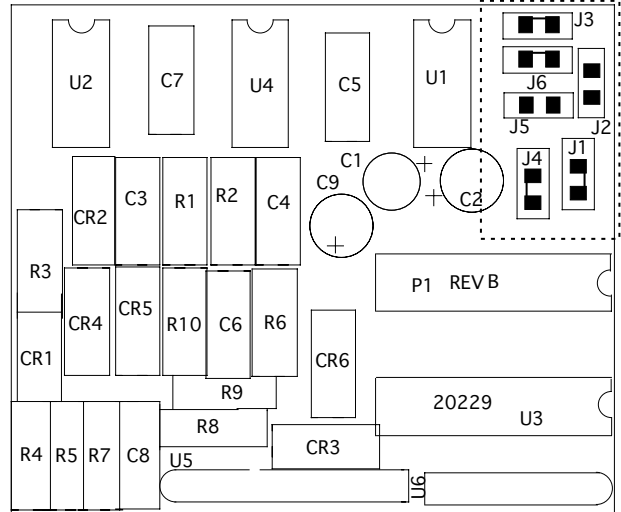
If the unit has the millivolt input bd.# 20229, the count input can be separately solder jumper programmed to accept either a low millivolt or 4-30 V input. Each unit shipped is programmed according to part number. If solder jumpers are made, the part number should be modified to reflect the changes made

C=CLOSE, O=OPEN

4-30V INPUT	**Millivolt** INPUT
J1-O, J2-C, J3-O	J1-C, J2-O, J3-C

FRONT PANEL OPERATIONS

726813

| STOP RST | A | B | C | D | E |
| ENTER | LOCK | PRE A | PROG | VIEW | START |
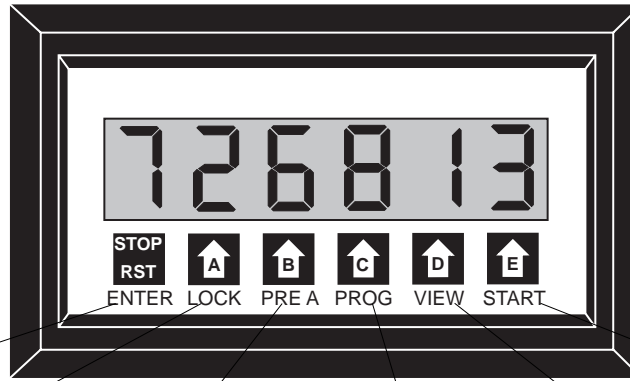
Press to STOP / RESET in operating mode; Press to "ENTER" in programming mode.

Press to "enter" LOCK code for panel lock.

Press to view or change Preset A

Press to cycle through PRO-GRAM choices; Press to step through set up choices in program mode.

Press to alter-nately view Rate, A Total or B Total

Press to Start

PROGRAMMING FLOWCHART

Start Here

PRGM

| PrE b | FACtor | Count | rAtE | LoC | rELAY |

ENTER

| ##### | dP FAC | rSt 0 ← → SEt Pr | SECS nninS HourS | LC Pr9 ← → LC ALL | tot ← → PrEuu |

RUN MODE

RUN MODE

dP LoC

9r tot ← → bA tot

HiCPS ← → LoCPS

RUN MODE

nor ##

Figur#

dLY #

RUN MODE

CodE

#####

RUN MODE

##.##

RUN MODE

8
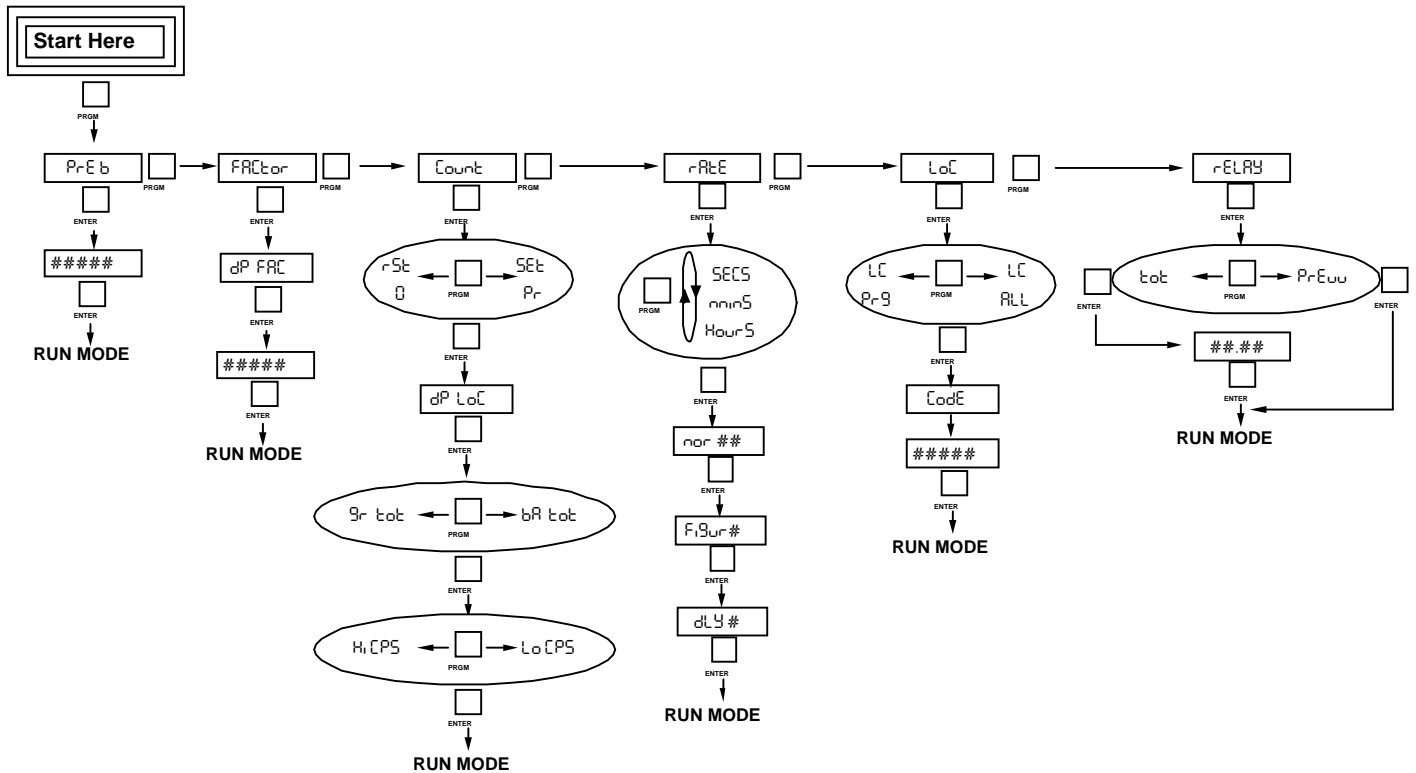
DEFINITIONS OF MENU PROMPTS

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

ABBREVIATION	DESCRIPTION
PrE b	PRESET B - This is the setpoint for Relay B. Preset B can be used as a Prewarn or Grand/Batch Total alarm.
FACtor	SCALING FACTOR - This portion of the menu is used to set the 5 digit dividing scale factor for the count input.
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.
Count	PORTION OF MENU FOR SETTING COUNTER VARIABLES
rSt 0	RESET TO 0 - Counter will reset to 0. The Batcher will count up from 0.
SEt Pr	SET TO PRESET - Counter will reset to preset A. The Batcher will count down from preset A.
dP LoC	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 counters , presets and rate display.
9r tot	GRAND TOTAL- This sets the second counter to count the Grand Total.
bA tot	BATCH TOTAL- This sets the second counter to count the number of Batches.
Hi CPS	HIGH COUNTS PER SECOND - This sets the unit for high count speeds (0-9.99 kHz)
Lo CPS	LOW COUNTS PER SECOND – This sets the unit for contact debounce filtering (0-40 Hz)
rAtE	PORTION OF MENU FOR SETTING RATE VARIABLES
SEC	SECONDS - The rate display will read in rate per second.
n ninS	MINUTES- The rate display will read in rate per minute.
HourS	HOURS - The rate display will read in rate per hour.
nor ##	NORMALIZING FACTOR - Normalizes (averages) the data being received. Higher settings provide more normalizing (averaging) for a more stable display. Derived from the equation: $$\frac{(\text{Old Data} \times \text{"NOR"} + \text{New Data})}{(\text{"NOR"} + 1)}$$
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.

DEFINITIONS OF MENU PROMPTS
(continued)

ABBREVIATION | DESCRIPTION

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 set lock functions (Lock functions apply only to front panel)
1) lock the program (Preset A is still accessible)
2) lock all (locks program & presets; Start & Stop are accessible).

LC Pr9   LOCK PROGRAM - This will lock the program. Preset A can be changed, start, stop & reset will function when the unit is in the lock mode (lock ON).

LC ALL   LOCK ALL - This will lock the program and the presets when the unit is in the locked mode. Preset A can be viewed, but not changed. Start and Stop buttons will still operate.

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.

PrEuu   PREWARN - When this is selected Relay B energizes when started and drops out at "Preset B" amount before batch is complete.

tot   RELAY B FOR TOTALIZER - When this is selected relay B will activate when the selected Grand or Batch total has reached Preset B.

b##.##   RELAY B DURATION - This message will appear when "TOT" is selected. It is the duration which the relay will remain energized (00.01 to 99.99 sec). If 00.00 is selected, the relay will latch until reset. When the duration is not at 00.00, the Grand/Batch totalizer will autorecycle.

CALCULATING SCALE FACTORS

The unit has a programmable scale factor to scale the input pulses. It is a 5 digit , floating decimal divider factor. The factor to enter is the number of pulses per the desired unit of measurement. The factor ranges from 0.0001 to 99999.

Scale factor calculations are simple. Here are some examples:

DECIMAL LOCATION:
When a decimal is desired for display, special care must be taken when programming the Factor (FACtor) and Decimal Location (dP LoC). The factor must be entered in pulses per units desired for display. (i.e. pulse per 1 unit, pulses per 0.1 units, pulses per 0.01 units, etc.) The Decimal Location (dP LoC) controls the decimal placement for the display. For each decimal place you move for dP LoC, you must also move the decimal for the factor (dP F A).

Example: The flow sensor outputs 678.4 pulses per gallon.
To display whole gallons (1 gal) enter   678.4 for the factor
To display tenths of gallons (0.1 gal) enter   67.84 for the factor
To display hundredths of gallons (0.01) gal) enter   6.784 for the factor

SCALING FACTOR EXAMPLES:

Flow Batching: You want to fill a 55.0 gallon drum. The flow sensor gives 387 pulses per gallon.

                Solution -   Dial in a scale factor of 38.7 (38.7 to display 0.1 gal; 387 for whole gal.)
                          Under Count, set dPLoC to dPLo.C to read tenths of gallons.
                          Set PRE A at 55.0; Wire Relay A to solenoid valve.

Conveyer Batching: You want to batch the amount of conveyer distance in feet. An inductive proximity sensor is used to sense a gear on a conveyer. The gear has 15 teeth (15 pulses per revolution). Each revolution of the gear equals 3 feet of conveyer movement. To find the number of pulses per foot, simply divide "15 pulse" by "3 feet" (15 ÷ 3 = 5).

                Solution -   There's 5 pulses/foot, enter 5 as the scale factor and the display will read in feet.
                          Set PRE A for the number of feet desired.
                          Wire Relay A to the conveyer RUN control.

Converting Scale Factors
When different units of measure are given than what is desired, simply convert the given Scale Factors to reflect the desired units using the following calculations.

$$\frac{\text{Pulses Per Unit (given)}}{\text{Units Conversion Factor}} = \text{Scale Factor}$$

Use the Units Conversion Chart below when converting the given Scale Factor. Be sure to use the Scale Factor for <u>whole</u> units and divide it by the proper Conversion Factor.

UNITS CONVERSION CHART			
To convert:	**divide factor by**	**To convert:**	**divide factor by**
ft to m	0.3048	kg to lb	2.2046
ft^2 to m^2	0.0929	l to ft^3	0.0353
ft^3 to m^3	0.02832	l to gal	0.2642
ft^3 to gal	7.4805	m to ft	3.2808
gal to l	3.7854	m^2 to ft^2	10.7639
gal to m^3	0.00379	m^3 to ft^3	35.3147
gal to ft^3	0.1337	m^3 to gal	264.172
gal to lb (H_2O)	8.3378	lb to kg	0.45359

PROGRAMMING
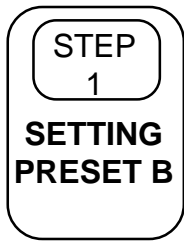
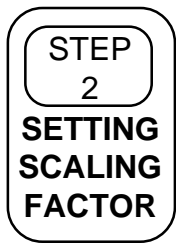|	PRESS	DISPLAY	REMARKS
STEP 1 **SETTING PRESET B**	☐ **PRGM**	PrE b	This section of the menu is used to set Preset B value.
	☐ **ENTER**	#####	This isPreset B. To change, press the arrow key under the digit(s) to change. Press ENTER to enter the displayed value.

	PRESS	DISPLAY	REMARKS
STEP 2 **SETTING SCALING FACTOR**	☐ **PRGM**	PrE b	
	☐ **PRGM**	FACtor	This section of the menu is used to set up the scaling factor for the count input.
	☐ **ENTER**	dP FAC	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 the count input. To change, press the arrow key under the digit(s) to change. Press ENTER to enter the displayed value.

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PROGRAMMING
(continued)

STEP 3
SETTING THE COUNTER

☐ **PRGM**   PrEb

☐ **PRGM**   FACtor

☐ **PRGM**   Count   This section of the menu sets up the counter information.

☐ **ENTER**   rSt 0
or
SEt Pr   Press the PRGM key to choose RST 0 (reset to 0, count up) or SET PR (set to preset, count down), press the ENTER key to enter the displayed choice.

☐ **ENTER**   dPLoC   This sets the decimal location for the A & B 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**   Gr tot
or
bA tot   This section sets the second counter operation. Press the program key to choose GR TOT (Grand Total) or BA TOT (Batch Total). 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.

PRESS	**DISPLAY**	**REMARKS**

STEP 4
SETTING THE RATE

PRESS	DISPLAY	REMARKS
☐ PRGM	PrEb	
☐ PRGM	FACtor	
☐ PRGM	Count	
☐ PRGM	rAtE	This section of the menu is used to set up the rate information.
☐ ENTER	SECS n ninS or HourS	Press the PRGM key to choose SECS (rate per second), n ninS (rate per minute) or HourS (rate per hour). 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.

	PRESS	DISPLAY	REMARKS
STEP 5 **SETTING LOCK**	PRGM	PrE b	
	PRGM	FACtor	
	PRGM	Count	
	PRGM	rAtE	
	PRGM	LoC	This section of the menu is used to set up the lockout type and code number.
	ENTER	LC P9 or LC ALL	LC PG = Locks program but presets and reset are accessible. (see description) LC ALL= Locks all keypad buttons except START, STOP & VIEW. 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. (see below to turn lock ON or OFF)
SETTING THE LOCK STATUS	LOCK	CodE Flashes followed by: 0	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.

	PRESS	**DISPLAY**	**REMARKS**

STEP 6
SETTING THE RELAYS

PRESS	DISPLAY	REMARKS
PRGM	PrE b	
PRGM	FACtor	
PRGM	Count	
PRGM	rAtE	
PRGM	LoC	
PRGM	rELAY	This section sets up the relay information.
ENTER	tot or PrEuu	Press the PRGM key to choose TOT (Relay B assigned to total) or PREW (Relay B assigned to prewarn). Press enter when the desired choice is displayed.
ENTER	b##.##	This will only appear if tot selected. This is the duration (.01 to 99.99 sec) that relay B will remain energized. If 00.00 is selected, the relay will latch until reset.

SETTING THE PRESETS

PRESS	DISPLAY	REMARKS
PRE A	PrE A Followed by last PRE A entered	PRE A = Preset A (Batch Amount); The set point at which output A will drop out after started. If the displayed value is not the desired preset, press the key(s) under the digit to be changed.
PRGM	PrE b	PRE B = Preset B ; a) tot selected — The set point at which output B will energize. b) PrEuu selected — The number of counts before batch ends that output B will drop out. If the displayed value is not the desired preset, press the key(s) under the digit to be changed.

RS 232 & RS422 INTERFACE CARD 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 six available items for the strobe display list are: (1) Preset A, (2) Preset B, (3) K-Factor A, (4) Rate of A, (5) Count A (Batch), (6) Grand / Batch Counter (Count B).

ENTER STROBE LIST:
DO NOT DISPLAY-0   DISPLAY-1
The unit will prompt you:
PRESET A<DISPLAY>?
PRESET B<DISPLAY>?
K-FACTOR A<DISPLAY>?
RATE<DISPLAY>?
COUNT A<DISPLAY>?
COUNT B<DISPLAY>?
If the above choices are entered, when the strobe line is triggered (3-30V positive pulse) the unit will transmit:
DEVICE# 1:
PA XXXXX
PB XXXXX
KA XXXXX
DR XXXXXX
DA XXXXXX
DB XXXXXX
(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.
DR ....Unit will display (transmit) rate A.
GO ....Unit will START. (relays energize)
ST ....Unit will STOP if batch is in progress (relays drop out)
KA ....Unit will display K-factor A.
†*KA(S)XXXXX ......Unit will load K-factor A 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 ....Counter A will reset
†*RA(S)XXXXXX....Unit will set Counter A to entered number.
RB ....Counter B will reset.
†*RB(S)XXXXXX....Unit will reset Batch / Grand Counter (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).
IF A NEGATIVE SIGN IS PRESENT, IT WILL NOT BE CHANGED.

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
RA(s)RB[RETURN]	RA RB
(UNIT PRESETS AND A K-FACTOR ARE SET AND BOTH COUNTERS ARE RESET)	
	12345
	1576

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.
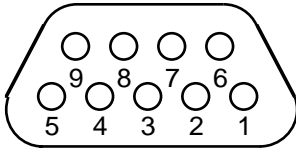
```
10 SCREEN 0,0:WIDTH 80

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

RS232 / RS422 Connector:

	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

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:

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:

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

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)

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)

ANALOG OUTPUT OPTION

Description:
An optional 4-20mA (0-20mA) output has been added to the Minitrol series. The output can be programmed to track rate or 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 conductive

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 rate
      SW2 ON (up): Analog output follows 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.

RS232 & RS422 Operation:
When the unit is suppled with RS232 or RS422, the analog output "low" and "high" settings can be accessed and changed through the serial port. The codes are as follows:
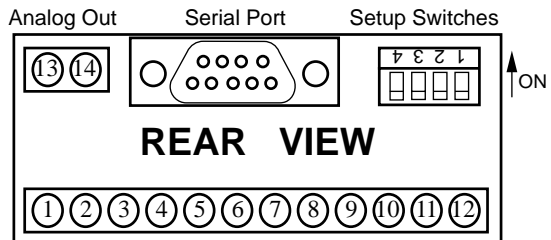
AL Unit will display (transmit) analog out "low" value.
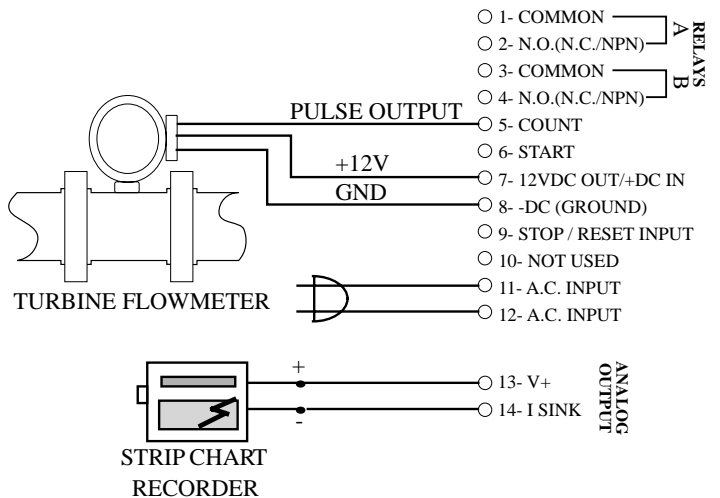**AL(S)XXXXX** Unit will load analog out "low" with entered
      number. (S) = space
AH Unit will display (transmit) analog out "high" value.
AH(S)XXXXX Unit will load analog out "high" with entered
      number. (S) = space

FIG. 1

Typical Wiring:

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. 5. Batcher is defective.	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 factor 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.
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. START not activated. 2. Wrong relay duration. 3. Relay set for wrong activation i.e. tot instead of PrEuu.	1. Relay A (and B if Prewarn) will only energize when start is activated. 2. Recheck programmed relay duration. 3. Recheck programmed relay activation mode.
Grand / Batch Counter resets before reaching 999999.	1. Relay duration is set at a value other than 00.00. This causes the counter to auto-reset at the preset.	1. If Relay B output is not being used, set the relay duration to 00.00.
Various menu items are not being displayed.	1. The menu flow chart and the setup steps show the setup for units with all of the available options. Options not ordered will be suppressed in the programming menu.	1. Disregard any menu items which appear on the flowchart and setup steps, but do not appear on the unit's display.

DECODING PART NUMBER:

MRT	W = Function	X = Operating Voltage	Y = Count Input	Z = Output

	W = 1 Rate & Total
	
	W = 2 Total Only
	
	W = 4 Batching
		X = 1 220 VAC
		
		X = 5 110 VAC
			Y = 3 Standard High
			    Impedance
			    4-30 VDC
			    9.99 Khz Max.
			
			Y = 5 Single Count With
			    Up/Down Input
			
			Y = Quadrature
			    4-30 VDC
			    9.99Khz Max.
				Z = 0 None
				
				Z = 1 RS - 232
				
				Z = 2 RS-422
				    Interface
				
				Z = 3 0(4)-20 mA