

## DITAK 8 - ADJUSTABLE TIMEBASE 5-DIGIT RATE INDICATOR

- LCD, POSITIVE REFLECTIVE OR NEGATIVE TRANSMISSIVE WITH YELLOW/GREEN OR RED BACKLIGHTING
- 0.6 INCH (15.2 mm) HIGH DIGITS
- ADJUSTABLE TIMEBASE FROM 4 MSEC TO 32 SEC
- INTERNAL LITHIUM BATTERY PROVIDES OVER 7 YEARS OF CONTINUOUS OPERATION
- NEMA 4X/IP65 SEALED FRONT PANEL BEZEL
- ACCEPTS MAGNETIC OR LOGIC TYPE SIGNAL INPUTS
- WIRE CONNECTIONS MADE VIA SCREW CLAMP TYPE TERMINALS



### DESCRIPTION

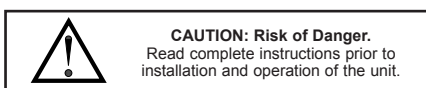
The Ditak 8 is a self-powered rate indicator which features selectable Timebase Increments by setting the appropriate DIP switches on the rear of the unit. The internal 3.0 VDC lithium battery will operate continuously for at least 7 years. It has a 5-digit LCD display with 0.6 inch (15.2 mm) high digits. The displays are available in positive image reflective (black digits, reflective background) or negative image transmissive (illuminated digits, dark background) with red or yellow/green backlighting. Backlight version units require power from an external 9 to 28 VDC supply.

The unit is constructed of a lightweight, high impact plastic case with a clear viewing window. The sealed front panel meets NEMA 4X/IP65 specifications for wash-down and/or dusty environments, when properly installed.

The optional Micro Line/Sensor Power Supply (MLPS1000) is designed to attach to the rear of an installed Ditak 8. The optional supply can be powered from 85 to 250 VAC, and can provide power for the backlighting of a unit and most sensors.

### SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



### SPECIFICATIONS

- DISPLAY:** 5-Digit LCD, 0.6" (15.2 mm) high digits.
- POWER SOURCE:** Internal 3.0 V lithium battery provides over 7 years of continuous service (battery life is dependent upon usage).
- BACKLIGHT POWER REQUIREMENTS:** 9 to 28 VDC @ 35 mA. Above 26 VDC, derate operating temperature to 50°C. Must use the MLPS1 or a Class 2 or SELV rated power supply.
- SIGNAL INPUT:** 0 to 10 KHz from a magnetic or bi-polar output (with a 50% duty cycle). Min. input sensitivity is 0.9 V. Max. input = 28 VDC.
- TIMEBASE:** Adjustable in 1/256 sec (3.906 msec) increments via DIP switches located at the rear of the unit. Timebase ranges from 3.906 msec to 31.998 sec; 0.01%  $\pm$  1 digit accuracy.
- ENVIRONMENTAL CONDITIONS:**
  - Operating Temperature:** 0 to 60°C (Above 50°C derate backlight operating voltage to 26 VDC max.)
  - Storage Temperature:** -40 to 80°C
  - Operating and Storage Humidity:** 85% max. (non-condensing) from 0°C to 60°C.
  - Altitude:** Up to 2000 meters
- CONSTRUCTION:** High impact plastic case with clear viewing window (Panel gasket and mounting clip included). Installation Category I, Pollution Degree 2.

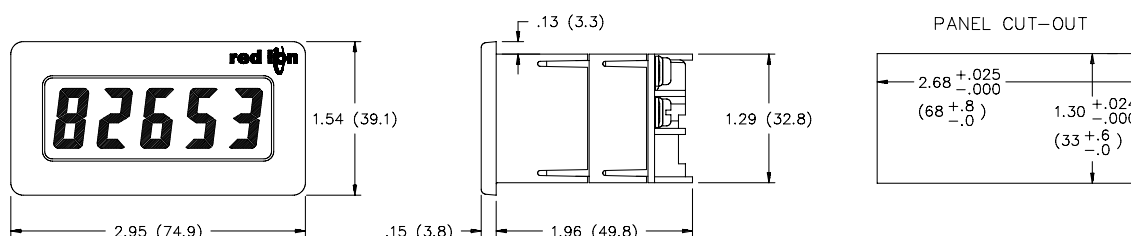
### ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
DT8	Adjustable Timebase Tachometer	DT800000
	Adjustable Timebase Tachometer with Yellow/Green Backlighting	DT800010
	Adjustable Timebase Tachometer with Red Backlighting	DT800020
MLPS	Micro Line Sensor/Power Supply	MLPS1000

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

### DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.15" (54.6) H x 3.00" (76.2) W.



## SPECIFICATIONS (Cont'd)

### 8. CERTIFICATIONS AND COMPLIANCES:

#### SAFETY

IEC 1010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

IP65 Enclosure rating (Face only), IEC 529

Type 4X Enclosure rating (Face only), UL50

#### ELECTROMAGNETIC COMPATIBILITY

##### Emissions and Immunity to EN 61326

##### Immunity:

Electrostatic discharge	EN 61000-4-2	Criterion B 4 kV contact discharge 8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Criterion A 10 V/m
Fast transients (burst)	EN 61000-4-4	Criterion B 2 kV power 2 kV signal
Surge	EN 61000-4-5	Criterion A 1 kV L-L, 2 kV L&N-E power 1 kV signal
RF conducted interference	EN 61000-4-6	Criterion A 3 V/rms
Voltage dip/interruptions	EN 61000-4-11	Criterion A 0.5 cycle

##### Emissions:

Emissions	EN 55011	Class B
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#### Notes:

1. Criterion A: Normal operation within specified limits.
2. Criterion B: Temporary loss of performance from which the unit self-recovers.

Refer to the EMC Installation Guidelines section of this bulletin for additional information.

### 9. WEIGHT: 3.4 oz (96.4 g)

## EMC INSTALLATION GUIDELINES

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the unit may be different for various installations. In extremely high EMI environments, additional measures may be needed. Cable length, routing and shield termination are very important and can mean the difference between a successful or a troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
  - a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
  - b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
  - c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.
2. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
3. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

Ferrite Suppression Cores for signal and control cables:

Fair-Rite # 0443167251 (RLC #FCOR0000)

TDK # ZCAT3035-1330A

Steward #28B2029-0A0

Line Filters for input power cables:

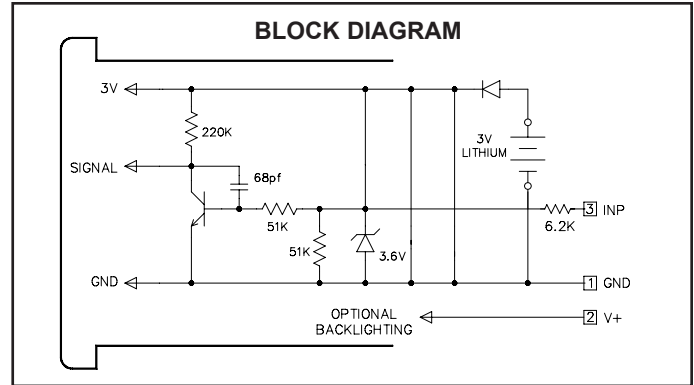
Schaffner # FN610-1/07 (RLC #LFIL0000)

Schaffner # FN670-1.8/07

Corcom #1VR3

**Note:** Reference manufacturer's instructions when installing a line filter.

5. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.

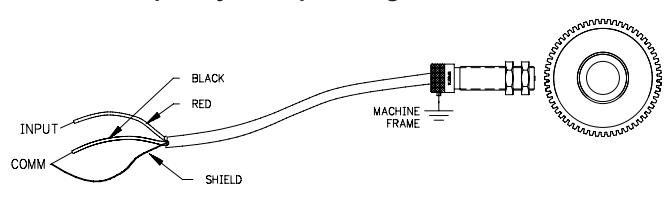


## WIRING CONNECTIONS

The electrical connections are made via rear screw-clamp terminals located on the back of the unit. All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker. When wiring the unit, use the label to identify the wire position with the proper function. Strip the wire, leaving approximately 1/4" bare wire exposed (stranded wires should be tinned with solder). Insert the wire into the screw-clamp terminal and tighten the screw until the wire is clamped tightly. Each terminal can accept up to two #14 AWG wires.

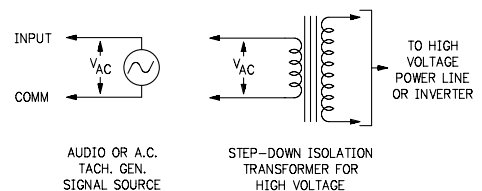
The backlighting for a backlight version unit is powered between Terminal 2 (V+) and Terminal 1 (GND).

### Variable Frequency AC Inputs, Signal Source Powered

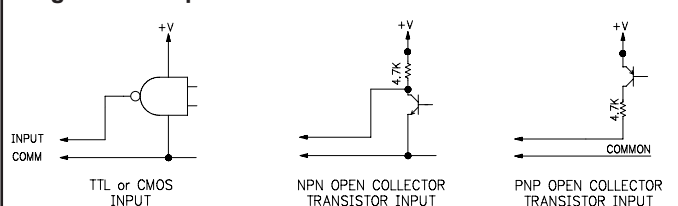


### Variable Frequency AC Inputs, Signal Source Powered

Minimum  $V_{AC}$  for operation is 0.9 V peak.

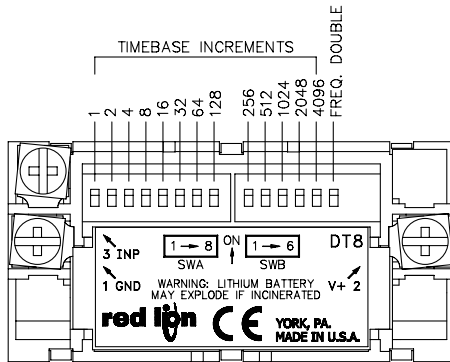


### Logic Pulse Inputs From Other Circuits & Sensors



## REAR PANEL DIP SWITCHES

When viewing the Ditak 8 from the rear, there are two banks of DIP switches located along the top edge of the PC board. The bank of eight switches to the left is labeled SWA and the bank of six switches to the right is labeled SWB. All of the SWA switches and five of the SWB switches are used to select the desired Timebase. The remaining switch of SWB is used to select Frequency Doubling.



**WARNING:** Lithium battery may explode if incinerated.

## FREQUENCY DOUBLING

DIP switch SWB 6 is the "Frequency Doubling" switch. When it is in the "ON" position, frequency doubling is disabled. When set to the "OFF" position, it is enabled and twice the number of input pulses are registered in the unit. This doubling of the input rate allows the Timebase Increment Total to be halved, thus allowing a faster update time for a given display value.

## TIMEBASE SELECTION

The Ditak 8 has a Timebase selection range from 3.906 msec to 31.998 sec. SWA 1 is set to the "ON" position for the minimum Timebase setting. SWA 1 through SWB 5 are set to the "ON" position for the maximum Timebase setting. A specific Timebase setting is achieved by adding the appropriate individual Timebase increments.

SWITCH	TIMEBASE INCREMENTS	SWITCH	TIMEBASE INCREMENTS
SWA 1	1	SWB 1	256
SWA 2	2	SWB 2	512
SWA 3	4	SWB 3	1024
SWA 4	8	SWB 4	2048
SWA 5	16	SWB 5	4096
SWA 6	32	SWB 6	FREQ. DBL.
SWA 7	64		
SWA 8	128		

The Timebase increment total is computed according to the following formula:

$$\text{TIMEBASE INCREMENT TOTAL (TBIT)} = \frac{\text{DR} \times 15,361}{\text{RPM} \times \text{PPR} \times \text{FQ.DBL.}}$$

### WHERE:

DR	=	Desired Reading
RPM	=	Revolutions Per Minute
PPR	=	Pulses Per Revolution
FQ.DBL.	=	Frequency Doubling disable (times 1 switch on, times 2 switch off)

**Example:** Find the appropriate Timebase DIP switch setting for desired parameters.

Desired Readout (DR)	=	2500
Revolutions Per Minute (RPM)	=	1250
Pulses Per Revolution (PPR)	=	50
FQ.DBL.	=	ON (times 1 switch on)

$$\text{TIMEBASE INCREMENT TOTAL (TBIT)} = \frac{2500 \times 15,361}{1250 \times 50 \times 1}$$

$$\text{TBIT} = 614.44$$

$$\text{TBIT} = 614 \text{ \{round to the nearest whole number\}}$$

$$\text{TBIT} = 614$$

DIP SWB 2	-	<u>512</u>	
		102	- Needed
DIP SWA 7	-	<u>64</u>	
		38	- Needed
DIP SWA 6	-	<u>32</u>	
		6	- Needed
DIP SWA 3	-	<u>4</u>	
		2	- Needed
DIP SWA 2	-	<u>2</u>	
		0	- Needed

Note: If no timebase switches are turned on, the Ditak 8 will default to 3.906 msec timebase.

DIP switches SWA 2, 3, 6, 7, and SWB 2 are all set to the "ON" position for a Timebase Increment Total of 614. If it is desired to know what the approximate Timebase is in seconds, use the following formula:

$$\begin{aligned} \text{TBIT} \times 0.003906 &= \text{Time in seconds} \\ 614 \times 0.003906 &= 2.398 \text{ sec.} \end{aligned}$$

## TYPICAL APPLICATION

### CONVEYOR BELT SPEED INDICATOR

It is desired to display the rate of a conveyor belt used to carry PC Boards through an infrared soldering chamber that is variable from 0 to 10 feet per minute. The rate must be adjusted depending on the size of the boards being soldered. The display of the rate indicator must read in feet per minute. The shaft of the variable speed motor contains a keyway. A speed of 100 RPM will produce a belt speed of 10 ft/min. A proximity sensor is used to monitor the speed of the shaft. The Ditak 8 can be used to display the belt speed in this application. The output signal of the sensor is connected to the Ditak 8 Terminal 3 (INP). The sensor common and shield are connected to the Ditak 8 Terminal 1 (GND). The Timebase setting is to be determined by using the formula.

$$\text{TIMEBASE INCREMENT TOTAL (TBIT)} =$$

$$\frac{\text{DR} \times 15,361}{\text{RPM} \times \text{PPR} \times \text{FQ.DBL.}} = \frac{10 \times 15,361}{100 \times 1 \times 1}$$

Desired Reading	=	10
MAX RPM Of Shaft	=	100
Pulses Per Revolution	=	1
FQ.DBL.	=	ON (times 1 switch on)

$$\text{TBIT} = 1536.1$$

$$\text{TBIT} = 1536 \text{ \{round to the nearest whole number\}}$$

$$\text{TBIT} = 1536$$

DIP SWB 3	-	<u>1024</u>	
		512	- Needed
DIP SWB 2	-	<u>512</u>	
		0	- Needed

With these DIP switch settings, the Timebase would be approximately 5.99 sec (1536 x 0.003906 = 5.995). To reduce the display update time, the "Frequency Doubling" switch can be enabled (set to the "OFF" position). Therefore, only half the Timebase will be necessary (768 x 0.003906 = 2.99 sec.).

$$\text{TBIT} = 768$$

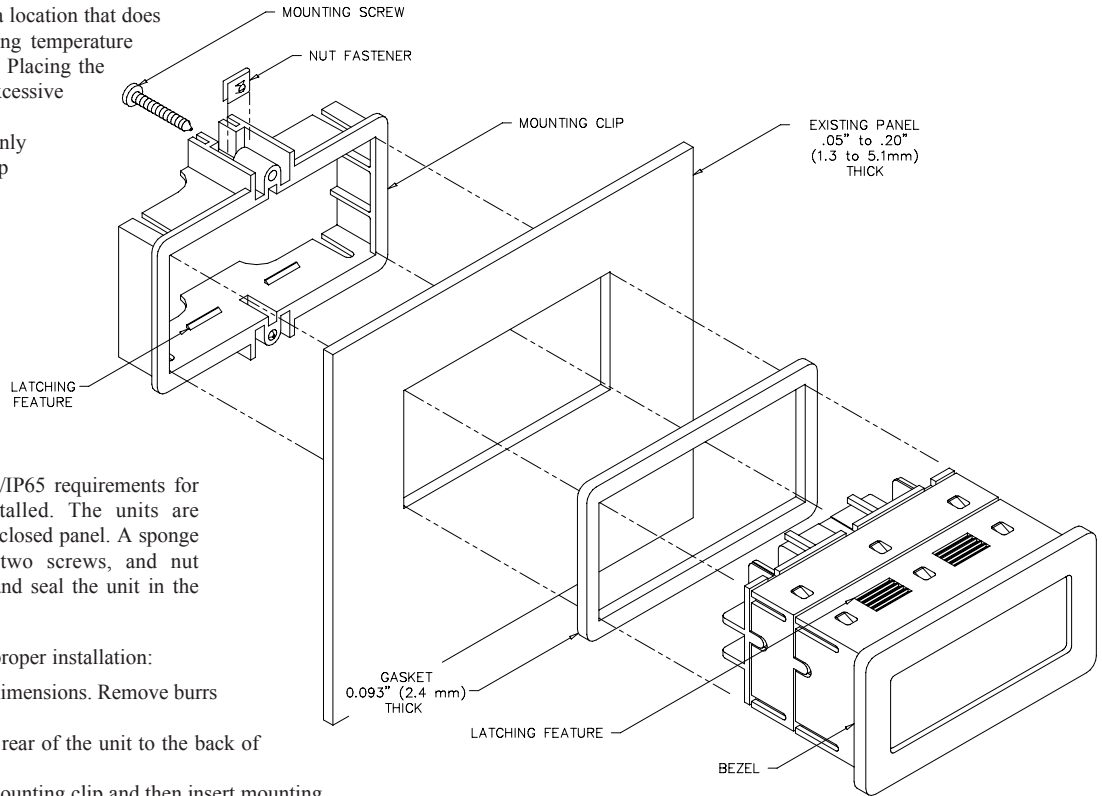
DIP SWB 2	-	<u>512</u>	
		256	- Needed
DIP SWB 1	-	<u>256</u>	
		0	- Needed
DIP SWB 6	-	OFF	- Frequency Doubling Enabled

## INSTALLATION ENVIRONMENT

The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents.

Continuous exposure to direct sunlight may accelerate the aging process of the bezel.



## INSTALLATION

The Ditak 8 meets NEMA 4X/IP65 requirements for indoor use, when properly installed. The units are intended to be mounted into an enclosed panel. A sponge rubber gasket, mounting clip, two screws, and nut fasteners are provided to install and seal the unit in the panel cut-out.

The following procedure assures proper installation:

1. Cut panel opening to specified dimensions. Remove burrs and clean panel opening.
2. Slide the panel gasket over the rear of the unit to the back of the bezel.
3. Slide nut fastener into slot on mounting clip and then insert mounting screw through nut on both sides of mounting clip. Tip of mounting screw should NOT project through hole on clip.
4. Install Ditak unit through panel cut-out.
5. Slide mounting clip over rear of unit until clip is against back of panel. The mounting clip and Ditak housing have a latching feature to hold the unit in place until tightened.

*Note: Hold the Ditak front bezel in place when sliding the mounting clip into position.*

6. Alternately tighten each mounting screw to ensure uniform gasket pressure. Visually inspect the gasket for proper seal. The gasket should be compressed approximately 75 to 80% of its original thickness.
7. If the gasket is not adequately compressed and the mounting screws cannot be tightened any further, loosen mounting screws and insure that the clip is latched as close as possible to the panel.
8. Repeat step #6 for tightening the mounting screws.

## TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

### LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company's liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company's option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company's products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.

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June 2, 2008

Customer  
Address  
City

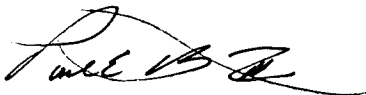
RE: Product Discontinuance

Red Lion has advised us that they have discontinued the DT9 Series of rate meters. The sole-sourced processor used for this product is not functioning according to specification and several attempts to rectify the problem were unsuccessful. Shown below, for your use, is a chart showing the recommended replacements.

P/N	Recommended Replacement	Panel Cut-out	Differences
DT900000	<u>DT800000</u>	Same	Display size, time base instead of time interval, no decimal points
	<u>CUB5R000</u>	Same	Display size, requires DC power (not battery powered) programs differently
DT900010	<u>CUB5B000</u>	Same	Display size, programs differently
	<u>DT800010</u>	Same	Display size, time base instead of time interval, no decimal points
DT900020	<u>CUB5B000</u>	Same	Display size, programs differently
	<u>DT800020</u>	Same	Display size, time base instead of time interval, no decimal points

Our records indicate that you last purchased Part No. \_\_\_\_\_ on your PO # \_\_\_\_\_. Please do not hesitate to contact anyone in our Inside Sales or Technical Services departments if you need assistance in replacing the DT9 Series

Sincerely,



Paul E. Burk III  
Vice President of Marketing

Cc: SEI Inside Sales, Field Sales, Technical Services



## DITAK 9 - ADJUSTABLE TIMEBASE 5-DIGIT RATE INDICATOR



- DESIGNED FOR MEDIUM/HIGH SPEED APPLICATIONS
- LCD, POSITIVE REFLECTIVE OR NEGATIVE TRANSMISSIVE WITH YELLOW/GREEN OR RED BACKLIGHTING
- 0.46 INCH (11.68 mm) HIGH DIGITS
- ADJUSTABLE TIMEBASE FROM 1 TO 7 SECONDS
- RATE MULTIPLIER FROM 0.0001 TO 1.9999
- SELECTABLE DECIMAL POINTS
- LITHIUM BATTERY PROVIDES OVER 7 YEARS OF CONTINUOUS OPERATION (Battery included)
- NEMA 4X/IP65 SEALED FRONT PANEL BEZEL
- ACCEPTS MAGNETIC OR LOGIC TYPE SIGNAL INPUTS

### DESCRIPTION

The DITAK 9 is a self-powered rate indicator designed to operate in medium/high speed applications. It is ideal for use with magnetic pick-ups or other bi-polar sensors operating at a minimum of 30 Hz\*. The unit features selectable timebase, rate multiplier, and decimal points via two front panel pushbuttons. It has a 5-digit LCD Display with 0.46" high digits that are available in positive image reflective (black digits, reflective background) or negative image transmissive red or yellow/green (illuminated digits, dark background). Backlight version units require power from an external 9 to 28 VDC supply.

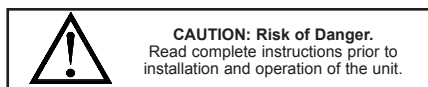
The unit is constructed of a lightweight, high impact plastic case with a clear viewing window. The sealed front panel meets NEMA 4X/IP65 specifications for wash-down and/or dusty environments, when properly installed. A DITAK 9 unit can be mounted in the same panel cut-out as the earlier DITAK 7 units.

The optional Micro Line/Sensor Power Supply (MLPS1000) is designed to attach to the rear of an installed backlight version DITAK 9. The optional supply can be powered from an 85 to 250 VAC source, and can provide power for the backlighting of a unit and a sensor. The maximum current draw for the sensor is 45 mA.

\* - For slow speed applications with low pulse rates, it is recommended to use the CUB5 Counter/Rate Indicator.

### SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



### SPECIFICATIONS

- DISPLAY:** 5-Digit LCD, 0.46" (11.68 mm) high digits.
- POWER SOURCE:** Internal 3.0 V lithium battery provides over 7 years of continuous service (battery life is dependent upon usage).
- BACKLIGHT POWER REQUIREMENTS:** 9 to 28 VDC @ 35 mA. Above 26 VDC, derate operating temperature to 50°C. Must use the MLPS or a Class 2 or SELV rated power supply.
- SIGNAL INPUT:** 0 to 10 KHz from a magnetic or bi-polar output (with a 50% duty cycle). Min. input sensitivity is 0.9 V. Max. input = 28 V.
- TIMEBASE:** Adjustable in 1 sec increments via front panel. Timebase ranges from 1 second to 7 seconds; 0.05% accuracy.
- CONSTRUCTION:** High impact plastic case with clear viewing window (Panel gasket and mounting clip included). Installation Category I, Pollution Degree 2.
- CERTIFICATIONS AND COMPLIANCES:**

#### SAFETY

IEC 1010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

IP65 Enclosure rating (Face only), IEC 529

Type 4X Enclosure rating (Face only), UL50

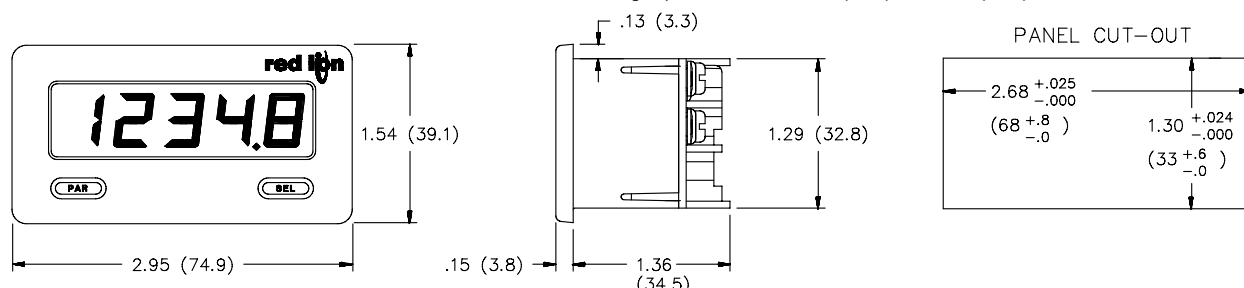
#### ELECTROMAGNETIC COMPATIBILITY

##### Emissions and Immunity to EN 61326

Electrostatic discharge	EN 61000-4-2	Criterion A 4 kV contact discharge 8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Criterion A 10 V/m
Fast transients (burst)	EN 61000-4-4	Criterion A 2 kV power 2 kV signal
Surge	EN 61000-4-5	Criterion A 2 kV power 1 kV signal
RF conducted interference	EN 61000-4-6	Criterion A 10 V/rms

### DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.15" (54.6) H x 3.00" (76.2) W.



## SPECIFICATIONS (Cont'd)

Power Frequency magnetic fields	EN 61000-4-8	Criterion A 30 A/m
Voltage dip/interruptions	EN 61000-4-11	Criterion A 0.5 cycle
Emissions	EN 55022	Class B

### Notes:

1. Criterion A: Normal operation within specified limits.

Refer to the EMC Installation Guidelines section of this bulletin for additional information.

## 8. ENVIRONMENTAL CONDITIONS:

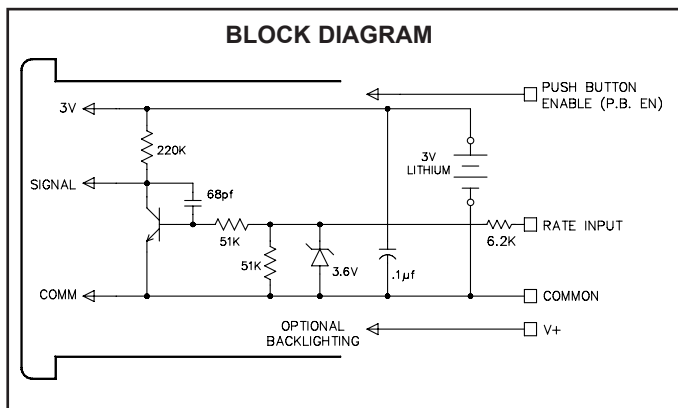
**Operating Temperature:** 0 to 75°C (Above 50°C derate backlight operating voltage to 26 VDC max.)

**Storage Temperature:** -30 to 80°C

**Operating and Storage Humidity:** 85% max. relative humidity (non-condensing) from 0°C to 75°C.

**Altitude:** Up to 2000 meters

## 9. WEIGHT: 3.3 oz (93.5 g)



grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.

3. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.

4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

Ferrite Suppression Cores for signal and control cables:

Fair-Rite # 0443167251 (RLC #FCOR0000)

TDK # ZCAT3035-1330A

Steward #28B2029-0A0

Line Filters for input power cables:

Schaffner # FN610-1/07 (RLC #LFIL0000)

Schaffner # FN670-1.8/07

Corcom #1VR3

**Note:** Reference manufacturer's instructions when installing a line filter.

5. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.

## EMC INSTALLATION GUIDELINES

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the unit may be different for various installations. In extremely high EMI environments, additional measures may be needed. Cable length, routing and shield termination are very important and can mean the difference between a successful or a troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.

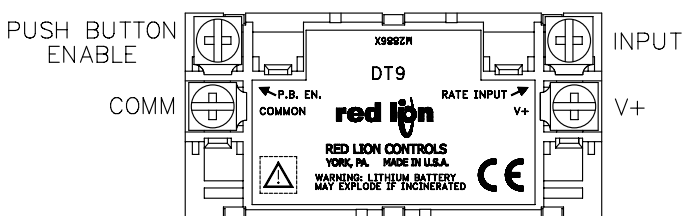
- Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
- Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
- Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.

2. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly

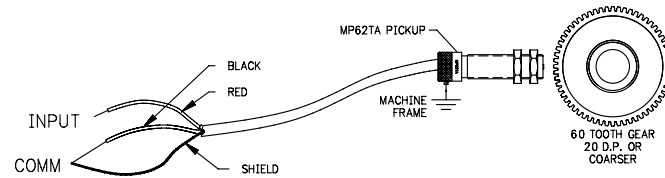
## WIRING CONNECTIONS

The electrical connections are made via rear screw-clamp terminals located on the back of the unit. All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker. When wiring the unit, use the label to identify the wire position with the proper function. Strip the wire, leaving approximately 1/4" bare wire exposed (stranded wires should be tinned with solder). Insert the wire into the screw-clamp terminal and tighten the screw until the wire is clamped tightly. Each terminal can accept up to two #14 AWG wires.

The backlighting for a backlight version unit is powered between the V+ Terminal and the Common Terminal.

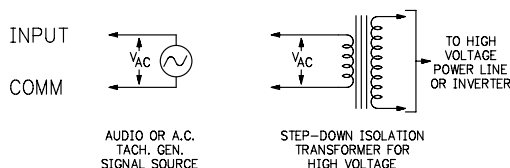


## Variable Frequency AC Inputs, Signal Source Powered

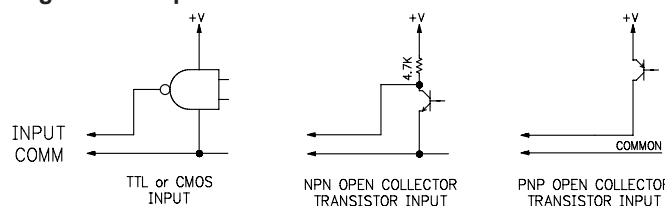


## Variable Frequency AC Inputs, Signal Source Powered

Minimum  $V_{AC}$  for operation is 0.9 V peak.



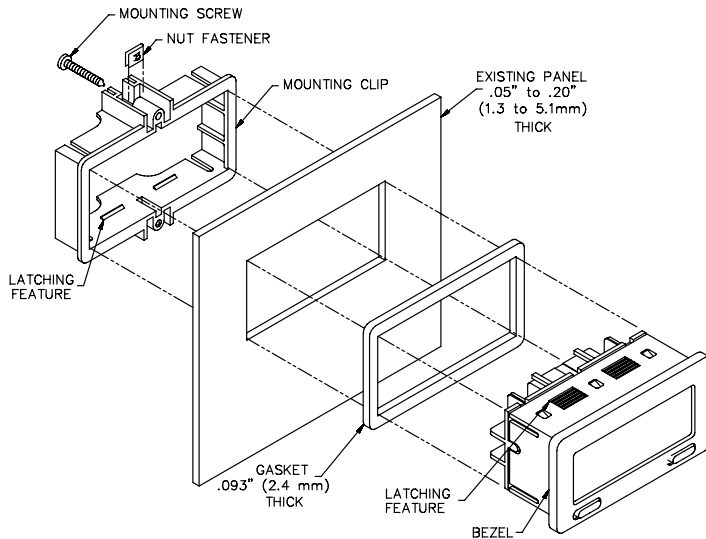
## Logic Pulse Inputs From Other Circuits & Sensors



## INSTALLATION ENVIRONMENT

The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.



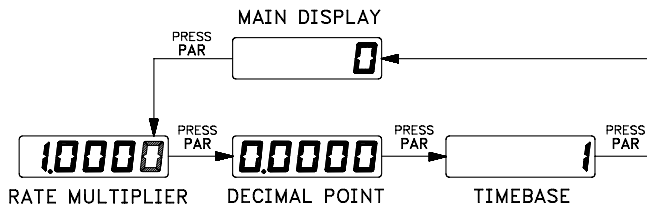
## INSTALLATION

The Ditak 9 meets NEMA 4X/IP65 requirements for indoor use, when properly installed. The units are intended to be mounted into an enclosed panel. A sponge rubber gasket, mounting clip, two screws, and nut fasteners are provided to install and seal the unit in the panel cut-out.

The following procedure assures proper installation:

1. Cut panel opening to specified dimensions. Remove burrs and clean panel opening.
  2. Slide the panel gasket over the rear of the unit to the back of the bezel.
  3. Slide nut fastener into slot on mounting clip and then insert mounting screw through nut on both sides of mounting clip. Tip of mounting screw should NOT project through hole on clip.
  4. Install Ditak unit through panel cut-out.
  5. Slide mounting clip over rear of unit until clip is against back of panel. The mounting clip and Ditak housing have a latching feature to hold the unit in place until tightened.
- Note: Hold the Ditak front bezel in place when sliding the mounting clip into position.*
6. Alternately tighten each mounting screw to ensure uniform gasket pressure. Visually inspect the gasket for proper seal. The gasket should be compressed approximately 75 to 80% of its original thickness.
  7. If the gasket is not adequately compressed and the mounting screws cannot be tightened any further, loosen mounting screws and insure that the clip is latched as close as possible to the panel.
  8. Repeat step #6 for tightening the mounting screws.

## PROGRAMMING MENU



*Note: The display changes on "PAR" or "SEL" push button release.*

## PROGRAMMING

From the factory, the Ditak 9 is programmed with a fixed 1 second timebase to read directly in HZ or RPM with a 60 tooth gear. To enter the programming mode, place a jumper between the Push Button Enable (P. B. En.) Terminal and the Common Terminal. Once the jumper is connected the programming buttons are now activated. The Programming Mode consists of three selections; Rate Multiplier, Decimal Point, and Timebase. There is a fourth display which is the main display or run mode. Once programming is complete, the unit must be returned to the main display before exiting the programming mode to obtain normal operation.

## RATE MULTIPLIER

The Ditak 9 has a Rate Multiplier (RM) selection range from 0.0001 to 1.9999. See Programming Calculations to determine the calculated value. After entering the programming mode, the least significant digit will be flashing. To increment this digit, press the **SEL** button. After the value 9, the digit will start over at 0. To move to the next digit press **PAR** and then that digit can be changed by pressing **SEL**. When reaching the most significant digit, pressing **PAR** will advance the meter to the Decimal Point selection.

## DECIMAL POINT SELECTION

The selection of the decimal point position for the display (DDP) is accomplished by repeatedly pressing **SEL**. This selection will always default to 0.0000 when advancing to it from the Rate Multiplier selection. By pressing **PAR**, the shown decimal point selection is entered and the Time base selection is shown.

## TIMEBASE SELECTION

The Ditak 9 has a Time Base selection range from 1 second to 7 seconds. See Programming Calculations to determine the calculated Rounded Time Base (RTB) value. The value is changed by pressing **SEL**. The value is entered by pressing **PAR** and the Main Display/Run Mode is shown.

*Note: The position of the decimal point has no effect on this selection.*

## MAIN DISPLAY/RUN MODE

This display follows the Timebase Selection. The unit must be in this mode to exit the Programming Mode and have the unit display properly. The push button enable jumper can be removed after the Ditak 9 is returned to the main display.



## PROGRAMMING CALCULATIONS (Select one of the following)

### USING KNOWN RPM

An amusement park director wants his parking tram operators to keep their speed under a certain limit. He has a magnetic sensor looking at a shaft on the tram with 30 pulses per revolution. When the shaft is turning at 50 RPM he wants the meter to show 15.5. The Ditak 9 is programmed as follows:

DR = Desired Reading  
DDP = Display Decimal Point  
RPM = Revolutions Per Minute  
PPR = Pulses Per Revolution  
DDP: Use the following corresponding numbers in the formula for the Display Decimal Point:  
0 = 1  
0.0 = 10  
0.00 = 100  
0.000 = 1000

RPM = 50  
PPR = 30  
DR = 15.5  
DDP = 10

$$\text{HERTZ (HZ)} = \frac{\text{RPM} \times \text{PPR}}{60} = \frac{50 \times 30}{60} = 25$$

$$\text{CALCULATED TIME BASE} = \frac{\text{DR} \times \text{DDP}}{\text{HZ}} = \frac{15.5 \times 10}{25} = 6.2$$

$$\text{ROUNDED TIME BASE (RTB)} = 6$$

$$\text{REMAINDER MULTIPLIER (RM)} = \frac{\text{DR} \times \text{DDP}}{\text{RTB} \times \text{HZ}} = \frac{15.5 \times 10}{6 \times 25} = 1.0333$$

RM = 1.0333  
Decimal = 0.0  
RTB = 6

ROUNDED TIME BASE (RTB) = Round Calculated Time Base to nearest whole number between 1-7.

If RM is greater than 1.9999, then remove a decimal location or add more pulses per revolution.

### USING KNOWN PULSES PER UNIT

A newspaper company wants to know the line speed of their press to tenths of feet per minute. They have an encoder that gives 125 pulses per foot. The Ditak 9 is programmed as follows:

TF = Time Factor  
DDP = Display Decimal Point  
PPU = Pulses Per (Single) Unit  
TF: = Use one of the following numbers in the formula for the Time Factor:  
Per second = 1  
Per minute = 60  
Per hour = 3600

DDP: Use the following corresponding numbers in the formula for the Display Decimal Point:  
0 = 1  
0.0 = 10  
0.00 = 100  
0.000 = 1000

Required minimum pulses per (single) unit:  
Per second = 0.07  
Per minute = 4.4  
Per hour = 259.0 } (multiply this value by DDP)

PPU = 125 (pulses per foot)

DDP = 10 (for tenths of a foot)

TF = 60 (for per minute)

$$\text{CALCULATED TIME BASE} = \frac{\text{TF} \times \text{DDP}}{\text{PPU}} = \frac{60 \times 10}{125} = 4.8$$

$$\text{ROUNDED TIME BASE (RTB)} = 5$$

$$\text{REMAINDER MULTIPLIER (RM)} = \frac{\text{TF} \times \text{DDP}}{\text{RTB} \times \text{PPU}} = \frac{60 \times 10}{5 \times 125} = 0.9600$$

RM = 0.9600  
Decimal = 0.0  
RTB = 5

ROUNDED TIME BASE (RTB) = Round Calculated Time Base to nearest whole number between 1-7.

If RM is greater than 1.9999, then remove a decimal location or add more pulses per unit.

## ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
DT9	Adjustable Timebase Tachometer	DT900000
	Adjustable Timebase Tachometer with Yellow/Green Backlighting	DT900010
	Adjustable Timebase Tachometer with Red Backlighting	DT900020
MLPS	MLPS Micro Line Sensor/Power Supply	MLPS1000
For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.		

## TROUBLESHOOTING

For further technical assistance, contact Technical Support at the appropriate company numbers listed.

Red Lion Controls  
20 Willow Springs Circle  
York PA 17406  
Tel +1 (717) 767-6511  
Fax +1 (717) 764-0839

Red Lion Controls BV  
Printerweg 10  
NL - 3821 AD Amersfoort  
Tel +31 (0) 334 723 225  
Fax +31 (0) 334 893 793

Red Lion Controls AP  
31, Kaki Bukit Road 3,  
#06-04/05 TechLink  
Singapore 417818  
Tel +65 6744-6613  
Fax +65 6743-3360

## GEMINI 5200 - PRESETTABLE DUAL RATE INDICATOR WITH RATIO (A/B)

- DIFFERENCE (A-B), OR DRAW [(A-B)/B] INDICATION
- 6-DIGIT, 0.56" (14.2 mm) HIGH LED DISPLAY WITH NEGATIVE SIGN, OVERFLOW & DISPLAYED VALUE INDICATORS
- THREE SEPARATELY DISPLAYABLE VALUES: A, B, & C
- TWO PRESETS ASSIGNABLE TO A, B, OR C
- SEPARATE INPUT SCALING FOR BOTH RATE A & B CHANNELS
- ACCEPTS COUNT RATES TO 10 KHz
- SOLID-STATE CURRENT SINK OUTPUTS
- OPTIONAL 20 mA CURRENT LOOP FOR SERIAL DATA COMMUNICATION
- OPTIONAL RELAY OUTPUTS (Field Replaceable)
- PROGRAMMABILITY OF DECIMAL POINT LOCATION & LEADING ZERO BLANKING
- PROGRAMMABLE TIMED OUTPUTS (0.01 TO 599.99 sec.)



- ABILITY TO LOCK OUT FRONT PANEL FUNCTIONS
- SEALED FRONT PANEL CONSTRUCTION (NEMA 4/IP65)
- NON-VOLATILE MEMORY (E<sup>2</sup>PROM)

### DESCRIPTION

The Gemini 5200 is a multifunction Dual Rate Indicator which can fulfill almost any rate indication application. The unit can operate as two independent rate indicators, with scaling, decimal point placement, and update times separately programmable for each channel. The Gemini 5200 also has three other unit personalities. These personalities feature a third display Channel C, which can indicate the ratio, difference or draw between the A and B rate channels.

The programming of the rate channels and the calculated display is a very straightforward task. Setting up Channel C only requires programming the desired amount of resolution (*for ratio and draw*) and the appropriate decimal point location. The Gemini 5200 simply takes the two rate values and mathematically calculates display "C" accordingly.

The rate indicators use a time interval method ( $1/\tau$ ) to calculate the rate value. This method enables high resolution at all input rates. The unit counts input pulses and after a programmable minimum update time has occurred, it waits until the next count edge occurs, then takes the elapsed time and number of edges and calculates the rate value. At slower rates, averaging can be accomplished by programming the "Rate Minimum Update Time" (0.5 sec. to 16 sec.) for the desired response. The minimum input frequency is 0.03 counts/sec. or one pulse every 32 sec. Extensive scaling capabilities allow practically any desired reading at very slow input rates.

The 20mA Current Loop Communications Option provides the capability of two-way serial communications between the Gemini and other equipment such as a printer, programmable controller, or host computer. The baud rate can be set to 300, 600, 1200, or 2400 baud. The format for transmitted and received data is 1 start bit, 7 data bits, 1 parity bit (odd), and a stop bit. When utilizing an external power supply (30 VDC max.), up to sixteen units can be installed in the loop, each with an individual address. When utilizing the Gemini's 20 mA current source, up to seven units can be installed in a loop. The Rate values, Presets, and Scale Factors can all be interrogated, while the Presets and Scale Factors can also be changed by sending the proper command codes and

numerical data. Various "Print Options" can be selected to automatically interrogate the Rate values, Presets, or Scale Factors by activating the "Print Request" terminal when a printer is being used.

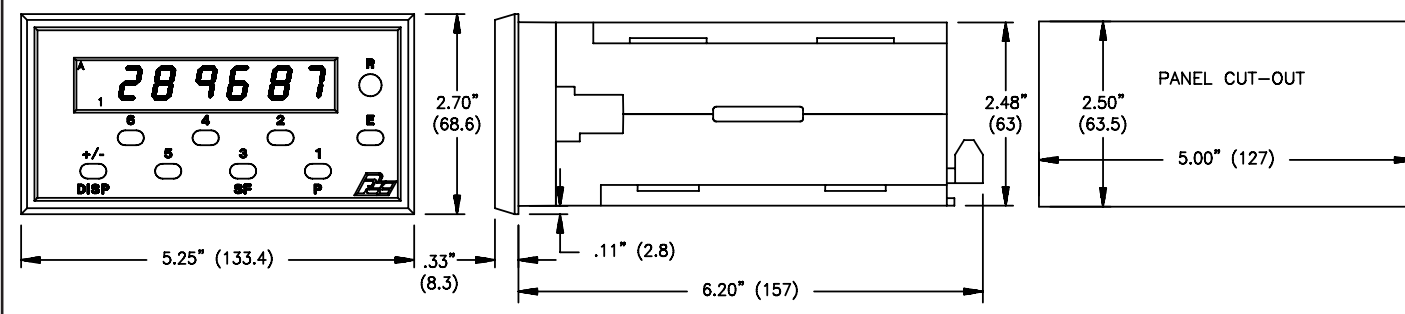
The construction of the Gemini 5200 features a metal die-cast bezel, offering maximum durability with a high quality appearance. The sealed front panel meets NEMA 4/IP65 specifications for wash-down and/or dust when properly installed. Electrical connections are made via plug-in terminal strips. Clamp-type pressure plate terminals accept stripped #14 AWG wire without lugs.

### SPECIFICATIONS

- DISPLAY:** 6-digit 0.56" (14.2 mm) High LED display.
  - POWER REQUIREMENTS:**
    - AC Operation:** Switch selectable 115/230 VAC ( $\pm 10\%$ ), 50/60 Hz, 20 VA
    - DC Operation:** 11 to 14 VDC @ 0.7 A max.
  - SENSOR POWER:** +12 VDC ( $\pm 25\%$ ) @ 100 mA.
  - MEMORY:** Non-volatile E<sup>2</sup>PROM memory retains all programming information when power is removed or interrupted.
    - Power Cycles (ON/OFF):** 100,000 min.
    - Data Retention:** 10 years min.
  - INPUTS A AND B:** Switch selectable to accept pulses from a variety of sources including switch contacts, outputs from CMOS or TTL circuits, and all standard RLC sensors.
    - Current Sourcing:** Unit provides 3.9 K $\Omega$  pull-down resistor for sensors with current sourcing outputs. (Max. input voltage = 28 VDC @ 7 mA.)
    - Current Sinking:** Unit provides 7.8 K $\Omega$  pull-up resistor for sensors with current sinking outputs. (Max. sensor current = 1.6 mA.)
    - Debounce:** Damping capacitor provided for switch contact debounce. Limits rate to 100 Hz max. with 50% duty cycle.
    - Lo Bias:** Input trigger levels  $V_{IL} = 1.5$  V max.,  $V_{IH} = 3.75$  V min.
    - Hi Bias:** Input trigger levels  $V_{IL} = 5.5$  V max.,  $V_{IH} = 7.5$  V min.
- Note: Bias levels given are  $\pm 10\%$  @ 12 VDC. These levels vary proportionally with sensor supply voltage at "DC OUT" terminal.*

### DIMENSIONS "In inches (mm)"

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 6.8" (173) W.



## SPECIFICATIONS (Cont'd)

### 6. MAGNETIC PICKUP INPUTS A & B:

**Sensitivity:** 150 mV peak (*typical @ 12 VDC*)

**Hysteresis:** 100 mV

**Input Impedance:** 26.5 K $\Omega$  @ 60 Hz

**Maximum Input Voltage:**  $\pm 50$  Vp

### 7. RATE ACCURACY AND REPEATABILITY: $\pm 0.025\%$

### 8. RATE MINIMUM INPUT FREQUENCY: 0.03 Hz

*Note: At frequencies below 0.03 Hz (1 pulse every 32 sec.) the rate indicator will display a zero.*

### 9. RATE MAXIMUM INPUT FREQUENCY: 10 KHz

### 10. CONTROL INPUTS:

**Reset:** Active Low ( $V_{IL} = 1.5$  V max.) internally pulled up to +12 VDC ( $I_{SNK} = 3$  mA), Activation and De-activation response time = 10 msec.

**Program Disable:** Active Low ( $V_{IL} = 1.5$  V max.), internally pulled up to +5 VDC ( $I_{SNK} = 1$  mA).

**Print Request:** (GEM521xx only) Active Low ( $V_{IL} = 1.5$  V max.), internally pulled up to +5 VDC ( $I_{SNK} = 1$  mA).

### 11. SERIAL COMMUNICATIONS (Optional):

**Type:** Bi-directional 20 mA current loop, 20 mA source provided. (*Powers up to seven units in a loop with internal current source.*)

**Baud Rate:** Programmable 300 to 2400.

**Maximum Address:** 16 units. (*Actual number in a single loop is limited by serial hardware specifications.*)

**Data Format:** 10 bit frame, Odd parity (*one start bit, 7 data bits, one odd parity bit, and one stop bit.*)

#### Serial Hardware Specifications:

**SO - Output Transistor Rating:**  $V_{MAX} = 30$  VDC,  $V_{SAT} = 1$  V $_{MAX}$  @ 20 mA.

**SI - Input Diode Rating:**  $V_F = 1.25$  V $_{TYP}$ ;  $1.5$  V $_{MAX}$

*Note: The compliance voltage rating of the source must be greater than the sum of the voltage drops around the loop.*

### 12. OUTPUTS:

**Solid-State:** Current sinking NPN Open Collector Transistors.  $I_{SNK} = 100$  mA max. @  $V_{CE} = 1$  V.  $V_{OH} = 30$  VDC max. (*Internal Zener Diode Protection.*)

**Relays (Optional):** Mounted on a field-replaceable P.C. board. Form C contacts rated 5 A @ 120/240 VAC or 28 VDC (*resistive load*), 1/8 H.P.

@120 VAC (*inductive load*). The operate time is 5 msec nominal and the release time is 3 msec nominal.

**Relay Life Expectancy:** 100,000 cycles at Max. Rating. (*As load level decreases, life expectancy increases.*)

**Programmed Timed Outputs:** The timed outputs can be set from 0.01 to 599.99 seconds,  $\pm(0.01\% + 10$  msec).

### 13. CERTIFICATIONS AND COMPLIANCES:

#### EMC EMISSIONS:

Meets EN 50081-2: Industrial Environment.

CISPR 11 Radiated and conducted emissions

#### EMC IMMUNITY:

Meets EN 50082-2: Industrial Environment.

ENV 50140 - Radio-frequency radiated electromagnetic field <sup>1</sup>

ENV 50141 - Radio-frequency conducted electromagnetic field <sup>2</sup>

EN 61000-4-2 - Electrostatic discharge (ESD) <sup>3</sup>

EN 61000-4-4 - Electrical fast transient/burst (EFT)

EN 61000-4-8 - Power Frequency Magnetic Field

#### Notes:

1. Unit mounted in a metal panel connected to earth ground (*protective earth*) with rear cover providing at least 6 dB of shielding effectiveness.

2. Two Ferrite suppression Cores (Fair-Rite #0443167251 [RLC #FCOR0000]) placed on DC mains cable for EMI frequencies above 40 MHz when using optional DC power supply.

3. Metal bezel of unit connected with ground lead from rear bezel screw to metal mounting panel.

Refer to the EMC Compliance Installation section of the manual for additional information.

### 14. ENVIRONMENTAL CONDITIONS:

**Operating Temperature:** 0 to 50°C

**Storage Temperature:** -40 to 70°C

**Operating and Storage Humidity:** 85% max. (non-condensing) from 0°C to 50°C.

**Altitude:** Up to 2000 meters

### 15. CONSTRUCTION:

Metal die-cast bezel, plastic case. This unit is rated for NEMA 4/IP65 indoor use. Installation Category II, Pollution Degree 2.

### 16. WEIGHT: 2.1 lbs. (0.9 kg)

## PROGRAMMABLE FUNCTIONS

### UNIT PERSONALITY

Functions as a programmable Dual Rate Indicator, with or without speed ratio, speed difference or draw indication.

### PRESETS

Range 0 to  $\pm 999999$

### SCALE FACTORS

Separate 5-digit input scaling for both rate channels. Range 0.0001 to 5.9999.

### SCALE MULTIPLIER

Multiplies the actual rate input by 1000, 100, 10, 1, 0.1, or 0.01 to view the desired number of significant digits on the 6-digit display.

### RESET OPERATION

Manual reset via front panel pushbutton or remote "RST" terminal can be programmed to act on one or both outputs. A separate "RST. A" terminal is available to provide independent reset of each channel. Front panel pushbutton reset may be disabled by a switch at the rear of the unit. Reset only applies to the outputs and has no effect on the sample time or the displayed value.

### RIGHT-HAND DUMMY ZEROS

Up to three non-functional zeros may be placed on the least significant end of the display when the unit is programmed in the dual rate only mode.

### UPDATE TIME

The Rate Minimum Update Time is programmable from 0.5 to 16 seconds. Provides averaging capability for non-consistent pulse spacing. Rate Maximum Update Time will vary with the minimum time selected.

### RATE CONVERSION FACTOR

Provides easy display conversion for readout in Rate Per Second, Rate Per Minute, or Rate Per Hour.

### DECIMAL POINT & LEADING ZERO BLANKING

Decimal point programmable to desired location. Leading zero blanking, when selected, begins with second digit to the left of the decimal point.

### OUTPUT TERMINATION MODES

Terminate at Manual Reset

Terminate at Manual Reset End

Terminate after Time Delay

Boundary

For positive preset value: Output terminates when Display is less than Preset.

For negative preset value: Output terminates when Display is greater than Preset, (*i.e. more positive*).

*Note: In any of the above modes, the unit may be programmed for "Reverse Phase" operation which complements the logic state of the output.*

### TIMED OUTPUTS

Programmable from 0.01 to 599.99 seconds. Accurate to  $\pm(0.01\% + 10$  msec.).

### FRONT PANEL LOCKOUT MODES

When the "Program Disable" control input is activated, the ability to change front panel programmed functions will be prevented as per the following modes:

Complete Front Panel Disabled

Presets Enabled Only

Scale Factors Enabled Only

Presets and Scale Factors Enabled

*Note: Manual Reset may be independently enabled or disabled in any of the above modes.*

### SELF-TEST

Performs a complete check on the display and output circuitry along with a functional check on the CPU.

## PROGRAMMING

The Gemini 5200 input circuit set-up is programmed using DIP switches on the rear of the unit. All other functions are programmed through the front panel pushbuttons.

To program or interrogate a function, the user first enters a two-digit function code. The unit will then display that function code along with a single-digit mode identifier.

**EXAMPLE:** The function code representing "Output 1 Termination Modes" is 52. The mode identifiers for this function are:

3. Terminate at Manual Reset
4. Terminate at Manual Reset End
5. Terminate after Timed Output 1
6. Boundary

To interrogate the output termination mode, Press "5", then "2":

Unit displays the function code along with mode identifier 3 (*Terminate at Manual Reset*).

To change this mode to "Terminate After Timed Output", Press "5":

To enter and save the new mode, Press "E":  
Unit enters new mode and returns display to the present selected display value.

The most commonly used functions, Presets and Scale Factors, are initialized through single front panel pushbuttons rather than a two-digit function code. Pressing the "P" or "SF" pushbuttons will immediately display the current Preset or Scale Factor value for the selected display. To change any digit, the user presses the pushbutton directly below that particular digit, which is then scrolled until the desired value is obtained. Each digit is changed, if necessary, in the same manner until the complete Preset or Scale Factor value is registered on the display. Pressing the "E" pushbutton completes the entry sequence.

To interrogate the Preset value, Press "P":  
Unit displays current Preset value.

To change the Preset value:  
Any digit may be changed by pressing the pushbutton directly below it. Release the pushbutton when the digit reaches the desired value.

Press "E":  
Unit enters new Preset value and returns display to the present selected display value.

The Gemini 5200 Series can display any of three selected display values as indicated by LED's along the left side of the display.

To display a different value:  
Press the "DISP" pushbutton repeatedly until the indicator corresponding to the desired value turns on.

## GEMINI 5200 APPLICATIONS

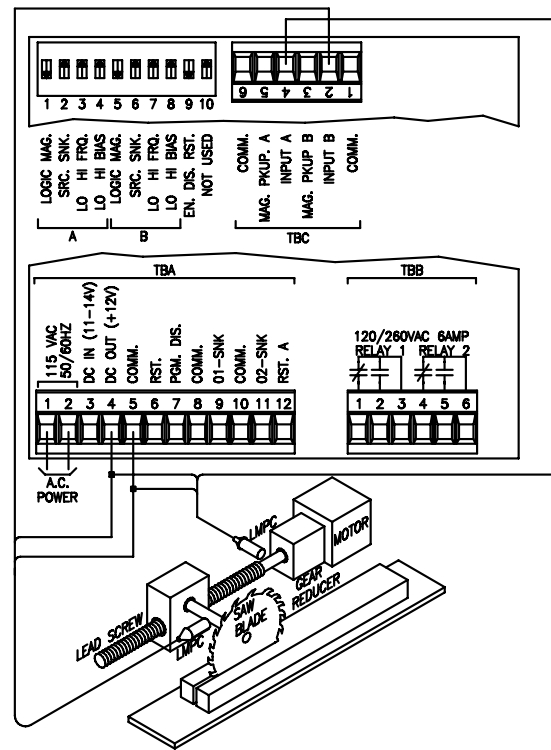
### MONITORING TWO SEPARATE RATES IN ONE PROCESS

Many applications require more than one rate to be monitored for a given process. The Gemini 5200 allows the monitoring of two independent rates with one instrument and provides separate scaling for each channel when required.

In this example, an industrial saw blade is used to cut timbers to length. The application requires monitoring both saw blade speed in RPM and feed rate in tenths of inches per minute. The blade is moved into the material with a lead screw which makes 12 revolutions per inch of travel. The lead screw is driven by a 1750 RPM motor through a 2:1 gear reducer which yields a speed of 875 RPM. Since the blade moves 1 inch in 12 revolutions, the feed rate of the blade will be 72.9 inches per minute. ( $875 \text{ RPM} / 12 \text{ revolutions per in.} = 72.9 \text{ in./min.}$ )

A Model LMPC sensor is used to sense a raised target on the lead screw which delivers 1 pulse per revolution to Rate Channel A of the Gemini 5200. In terms of travel, one pulse represents 0.0833" ( $1/12$ "). However, since the desired readout is in tenth inches, the input must be multiplied by 10. Therefore, a scale factor of 0.8333 is programmed into Channel A. A decimal point is programmed to the left of digit 1 and the Rate A conversion factor is programmed for Rate per Minute ( $\times 60$ ) which automatically multiplies the input pulses by 60 to yield a direct readout in inches per minute.

Measuring saw blade speed is a simple matter of using an LMPC sensor to detect a keyway in the blade drive shaft which delivers one pulse per shaft revolution to Channel B of the Gemini 5200. Programming the Rate B scaler for rate per minute ( $\times 60$ ) yields a direct reading of blade speed in RPM.



GEMINI 5200 APPLICATIONIS (Cont'd)

CONTROLLING THE RELATIONSHIP BETWEEN SPECIFIED AMOUNTS OF MATERIAL

This application involves the monitoring and control of a glue allocation process on a continuous web of industrial grade paper. In this case, the desired results are to maintain a flow of glue between 2.00 and 2.50 gallons per 100 feet of web. To accomplish this, a Gemini 5200 is used in the A/B ratio indicator mode, which will yield a direct readout in gallons per 100 feet to the nearest hundredth gallon.

Channel A is connected to a 100 PPR RPGC pulse generator which is mounted to the shaft of the glue pump. The pump delivers 0.38 gallons per shaft revolution. Therefore, a scale factor of 0.3800 is programmed into Channel A of the Gemini 5200 to yield 38 pulses per revolution. This effectively multiplies the glue flow rate by 100 which allows a decimal point to be programmed to the left of digit 2, producing a display of gallons per second to the nearest hundredth gallon on Channel A.

A length sensor providing one pulse per foot of web material is fed into Channel B of the Gemini. The Channel B scale multiplier is programmed for x100 to produce a display reading of feet per second to the nearest hundredth on Channel B.

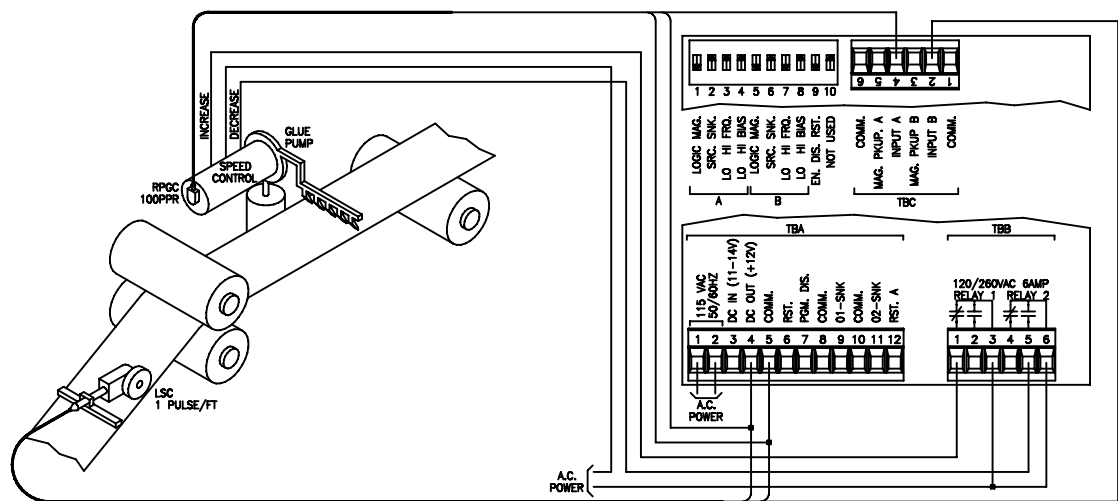
The Gemini 5200 performs the A/B calculation and displays the ratio in gallons per feet on Channel C. Since the application requires resolution in hundredths of gallons, the Channel C display must be multiplied by 100 to provide such resolution. However, the desired readout is not in terms of

gallons per foot, but rather gallons per 100 feet which requires the display to be multiplied by another factor of 100. Therefore, the Channel C scale multiplier is programmed for x10,000 (i.e. 100 x 100) which provides the desired Channel C reading of gallons per 100 feet to the nearest hundredth gallon.

The relay outputs of the Gemini 5200 are connected to a speed control mechanism on the glue pump which increases or decreases the glue flow rate while the appropriate relay contacts are closed. Both preset outputs are assigned to Channel C in the boundary mode of operation and are programmed for the upper and lower acceptable limits of the glue flow rate. In this case, the pump initially increases the output flow until a rate of 2.00 gallons per 100 feet is reached, at which time Output 1 toggles to prevent further increase in speed.

If the flow rate reaches or exceeds 2.50 gallons per 100 feet, Output 2 will toggle and send a correction signal to the pump until the speed slows to acceptable limits. If the rate falls back below the lower limit, Output 1 again toggles to speed-up the glue pump.

The Gemini 5200 can be used in this type of application to indicate and control virtually any process that requires the distribution of a specified amount of material in relation to another specified amount of material.



ORDERING INFORMATION

MODEL NO.	DESCRIPTION	OPTIONS		PART NUMBERS
		W/RELAY BOARD	W/20 mA CURRENT LOOP	
GEM52	Gemini 5200	Yes	No	GEM52060
		No	No	GEM52061
		Yes	Yes	GEM52160
		No	Yes	GEM52161
—	Gemini 5200 Relay Board	N/A	N/A	RLYBD002

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.



**GEMINI 5200 PROGRAMMING CHARTS**  
**CHART #1 - DUAL RATE [NO DISPLAY C]**  
**FEATURE & MODE SELECTION (See Programming Procedure)**

**DETAILED MODE MENUS**  
**UNIT PERSONALITY\***

41 ( )	<p>(± 1) DUAL RATE (± 3) DUAL RATE W/SPD. DIFF. (± 2) DUAL RATE W/SPD. RATIO (± 4) DUAL RATE W/SPD. DRAW</p> <p>* Changing Unit Personality will load factory settings into the unit. A (-) sign modifier in front of the mode identifier will also load factory settings.</p>																																																															
42 ( )	<p><b>RESET BUTTON &amp; TERMINAL ACTUATION MODES</b></p> <p>(1) RST RATE A OUTPUT(S) (2) RST RATE B OUTPUT(S) (3) RST RATE A &amp; B OUTPUTS</p>																																																															
43 ( )	<p><b>RATE B CONVERSION FACTOR</b></p> <p>(1) RATE/SEC (x1) (2) RATE/MINUTE (x60) (3) RATE/HR. (x3600)</p>																																																															
44 ( )	<p><b>RATE B MINIMUM UPDATE TIME*</b></p> <p>(1) 0.5Sec (2) 1Sec (3) 2Sec (4) 4Sec (5) 8Sec (6) 16Sec</p> <p>*Maximum update time varies with each minimum update time.</p>																																																															
45 ( )	<p><b>RATE B SCALE MULTIPLIER</b></p> <p>(1) x1000 (2) x100 (3) x10 (4) x1 (5) x0.1 (6) x0.01</p>																																																															
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51 ( )	<p><b>OUTPUT ASSIGNMENT*</b></p> <p>(± 1) OUT 1 → RATE A, OUT 2 → RATE B (± 2) OUT 1 &amp; 2 → RATE B (± 3) OUT 1 &amp; 2 → RATE A</p> <p>*A (-) preceding the mode identifier enables Preset 1 to track Preset 2</p>																																																															
52 ( )	<p><b>OUTPUT 1 TERMINATION MODES</b></p> <table border="1"> <thead> <tr> <th>MODE</th> <th>AT RESET START</th> <th>AT RESET END</th> <th>AFTER TIMED OUTPUT 1</th> <th>BOUNDARY MODE</th> <th>OUTPUT 1 NORMALLY "OFF"</th> <th>OUTPUT 1 NORMALLY "ON"</th> </tr> </thead> <tbody> <tr> <td>(3)</td> <td>●</td> <td></td> <td></td> <td></td> <td>●</td> <td></td> </tr> <tr> <td>(-3)</td> <td>●</td> <td></td> <td></td> <td></td> <td></td> <td>●</td> </tr> <tr> <td>(4)</td> <td></td> <td>●</td> <td></td> <td></td> <td>●</td> <td></td> </tr> <tr> <td>(-4)</td> <td></td> <td>●</td> <td></td> <td></td> <td></td> <td>●</td> </tr> <tr> <td>± (5)</td> <td></td> <td></td> <td>●</td> <td></td> <td>●</td> <td></td> </tr> <tr> <td>± (-5)</td> <td></td> <td></td> <td>●</td> <td></td> <td></td> <td>●</td> </tr> <tr> <td>* (6)</td> <td></td> <td></td> <td></td> <td>●</td> <td>●</td> <td></td> </tr> <tr> <td>* (-6)</td> <td></td> <td></td> <td></td> <td>●</td> <td></td> <td>●</td> </tr> </tbody> </table> <p>‡ Output 1 activates when Rate &gt; Preset 1 in modes [51 1].  Output 1 activates when Rate &lt; Preset 1 in modes [51 2,3].  *BOUNDARY MODE: Output goes "OFF" when Rate &lt; Preset and goes "ON" when Rate is ≥ Preset as the value goes up and down through the Preset.</p>	MODE	AT RESET START	AT RESET END	AFTER TIMED OUTPUT 1	BOUNDARY MODE	OUTPUT 1 NORMALLY "OFF"	OUTPUT 1 NORMALLY "ON"	(3)	●				●		(-3)	●					●	(4)		●			●		(-4)		●				●	± (5)			●		●		± (-5)			●			●	* (6)				●	●		* (-6)				●		●
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# **CHART #2 - DUAL RATE W/SPEED RATIO OR DRAW (DISPLAY C)** **FEATURE & MODE SELECTION (See Programming Procedure)**

## **DETAILED MODE MENUS**

41 (2 or 4)	<b>UNIT PERSONALITY*</b> (± 1) DUAL RATE (± 2) DUAL RATE W/SPD. RATIO (± 3) DUAL RATE W/SPD. DIFF. (± 4) DUAL RATE W/SPD. DRAW * Changing Unit Personality will load factory settings into the unit. A (-) sign modifier in front of the mode identifier will also load factory settings.																																																																				
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63	<b>RATE MINIMUM UPDATE TIME*</b> (1) 0.5Sec (2) 1Sec (3) 2Sec (4) 4Sec (5) 8Sec (6) 16Sec *Maximum update time varies with each minimum update time.																																																																				
64	<b>RATE A SCALE MULTIPLIER</b> (1) x1000 (2) x100 (3) x10 (4) x1 (5) x0.1 (6) x0.01																																																																				
65	<b>RATE A &amp; B DECIMAL POINT &amp; LEADING ZERO BLANKING</b> <table border="1"> <tr> <td>(1)</td> <td>0</td> <td>(-1)</td> <td>0 0 0 0 0 0</td> <td>(NO L.Z.B.)</td> </tr> <tr> <td>(2)</td> <td>0.0</td> <td>(-2)</td> <td>0 0 0 0 0.0</td> <td></td> </tr> <tr> <td>(3)</td> <td>0.0 0</td> <td>(-3)</td> <td>0 0 0 0 0.0</td> <td></td> </tr> <tr> <td>(4)</td> <td>0.0 0 0</td> <td>(-4)</td> <td>0 0 0 0 0.0</td> <td></td> </tr> <tr> <td>(5)</td> <td>0.0 0 0 0</td> <td>(-5)</td> <td>0 0 0 0 0.0</td> <td></td> </tr> <tr> <td>(6)</td> <td>0.0 0 0 0 0</td> <td>(-6)</td> <td>0 0 0 0 0.0</td> <td></td> </tr> </table>						(1)	0	(-1)	0 0 0 0 0 0	(NO L.Z.B.)	(2)	0.0	(-2)	0 0 0 0 0.0		(3)	0.0 0	(-3)	0 0 0 0 0.0		(4)	0.0 0 0	(-4)	0 0 0 0 0.0		(5)	0.0 0 0 0	(-5)	0 0 0 0 0.0		(6)	0.0 0 0 0 0	(-6)	0 0 0 0 0.0																																		
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66	<b>*OPERATOR ACCESSIBLE FUNCTIONS* MODES</b> (With "PGM. DIS." terminal to "COMM") <table border="1"> <tr> <th>MODE</th> <th>PRESET VALUES</th> <th>SCALE FACTORS</th> <th>RESET BUTTON &amp; TERMINAL</th> </tr> <tr> <td>(1)</td> <td></td> <td></td> <td>●</td> </tr> <tr> <td>(-1)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>(2)</td> <td>●</td> <td></td> <td>●</td> </tr> <tr> <td>(-2)</td> <td>●</td> <td></td> <td></td> </tr> <tr> <td>(3)</td> <td></td> <td>●</td> <td>●</td> </tr> <tr> <td>(-3)</td> <td></td> <td>●</td> <td></td> </tr> <tr> <td>(4)</td> <td></td> <td>●</td> <td>●</td> </tr> <tr> <td>(-4)</td> <td></td> <td>●</td> <td></td> </tr> </table>						MODE	PRESET VALUES	SCALE FACTORS	RESET BUTTON & TERMINAL	(1)			●	(-1)				(2)	●		●	(-2)	●			(3)		●	●	(-3)		●		(4)		●	●	(-4)		●																												
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# **CHART #3 - DUAL RATE W/DIFFERENCE (DISPLAY C)** **FEATURE & MODE SELECTION (See Programming Procedure)**

## **DETAILED MODE MENUS**

41 ( 3 )

42 ( )

43 ( )

45 ( )

46 ( )

51 ( )

52 ( )

53 ( )

54 ( )

55 ( )

62 ( )

63 ( )

64 ( )

65 ( )

66 ( )

**UNIT PERSONALITY\***

(± 1) DUAL RATE (± 2) DUAL RATE W/SPD. RATIO  
 (± 3) DUAL RATE W/SPD. DIFF. (± 4) DUAL RATE W/SPD. DRAW  
 \* Changing Unit Personality will load factory settings into the unit. A (-) sign modifier in front of the mode identifier will also load factory settings.

**RESET BUTTON & TERMINAL ACTUATION MODES**

(1) RST RATE A OUTPUT(S) (2) RST RATE B OUTPUT(S) (3) RST RATE A & B OUTPUTS  
 (4) RST DISP C OUTPUT(S) (5) RST DISP C & RATE A OUTPUTS (6) RST DISP C & RATE B OUTPUTS

**RATE B CONVERSION FACTOR**

(1) RATE/SEC (x1) (2) RATE/MINUTE (x60) (3) RATE/HR. (x3600)

**RATE B SCALE MULTIPLIER**

(1) x1000 (2) x100 (3) x10 (4) x1 (5) x0.1 (6) x0.01

**DISPLAY C DECIMAL POINT & LEADING ZERO BLANKING**

(1)	0	(-1)	0 0 0 0 0 0 (NO L.Z.B.)
(2)	0.0	(-2)	0 0 0 0 0 0
(3)	0.0 0	(-3)	0 0 0 0 0 0
(4)	0.0 0 0	(-4)	0 0 0 0 0 0
(5)	0.0 0 0 0	(-5)	0 0 0 0 0 0
(6)	0.0 0 0 0 0	(-6)	0 0 0 0 0 0

**OUTPUT ASSIGNMENT\***

(± 1) OUT 1 → RATE A, OUT 2 → RATE B (± 2) OUT 1 & 2 → RATE B (± 3) OUT 1 & 2 → RATE A  
 (± 4) OUT 1 → B, OUT 2 → DISP C (± 5) OUT 1 → RATE A, OUT 2 → DISP C (± 6) OUT 1 & 2 → DISP C  
 \*A (-) preceding the mode identifier enables Preset 1 to track Preset 2

**OUTPUT 1 TERMINATION MODES**

MODE	AT RESET START	AT RESET END	AFTER TIMED OUTPUT 1	BOUNDARY MODE	OUTPUT 1 NORMALLY "OFF"	OUTPUT 1 NORMALLY "ON"
(3)	●				●	
(-3)	●					●
(4)		●			●	
(-4)		●				●
‡ (5)			●		●	
‡ (-5)			●			●
* (6)				●	●	
* (-6)				●		●

‡ Output 1 activates when Rate ≥ Preset 1 in modes [51 1,4,5].  
 Output 1 activates when Rate < Preset 1 in modes [51 2,3,6].  
 \*BOUNDARY MODE: Output goes "OFF" when Rate < Preset and goes "ON" when Rate is ≥ Preset as the value goes up and down through the Preset.

**TIMED OUTPUT 1 VALUE**

Timed Output Value range: 0.01 to 599.99Sec

**OUTPUT 2 TERMINATION MODES**

MODE	AT RESET START	AT RESET END	AFTER TIMED OUTPUT 2	BOUNDARY MODE	OUTPUT 2 NORMALLY "OFF"	OUTPUT 2 NORMALLY "ON"
(3)	●				●	
(-3)	●					●
(4)		●			●	
(-4)		●				●
‡ (5)			●		●	
‡ (-5)			●			●
* (6)				●	●	
* (-6)				●		●

‡ Output 2 activates when Rate ≥ Preset 2.  
 \*BOUNDARY MODE: Output goes "OFF" when Rate < Preset and goes "ON" when Rate is ≥ Preset as the value goes up and down through the Preset.

**TIMED OUTPUT 2 VALUE**

Timed Output Value range: 0.01 to 599.99Sec

**RATE A CONVERSION FACTOR**

(1) RATE/SEC (x1) (2) RATE/MINUTE (x60) (3) RATE/HR. (x3600)

**RATE MINIMUM UPDATE TIME\***

(1) 0.5Sec (2) 1Sec (3) 2Sec  
 (4) 4Sec (5) 8Sec (6) 16Sec  
 \*Maximum update time varies with each minimum update time.

**RATE A SCALE MULTIPLIER**

(1) x1000 (2) x100 (3) x10 (4) x1 (5) x0.1 (6) x0.01

**RATE A & B DECIMAL POINT & LEADING ZERO BLANKING**

(1)	0	(-1)	0 0 0 0 0 0 (NO L.Z.B.)
(2)	0.0	(-2)	0 0 0 0 0 0
(3)	0.0 0	(-3)	0 0 0 0 0 0
(4)	0.0 0 0	(-4)	0 0 0 0 0 0
(5)	0.0 0 0 0	(-5)	0 0 0 0 0 0
(6)	0.0 0 0 0 0	(-6)	0 0 0 0 0 0

**\*OPERATOR ACCESSIBLE FUNCTIONS\* MODES**  
 (With "PGM. DIS." terminal to "COMM")

MODE	PRESET VALUES	SCALE FACTORS	RESET BUTTON & TERMINAL
(1)			●
(-1)			
(2)	●		●
(-2)	●		
(3)		●	●
(-3)		●	
(4)	●	●	●
(-4)	●	●	

# GEMINI 5200 PROGRAMMING

## SOME NOTES & HINTS ON PROGRAMMING THE GEMINI 5200

1. Be systematic about programming! Plan out the exact features & functions you need for your application. Write out the code entries you need from start to finish, and then enter the codes completely. Don't start in the middle of the program codes and make arbitrary entries to "see what it will do". This is a sure way to create confusing results. Finally, after you are done, record your program & file it where you can find it later if you want to make changes. You can use this card to write in your codes in the program ladder on the reverse side, together with any fixed data entries, for convenient future reference.
2. Watch out for conflicting modes! The programs in the GEMINI 5200 have been written to prevent illegal code entry.

However, to provide optimum flexibility, some reliance must be placed on the programmer to avoid conflicting codes.

3. The GEMINI 5200 can be interrogated at any time to see what modes & data entries have been made. Such interrogation can be made during a counting cycle without interrupting the normal counting process. In the lockout mode, all functions can also be interrogated, but those functions locked out cannot be changed. Making changes in program modes or data during a run is not recommended since mid-cycle changes can result in unanticipated outputs for that particular cycle.

## PROGRAMMING PROCEDURE FOR FUNCTION & MODE SELECTION☆ (Applies to Programming Chart)

To enter a programmable function or mode, enter the function selector code desired and then select the particular mode identifier required.

For example, to set up a decimal point to display a reading in 1/100ths with leading zero blanking, function selector code #46 must be entered. (See codes on reverse side.)

Press button #4, then button #6. The display will temporarily interrupt its normal readout (without interfering with the normal operation of the unit).

It will then display the entered code on the L.H. side.

[46 ] (DISPLAY READOUT)

Next, enter the mode identifier (button #3) that defines the decimal point location & L2B condition. This code is displayed on the right.

[46 3] (DISPLAY READOUT)

Now, enter this new selection by pressing the "E" button.

## PROGRAMMING PROCEDURE FOR DATA ENTRY

In data entry, the front panel pushbuttons are identified by two different sets of references and will cause two different reactions in the course of making a data entry.

In the first phase of a data entry cycle, the particular data entry mode is called up by pushing the buttons identified by their panel markings (i.e. Buttons "5", "3", "P(1)", "P(2)", or "SF"). Once the data entry mode has been entered, the existing data appears on the display and the buttons below the display reference themselves to the digits directly above each button. The data can then be changed a digit at a time by pressing the button directly below the digits to be changed.

After the new data value is obtained, the "E" button is pressed to enter the new value.

### [53,55 ] TIMED OUTPUT VALUES☆

Entering Code "53" or "55" will call up the Timed Output 1 or 2 Value in seconds & hundredths. The value can be set to a new value by incrementing each digit with the button underneath that digit.

Press the "E" button to enter the new Timed Output value. (Max. Timed Output value = 599.99sec.)

### [S.F. ] SCALE FACTORS

One stroke of the "SF" (3) button calls up the Scale Factor for the currently displayed rate value. (The Scale Factor is the multiplier used to convert the actual rate to the direct readout display.) The value can be changed by incrementing each digit with the button below it. Pressing the "E" key enters the new S.F. The S.F. can be set at any value from 0.0001 to 5.9999.

### [P(1),P(2) ] PRESETS

One stroke of the "P(1)" or "P(2)" button calls up the Preset 1 or 2 Value, which can then be changed by incrementing each digit with the button below it. Press the "E" button to enter the new Preset.

☆Program before connecting "PGM. DIS." to "COMMON".

## SELF-TEST ROUTINE 6, +/-

Depressing "6" & then "+/-" starts the self-test routine by lighting all decimal points, then all 9's, all 8's, all 7's, etc., until alternate 8's & 9's are displayed. At this time, the outputs can be manually activated for testing by pressing the "P(1)" or "P(2)" button. (The Output test is

disabled when "PGM. DIS." terminal is pulled to "COMMON".) An automatic exit will occur six (6) seconds after the Test Mode is completed. Test Mode can be run at any time and will not interfere with the normal operation of the Gemini 5200 during a run.

## MODEL PAXLR - PAX LITE RATE METER



- RATE INDICATION
- 6-DIGIT, 0.56" (14.2 mm) HIGH LED DISPLAYS
- INPUT RATES UP TO 25 KHZ
- ACCEPTS A WIDE VARIETY OF SENSORS
- PROGRAMMABLE SCALING
- PROGRAMMABLE UPDATE TIME
- PROGRAMMABLE DECIMAL POINTS
- NEMA 4X/IP65 SEALED FRONT BEZEL



### GENERAL DESCRIPTION

The PAX Lite Rate Meter, Model PAXLR, provides the versatility and flexibility needed to accommodate virtually any rate measuring application. The meter has the ability to scale for direct readout in terms of the units being measured. Whether a machine produces bottles, cloth, wire, or beverage mix, operation is enhanced when the rate readout is expressed directly in bottles/min., feet/min., gallons/min., or whatever units are needed in plant applications.

The PAXLR can accommodate magnetic pickups, logic sensors, and NPN open collector sensors. The pulses are received and scaled, so the desired display can be achieved. The meter is programmed through both the front panel buttons and DIP switches. Once the programming is complete, the front panel buttons can be disabled by a DIP switch setting.

The meter has been specifically designed for harsh industrial environments. With NEMA 4X/IP65 sealed bezel and extensive testing to meet CE requirements, the meter provides a tough, yet reliable application solution.

### SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the literature or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



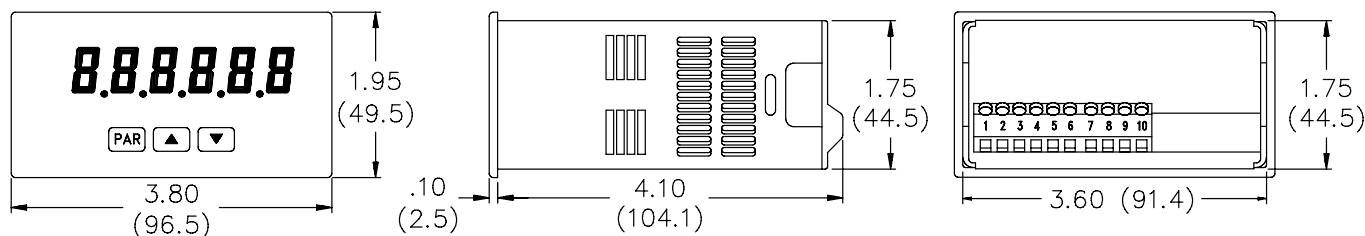
**CAUTION:** Read complete instructions prior to installation and operation of the unit.



**CAUTION:** Risk of electric shock.

### DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1" (53.4) H x 5" (127) W.



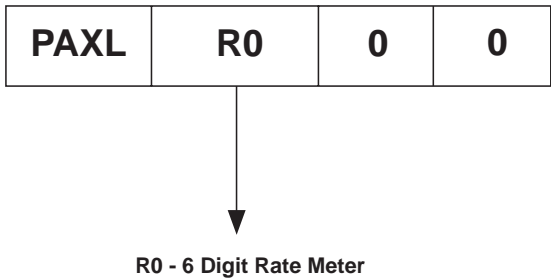


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## ORDERING INFORMATION

### Meter Part Numbers



# GENERAL METER SPECIFICATIONS

1. **DISPLAY:** 6-digit, 0.56" (14.2 mm), 7-segment LED.  
Decimal points are programmed by front panel keys.
2. **POWER:**  
**AC Power:** 115/230 VAC, switch selectable. Allowable power line variation  $\pm 10\%$ , 50/60 Hz, 6 VA. @ 100 mA max.  
**Isolation:** 2300 Vrms for 1 min. to input and DC Out/In.  
**DC Power:** 10 to 16 VDC @ 0.1 A max.
3. **SENSOR POWER:** 9 to 17.5 VDC @ 100 mA max.
4. **KEYPAD:** 3 programming keys, the ▼ (Down Arrow) key can also function as the front panel reset button.
5. **INPUT:** (DIP switch selectable)  
Accepts pulses from a variety of sources including NPN-OC, PNP-OC, TTL Outputs, Magnetic Pickups and all standard Red Lion sensors.  
**Logic:** Input trigger levels  $V_{IL} = 1.5$  V max.;  $V_{IH} = 3.75$  V min.  
**Current Sinking:** Internal 7.8 K $\Omega$  pull-up to +12 VDC,  $I_{MAX} = 1.9$  mA  
**Current Sourcing:** Internal 3.9 K $\Omega$  pull-down, 8 mA max. @ 30 VDC max.  
**MAGNETIC PICK-UP:**  
**Sensitivity:** 200 mV peak  
**Hysteresis:** 100 mV  
**Input impedance:** 3.9K $\Omega$  @ 60 Hz  
**Maximum input voltage:**  $\pm 40$  V peak, 30 Vrms
6. **INPUT FREQUENCY RANGE:**  
**Max Frequency:** 25 KHz  
**Min Frequency:** 0.01 Hz  
**Accuracy:**  $\pm 0.01\%$
7. **MEMORY:** Nonvolatile E<sup>2</sup>PROM retains all programmable parameters and display values.
8. **ENVIRONMENTAL CONDITIONS:**  
**Operating Temperature:** 0° to 60°C  
**Storage Temperature:** -40° to 60°C  
**Operating and Storage Humidity:** 0 to 85% max. relative humidity (non-condensing)  
**Altitude:** Up to 2000 meters
9. **CERTIFICATIONS AND COMPLIANCES:**  
**SAFETY**  
UL Recognized Component, File # E179259, UL3101-1, CSA C22.2 No. 1010-1  
Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.  
UL Listed, File # E137808, UL508, CSA C22.2 No. 14-M95  
LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards  
Type 4X Enclosure rating (Face only), UL50

IECEE CB Scheme Test Certificate # UL/7470/UL  
CB Scheme Test Report # 03ME09282-08292003

Issued by Underwriters Laboratories, Inc.

IEC 1010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

IP65 Enclosure rating (Face only), IEC 529

IP20 Enclosure rating (Rear of unit), IEC 529

## ELECTROMAGNETIC COMPATIBILITY

Emissions and Immunity to EN 61326: Electrical Equipment for Measurement, Control and Laboratory use.

### Immunity to Industrial Locations:

Electrostatic discharge	EN 61000-4-2	Criterion A 4 kV contact discharge 8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Criterion A 10 V/m
Fast transients (burst)	EN 61000-4-4	Criterion A <sup>2</sup> 2 kV power 2 kV signal
Surge	EN 61000-4-5	Criterion A <sup>2</sup> 1 kV L-L, 2 kV L&N-E power 1 kV signal
RF conducted interference	EN 61000-4-6	Criterion A 3 V/rms
Power frequency magnetic fields	EN 61000-4-8	Criterion A 30 A/m
Voltage dip/interruptions	EN 61000-4-11	Criterion A 0.5 cycle

### Emissions:

Emissions	EN 55011	Class B
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### Notes:

1. Criterion A: Normal operation within specified limits.

2. EMI filter placed on the DC power supply, when DC powered: Corcom #1VB3 or Schaffner #FN610-1/07 (RLC #LFIL0000).

10. **CONNECTIONS:** High compression cage-clamp terminal block

Wire Strip Length: 0.3" (7.5 mm)

Wire Gage Capacity: 30-14 AWG copper wire.

Torque: 4.5 inch-lbs (0.51 N-m) max.

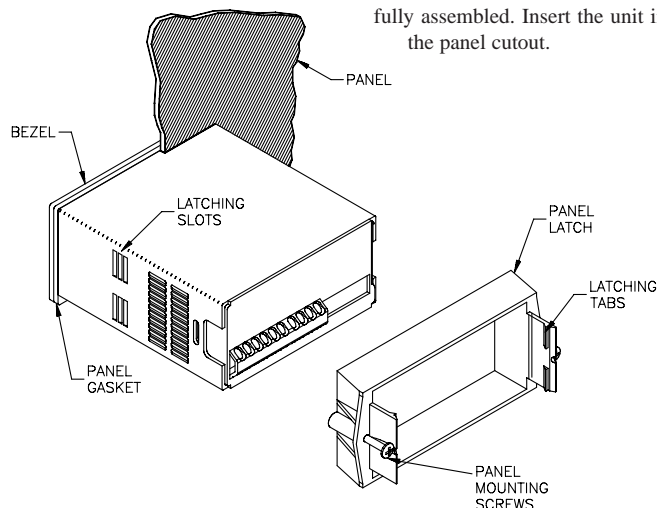
11. **CONSTRUCTION:** This unit is rated for NEMA 4X/IP65 outdoor use. IP20 Touch safe. Installation Category II, Pollution Degree 2. One piece bezel/case. Flame resistant. Synthetic rubber keypad. Panel gasket and mounting clip included.

12. **WEIGHT:** 12 oz (340 g)

## 1.0 INSTALLING THE METER

### Installation

The PAX meets NEMA 4X/IP65 requirements when properly installed. The unit is intended to be mounted into an enclosed panel. Prepare the panel cutout to the dimensions shown. Remove the panel latch from the unit. Slide the panel gasket over the rear of the unit to the back of the bezel. The unit should be installed fully assembled. Insert the unit into the panel cutout.



While holding the unit in place, push the panel latch over the rear of the unit so that the tabs of the panel latch engage in the slots on the case. The panel latch should be engaged in the farthest forward slot possible. To achieve a proper seal, tighten the latch screws evenly until the unit is snug in the panel (Torque to approximately 7 in-lbs [79N-cm]). Do not over-tighten the screws.

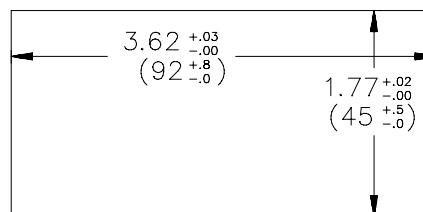
### Installation Environment

The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

PANEL CUT-OUT



## 2.0 SETTING THE SWITCHES

The meter has switches that must be checked and/or changed prior to applying power. To access the power switch, remove the meter base from the case by firmly squeezing and pulling back on the side rear finger tabs. This should lower the latch below the case slot (which is located just in front of the finger tabs). It is recommended to release the latch on one side, then start the other side latch.

### Power Selection Switch



Caution: Insure the AC power selection switch is set for the proper voltage before powering-up the meter. The meter is shipped from the factory in the 230 VAC position.

### Set-Up DIP Switches

A DIP switch is located at the rear of the meter, and is fully accessible when the unit is in the case. It is used for the selection of the input parameters and program disable.

SWITCH	FUNCTION
1	SNK.
2	SRC.
3	HI/LO FREQ.
4	LOGIC/MAG
5	EN/DIS PGM
6	Not Active

#### SWITCH 1

**SNK.:** Adds internal 7.8 K $\Omega$  pull-up resistor to + 12 VDC,  $I_{MAX} = 1.9$  mA.

#### SWITCH 2

**SRC.:** Adds internal 3.9 K $\Omega$  pull-down resistor, 8 mA max. @ 30 VDC max.

#### SWITCH 3

**HI Frequency:** Removes damping capacitor and allows max. frequency.

**LO Frequency:** Limits input frequency to 50 Hz and input pulse widths to 10 msec.

#### SWITCH 4

**LOGIC:** Input trigger levels  $V_{IL} = 1.5$  V max.;  $V_{IH} = 3.75$  V max.

**MAG:** 200 mV peak input (must have SRC on).

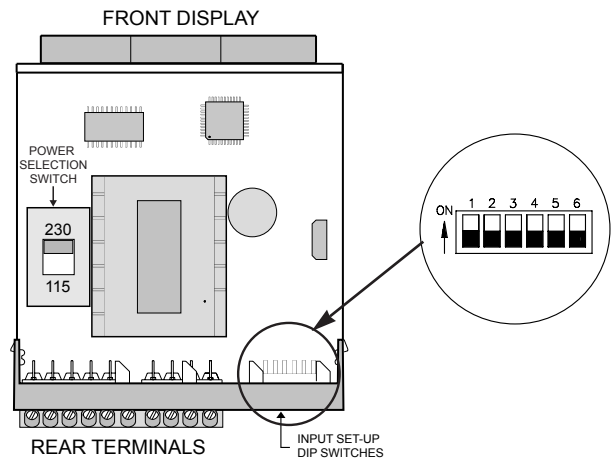
#### SWITCH 5

**Enable Programming:** Enables programming through the front panel buttons.

**Disables Programming:** Disables the front panel buttons from any programming changes.

#### SWITCH 6

**Not Active for the Rate Meter**



## 3.0 WIRING THE METER

### WIRING OVERVIEW

Electrical connections are made via screw-clamp terminals located on the back of the meter. All conductors should conform to the meter's voltage and current ratings. All cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that the power supplied to the meter (DC or AC) be protected by a fuse or circuit breaker.

When wiring the meter, compare the numbers embossed on the back of the meter case against those shown in wiring drawings for proper wire position. Strip the wire, leaving approximately 0.3" (7.5 mm) bare lead exposed (stranded wires should be tinned with solder.) Insert the lead under the correct screw-clamp terminal and tighten until the wire is secure. (Pull wire to verify tightness.)

### EMC INSTALLATION GUIDELINES

Although this meter is designed with a high degree of immunity to Electro-Magnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the meter may be different for various installations. The meter becomes more immune to EMI with fewer I/O connections. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. The meter should be mounted in a metal enclosure, which is properly connected to protective earth.
2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
  - a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
  - b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.

c. Connect the shield to common of the meter and leave the other end of the shield unconnected and insulated from earth ground.

3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be ran in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
4. Signal or Control cables within an enclosure should be routed as far as possible from contactors, control relays, transformers, and other noisy components.
5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

Ferrite Suppression Cores for signal and control cables:

Fair-Rite # 0443167251 (RLC# FCOR0000)

TDK # ZCAT3035-1330A

Steward # 28B2029-0A0

Line Filters for input power cables:

Schaffner # FN610-1/07 (RLC# LFIL0000)

Schaffner # FN670-1.8/07

Corcom # 1 VR3

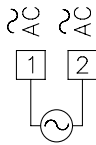
*Note: Reference manufacturer's instructions when installing a line filter.*

6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.  
Snubber: RLC# SNUB0000.

3.1 POWER WIRING

AC Power

Terminal 1: VAC  
Terminal 2: VAC



DC Power

Terminal 3: +VDC  
Terminal 4: COMM



3.2 INPUT WIRING

<p><b>Magnetic Pickup</b></p>	<p><b>AC Inputs From Tach Generators, Etc.</b></p>	<p><b>Two Wire Proximity, Current Source</b></p>
<p><b>Current Sinking Output</b></p>	<p><b>Current Sourcing Output</b></p>	<p><b>Interfacing With TTL</b></p>
<p><b>Emitter Follower; Current Source</b></p>		

\*Switch position is application dependent.

## 4.0 REVIEWING THE FRONT BUTTONS AND DISPLAY



KEY	DISPLAY MODE OPERATION	PROGRAMMING MODE OPERATION
PAR	Access Programming Mode	Store selected parameter and index to next parameter
▲	No Function	Increment selected digit of parameter value
▼	No Function	Select digit position in parameter value

## 5.0 SCALING THE METER

### RATE SCALING

To scale the Rate, enter a Scaling Display value with a corresponding Scaling Input value. These values are internally plotted to a Display value of 0 and Input value of 0 Hz. A linear relationship is formed between these points to yield a rate display value that corresponds to the incoming input signal rate. The location of the scaling point should be near the process end limit for the best possible accuracy. The PAXLR is capable of showing a rate display value for any linear process.

### SCALING CALCULATION

If a display value versus input signal (in pulses per second) is known, then those values can be entered into Scaling Display ( $r_k - d5P$ ) and Scaling Input ( $r_k - i1P$ ). No further calculations are needed.

If only the number of pulses per 'single' unit (i.e. # of pulses per foot) is known, then it can be entered as the Scaling Input value and the Scaling Display value will be entered as the following:

RATE PER	DISPLAY ( $r_k - d5P$ )	INPUT ( $r_k - i1P$ )
Second	1	# of pulses per unit
Minute	60	# of pulses per unit
Hour	3600	# of pulses per unit

### NOTES:

1. If # of pulses per unit is less than 10, then multiply both Input and Display values by 10.
2. If # of pulses per unit is less than 1, then multiply both Input and Display values by 100.
3. If the Display value is raised or lowered, then Input value must be raised or lowered by the same proportion (i.e. Display value for per hour is entered by a third less (1200) then Input value is a third less of # of pulses per unit). The same is true if the Input value is raised or lowered, then Display value must be raised or lowered by the same proportion.
4. Both values must be greater than 0.0.

### EXAMPLE:

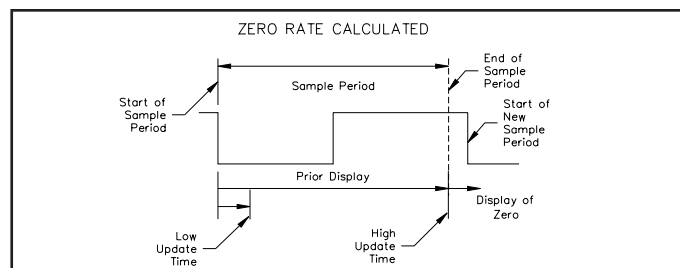
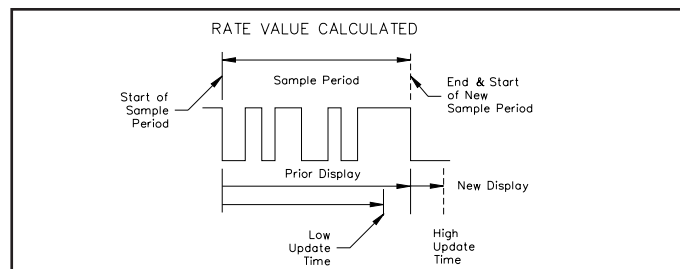
1. With 15.1 pulses per foot, show feet per minute in tenths.  
Scaling Display = 60.0 Scaling Input = 15.1
2. With 0.25 pulses per gallon, show whole gallons per hour. (To have greater accuracy, multiply both Input and Display values by 10.)  
Scaling Display = 3600 Scaling Input = 2.5

### RATE DISPLAY OVERFLOW

The rate of the input signal along with the programmed scaling values can cause the calculated rate display to exceed the meter's 6-digit capacity. If this occurs, the display will show "OL OL OL" to indicate an overflow condition.

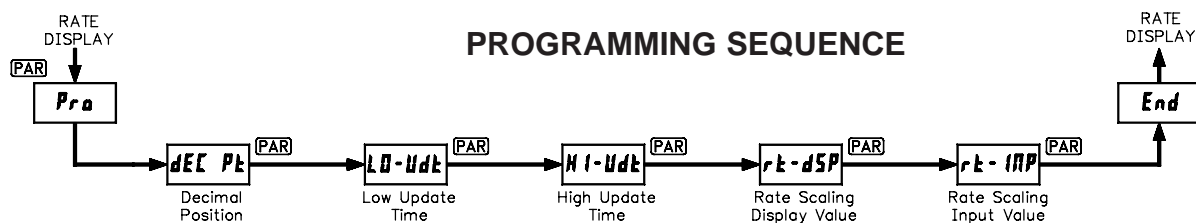
### INPUT FREQUENCY CALCULATION

The meter determines the input frequency by summing the number of falling edges received during a sample period of time. The sample period begins on the first falling edge. At this falling edge, the meter starts accumulating time towards Low Update and High Update values. Also, the meter starts accumulating the number of falling edges. When the time reaches the Low Update Time value, the meter looks for one more falling edge to end the sample period. If a falling edge occurs (before the High Update Time value is reached), the Rate display will update to the new value and the next sample period will start on the same edge. If the High Update Time value is reached (without receiving a falling edge after reaching Low Update Time), then the sample period will end but the Rate display will be forced to zero. The High Update Time value must be greater than the Low Update Time value. Both values must be greater than 0.0. The input frequency calculated during the sample period, is then shown as a Rate value determined by either scaling method.





# 6.0 PROGRAMMING THE METER



The Rate Indicator has five programmable parameters which are entered in the sequence shown above, using the front panel push buttons.

Before programming, refer to the section on Scaling the Meter to determine the Rate Scaling Display Value and Rate Scaling Input Value to use for the specific application.

*Note: Programming mode can be locked out with the Program Disable DIP switch. With the switch in the Disabled (up) position the meter will not enter programming mode. Refer to the section on DIP switch setup.*

## PROGRAMMING MODE ENTRY

Press the **PAR** key to enter Programming Mode. The meter briefly displays **Pra** followed by the first programming parameter described below.

## PROGRAMMING PARAMETERS

In programming mode, the display alternates between the parameter and the current selection or value for that parameter. The dual display with arrows is used below to illustrate the alternating display. The selection choices or value range for each parameter is shown to the right of the alternating display.

### DECIMAL POSITION



This parameter selects the decimal point position on the display. The selection does not affect scaling calculations.

Press the arrow keys (**▲** or **▼**) to sequence through the selection list until the desired selection is shown. Press the **PAR** key to save the displayed selection and advance to the next parameter.

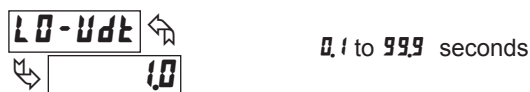
## ENTERING NUMERICAL VALUES

The parameters which follow are displayed as a multi-digit numerical values with one selected digit flashing (initially the far left digit). Press the **▲** (up arrow) key to increment the value of the selected (flashing) digit. Holding the **▲** key automatically scrolls the value of the selected digit.

Press the **▼** (down arrow) key to select the next digit position to the right. Use the **▲** key to increment the value of this digit to the desired number. Press the **▼** key again to select the next digit to be changed. Holding the **▼** key automatically scrolls through each digit position.

Repeat the "select and set" sequence until all digits are displaying the desired numerical value. Press the **PAR** key to save the displayed value and advance to the next parameter.

### LOW UPDATE TIME (DISPLAY UPDATE)



The Low Update Time is the minimum amount of time between display updates. The factory setting of 1.0 allows a minimum of one second between updates. Low values below 0.3 seconds will update the display correctly, but may cause the display to appear unsteady.

For more details on display updating, refer to Input Frequency Calculation.

### HIGH UPDATE TIME (DISPLAY ZERO)



The High Update Time is the maximum amount of time before the display is forced to zero. The High Update Time **must** be higher than the Low Update Time and also higher than the desired slowest readable speed (one divided by pulses per second). The factory setting of 2.0 will force the display to zero for speeds below 0.5 Hz or one pulse every 2 seconds.

For more details on display updating, refer to Input Frequency Calculation.

### RATE SCALING DISPLAY VALUE



Enter the desired Rate Display value to be shown for the corresponding Rate Input value entered below. For more explanation, refer to Rate Scaling.

If a decimal point was selected in the Decimal Position (**dEC Pl**) parameter, it will be displayed at the same position for this parameter value.

### RATE SCALING INPUT VALUE



Enter the Rate Input value that corresponds to the Rate Display value entered above. This value is always in pulses per second (Hz). For more explanation, refer to Rate Scaling.

## PROGRAMMING MODE EXIT

The meter exits Programming Mode when the **PAR** key is pressed to save the Rate Scaling Input Value. The meter briefly displays **End** upon exiting Programming Mode. All programmed selections are now transferred to the non-volatile memory and the meter returns to the Rate display.

(If power loss occurs during programming mode, verify parameter changes and reprogram, if necessary, when power is restored.)

## PROGRAMMING MODE TIME OUT

The Programming Mode has an automatic time out feature. If no keypad activity is detected for approximately 60 seconds, the meter automatically exits Programming Mode. The meter briefly displays **End** and returns to the Rate display. When automatic timeout occurs, any changes that were made to the parameter currently being programmed, will not be saved.

## FACTORY SETTINGS

The factory settings for the programming parameters are shown above in the alternating display illustrations. The factory settings can be easily restored by removing power from the meter, and then pressing and holding the **PAR** key while power is reapplied. The meter displays **rESEt** until the **PAR** key is released. The normal power-up sequence then resumes, with the factory settings loaded and saved in non-volatile memory.

*Note: The Program Disable DIP switch must be in the Enabled (down) position to allow loading factory settings. See section on DIP switch setup.*

### LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to one year from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company's liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company's option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company's products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.

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## MODELS APLRI - APOLLO TIME INTERVAL RATE INDICATOR AND PBLRI - 4/6 DIGIT MODULE FOR USE WITH THE LARGE DIGIT DISPLAY (LDD)

- OPERATES ON LOW INPUT RATES
- 6-DIGIT, 0.56" (14.2 mm) HIGH LED DISPLAY (APLRI)
- COUNT RATES UP TO 10 KHz
- EASY SELECTION OF RATE MULTIPLIER
- PROGRAMMABLE INPUT CIRCUIT, ACCEPTS OUTPUTS FROM A WIDE VARIETY OF SENSORS
- LEADING ZERO BLANKING
- PROGRAMMABLE DECIMAL POINTS
- 0.02% ACCURACY
- EIGHT PULSE MOVING WINDOW AVERAGE
- NEMA 4/IP65 SEALED FRONT PANEL METAL BEZEL



### DESCRIPTION

The Apollo Time Interval Rate Indicator (Model APLRI) and Module (Model PBLRI), provide the capability of measuring very slow input rates and scaling these low rates in terms of a readily usable and recognizable engineering unit (i.e. bottles/min., rolls/hr., cases/shift, barrels/day, etc.). The APLRI/PBLRI measures the time (with crystal controlled accuracy) between input pulses, inverting this measured time, then multiplying it by the programmed scale multipliers set by the rear panel DIP switches.

The units can also accommodate magnetic pickups, logic sensors, and NPN open collector sensors, as well as switch contact closure sensors.

These units have a self-test feature, which checks all the microprocessor and display driver circuitry after power-up, if enabled. This self-test can also be used to test the multiplier select DIP switches and decimal point select DIP switches, to make certain all switches are functioning properly.

Power and input connections are made via a removable terminal block, located at the rear of the unit. Each terminal can accept one #14 AWG wire. DIP switches at the side of the unit are used to program the input configuration.

The Model APLRI has a sealed metal die-cast bezel which meets NEMA 4/IP65 specifications for wash-down and/or dust, when properly installed. The Model APLRI has a 6-digit, 0.56" high LED display, which is readable to 23 feet (7M).

### SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



**CAUTION:** Read complete instructions prior to installation and operation of the unit.



**CAUTION:** Risk of electric shock.

### SPECIFICATIONS

1. **DISPLAY:** 6-Digit, 0.56" (14.2 mm) High Red LED's (APLRI).
2. **POWER REQUIREMENTS:**

#### APLRI

**AC Operation:** Available in three voltages.  
115 VAC,  $\pm 10\%$ , 50/60 Hz, 14 VA or  
230 VAC,  $\pm 10\%$ , 50/60 Hz, 14 VA

#### DC Operation:

24 VDC, 10% @ 0.6 A max.

*Note: All available units can be powered at Terminal #3 from a 11 to 14 VDC, 0.6 A max. power supply.*

#### PBLRI

**AC Operation:** Switch selected via the LDD power supply board,  
115/230 (+/-10%), 50/60 Hz, 10 VA for 4-digit, 15 VA for 6 digit (including LDD).

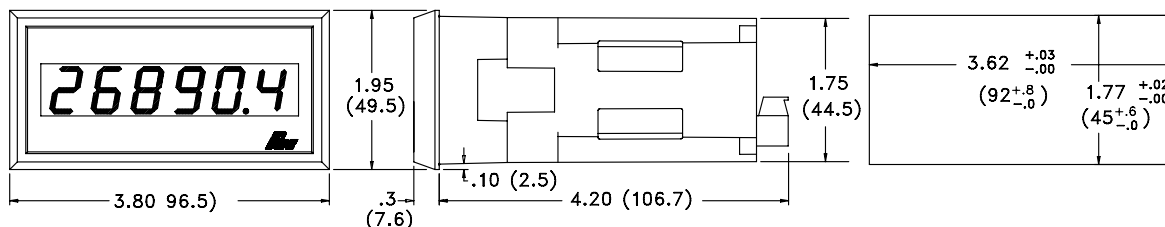
3. **SENSOR POWER:** +12 VDC,  $\pm 25\%$  @ 100 mA max.
4. **OPERATING FREQUENCY RANGE:** 0.1 pulse/sec. to 10,000 pulses/sec. in the rate per second mode. 0.36 pulses/min. to 600,000 pulses/min. in the rate per minute mode.  
*Note: When the value to be displayed exceeds the full scale display capacity, six dashes are displayed. Also if the display input is too low, the unit will display a zero.*
5. **ACCURACY AND REPEATABILITY:** 0.02%
6. **RATE MULTIPLIER INCREMENT TOTAL, SELECTION RANGE:** From 1 to 8191.
7. **DISPLAY UPDATE TIME:** The display will update every 0.65 sec. plus one input pulse when the input pulse rate is 1.54 pulses/sec. or higher. When the input pulse rate is below 1.54 pulses/sec. the display will update on every input pulse.

*Note: When the input pulse rate is 3 pulses/sec. or lower, the unit will utilize, if selected, a technique known as a "moving window average". (This continually averages the last eight input pulses.)*

### DIMENSIONS "In inches (mm)"

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1" (53.4) H x 5.5" (140) W.

#### PANEL CUT-OUT



## SPECIFICATIONS (Con't)

8. **MAXIMUM INPUT VOLTAGE AND CURRENT:** When the "SIG. IN" (Terminal 5) is driven from external signal voltages, maximum voltage swing is  $\pm 50$  V peak. Input voltage can be dropped by an external series resistance that limits input current to  $\pm 5$  mA. (These ratings are for S3 "OFF".)
9. **INPUT IMPEDANCE:** With S1 and S3 "OFF", the resistive input impedance exceeds 1megohm as long as the "SIG. IN" (Terminal 5) input voltage is between zero and +12 VDC. Beyond these levels, the high and low clamping diode will start to conduct, thus decreasing the input impedance. With S3 "ON" the maximum input voltage to Terminal 5 must be limited to 28 VDC.
10. **PARALLELING WITH APOLLO TOTALIZER (RLC standard count input) INPUTS:** Apollo Rate Indicators may be parallel connected with counters having the RLC standard count input circuitry. These can operate from a common current sink or source sensor, by connecting the appropriate terminals in common. S3 on the Rate Indicator should be turned "OFF" since pull-up or pull-down resistors are already present in the counter. The Rate Indicator will not add appreciable sensor load with this arrangement.
- Note: Rate Indicators cannot be operated in parallel with standard input counters when 2-wire proximity sensors are used.*
11. **INPUT AND POWER CONNECTIONS:** There is a plug-in, compression-type, terminal block located at the rear of the unit. This block can be removed from the rear of the unit for ease of wiring. After wiring is complete, the connector can be plugged back onto the unit.
12. **CERTIFICATIONS AND COMPLIANCES:**

### ELECTROMAGNETIC COMPATIBILITY

#### Immunity to EN 50082-2

Electrostatic discharge	EN 61000-4-2	Level 2; 4 Kv contact <sup>1</sup> Level 3; 8 Kv air
Electromagnetic RF fields	EN 61000-4-3	Level 3; 10 V/m 80 MHz - 1 GHz
Fast transients (burst)	EN 61000-4-4	Level 4; 2 Kv I/O <sup>2</sup> Level 3; 2 Kv power
RF conducted interference	EN 61000-4-6	Level 3; 10 V/rms 150 KHz - 80 MHz
Simulation of cordless telephone	ENV 50204	Level 3; 10 V/m 900 MHz $\pm$ 5 MHz 200 Hz, 50% duty cycle

#### Emissions to EN 50081-2

RF interference	EN 55011	Enclosure class A Power mains class A
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#### Notes for APLRI only:

1. Metal bezel of unit connected to earth ground (protective earth) at the mounting panel.
2. EMI filter placed on the DC power supply, when DC powered: Corcom #1VB3 or Schaffner #FN610-1/07 (RLC #LFIL0000).

Refer to the EMC Installation Guidelines section of this bulletin for additional information

### 13. ENVIRONMENTAL CONDITIONS:

**Operating Temperature:** 0 to 50°C

**Storage Temperature:** -40 to 70°C

**Operating and Storage Humidity:** 85% max. relative humidity (non-condensing) from 0°C to 50°C.

**Altitude:** Up to 2000 meters

14. **CONSTRUCTION:** Die-cast metal front bezel with black, high impact plastic insert. Front panel meets NEMA 4/IP65 requirements for indoor use when properly installed. Installation Category II, Pollution Degree 2. (Panel gasket and mounting clip included with unit.)

### 15. WEIGHT:

APLRI: 1.5 lbs. (0.8 Kgs)

PBLRI: 0.4 lbs. (0.18 Kgs)

## INPUT SET-UP

The selection of input set-up is accomplished by the first three of six DIP switches, located along the side of the unit. DIP switches 1-3 are used to configure the input. Each of these switches are discussed below.

*Note: Rate indicators frequently use magnetic pickups for input devices.*

*Consequently, there are basic differences between counter and rate-indicator input circuits. In the APLRI/PBLRI input circuit, the hysteresis level is quite small and the bias levels are significantly different to accommodate both magnetic pickup inputs, as well as the +5 V and higher logic levels.*

**S1 - ON [MAG.PKUP.]:** Connects a 0.1  $\mu$ F damping input capacitor from input to common. This capacitor is used mostly with magnetic pickup inputs

and serves to filter out high frequency noise. It can also be used to filter switch contact closures.

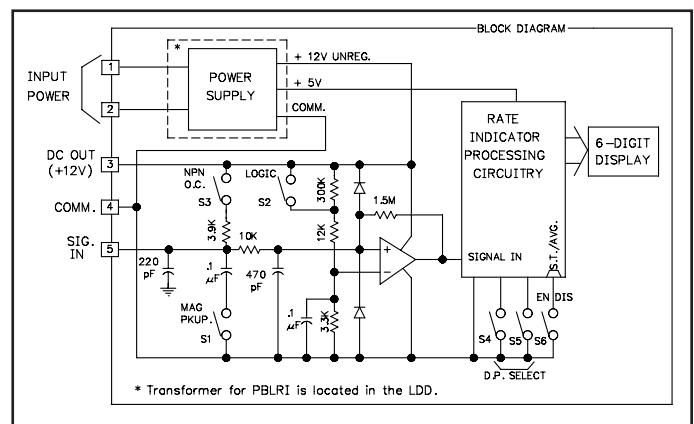
*Note: If excessive contact "bounce" is encountered, an additional external filter capacitor may be necessary. Reed switches, mercury wetted contacts, snap action limit switches, and silver alloy relay contacts with wiping action are usually satisfactory for generating count input signals. Motor starter contacts, tungsten contacts, and brush-type contacts should not be used.*

**S2 - ON [LOGIC]:** Sets the bias reference so that input logic signals trigger count pulses as they cross a level of approximately +2.5 V.

**OFF:** Sets the bias reference so that a signal of 150 millivolts or more will trigger count pulses. This provides the sensitivity required for low speed magnetic pickup sensors.

*Note: Hysteresis for both S2 "ON" and "OFF" conditions is about 25 millivolts. This means the difference between  $V_{IL}$  and  $V_{IH}$  with logic inputs (S2) is almost insignificant and only a very small swing about the 2.5V bias level will trigger the input.*

**S3 - ON [NPN O.C.]:** Connects a 3.9 K $\Omega$  pull-up load resistor for sensors or circuits with current sink outputs. Sensor output must sink 4 mA @  $V_{OL}$  of 1 V or less. Unlike the time base rate indicator, the APLRI/PBLRI can work with switch contact closures because of the low count rate capability. S1 should be closed when switch contact closures are used as inputs to the unit.



## DECIMAL POINT SELECTION

The selection of Decimal Point is accomplished by DIP switches 4 and 5. The table at the right shows what combination of switches is needed to obtain the desired decimal point location. The unit always has leading zero blanking. *Note: D.P. will change only at the normal display update time of the unit.*

SW 4	SW 5	D.P. LOCATION
↓ (0)	↓ (0)	0
↑ (1)	↓ (0)	0.0
↓ (0)	↑ (1)	0.00
↑ (1)	↑ (1)	0.000

## MOVING WINDOW AVERAGING & SELF-TEST

DIP switch 6, the S.T./AVG. switch, serves a dual function of disabling or enabling the "MOVING WINDOW AVERAGE" (MWA) function and the self-test function. When the switch is "UP", MWA and the self-test are both disabled. When the switch is "DOWN", MWA and self-test are both enabled.

## MOVING WINDOW AVERAGING

This allows the unit to "collect" and average the last eight input pulses which is continually updated whenever a new pulse occurs. The oldest input data is discarded and replaced with the newest data.

## SELF-TEST

This unit has a built-in self-test feature which can only be activated immediately after power-up (the unit will not count while in self-test). To activate self-test, set the S.T./AVG. DIP switch (D.S. 6) to the enable position. Then power the unit up. With this test, all digits are cycled through starting with a string of six zeros. This will be shown for about half a second, then a string of ones will appear for about the same time duration. Following these, a string of twos and so on, up to nines will be displayed. After this portion, an interlace pattern of 1, 0, 1, 0, 1, 0, then 1, 2, 1, 2, 1, 2, and so on, until all digits from zero to nine have been displayed.

The next portion of self-test will display four groups of zeros and/or ones. (The first two digits from the left, in each group, will always show a zero.) In the first group, the third digit represents the 13th (x4096) DIP switch setting.

The fourth and fifth digits show the setting for the Decimal Point select DIP switches. (The fourth position digit represents DIP switch 4 and the fifth position digit represents DIP switch 5.) The state of these digits coincides with the table listed under the “Decimal Point Selection” section.

The last digit will always show a one. The next three groups are shown on the right, and correspond to the DIP switch shown directly above it. (Note: The first two digits in each group are always shown as zeros.)

Group 2:	9	10	11	12 (DIP SWITCH)
0	0	X	X	X
Group 3:	5	6	7	8 (DIP SWITCH)
0	0	X	X	X
Group 4:	1	2	3	4 (DIP SWITCH)
0	0	X	X	X

The X's represent a zero or one (depending on the setting of the DIP switch) in the display. Self-test is automatically exited 8 seconds after the last DIP switch is changed.

## EMC INSTALLATION GUIDELINES

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the unit may be different for various installations. In extremely high EMI environments, additional measures may be needed. Cable length, routing and shield termination are very important and can mean the difference between a successful or a troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

- The unit should be mounted in a metal enclosure, that is properly connected to protective earth.
  - If the bezel is exposed to high Electro-Static Discharge (ESD) levels, above 4 Kv, it should be connected to protective earth. This can be done by making sure the metal bezel makes proper contact to the panel cut-out or connecting the bezel screw with a spade terminal and wire to protective earth.
- Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
  - Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
  - Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
  - Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.
- Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
- Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
- In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible.
 

Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

Ferrite Suppression Cores for signal and control cables:

Fair-Rite # 0443167251 (RLC #FCOR0000)

TDK # ZCAT3035-1330A

Steward #28B2029-0A0

Line Filters for input power cables:

Schaffner # FN610-1/07 (RLC #LFIL0000)

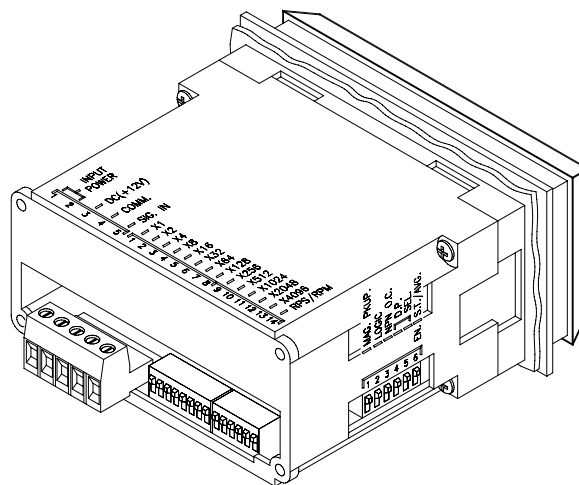
Schaffner # FN670-1.8/07

Corcom #1VB3

Corcom #1VR3

**Note:** Reference manufacturer's instructions when installing a line filter.

- Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.



## WIRING CONNECTIONS

As depicted in the drawing showing the rear view of the Apollo Time Interval Rate Indicator, there is a terminal block where all wiring connections are made. All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker. Remove the block for easy access to the terminal screws. To remove the block, pull from the back of the block until it slides clear of the terminal block shroud.

Enclosed with the PBLRI module is an adhesive backed label(s) showing the terminal block pin-out. This label is for wiring reference only, do not use for specifications. This label should be applied to the appropriate location by the user.



**CAUTION:** The terminal block should NOT be removed with power applied to the unit. The module should not be removed from the LDD with power applied to the LDD or the module.

Terminal 3 is the “DC” (+12 V) terminal. This terminal is for sensor supply and can provide up to 100 mA of current. An external +11 V to +14 VDC can also be applied to this terminal to power the unit in the absence of A.C. power.

Terminal 4 is the “COMM.” (common) terminal, which is the common line to which the sensor and other input commons are connected.

Terminal 5 is the “SIG. IN” (signal in) terminal. When the signal at this terminal goes low, a count will be registered in the unit. (See “Input Ratings” under “Specifications” section.)

## POWER WIRING (A.C. Version)

Primary AC power is connected to Terminals 1 and 2 (marked VAC 50/60 Hz, located on the left-hand side of the block). For best results, the AC power should be relatively “clean” and within the specified  $\pm 10\%$  variation limit. Drawing power from heavily loaded circuits or from circuits that also power loads that cycle on and off, should be avoided.

## POWER WIRING (APLRI D.C. Version only)

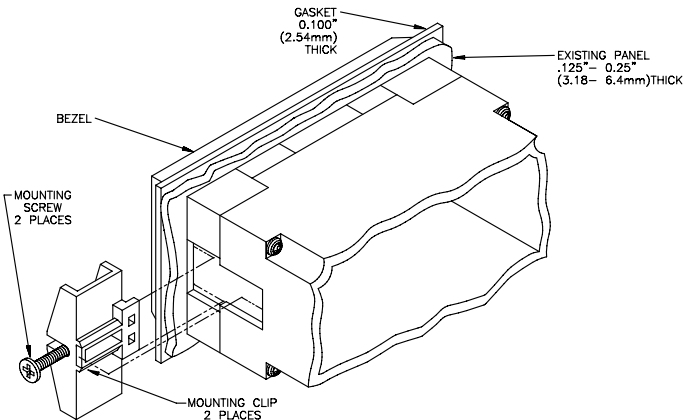
The DC Version unit will operate from a 24 VDC power supply. The positive wire of the DC power source connects to Terminal #1 and the minus “-” to Terminal #2.



## INSTALLATION ENVIRONMENT

The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.



## INSTALLATION

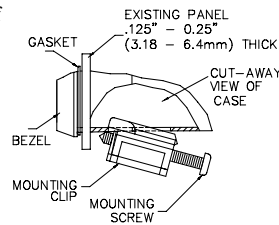
PBLRI installation information is contained in the LDD bulletin. Refer to that bulletin for instructions on installing the module.

The unit meets NEMA 4/IP65 requirements for indoor use when properly installed. The units are intended to be mounted into an enclosed panel. Two mounting clips and screws are provided for easy installation. Consideration should be given to the thickness of the panel. A panel which is too thin may distort and not provide a water-tight seal. (Recommended minimum panel thickness is 1/8".)

Cut the panel opening to the specified dimensions. Remove burrs and clean around the panel opening. Slide the panel gasket over the rear of the unit to the back of the bezel. Insert the unit into the panel cutout.

As depicted in the drawing, install the screws into the narrow end of the mounting clips. Thread the screws into the clips until the pointed end just protrudes through the other side. Install each of the mounting clips by inserting the wide lip of the clips into the wide end of the hole, located on either side of the case. Then snap the clip onto the case.

Tighten the screws evenly to apply uniform compression, thus providing a water-tight seal. **CAUTION:** Only minimum pressure is required to seal panel. Do **NOT** overtighten screws.



## REAR PANEL DIP SWITCHES

As can be seen from the rear panel of the unit, there is a row of 14 DIP switches located beside the input and power terminal block. DIP switches 1 through 13 are Rate Multiplier Increment Total (RMIT) switches. When the switch is "ON", it will multiply the input rate by the rate multiplier value it represents.

DIP switch 14 is the Rate Per Second (RPS)/Rate Per Minute (RPM) DIP switch. When the switch is "OFF", the unit is set up for input pulse rate in RPS. When the switch is "ON", the unit is set up for input pulse rate in RPM. In actuality, the RPS/RPM switch is a x 60 multiplier (It will multiply the input rate by a value of 60). In other words, if the input pulse rate is known per second, and the rate lies between .1 pulses/sec. and 10,000 pulses/sec., set DIP switch 14 to RPS. If the input pulse rate is known per minute, and the rate lies between 0.36 pulses/min. and 600,000 pulses/min., set DIP switch 14 to RPM.

## RATE MULTIPLIER SELECTION PROCEDURE

The APLRI/PBLRI has a rate multiplier selection range from 1 to 8191. For the minimum scaled reading (direct readout of the input rate), the x1 DIP switch would be set to "ON". For the maximum scaled reading (8191 times the input rate), all of the rear panel RMIT DIP switches would be turned "ON". Therefore, a specific Rate Multiplier Increment Total is achieved by adding up the appropriate individual rate multiplier values.

The rate multiplier increment total is computed according to the following formula:

$$\text{RATE MULTIPLIER INCREMENT TOTAL (RMIT)} = \frac{\text{Display Readout Desired}}{(\text{Known Input Pulse Rate})^*}$$

\* - Input Pulse Rate Per Second (set RPS/RPM switch to RPS) or Input Pulse Rate Per Minute (set RPS/RPM switch to RPM).

### EXAMPLE 1:

DISPLAY READOUT DESIRED = 4700

KNOWN INPUT PULSE RATE = 3PPS

RPS/RPM set to RPS

$$\text{RMIT} = \frac{4700}{3} = 1566.66 \left[ \begin{array}{l} \text{round to the nearest} \\ \text{whole number} \end{array} \right] = 1567$$

The appropriate rate multiplier switches, which together add up to 1,567 are then set "ON".

Start by selecting the first increment which is greater than half the desired RMIT, and add subsequent increments that are more than half the difference needed.

RMIT = 1,567

DIP switch 11 . . . . .	1024	Needed =	543
DIP switch 10 . . . . .	512	Needed =	31
DIP switch 5 . . . . .	16	Needed =	15
DIP switch 4 . . . . .	8	Needed =	7
DIP switch 3 . . . . .	4	Needed =	3
DIP switch 2 . . . . .	2	Needed =	1
DIP switch 1 . . . . .	1		

If the input pulse rate was known in Rate Per Minute (60 x RPS), the RPS/RPM switch would be set to RPM and the calculations would be as follows.

$$\text{RMIT} = \frac{4700}{180} = 26.11 \left[ \begin{array}{l} \text{round to the nearest} \\ \text{whole number} \end{array} \right] = 26$$

DIP switch 5 . . . . .	16	Needed =	10
DIP switch 4 . . . . .	8	Needed =	2
DIP switch 2 . . . . .	2		

Therefore, DIP switches 2, 4, and 5, would be set to "ON", and the RPS/RPM DIP switch would be switched to "RPM".

### EXAMPLE 2:

DISPLAY READOUT DESIRED = 432,000 bolts per day

INPUT PULSE RATE PER SECOND = 5 bolts (pulses) per sec.

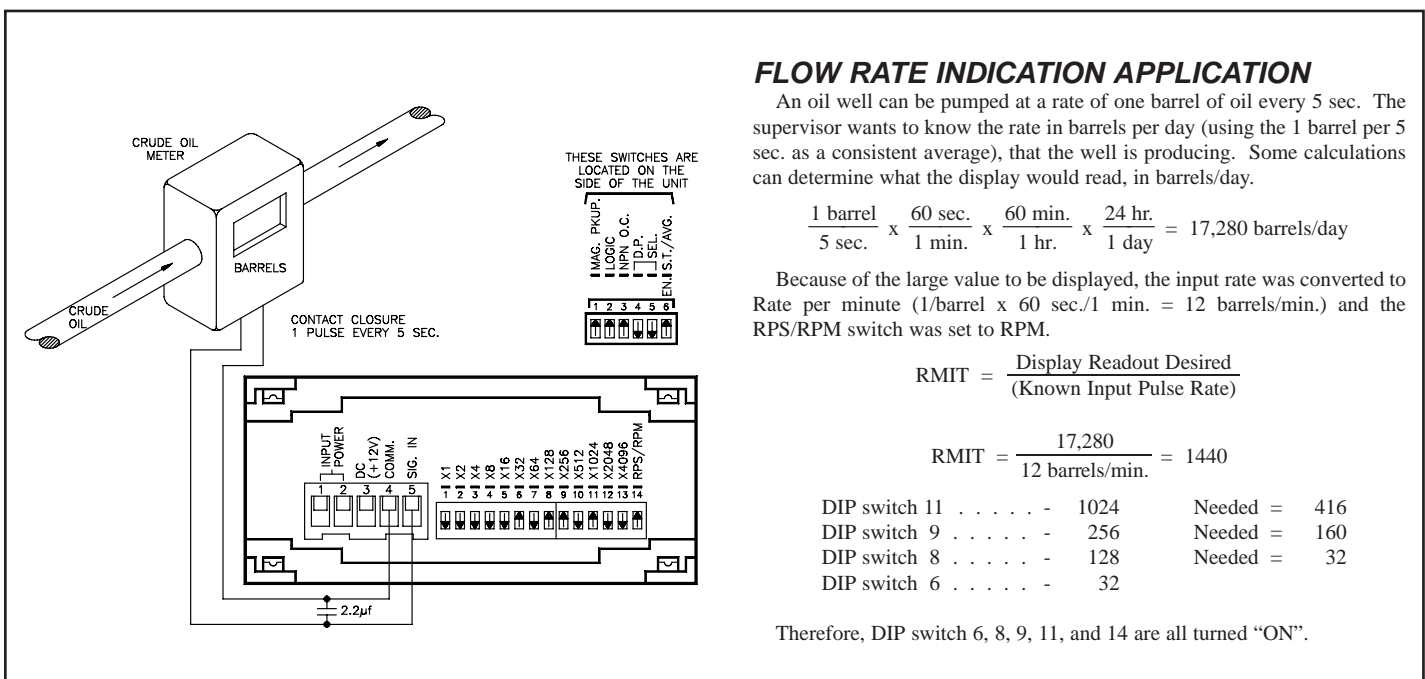
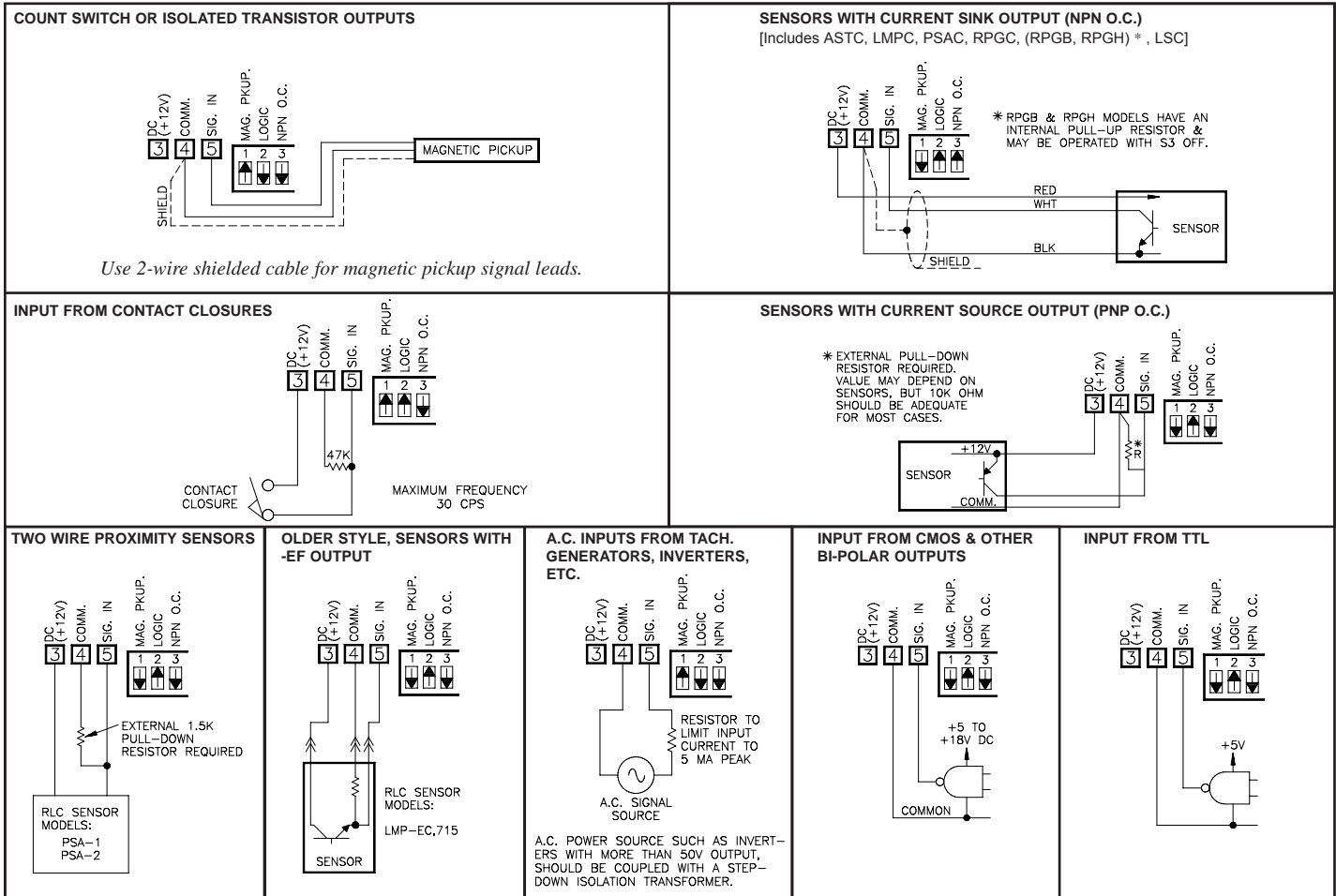
Since the value to be displayed in this example is so large, the input rate was converted to rate per minute (5 x 60 = 300 BPM) and the RPS/RPM switch was set to RPM. The following calculations were performed:

$$\text{RMIT} = \frac{432,000}{300} = 1440$$

DIP switch 11 . . . . .	1024	Needed =	416
DIP switch 9 . . . . .	256	Needed =	160
DIP switch 8 . . . . .	128	Needed =	32
DIP switch 6 . . . . .	32		

Therefore, DIP switches 6, 8, 9, 11, and 14 (RPS/RPM DIP switch) would be turned "ON".

## CONNECTIONS & CONFIGURATION SWITCH SET-UP FOR VARIOUS SENSOR OUTPUTS



## SLOW TURNING SHAFT APPLICATION

The drawing shows one of the most common uses for the Model APLRI Time Interval Rate Indicator. This is a slow turning shaft without the capability of placing a gear on the end of the shaft (due to space limitations, size of shaft, etc.). A PSAC is used to sense the keyway which is the only means of picking up a signal from the shaft. The shaft turns at speeds from 0.5 RPM to 10 RPM with an average speed of 5 RPM. The foreman wants to know the rate, in cases of motor parts per shift, in which the assembly line is moving. At the average speed of the shaft, the display reading would be 1918 cases/shift. The formula is then used to figure out the required multiplier:

$$RMIT = \frac{\text{Display Readout Desired} \times \text{D.P.}}{(\text{Known Input Pulse Rate})}$$

D.P. : Decimal Point

Use one of the following numbers in the above formula for the decimal point position.

X1 = 0

X10 = 0.0

X100 = 0.00

DISPLAY READOUT DESIRED = 1918 cases/shift

INPUT PULSE RATE = 5 PPM\*

\* Note: Since the input rate is in RPM, set the RPS/RPM switch to RPM. Also, since the input pulse rate could go below and usually is below 0.1 pulses/sec., the RPS/RPM switch must be set to RPM. Therefore,

$$RMIT = \frac{1918}{5} = 383.6 \left[ \begin{array}{l} \text{round to the nearest} \\ \text{whole number} \end{array} \right] = 384$$

RMIT = 384

DIP switch 9 . . . . . - 256      Needed = 128

DIP switch 8 . . . . . - 128

DIP switches 8,9, and 14 are turned "ON".

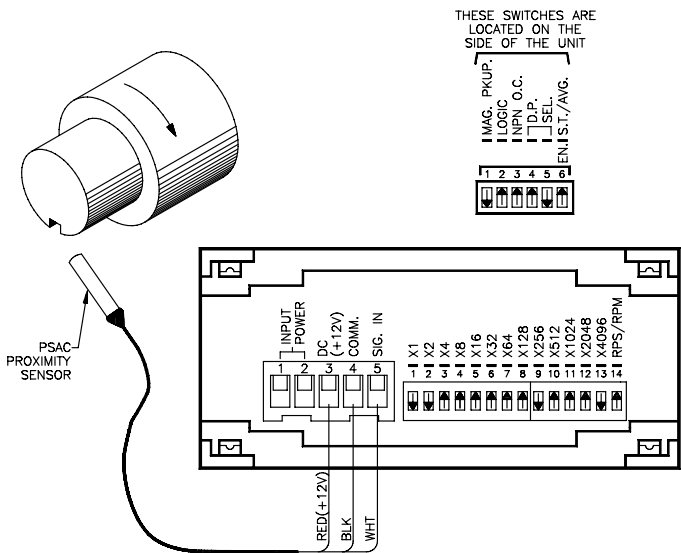
If the rounding error introduced above is unacceptable, a decimal point and a times 10 multiplier value can be used to give a more exact reading.

RMIT = 383.6 x 10 = 3836

RMIT = 3836

DIP switch 12 . . . . . - 2048      Needed = 1788

DIP switch 11 . . . . . - 1024      Needed = 764



DIP switch 10 . . . . .	-	512	Needed = 252
DIP switch 8 . . . . .	-	128	Needed = 124
DIP switch 7 . . . . .	-	64	Needed = 60
DIP switch 6 . . . . .	-	32	Needed = 28
DIP switch 5 . . . . .	-	16	Needed = 12
DIP switch 4 . . . . .	-	8	Needed = 4
DIP switch 3 . . . . .	-	4	

Dip switches 3-8, 10-12, and 14 would be set to "ON". Also, the side panel DIP switch 4 would be set to "ON" to turn on the tenths position D.P. (Note: D.P. will only change at normal display update times.)

## TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

## ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES		
		230 VAC	115 VAC	24 VDC
APLRI	Apollo Time Interval Rate Indicator	APLRI610	APLRI600	APLRI630

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

## PERSONALITY MODULE

MODEL NO.	DESCRIPTION	PART NUMBERS
PBLRI *	Time Interval Rate Module for use with the 4 or 6 digit Large Digit Display	115/230 VAC
		PBLRI600

\* Requires an LDD for use.

Red Lion Controls Inc  
20 Willow Springs Circle  
York PA 17402  
Tel +1 (717) 767-6511  
Fax +1 (717) 764-6587

Red Lion Controls France  
56 Boulevard du Courcerin, Batiment 21,  
ZI Pariest F-77183 Croissy Beaubourg  
Tel +33 (64) 80 12 12  
Fax +33 (64) 80 12 13

Red Lion UK Ltd  
Tapton Park  
Chesterfield S41 OTZ  
Tel +44 (1246) 22 21 22  
Fax +44 (1246) 22 12 22

## MODELS HHT & HHTP - ACCURATE 5-DIGIT PRECISION MEASURING HAND HELD TACHOMETERS

### ● MICRO-COMPUTER CIRCUITRY

The exclusive one chip Micro-computer LSI-circuit and crystal time base is used to accurately provide a wide measurement range.

### ● MEMORY

The last maximum/minimum reading will be automatically stored in memory and can be displayed by pressing the "MEMORY" switch.

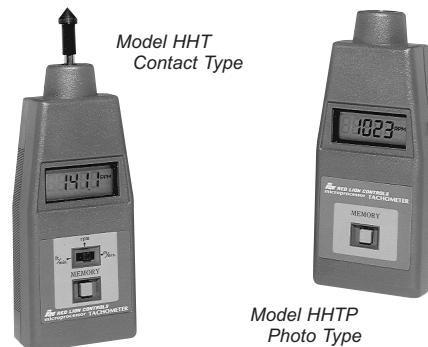
### ● ERROR-FREE READING

Highly visible LCD display, with Leading Zero Blanking gives exact RPM with no guessing or errors and saves battery energy.

### ● RUGGED AND LIGHTWEIGHT CONSTRUCTION

The use of durable, long-lasting components, including a strong, lightweight ABS-plastic housing assures maintenance-free performance for many years. The housing has been carefully shaped to fit comfortably in either hand.

### ● BATTERIES INCLUDED



## DESCRIPTION

The CONTACT TACHOMETER (Model HHT) incorporates precision bearings instead of gears to ensure long life while providing minimal loading to the rotating shaft. A built-in photo-sensor and slotted disc detect the number of revolutions for a high degree of accuracy. By simply pressing the "MEASURE" button and lightly contacting the conical tip against the center hole of a rotating shaft, the RPM will be displayed and updated every second. By attaching the circumferential speed wheel (included), the Model HHT can measure surface speed in "Switch Selectable" units of either feet per minute (FT/MIN) or meters per minute (M/MIN).

The PHOTO TACHOMETER (Model HHTP) provides for non-contact RPM measurements which enhances operator safety when measuring high speed shafts. By pressing the "MEASURE" button and aiming the Visible Light Beam at a piece of reflective tape (included) on the rotating shaft, RPM will be displayed and updated every second. A display indicator blinks once each revolution to ensure that the reflecting mark is within the 2" to 12" sensing distance of the Model HHTP.

Both units can display Memory values which are obtained immediately before turning off the "MEASURE" button. The last value, Maximum value and Minimum value can be displayed by pushing the "MEMORY" button as follows:

1. First Push and Hold = Last value displayed:  
"LA" and last value alternately displayed.
2. Second Push and Hold = Maximum value displayed:  
"UP" and maximum value alternately displayed.
3. Third Push and Hold = Minimum value displayed:  
"DN" and minimum value alternately displayed.

These memory features are useful when the measurement to be made is in a "hard-to-access" area where the display is not visible to the operator.

A "LO" (low battery) display is incorporated in both units and is a visible reminder when batteries are to be replaced.

## BATTERY REPLACEMENT

- A) When it is necessary to replace the batteries (battery voltage less than approx. 4.5 V), "LO" will appear in the display.
- B) Slide the battery cover away from the instrument and remove the batteries.
- C) Install new batteries correctly into the case. Permanent damage to the tachometer circuit may result from incorrect installation.

## CONTACT TACHOMETER SPECIFICATIONS

1. **MEASUREMENT RANGE:**  
0.5 to 8,000 RPM  
0.05 to 1999.9 m/min.  
0.2 to 6560 ft/min.
2. **RESOLUTION:**  
0.1 RPM (0.5 to 999.9 RPM)  
1 RPM (over 1000 RPM)  
0.01 m/min. (0.05 to 99.99 m/min.)  
0.1 m/min. (over 1000 m/min.)  
0.1 ft/min. (0.1 to 999.9 ft/min.)  
1 ft/min. (over 1000 ft/min.)
3. **ACCURACY:**  $\pm(0.05\% \text{ full scale} + 1 \text{ digit})$
4. **SAMPLE TIME:** 1 sec. (over 6 RPM)
5. **POWER CONSUMPTION:** Approximately 10 mA.
6. **ACCESSORIES INCLUDED:** RPM adapters (1 cone, 1 funnel), Surface speed test wheel, Carrying Case, Instruction Manual.
7. **WEIGHT:** 0.58 lb. (260 g) including battery

## PHOTO TACHOMETER SPECIFICATIONS

1. **MEASUREMENT RANGE:** 5 to 99,999 RPM (one reflecting mark)
2. **RESOLUTION:** 0.1 RPM (0.5 to 999.9 RPM)  
1 RPM (over 1000 RPM)
3. **ACCURACY:**  $\pm(0.05\% \text{ full scale} + 1 \text{ digit})$
4. **SAMPLING TIME:** 1 sec. (over 60 RPM)
5. **DETECTING DISTANCE:** (2-6 inches) (50 to 150 mm) Typical max. 12 inches (300 mm) depending upon ambient light.
6. **POWER CONSUMPTION:** Approximately 150 mA (Operation).  
Approximately 20 mA (Memory Recall)
7. **ACCESSORIES INCLUDED:** Carrying Case, 23.6 inches (600 mm) Reflective tape, Instruction Manual.
8. **WEIGHT:** 0.55 lb. (250 g) including battery

## COMMON SPECIFICATIONS

1. **DISPLAY:** 5-digit, 0.4" high LCD.
2. **MEMORY TIME:** 10 sec. nominal.
3. **TIME BASE:** Quartz crystal.
4. **BATTERY:** 4 x 1.5 V AA size.
5. **OPERATING TEMPERATURE:** 32°F to 120°F (0°C to 50°C).
6. **SIZE:** 6.7" x 2.8" x 1.5" (170 mm x 72 mm x 37 mm)

## ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
HHT	LCD Hand Held Contact Tachometer	HHT00000
HHTP	LCD Hand Held Photo Tachometer	HHTP0000
-	Replacement 1/2" x 2' Reflective Tape For HHTP	HHTRT000
-	HHT Rubber Wheel	HHTWHL00
-	HHT Cone Point Disc With Shaft	HHTCONE0
-	HHT Concave Disc	HHTCONC0

## MOTOR DRIVE CONTROLLER



- MASTER AND FOLLOWER MODES OF OPERATION
- PROGRAMMABLE SETPOINTS:  
TWO SPEED (Master)  
TWO RAMP RATE (Master)  
TWO RATIO (Follower)  
TWO RATIO RAMP RATE (Follower)  
ONE JOG SPEED  
ONE JOG RAMP RATE
- 8 CHARACTER BY 2 LINE ALPHANUMERIC DISPLAY



- FOUR PROGRAMMABLE INDICATION DISPLAYS
- ON LINE SETPOINT INCREMENT/DECREMENT
- SELECTABLE DISPLAY SCROLLING
- ABILITY TO LIMIT OPERATOR ACCESS TO PROGRAMMING PARAMETERS
- ENGLISH PROGRAMMING MENUS
- FREQUENCY INPUTS ARE SWITCH SELECTABLE FOR A VARIETY OF SOURCES
- PROGRAMMABLE CONTROL INPUTS
- THREE SOLID STATE OUTPUTS
- VARIABLE SPAN (5 TO 15VDC) ISOLATED DRIVE OUTPUT
- FEEDBACK LOSS DETECTION
- PROGRAMMABLE ALARM TYPES
- INTERNAL OR EXTERNAL DRIVE OUTPUT REFERENCE
- DIAGNOSTICS MODE
- 115/230VAC SWITCH SELECTABLE
- NON-VOLATILE MEMORY
- NEMA 4X/IP65 SEALED FRONT PANEL BEZEL

### DESCRIPTION

The Motor Drive Controller (MDC) regulates motor speed by varying an isolated DC control signal to the motor drive system. There are two modes of operation, Master and Follower.

Master Mode provides control of a motor's speed directly via programmed speed setpoints in the MDC. Regulation is maintained by a feedback frequency to the MDC taken from the motor shaft or a downstream shaft pulse encoder. Follower Mode controls a motor's speed as a ratio to a second motor's speed or outside frequency source. Ratio setpoints are programmed into the MDC causing the motor to "follow" the lead motor or frequency at a fixed speed ratio.

Master Mode has two speed setpoints and two ramp setpoints. Follower Mode has two ratio setpoints and two ratio ramp setpoints. Both modes share a jog speed setpoint, a jog ramp setpoint, two alarm values and a gain value. All setpoints are retained in non-volatile memory when the unit is powered down.

The Motor Drive Controller has the added feature of allowing real time adjustment of the Speed (*Master Mode*) or Ratio (*Follower Mode*) setpoint while the unit is operating a motor drive system. The setpoint may be adjusted via the front panel keypad using the "Up" or "Down" arrow keys, or via 2 User Inputs programmed for increment setpoint and decrement setpoint.

User flexibility is provided through the two-line by eight-character alphanumeric display. The display features English language menus for easy viewing and simplified programming. The four scroll-through indication displays can be programmed to show various parameters and to automatically scroll, if desired. A program disable DIP switch used with an external User Input can be utilized to protect the settings and guarantee that no unwanted changes occur during operation.

There are five dedicated control inputs on the MDC:

RUN  
RAMP STOP  
FAST STOP  
JOG  
OPEN LOOP

There are six programmable control inputs: two front panel function keys and four remote user inputs. The F1 and F2 keys are factory programmed for RUN and R-STOP respectively. This eliminates the need for external switches in some applications.

There are three solid state outputs, two are programmable alarms and one is a dedicated Drive Enable output. Programmable alarm functions include:

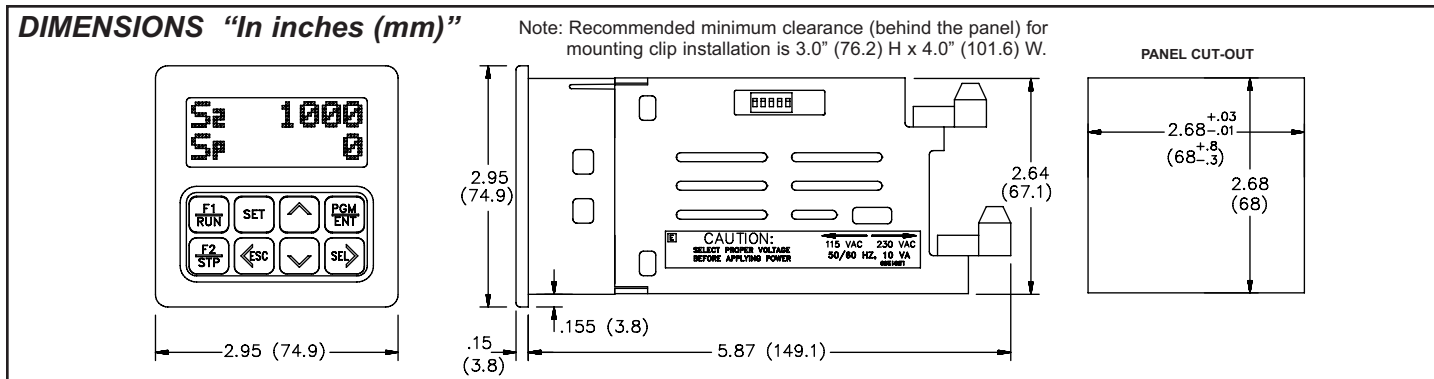
High Alarm  
Low Alarm  
Deviation Alarm  
Zero Speed  
Disabled

These may be programmed for boundary or latching operation, high or low acting.

Changing speed setpoints and programming information is easily accomplished by scrolling through menus and selecting the correct parameter. There are three main modules or menu loops:

Display Module  
User Setpoint Module  
Programming Module

Scaling is accomplished by entering the desired values for feedback pulses per revolution (PPR), the maximum RPM, and the maximum display value.





## DESCRIPTION (Cont'd)

The unit is factory configured for an isolated 0 to 10 VDC drive output signal. The output drive signal can be adjusted to span from 0 to 15 VDC via an accessible potentiometer. The drive output is jumper selectable for an external reference. To use the external reference, the MDC is connected to the drive in place of an external potentiometer.

The Motor Drive Controller has a light weight, high impact plastic case with a clear viewing window. The sealed front panel meets NEMA4X/IP65 specifications for wash-down and/or dusty environments, when properly installed. Plug-in style terminal blocks simplify installation and wiring change-outs.

## SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Do not use this unit to directly command motors, valves, or other actuators not equipped with safeguards. To do so, can be potentially harmful to persons or equipment in the event of a fault to the unit.

## SPECIFICATIONS:

- DISPLAY:** 2x8, 0.3" (7mm) high characters, negative image transmissive LCD, with red LED backlighting.
- POWER:** 115/230 VAC  $\pm 10\%$ , 50/60 Hz, 10 VA, switch selectable.
- MEMORY:** Non-volatile E<sup>2</sup>Prom retains all programming information and values when power is removed or interrupted.

**Power Cycles(ON/OFF):** 100,000 min.

**Data Retention:** 10 years min.

- SENSOR POWER:** +12 VDC  $\pm 25\%$  @ 100 mA.

- INPUTS (LEAD AND FEEDBACK):** DIP Switch selectable to accept input pulses from a variety of sources including outputs from CMOS or TTL circuits and all standard RLC sensors.

**Input Freq:**

1 Hz to 20 KHz (Master Mode), 1 Hz to 12 KHz (Follower Mode).

**Logic:** Input trigger levels  $V_{IL} = 1.5 V_{MAX}$ ;  $V_{IH} = 3.75 V_{MIN}$ .

**Current Sinking:** Internal 7.8 K $\Omega$  pull-up to +12 VDC,  $I_{MAX} = 1.6$  mA.

**Current Sourcing:** Internal 3.9 K $\Omega$  pull-down, 7.3 mA @ 28 VDC<sub>MAX</sub>.

**Magnetic Pickup:**

**Sensitivity:** 200 mV PEAK.

**Hysteresis:** 100 mV.

**Input impedance:** 3.9 K $\Omega$  @ 60 Hz.

**Maximum input voltage:**  $\pm 50$  V PEAK.

*Note: For magnetic pickup input, the Sink/Source DIP switch must be in the SRC position.*

- CONTROL LOOP RESPONSE:** 10 msec (Master Mode), 20 msec (Follower Mode).

- CONTROL ACCURACY:**

0.01% of Speed Setpoint (Master Mode)

0.02% of Ratio Setpoint (Follower Mode)

**Minimum Frequency Resolution:** 0.00125 Hz

- ERROR TRIM:**  $\pm 4095$  BITS.

- ERROR GAIN:** 0 to 99%.

- RAMP RATE:** (Ramp 1, Ramp 2, and Jog Ramp)

1 to 20 KHz/sec, set in user units/sec.

0.0001 to 1.9999 ratio units/sec (Ramp 1 & 2 in Follower Mode).

- CONTROL INPUTS:**

Internal 10 K $\Omega$  pull-up to +5 VDC.  $V_{IL} = 1.0 V_{MAX}$ ;  $V_{IH} = 4.0 V_{MIN}$ . Response time = 10 msec nominal, 30 msec max.

### INPUTS

RUN

FAST STOP

RAMP STOP

JOG

OPEN LOOP

USER INPUTS(4)

### SWITCH CONNECTIONS

Momentary N.O.

Momentary N.C.

Momentary N.C.

Sustained N.O.

Maintained

Function Specific

- OUTPUTS:**

**Drive Enable, Alarm 1, and Alarm 2:**

Solid state, current sinking NPN Open collector transistor.

$V_{CE} = 1.1 V_{SAT}$  @ 100 mA max.,  $V_{OH} = 30$  VDC max.

(Internal zener diode protection.)

**Response Time:**

**Drive Enable:** 10 msec nominal; 30 msec max.

**Alarm 1&2:** Programmable

**Normal:** 1 sec nominal, 2 sec max.

**Fast:** 20 msec nominal, 40 msec max.

**Isolated Drive Output:** Jumper selectable internal/external reference 5 mA max.

**Internal Reference:** Pot adjustable from 0 to 5 VDC min. through 0 to 15 VDC max. span.

**External Reference:** 0 to 15 VDC max. (positive polarity only).

## 13. CERTIFICATIONS AND COMPLIANCES:

### EMC EMISSIONS:

Meets EN 50081-2: Industrial Environment.

CISPR 11 Radiated and conducted emissions

### EMC IMMUNITY:

Meets EN 50082-2: Industrial Environment.

ENV 50140 - Radio-frequency radiated electromagnetic field

ENV 50141 - Radio-frequency conducted electromagnetic field

EN 61000-4-2 - Electrostatic discharge (ESD)

EN 61000-4-4 - Electrical fast transient/burst (EFT)

EN 61000-4-8 - Power frequency magnetic field

*Note: Refer to the EMC Installation Guidelines for additional information.*

## 14. ENVIRONMENTAL CONDITIONS:

**Operating Temperature:** 0 to 50°C

**Storage Temperature:** -40 to 70°C

**Operating and Storage Humidity:** 85% max. (non-condensing) from 0°C to 50°C.

**Altitude:** Up to 2000 meters

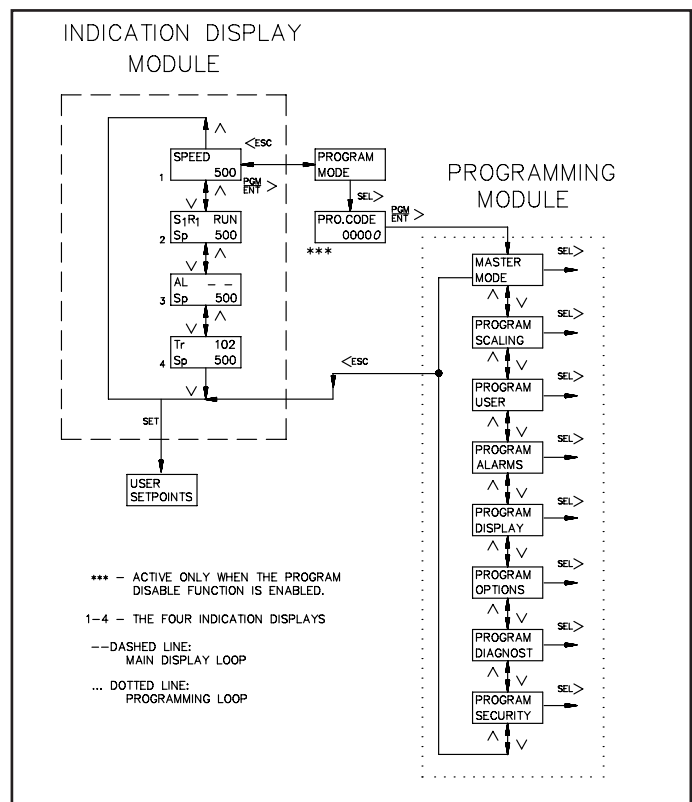
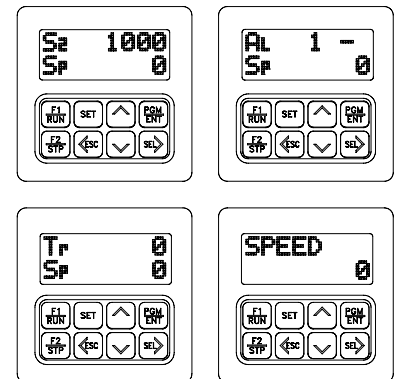
## 15. CONSTRUCTION: High impact plastic case with clear viewing window.

The front panel meets NEMA4X/IP65 requirements for indoor use when properly installed. Installation Category II, Pollution Degree 2. Panel gasket and mounting clips included.

## 16. WEIGHT: 1.5 lbs. (0.68 Kg).

## PROGRAMMING

Programming the MDC unit is accomplished through the front panel keypad, which allows the user to enter into Main Menus, Sub-Menus, and Edit Menus. The English language prompts, the flashing parameter values, and the front panel keypad aid the operator during programming. In the normal run mode, the main display loop allows the user to scroll through the four programmable indication displays, using the direction keys. From the main loop, setpoints, alarm values and a gain value may be accessed directly for changes, without entering the programming loop. All other parameters are accessed through the programming loop, which can be set to require an access code number for loop entry. In the programming loop, parameters can be viewed or changed and the operator can exit anywhere in the loop.



\*\*\* - ACTIVE ONLY WHEN THE PROGRAM DISABLE FUNCTION IS ENABLED.

1-4 - THE FOUR INDICATION DISPLAYS

--DASHED LINE: MAIN DISPLAY LOOP

... DOTTED LINE: PROGRAMMING LOOP



## PROGRAMMABLE FUNCTIONS

### MODES

Master  
Follower

### SCALING

Pulses per Revolution Feedback (PPR FB) ranges from 1 to 59999  
Maximum RPM Feedback (MAX RPM FB) ranges from 1 to 59999  
Display Decimal Point (DSP DP) ranges from 0 to 0.00000  
Maximum Display Units (DSP UNIT) ranges from 1 to 99999  
\*Pulses per Revolution Lead (PPR LD) ranges from 1 to 59999  
\*Maximum RPM Lead (MAX RPM LD) ranges from 1 to 59999

*\*These parameters are available in Follower Mode only.*

*Note: Values may be programmed in the range listed, provided that the maximum equivalent frequency does not exceed 20971 Hz. If this occurs, "OVFLW" will flash and a new entry will be required.*

### SETPOINTS

**2 SPEED (Master Mode)** - ranges from 0 to 99999 (or Display Unit Max.).  
**2 RAMP RATE (Master Mode)** - ranges from 1 to 99999.  
**2 RATIO (Follower Mode)** - ranges from 0.0001 to 1.9999.  
**2 RAMP RATE (Follower Mode)** - ranges from 0.0001 to 1.9999 ratio units.  
**1 JOG SPEED** - ranges from 0 to 99999 (or Display Unit Maximum).  
**1 JOG RAMP RATE** - ranges from 1 to 99999.  
**2 ALARM** - ranges from 0 to 99999.  
**1 GAIN** - ranges from 0 to 99.

*Note: Values may be programmed in the ranges listed, provided that the maximum equivalent frequency does not exceed 20,971 Hz ( 20 KHz/sec for Ramp Rate). If this occurs, a message will flash and the maximum is automatically entered by the unit.*

### USER INPUTS

There are four programmable external user inputs and two programmable front panel function keys. The options for each user input are the same, except for the two function keys (F1/RUN & F2/STP), which have additional options.

#### No Mode:

If a user input terminal or a function key is activated, it will be ignored.

#### View Display 1-4:

Causes the selected indication display (1, 2, 3, or 4) to be displayed and held from anywhere in the main display loop.

#### Change Display:

Causes the indication display to toggle to the next indication display.

#### Reset Alarm(s) Output:

Places the alarm(s) output(s) in its inactive state.

#### Setpoint Select/Toggle:

Selects Setpoint 1 or Setpoint 2 for the active speed (or ratio) setpoint. This is a maintained select action for User Inputs 1 to 4, and a momentary toggle action for F1 or F2.

#### Ramp Select/Toggle:

Selects Ramp 1 or Ramp 2 for the active acceleration and deceleration ramp rate. This is a maintained select action for User Inputs 1 to 4, and a momentary toggle action for F1 or F2.

#### Ramp Override:

Overrides the acceleration/deceleration ramp routine causing the unit to jump to the ramp endpoint.

#### Setpoint Increment:

Only an external User Input can be used for this option. The currently active speed or ratio setpoint is incremented when the User Input is made active. If the input remains active for more than 5 display unit increments, the scroll rate will progressively increase.

#### Setpoint Decrement:

Only an external User Input can be used for this option. The currently active speed or ratio setpoint is decremented when the User Input is made active. If the input remains active for more than 5 display unit increments, the scroll rate will progressively increase.

#### Program Disable:

Only an external user input can be used for this option. When used with the program disable DIP switch, this option can limit operator access to programmable parameters.

#### Run (F1 only):

Pressing the F1 button causes the MDC to accelerate the motor from Stop mode to the active speed setpoint using the active ramp rate.

#### R-Stop(F1 or F2 only):

Pressing the function key programmed for R-Stop causes the unit to decelerate the motor from its active speed to Stop mode using the active ramp rate.

#### F-Stop(F1 or F2 only):

Pressing the function key programmed for F-Stop causes the unit to execute a fast stop, taking the motor from its current speed immediately to the stop mode. The deceleration is limited only by the motor and drive.

#### Jog(F1 or F2 only):

This function is only available from the Stop mode. Pressing and holding the function key programmed for Jog causes the unit to accelerate the motor to the jog speed setpoint using the jog ramp rate.

### ALARMS

#### Type Of Alarm:

**High Alarm:** Alarm output activates when the feedback input is greater than or equal to the alarm value.

**Low Alarm:** Alarm output activates when the feedback input is less than or equal to the alarm value.

**Deviation Alarm:** The alarm output activates when the feedback input is outside a  $\pm$  band.

**Zero Speed Alarm:** Alarm output activates when the feedback input receives no input pulse for at least one second.

**Disabled:** The alarm output is inactive when disabled.

#### Phase:

Each output can have its active logic state set for Positive phase (ON) or Negative phase (OFF).

#### Latched Or Boundary:

An alarm programmed for a latched output stays active until it is manually reset by a User Input. An alarm programmed for boundary output stays active as long as the alarm condition exists, after which the output returns to its inactive state.

#### Fast Or Normal Update:

The normal update rate for the alarm outputs is once each second. The fast update rate occurs at an interval less than or equal to 40 msec.

### INDICATION DISPLAYS

If an indication display is to show two different numeric values, one for each line, there will be a single or dual character mnemonic to the left of the numeric value. Each line of each indication display can be programmed to show mnemonics or a numeric value. The following list shows the single or dual character mnemonics that will be displayed when value is selected and the mnemonics for each programmable option.

VAL	MNE	DESCRIPTION
S1 99999	SETPT. 1	Speed or ratio setpoint 1
S2 99999	SETPT. 2	Speed or ratio setpoint 2
Sp 99999	SPEED	Actual speed in user display units (feedback)
R 1.999	RATIO	Actual ratio (follower mode)
%D 100.0	% DEV.	% deviation of actual speed from target speed
%O 100.0	% OUTPUT	Analog drive output- % of full scale voltage
FB 20972	FB. FREQ	Feedback frequency in pulses/sec (Hz.)
LD 12000	LD. FREQ	Lead frequency in pulses/sec (Hz.)
A1 99999	ALARM 1	Alarm 1 setpoint
A2 99999	ALARM 2	Alarm 2 setpoint
Tr 4095	TRIM	Error correction in bits (-4095 to +4095)

### STATUS DISPLAYS

#### Operating Status:

Setpoint 1, ramp rate 1, Stop mode

#### Alarm Output Status:

Alarm 1 active, alarm 2 inactive

#### Operating Status:

The operating status display indicates the currently active speed or ratio setpoint (S1 or S2), the currently active ramp rate (R1 or R2), and the mode of operation (RUN, STP, or JOG). An arrow will replace the "R" for the currently active ramp rate indication when an actual ramp up or down is in progress.

#### Alarm Status:

The alarm status display indicates that an alarm output is active when the corresponding output number (1 or 2) is displayed. When an alarm output is inactive, a dash is displayed.

## OPERATOR ACCESS

This is used with the program disable DIP switch or an external user input that is selected for the program disable function. When a setpoint is selected as NO, it can be viewed, but NOT changed from the front panel keypad. The following setpoint values can be disabled from front panel access programming:

Speed/Ratio Setpoint 1 and 2	Jog Speed
Ramp Rate 1 and 2	Jog Ramp
Alarm Setpoint 1 and 2	Gain
Setpoint Scroll Menu	

## USER SETTINGS

The operator can reset ALL parameters to the factory settings if desired.

## PROGRAM DIAGNOSTICS

This allows testing of the various MDC inputs and outputs. It is especially useful after unit installation to independently test the operation of external switches, relays, the feedback transducer, and the motor drive system.

**Inputs** - The MDC displays an alphanumeric character to indicate a Dedicated Function Input or a User Input is active. This allows the user to check switch operation and wiring connections to the Inputs.

**Alarm Outputs** - The up and down arrow keys are used to select an alarm output and set it to the active or inactive state. This allows the user to check the operation of devices wired to the alarm outputs and the wiring connections.

**Drive Output** - This function allows the user to test the Drive System. A % Output value is entered through the front panel keypad causing the motor to run at the corresponding open loop speed. The display indicates the motor's feedback frequency.

## PROGRAM SECURITY

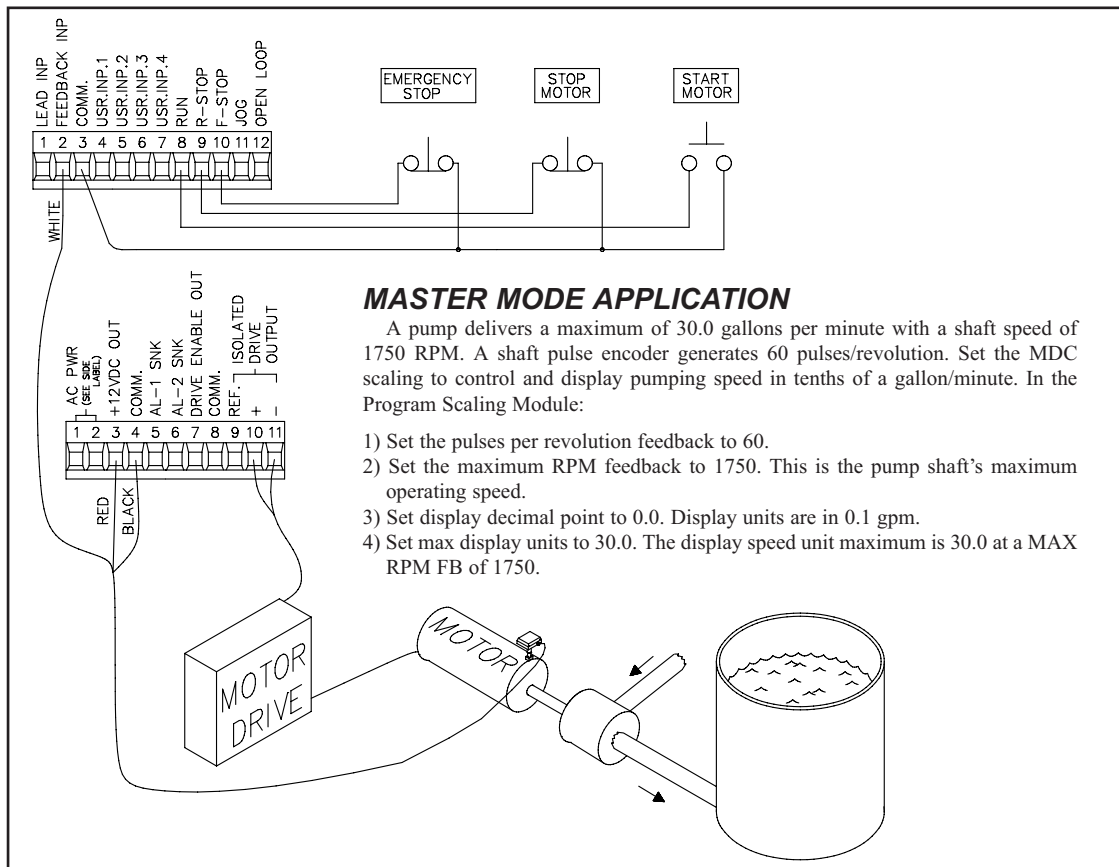
The programmable code number is used in conjunction with the program disable DIP switch and/or a user input programmed for the program disable function to limit operator access to programming.

## FOLLOWER MODE APPLICATION

A fertilizer production facility is mixing pellets containing Nitrogen with pellets that contain Phosphorus. A chemical ratio of 1:1 is determined by the speed of two different conveyors. Because of differences in the gearing of the conveyor and concentration of the pellets, the Nitrogen conveyor motor must run at 3 times the speed of the Phosphorus conveyor motor in order to produce a 1:1 mixture. The maximum speed of both motors is 2000 RPM. Set the follower MDC scaling to produce a 1:1 mixture of Nitrogen and Phosphorus when a setpoint of 1.0000 is entered. Display speed units are in RPM's. Both the lead and feedback frequency are taken from 60 tooth gears on each motor shaft.

- 1) Choose the Phosphorus conveyor motor for the follower MDC. It runs slower than the Nitrogen conveyor motor.
- 2) Set the Pulses per revolution feedback to 60.
- 3) Set the MAX RPM feedback to 2000. This is the conveyor motor's maximum operating speed.
- 4) Set display decimal point to 0.
- 5) Set display unit to 2000. The display speed unit maximum is 2000 at a MAX RPM FB of 2000. If the display units wanted were conveyor feet/minute or Phosphorus pellets in lbs/sec, the equivalent display value for 2000 RPM would be entered.
- 6) Set the pulses per revolution lead to 60.
- 7) Setting the MAX RPM Lead:

This is the Lead RPM that would be necessary to have a 1:1 mixture if the Follower Speed was MAX RPM FB (2000 RPM). Since the Nitrogen conveyor motor must run 3 times as fast as the Phosphorus motor, MAX RPM LD =  $3 * 2000 = 6000$  RPM. Set MAX RPM LD = 6000 RPM. This is the correct value, even though the Nitrogen conveyor motor would never actually run at 6000 RPM. A ratio setpoint of 1.0000 on the MDC is now equal to a 1:1 mixture of Phosphorus and Nitrogen.



## MASTER MODE APPLICATION

A pump delivers a maximum of 30.0 gallons per minute with a shaft speed of 1750 RPM. A shaft pulse encoder generates 60 pulses/revolution. Set the MDC scaling to control and display pumping speed in tenths of a gallon/minute. In the Program Scaling Module:

- 1) Set the pulses per revolution feedback to 60.
- 2) Set the maximum RPM feedback to 1750. This is the pump shaft's maximum operating speed.
- 3) Set display decimal point to 0.0. Display units are in 0.1 gpm.
- 4) Set max display units to 30.0. The display speed unit maximum is 30.0 at a MAX RPM FB of 1750.

## ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBERS
MDC	Motor Drive Controller with Red Backlighting	115/230VAC MDC00100

## MODEL PAX - 1/8 DIN DIGITAL INPUT PANEL METERS



- COUNT, DUAL COUNTER, RATE AND SLAVE DISPLAY
- 0.56" RED SUNLIGHT READABLE DISPLAY
- VARIABLE INTENSITY DISPLAY
- 10 POINT SCALING FOR NON-LINEAR PROCESSES (PAXI)
- FOUR SETPOINT ALARM OUTPUTS (W/Option Card)
- RETRANSMITTED ANALOG OUTPUT (W/Option Card) (PAXI)
- COMMUNICATION AND BUS CAPABILITIES (W/Option Card) (PAXI)
- BUS CAPABILITIES; DEVICENET, MODBUS, AND PROFIBUS-DP
- CRIMSON PROGRAMMING SOFTWARE (PAXI)
- ETHERNET(W/ External Gateway) (PAXI)
- NEMA 4X/IP65 SEALED FRONT BEZEL



### GENERAL DESCRIPTION

The PAX Digital Input Panel Meters offer many features and performance capabilities to suit a wide range of industrial applications. Available in three different models, PAXC Counter/Dual Counter, PAXR Rate Meter and the PAXI which offers both counting and rate in the same package. Refer to pages 4 - 5 for the details on the specific models. The PAXC and PAXR offer only the Setpoint Option, while the PAXI is the fully featured version offering all the capabilities as outlined in this bulletin as well as a slave display feature. The optional plug-in output cards allow the opportunity to configure the meter for present applications, while providing easy upgrades for future needs.

The meters employ a bright 0.56" LED display. The meters are available with a red sunlight readable or standard green LED display. The intensity of the display can be adjusted from dark room applications up to sunlight readable, making it ideal for viewing in bright light applications.

The meters accept digital inputs from a variety of sources including switch contacts, outputs from CMOS or TTL circuits, magnetic pickups and all standard RLC sensors. The meter can accept directional, uni-directional or Quadrature signals simultaneously. The maximum input signal varies up to 34 KHz depending on the count mode and function configurations programmed. Each input signal can be independently scaled to various process values.

The Rate Meters provide a MAX and MIN reading memory with programmable capture time. The capture time is used to prevent detection of false max or min readings which may occur during start-up or unusual process events.

The meters have four setpoint outputs, implemented on Plug-in option cards. The Plug-in cards provide dual FORM-C relays (5A), quad FORM-A (3A), or either quad sinking or quad sourcing open collector logic outputs. The setpoint alarms can be configured to suit a variety of control and alarm requirements.

Communication and Bus Capabilities are also available as option cards for the PAXI only. These include RS232, RS485, Modbus, DeviceNet, and Profibus-DP. Readout values and setpoint alarm values can be controlled

through the bus. Additionally, the meters have a feature that allows a remote computer to directly control the outputs of the meter. With an RS232 or RS485 card installed, it is possible to configure the meter using Red Lion's Crimson software. The configuration data can be saved to a file for later recall.

A linear DC output signal is available as an optional Plug-in card for the PAXI only. The card provides either 20 mA or 10 V signals. The output can be scaled independent of the input range and can track any of the counter or rate displays.

Once the meters have been initially configured, the parameter list may be locked out from further modification in its entirety or only the setpoint values can be made accessible.

The meters have been specifically designed for harsh industrial environments. With NEMA 4X/IP65 sealed bezel and extensive testing of noise effects to CE requirements, the meter provides a tough yet reliable application solution.

### SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in this literature or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Do not use this meter to directly command motors, valves, or other actuators not equipped with safeguards. To do so can be potentially harmful to persons or equipment in the event of a fault to the meter.



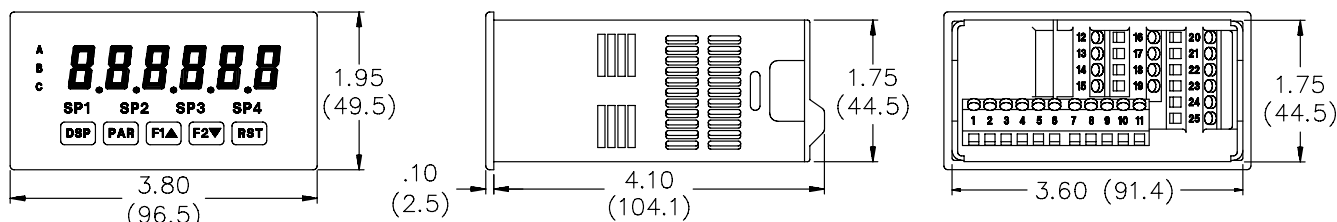
**CAUTION: Risk of Danger.**  
Read complete instructions prior to installation and operation of the unit.



**CAUTION: Risk of electric shock.**

### DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1" (53.4) H x 5" (127) W.

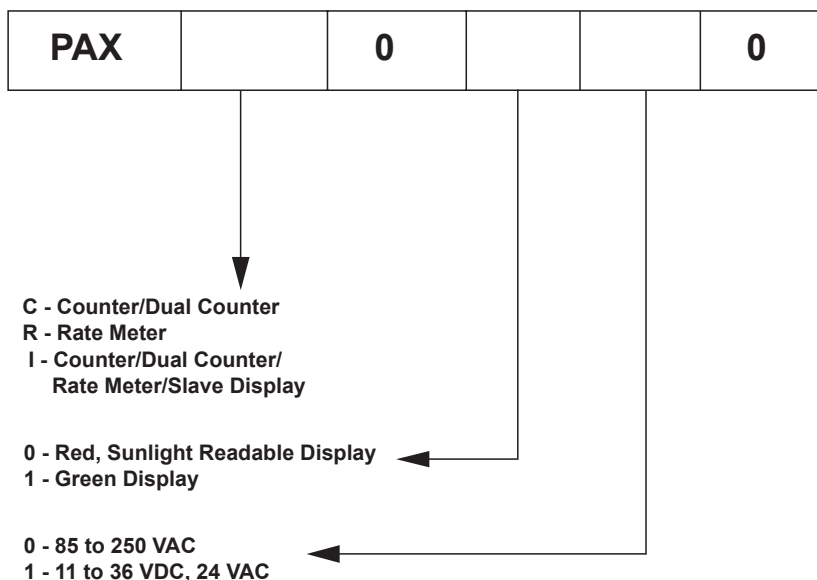


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## ORDERING INFORMATION

### Meter Part Numbers



### Option Card and Accessories Part Numbers

TYPE	MODEL NO.	DESCRIPTION	PART NUMBERS
Optional Plug-In Cards	PAXCDS	Dual Setpoint Relay Output Card	PAXCDS10
		Quad Setpoint Relay Output Card	PAXCDS20
		Quad Setpoint Sinking Open Collector Output Card	PAXCDS30
		Quad Setpoint Sourcing Open Collector Output Card	PAXCDS40
	PAXCDC	RS485 Serial Communications Card with Terminal Block	PAXCDC10
		Extended RS485 Serial Communications Card with Dual RJ11 Connector	PAXCDC1C
		RS232 Serial Communications Card with Terminal Block	PAXCDC20
		Extended RS232 Serial Communications Card with 9 Pin D Connector	PAXCDC2C
		DeviceNet Communications Card	PAXCDC30
		Modbus Communications Card	PAXCDC40
		Extended Modbus Communications Card with Dual RJ11 Connector	PAXCDC4C
		Profibus-DP Communications Card	PAXCDC50
		Analog Output Card	PAXCDL10
Accessories	SFCRD*	Crimson 2 PC Configuration Software for Windows 98, ME, 2000 and XP	SFCRD200
	ICM8	Communication Gateway	ICM80000

\*Crimson software is available for free download from <http://www.redlion.net/>

Shaded areas are only available for the PAXI

# GENERAL METER SPECIFICATIONS

1. **DISPLAY:** 6 digit, 0.56" (14.2 mm) red sunlight readable or standard green LED
2. **POWER:**
  - AC Versions:
    - AC Power: 85 to 250 VAC, 50/60 Hz, 18 VA
    - Isolation: 2300 Vrms for 1 min. to all inputs and outputs. (300 V working)
  - DC Versions:
    - DC Power: 11 to 36 VDC, 14 W
    - (derate operating temperature to 40° C if operating <15 VDC and three plug-in option cards are installed)
    - AC Power: 24 VAC,  $\pm 10\%$ , 50/60 Hz, 15 VA
    - Isolation: 500 Vrms for 1 min. to all inputs and outputs (50 V working).
3. **SENSOR POWER:** 12 VDC,  $\pm 10\%$ , 100 mA max. Short circuit protected
4. **KEYPAD:** 3 programmable function keys, 5 keys total
5. **USER INPUTS:** Three programmable user inputs
  - Max. Continuous Input: 30 VDC
  - Isolation To Sensor Input Commons: Not isolated
  - Logic State: Jumper selectable for sink/source logic

INPUT STATE	SINKING INPUTS 5.1 K $\Omega$ pull-up to +12 V	SOURCING INPUTS 5.1 K $\Omega$ pull-down
Active	$V_{IN} < 0.9$ VDC	$V_{IN} > 3.6$ VDC
Inactive	$V_{IN} > 3.6$ VDC	$V_{IN} < 0.9$ VDC

Response Time: 6 msec. typical; function dependent. Certain resets, stores and inhibits respond within 25  $\mu$ sec if an edge occurs with the associated counter or within 6 msec if no count edge occurs with the associated counter. These functions include **Enter**, **Store**, **Hold**, **Release**, **Input**, **Set**, and **Pres**. Once activated, all functions are latched for 50 msec min. to 100 msec max. After that period, another edge/level may be recognized.

6. **MEMORY:** Nonvolatile E<sup>2</sup>PROM retains all programmable parameters and display values.
7. **CERTIFICATIONS AND COMPLIANCES:**
  - SAFETY**
    - UL Recognized Component, File #E179259, UL61010A-1, CSA C22.2 No. 1010-1
    - Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
    - UL Listed, File #E137808, UL508, CSA C22.2 No. 14-M95
    - LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
    - Type 4X Enclosure rating (Face only), UL50
    - IECEE CB Scheme Test Certificate #US/8843/UL
    - CB Scheme Test Report #04ME11209-20041018
    - Issued by Underwriters Laboratories, Inc.
    - IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
    - IP65 Enclosure rating (Face only), IEC 529
    - IP20 Enclosure rating (Rear of unit), IEC 529

## ELECTROMAGNETIC COMPATIBILITY

### Immunity to EN 50082-2

Electrostatic discharge	EN 61000-4-2	Level 2; 4 Kv contact Level 3; 8 Kv air
Electromagnetic RF fields	EN 61000-4-3	Level 3; 10 V/m 80 MHz - 1 GHz
Fast transients (burst)	EN 61000-4-4	Level 4; 2 Kv I/O Level 3; 2 Kv power
RF conducted interference	EN 61000-4-6	Level 3; 10 V/rms 150 KHz - 80 MHz
Simulation of cordless telephones	ENV 50204	Level 3; 10 V/m 900 MHz $\pm 5$ MHz 200 Hz, 50% duty cycle

### Emissions to EN 50081-2

RF interference	EN 55011	Enclosure class A Power mains class A
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#### Note:

Refer to EMC Installation Guidelines section of the bulletin for additional information.

### 8. ENVIRONMENTAL CONDITIONS:

Operating Temperature Range: 0 to 50°C (0 to 45°C with all three plug-in cards installed)

Storage Temperature Range: -40 to 60°C

Operating and Storage Humidity: 0 to 85% max. relative humidity non-condensing

Altitude: Up to 2000 meters

### 9. CONNECTIONS: High compression cage-clamp terminal block

Wire Strip Length: 0.3" (7.5 mm)

Wire Gauge: 30-14 AWG copper wire

Torque: 4.5 inch-lbs (0.51 N-m) max.

### 10. CONSTRUCTION: This unit is rated for NEMA 4X/IP65 outdoor use. IP20 Touch safe. Installation Category II, Pollution Degree 2. One piece bezel/case. Flame resistant. Synthetic rubber keypad. Panel gasket and mounting clip included.

### 11. WEIGHT: 10.1 oz. (286 g)

# MODEL PAXC - 1/8 DIN COUNTER

- 6-DIGIT LED DISPLAY (Alternating 8 digits for counting)
- DUAL COUNT QUAD INPUTS
- UP TO 3 COUNT DISPLAYS
- SETPOINT ALARM OUTPUTS (W/Plug-in card)

## PAXC SPECIFICATIONS

### MAXIMUM SIGNAL FREQUENCIES:

To determine the maximum frequency for the input(s), first answer the questions with a yes (Y) or no (N). Next determine the Count Mode to be used for the counter(s). If dual counters are used with different Count Modes, then the lowest frequency applies to both counters.

FUNCTION QUESTIONS	Single: Counter A or B				Dual: Counter A & B			
Are any setpoints used?	N	N	Y	Y	N	N	Y	Y
Is Counter C used?	N	Y	N	Y	N	Y	N	Y
COUNT MODE	(Values are in KHz)				(Values are in KHz)			
Count x1	34	25	18	15	13	12	9	7.5
Count x2	17	13	9	7	9	7	5	4
Quadrature x1	22	19	12	10	7	6	4	3.5
Quadrature x2	17	13	9	7	7	6	4	3.5
Quadrature x4	8	6	4	3				

### Notes:

1. Counter Modes are explained in the Module 1 programming section.
2. Listed values are with frequency DIP switch set on HI frequency.

### ANNUNCIATORS:

- A - Counter A
- B - Counter B
- C - Counter C
- BF - Upper significant digit display of counter
- SP1 - setpoint 1 output state
- SP2 - setpoint 2 output state
- SP3 - setpoint 3 output state
- SP4 - setpoint 4 output state

### COUNTER DISPLAYS:

Maximum display: 8 digits:  $\pm 99999999$  (greater than 6 digits display Alternates between high order and low order.)

### INPUTS A and B:

DIP switch selectable to accept pulses from a variety of sources including switch contacts, TTL outputs, magnetic pickups and all standard RLC sensors.

LOGIC: Input trigger levels  $V_{IL} = 1.5 \text{ V max.}$ ;  $V_{IH} = 3.75 \text{ V min.}$

Current sinking: Internal  $7.8 \text{ K}\Omega$  pull-up to +12 VDC,  $I_{MAX} = 1.9 \text{ mA.}$

Current sourcing: Internal  $3.9 \text{ K}\Omega$  pull-down,  $7.3 \text{ mA max. @ 28 VDC,}$   
 $V_{MAX} = 30 \text{ VDC.}$

Filter: Damping capacitor provided for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec. minimum.

### DUAL COUNT MODES:

When any dual count mode is used, then User Inputs 1 and/or 2 will accept the second signal of each signal pair. The user inputs do not have the Logic/Mag, HI/LO Freq, and Sink/Source input setup switches. The user inputs are inherently a logic input with no low frequency filtering. Any mechanical contacts used for these inputs in a dual count mode must be debounced externally. The user input may only be selected for sink/source by the User Jumper placement.

# MODEL PAXR - 1/8 DIN RATE METER

- 5-DIGIT LED DISPLAY
- RATE INDICATION
- MINIMUM/MAXIMUM RATE DISPLAYS
- SETPOINT ALARM OUTPUTS (W/Plug-in card)

## PAXR SPECIFICATIONS

### ANNUNCIATORS:

- r - Rate
- H - Maximum (High) Rate
- L - Minimum (Low) Rate
- SP1 - setpoint 1 output state
- SP2 - setpoint 2 output state
- SP3 - setpoint 3 output state
- SP4 - setpoint 4 output state

### RATE DISPLAY:

Accuracy:  $\pm 0.01\%$   
 Minimum Frequency: 0.01 Hz  
 Maximum Frequency: 34 KHz  
 Maximum Display: 5 Digits: 99999  
 Adjustable Display (low) Update: 0.1 to 99.9 seconds  
 Over Range Display: "r **OL OL**"

### INPUT A:

DIP switch selectable to accept pulses from a variety of sources including TTL outputs, magnetic pickups and all standard RLC sensors.

LOGIC: Input trigger levels  $V_{IL} = 1.5 \text{ V max.}$ ;  $V_{IH} = 3.75 \text{ V min.}$

Current sinking: Internal  $7.8 \text{ K}\Omega$  pull-up to +12 VDC,  $I_{MAX} = 1.9 \text{ mA.}$

Current sourcing: Internal  $3.9 \text{ K}\Omega$  pull-down,  $7.3 \text{ mA max. @ 28 VDC,}$   
 $V_{MAX} = 30 \text{ VDC.}$

### MAGNETIC PICKUP:

Sensitivity: 200 mV peak  
 Hysteresis: 100 mV  
 Input impedance:  $3.9 \text{ K}\Omega @ 60 \text{ Hz}$   
 Maximum input voltage:  $\pm 40 \text{ V peak, } 30 \text{ Vrms}$



# MODEL PAXI - 1/8 DIN COUNTER/RATE METER

- COUNT, RATE AND SLAVE DISPLAY
- 6-DIGIT 0.56" RED SUNLIGHT READABLE DISPLAY
- VARIABLE INTENSITY DISPLAY
- 10 POINT SCALING (FOR NON-LINEAR PROCESSES)
- FOUR SETPOINT ALARM OUTPUTS (W/OPTION CARD)
- RETRANSMITTED ANALOG OUTPUT (W/OPTION CARD)
- COMMUNICATION AND BUS CAPABILITIES (W/OPTION CARD)
- BUS CAPABILITIES; DEVICENET, MODBUS, AND PROFIBUS-DP
- CRIMSON PROGRAMMING SOFTWARE

## PAXI SPECIFICATIONS

### MAXIMUM SIGNAL FREQUENCIES TABLE

To determine the maximum frequency for the input(s), first answer the questions with a yes (Y) or no (N). Next determine the Count Mode to be used for the counter(s). If dual counters are used with different Count Modes, then the lowest frequency applies to both counters.

FUNCTION QUESTIONS	Single: Counter A or B (with/without rate) or Rate only								Dual: Counter A & B or Rate not assigned to active single counter							
Are any setpoints used?	N	N	N	N	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y
Is Prescaler Output used?	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y
Is Counter C used?	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
COUNT MODE	(Values are in KHz)				(Values are in KHz)				(Values are in KHz)				(Values are in KHz)			
Count x1	34	25	21	17	18	15	13	11	13	12	13	11	9	7.5	9	7
Count x2	17	13	16	12	9	7	8	7	9 *	7 *	9 *	7 *	5 *	4 *	5 *	4 *
Quadrature x1	22	19	20	17	12	10	11	10	7 *	6 *	6 *	5 *	4 *	3.5 *	3.5 *	3 *
Quadrature x2	17	13	16	12	9	7	8	6	7 *	6 *	6 *	5 *	4 *	3.5 *	3.5 *	3 *
Quadrature x4	8	6	8	6	4	3	4	3								
Rate Only	34	N/A	21	N/A	34	N/A	21	N/A								

### Notes:

1. Counter Modes are explained in the Module 1 programming section.
2. If using Rate with single counter with direction or quadrature, assign it to Input A for the listed frequency.
3. \* Double the listed value for Rate frequency.
4. Listed values are with frequency DIP switch set on HI frequency.
5. Derate listed frequencies by 20% during serial communications. (Placing a 5 msec. delay between serial characters will eliminate the derating.)

### ANNUNCIATORS:

- A - Counter A
- B - Counter B
- C - Counter C
- r** - Rate
- H** - Maximum (High) Rate
- L** - Minimum (Low) Rate
- BF** - Upper significant digit display of counter
- SP1 - setpoint 1 output state
- SP2 - setpoint 2 output state
- SP3 - setpoint 3 output state
- SP4 - setpoint 4 output state

### RATE DISPLAY:

- Accuracy:  $\pm 0.01\%$
- Minimum Frequency: 0.01 Hz
- Maximum Frequency: see Max Signal Frequencies Table.
- Maximum Display: 5 Digits: 99999
- Adjustable Display (low) Update: 0.1 to 99.9 seconds
- Over Range Display: "**r BLBL**"

### COUNTER DISPLAYS:

- Maximum display: 8 digits:  $\pm 99999999$  (greater than 6 digits display
- Alternates between high order and low order.)

### INPUTS A and B:

DIP switch selectable to accept pulses from a variety of sources including switch contacts, TTL outputs, magnetic pickups and all standard RLC sensors.

LOGIC: Input trigger levels  $V_{IL} = 1.5$  V max.;  $V_{IH} = 3.75$  V min.

Current sinking: Internal 7.8 K $\Omega$  pull-up to +12 VDC,  $I_{MAX} = 1.9$  mA.

Current sourcing: Internal 3.9 K $\Omega$  pull-down, 7.3 mA max. @ 28 VDC,  $V_{MAX} = 30$  VDC.

Filter: Damping capacitor provided for switch contact bounce. Limits input frequency to 50 Hz and input pulse widths to 10 msec. minimum.

### MAGNETIC PICKUP:

Sensitivity: 200 mV peak

Hysteresis: 100 mV

Input impedance: 3.9 K $\Omega$  @ 60 Hz

Maximum input voltage:  $\pm 40$  V peak, 30 Vrms

### DUAL COUNT MODES:

When any dual count mode is used, then User Inputs 1 and/or 2 will accept the second signal of each signal pair. The user inputs do not have the Logic/Mag, HI/LO Freq, and Sink/Source input setup switches. The user inputs are inherently a logic input with no low frequency filtering. Any mechanical contacts used for these inputs in a dual count mode must be debounced externally. The user input may only be selected for sink/source by the User Jumper placement.

### PRESCALER OUTPUT:

NPN Open Collector:  $I_{SNK} = 100$  mA max. @  $V_{OL} = 1$  VDC max.  $V_{OH} = 30$  VDC max. With duty cycle of 25% min. and 50 % max.

# OPTIONAL PLUG-IN OUTPUT CARDS



**WARNING: Disconnect all power to the unit before installing Plug-in cards.**

## Adding Option Cards

The PAX and MPAX series meters can be fitted with up to three optional plug-in cards. The details for each plug-in card can be reviewed in the specification section below. Only one card from each function type can be installed at one time. The function types include Setpoint Alarms (PAXCDS), Communications (PAXCDC), and Analog Output (PAXCDL). The plug-in cards can be installed initially or at a later date.

## PAXI COMMUNICATION CARDS (PAXCDC)

A variety of communication protocols are available for the PAX and MPAX series. Only one of these cards can be installed at a time. When programming the unit via Crimson, a Windows® based program, the RS232 or RS485 Cards must be used.

PAXCDC10 - RS485 Serial (Terminal)    PAXCDC30 - DeviceNet  
PAXCDC1C - RS485 Serial (Connector)    PAXCDC40 - Modbus (Terminal)  
PAXCDC20 - RS232 Serial (Terminal)    PAXCDC4C - Modbus (Connector)  
PAXCDC2C - RS232 Serial (Connector)    PAXCDC50 - Profibus-DP

### SERIAL COMMUNICATIONS CARD

**Type:** RS485 or RS232  
**Isolation To Sensor & User Input Commons:** 500 Vrms for 1 min.  
Working Voltage: 50 V. Not Isolated from all other commons.  
**Data:** 7/8 bits  
**Baud:** 300 to 19,200  
**Parity:** no, odd or even  
**Bus Address:** Selectable 0 to 99, Max. 32 meters per line (RS485)  
**Transmit Delay:** Selectable for 2 to 50 msec or 50 to 100 msec (RS485)

### DEVICENET™ CARD

**Compatibility:** Group 2 Server Only, not UCMM capable  
**Baud Rates:** 12.5 Kbaud, 250 Kbaud, and 500 Kbaud  
**Bus Interface:** Phillips 82C250 or equivalent with MIS wiring protection per DeviceNet™ Volume I Section 10.2.2.  
**Node Isolation:** Bus powered, isolated node  
**Host Isolation:** 500 Vrms for 1 minute (50 V working) between DeviceNet™ and meter input common.

### MODBUS CARD

**Type:** RS485; RTU and ASCII MODBUS modes  
**Isolation To Sensor & User Input Commons:** 500 Vrms for 1 minute.  
Working Voltage: 50 V. Not isolated from all other commons.  
**Baud Rates:** 300 to 38400.  
**Data:** 7/8 bits  
**Parity:** No, Odd, or Even  
**Addresses:** 1 to 247.  
**Transmit Delay:** Programmable; See Transmit Delay explanation.

### PROFIBUS-DP CARD

**Fieldbus Type:** Profibus-DP as per EN 50170, implemented with Siemens SPC3 ASIC  
**Conformance:** PNO Certified Profibus-DP Slave Device  
**Baud Rates:** Automatic baud rate detection in the range 9.6 Kbaud to 12 Mbaud  
**Station Address:** 0 to 126, set by the master over the network. Address stored in non-volatile memory.  
**Connection:** 9-pin Female D-Sub connector  
**Network Isolation:** 500 Vrms for 1 minute (50 V working) between Profibus network and sensor and user input commons. Not isolated from all other commons.

## PROGRAMMING SOFTWARE

Crimson is a Windows® based program that allows configuration of the PAX meter from a PC. Crimson offers standard drop-down menu commands, that make it easy to program the PAX meter. The PAX program can then be saved in a PC file for future use. A PAX serial plug-in card is required to program the meter using the software.

## SETPOINT CARDS (PAXCDS)

The PAX and MPAX series has 4 available setpoint alarm output plug-in cards. Only one of these cards can be installed at a time. (Logic state of the outputs can be reversed in the programming.) These plug-in cards include:

PAXCDS10 - Dual Relay, FORM-C, Normally open & closed  
PAXCDS20 - Quad Relay, FORM-A, Normally open only  
PAXCDS30 - Isolated quad sinking NPN open collector  
PAXCDS40 - Isolated quad sourcing PNP open collector

### DUAL RELAY CARD

**Type:** Two FORM-C relays  
**Isolation To Sensor & User Input Commons:** 2000 Vrms for 1 min.  
Working Voltage: 240 Vrms  
**Contact Rating:**  
One Relay Energized: 5 amps @ 120/240 VAC or 28 VDC (resistive load), 1/8 HP @120 VAC, inductive load  
Total current with both relays energized not to exceed 5 amps  
**Life Expectancy:** 100 K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads  
**Response Time:** 5 msec. nominal with 3 msec. nominal release  
**Time Accuracy:** Counter =  $\pm 0.01\% + 10$  msec.  
Rate =  $\pm 0.01\% + 20$  msec.

### QUAD RELAY CARD

**Type:** Four FORM-A relays  
**Isolation To Sensor & User Input Commons:** 2300 Vrms for 1 min.  
Working Voltage: 250 Vrms  
**Contact Rating:**  
One Relay Energized: 3 amps @ 250 VAC or 30 VDC (resistive load), 1/10 HP @120 VAC, inductive load  
Total current with all four relays energized not to exceed 4 amps  
**Life Expectancy:** 100K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads  
**Response Time:** 5 msec. nominal with 3 msec. nominal release  
**Time Accuracy:** Counter =  $\pm 0.01\% + 10$  msec.  
Rate =  $\pm 0.01\% + 20$  msec.

### QUAD SINKING OPEN COLLECTOR CARD

**Type:** Four isolated sinking NPN transistors.  
**Isolation To Sensor & User Input Commons:** 500 Vrms for 1 min.  
Working Voltage: 50 V. Not Isolated from all other commons.  
**Rating:** 100 mA max @  $V_{SAT} = 0.7$  V max.  $V_{MAX} = 30$  V  
**Response Time:** Counter = 25  $\mu$ sec; Rate = Low Update time  
**Time Accuracy:** Counter =  $\pm 0.01\% + 10$  msec.  
Rate =  $\pm 0.01\% + 20$  msec.

### QUAD SOURCING OPEN COLLECTOR CARD

**Type:** Four isolated sourcing PNP transistors.  
**Isolation To Sensor & User Input Commons:** 500 Vrms for 1 min.  
Working Voltage: 50 V. Not Isolated from all other commons.  
**Rating:** Internal supply: 24 VDC  $\pm 10\%$ , 30 mA max. total  
External supply: 30 VDC max., 100 mA max. each output  
**Response Time:** Counter = 25  $\mu$ sec; Rate = Low Update time  
**Time Accuracy:** Counter =  $\pm 0.01\% + 10$  msec.  
Rate =  $\pm 0.01\% + 20$  msec.

## PAXI LINEAR DC OUTPUT (PAXCDL)

Either a 0(4)-20 mA or 0-10 V retransmitted linear DC output is available from the analog output plug-in card. The programmable output low and high scaling can be based on various display values. Reverse slope output is possible by reversing the scaling point positions.

PAXCDL10 - Retransmitted Analog Output Card

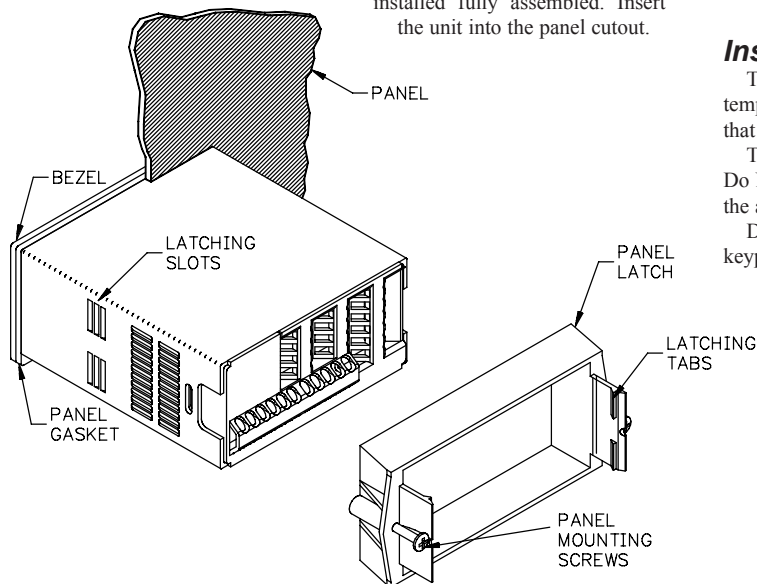
### ANALOG OUTPUT CARD

**Types:** 0 to 20 mA, 4 to 20 mA or 0 to 10 VDC  
**Isolation To Sensor & User Input Commons:** 500 Vrms for 1 min.  
Working Voltage: 50 V. Not Isolated from all other commons.  
**Accuracy:** 0.17% of FS (18 to 28°C); 0.4% of FS (0 to 50°C)  
**Resolution:** 1/3500  
**Compliance:** 10 VDC: 10 K $\Omega$  load min., 20 mA: 500  $\Omega$  load max.  
**Response Time:** 50 msec. max., 10 msec. typ.

# 1.0 INSTALLING THE METER

## Installation

The PAX meets NEMA 4X/IP65 requirements when properly installed. The unit is intended to be mounted into an enclosed panel. Prepare the panel cutout to the dimensions shown. Remove the panel latch from the unit. Slide the panel gasket over the rear of the unit to the back of the bezel. The unit should be installed fully assembled. Insert the unit into the panel cutout.



While holding the unit in place, push the panel latch over the rear of the unit so that the tabs of the panel latch engage in the slots on the case. The panel latch should be engaged in the farthest forward slot possible. To achieve a proper seal, tighten the latch screws evenly until the unit is snug in the panel (Torque to approximately 7 in-lbs [79N-cm]). Do not over-tighten the screws.

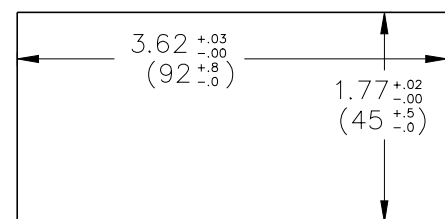
## Installation Environment

The unit should be installed in a location that does not exceed the operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

The bezel should only be cleaned with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

PANEL CUT-OUT



# 2.0 SETTING THE JUMPER AND DIP SWITCHES

To access the jumper and switches, remove the meter base from the meter case by firmly squeezing and pulling back on the side rear finger tabs. This should lower the latch below the case slot (which is located just in front of the finger tabs). It is recommended to release the latch on one side, then start the other side latch.

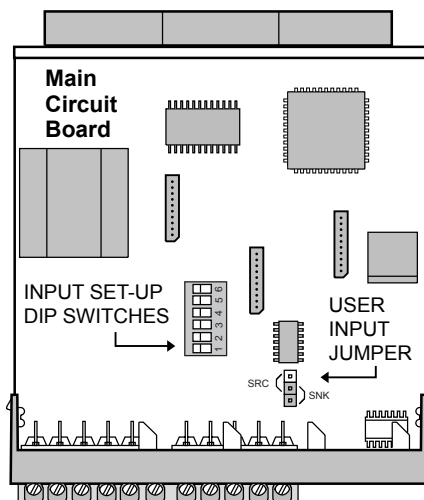


**Warning:** Exposed line voltage exists on the circuit boards. Remove all power to the meter and load circuits before accessing inside of the meter.

## 2.1 SETTING THE JUMPER

The meter has one jumper for user input logic. When using the user inputs this jumper must be set before applying power. The Main Circuit Board figure shows the location of the jumper and DIP switch.

The user input jumper determines signal logic for the user inputs, when they are used with user functions or for input signal direction. All user inputs are set by this jumper.



## 2.2 SETTING THE INPUT DIP SWITCHES

The meter has six DIP switches for Input A and Input B terminal set-up that must be set before applying power. NOTE: The PAXR only uses switches 1-3.

Input B LO Freq.	<input type="checkbox"/>	6	HI Freq.
Input B SRC.	<input type="checkbox"/>	5	SNK.
Input B MAG.	<input type="checkbox"/>	4	Logic
Input A LO Freq.	<input type="checkbox"/>	3	HI Freq.
Input A SRC.	<input type="checkbox"/>	2	SNK.
Input A MAG.	<input type="checkbox"/>	1	Logic
		ON	
■ Factory Setting			

### SWITCHES 3 and 6

**HI Frequency:** Removes damping capacitor and allows max. frequency.

**LO Frequency:** Adds a damping capacitor for switch contact bounce. Also limits input frequency to 50 Hz and input pulse widths to 10 msec.

### SWITCHES 2 and 5

**SRC.:** Adds internal 3.9 K $\Omega$  pull-down resistor, 7.3 mA max. @ 28 VDC, V<sub>MAX</sub> = 30 VDC.

**SNK.:** Adds internal 7.8 K $\Omega$  pull-up resistor to +12 VDC, I<sub>MAX</sub> = 1.9 mA.

### SWITCHES 1 and 4

**LOGIC:** Input trigger levels V<sub>IL</sub> = 1.5 V max.; V<sub>IH</sub> = 3.75 V min.

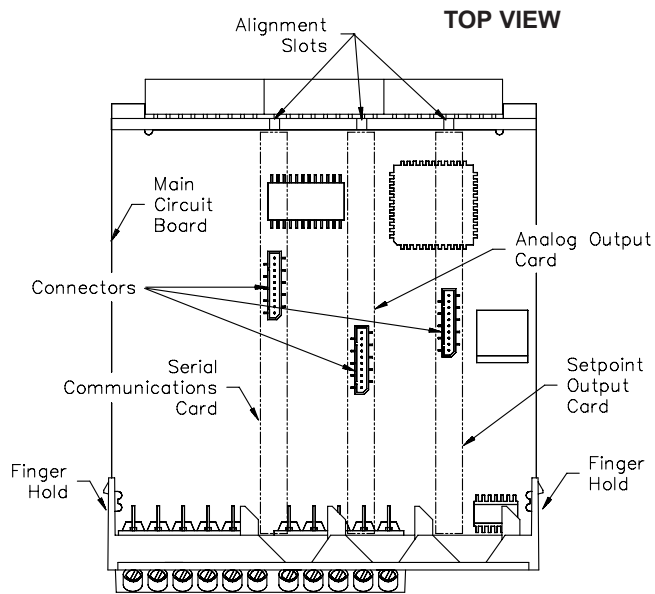
**MAG:** 200 mV peak input (must also have SRC on). Not recommended with counting applications.

## 3.0 INSTALLING PLUG-IN CARDS

The Plug-in cards are separately purchased optional cards that perform specific functions. These cards plug into the main circuit board of the meter. The Plug-in cards have many unique functions when used with the PAX. The literature that comes with these cards should be discarded, unless it specifically states in the Plug-in Card literature that the information applies to the PAX. *Note: The PAXC and PAXR only use the setpoint option card.*



**CAUTION:** The Plug-in card and main circuit board contain static sensitive components. Before handling the cards, discharge static charges from your body by touching a grounded bare metal object. Ideally, handle the cards at a static controlled clean workstation. Also, only handle the cards by the edges. Dirt, oil or other contaminants that may contact the cards can adversely affect circuit operation.

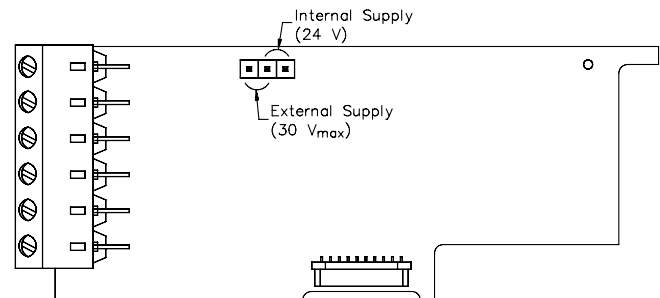


### To Install:

1. With the case open, locate the Plug-in card connector for the card type to be installed. The types are keyed by position with different main circuit board connector locations. When installing the card, hold the meter by the rear terminals and not by the front display board.\*
2. Install the Plug-in card by aligning the card terminals with the slot bay in the rear cover. Be sure the connector is fully engaged and the tab on the Plug-in card rests in the alignment slot on the display board.
3. Slide the meter base back into the case. Be sure the rear cover latches fully into the case.
4. Apply the Plug-in card label to the bottom side of the meter in the designated area. Do Not Cover the vents on the top surface of the meter. The surface of the case must be clean for the label to adhere properly.

### Quad Sourcing Open Collector Output Card Supply Select

\* If installing the Quad sourcing Plug-in Card (PAXCDS40), set the jumper for internal or external supply operation before continuing.



# 4.0 WIRING THE METER

## WIRING OVERVIEW

Electrical connections are made via screw-clamp terminals located on the back of the meter. All conductors should conform to the meter's voltage and current ratings. All cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that the power supplied to the meter (DC or AC) be protected by a fuse or circuit breaker.

When wiring the meter, compare the numbers embossed on the back of the meter case against those shown in wiring drawings for proper wire position. Strip the wire, leaving approximately 0.3" (7.5 mm) bare lead exposed (stranded wires should be tinned with solder.) Insert the lead under the correct screw-clamp terminal and tighten until the wire is secure. (Pull wire to verify tightness.) Each terminal can accept up to one #14 AWG (2.55 mm) wire, two #18 AWG (1.02 mm), or four #20 AWG (0.61 mm).

## EMC INSTALLATION GUIDELINES

Although this meter is designed with a high degree of immunity to Electro-Magnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the meter may be different for various installations. The meter becomes more immune to EMI with fewer I/O connections. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. The meter should be mounted in a metal enclosure, which is properly connected to protective earth.
2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
  - a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).

- b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
  - c. Connect the shield to common of the meter and leave the other end of the shield unconnected and insulated from earth ground.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be ran in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
  4. Signal or Control cables within an enclosure should be routed as far as possible from contactors, control relays, transformers, and other noisy components.
  5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

Ferrite Suppression Cores for signal and control cables:

Fair-Rite # 0443167251 (RLC# FCOR0000)

TDK # ZCAT3035-1330A

Steward # 28B2029-0A0

Line Filters for input power cables:

Schaffner # FN610-1/07 (RLC# LFIL0000)

Schaffner # FN670-1.8/07

Corcom # 1 VR3

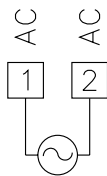
*Note: Reference manufacturer's instructions when installing a line filter.*

6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
7. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.  
Snubber: RLC# SNUB0000.

## 4.1 POWER WIRING

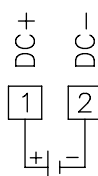
### AC Power

Terminal 1: VAC  
Terminal 2: VAC



### DC Power

Terminal 1: +VDC  
Terminal 2: -VDC



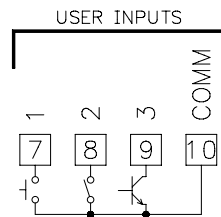
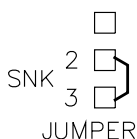
## 4.2 USER INPUT WIRING

Before connecting the wires, the User Input Logic Jumper should be verified for proper position. If User Input 1 and/or 2 are wired for quadrature or directional counting, an additional switching device should not be connected to that User Input terminal. Only the appropriate User Input terminal has to be wired.

### Sinking Logic

Terminals 7-9 } Connect external switching device between the  
Terminal 10 } appropriate User Input terminal and User Comm.

The user inputs of the meter are internally pulled up to +12 V with 5.1 K resistance. The input is active when it is pulled low (<0.9 V).

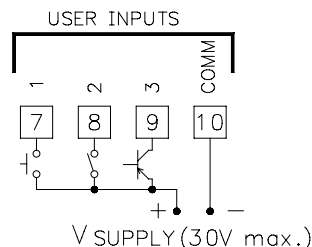
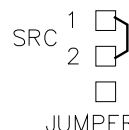


### Sourcing Logic

Terminals 7-9:  
+ VDC through external switching device

Terminal 10:  
-VDC through external switching device

The user inputs of the meter are internally pulled down to 0 V with 5.1 K resistance. The input is active when a voltage greater than 3.6 VDC is applied.

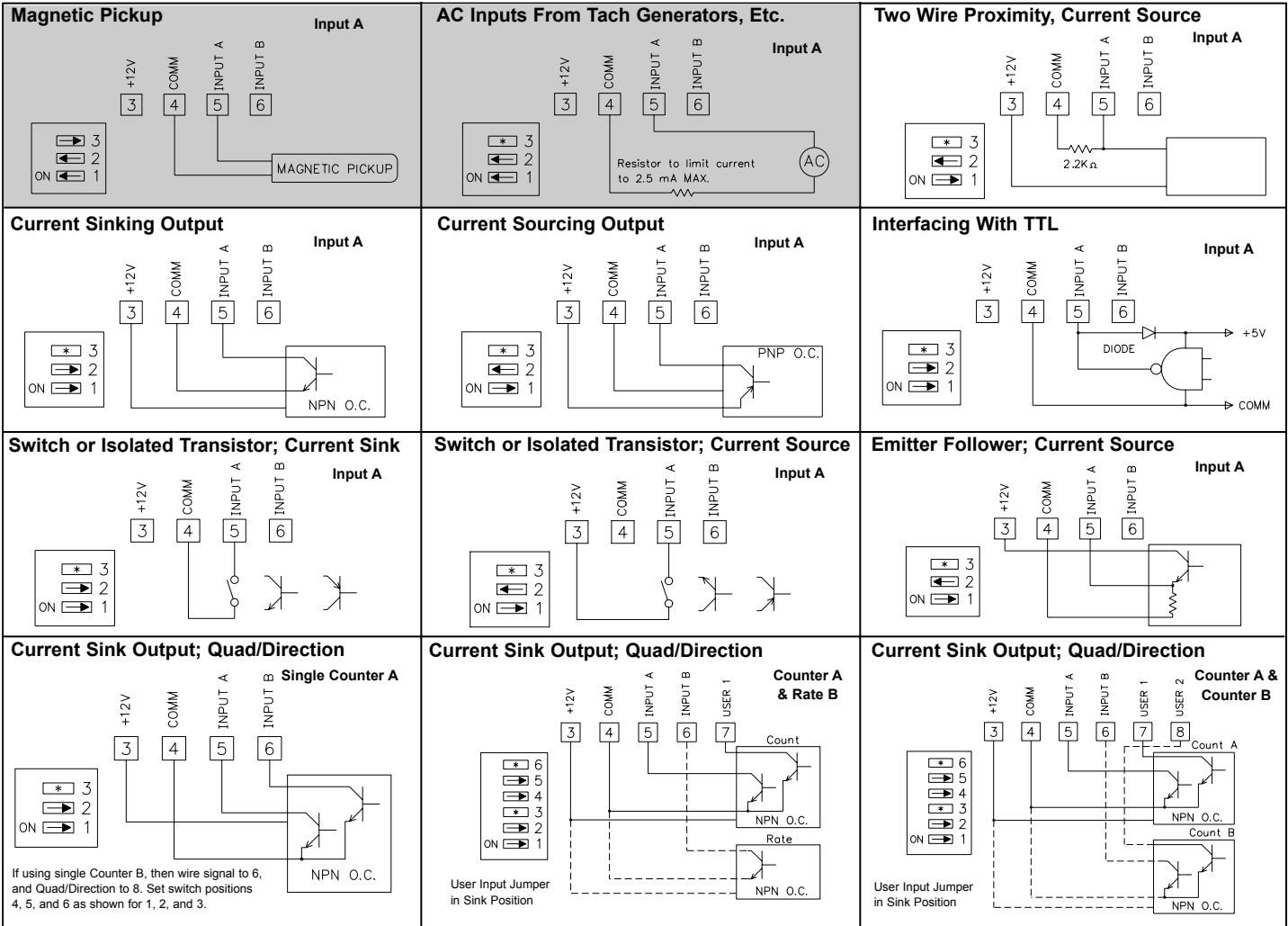


## 4.3 INPUT WIRING



**CAUTION:** Sensor input common is NOT isolated from user input common. In order to preserve the safety of the meter application, the sensor input common must be suitably isolated from hazardous live earth referenced voltage; or input common must be at protective earth ground potential. If not, hazardous voltage may be present at the User Inputs and User Input Common terminals. Appropriate considerations must then be given to the potential of the user input common with respect to earth ground; and the common of the isolated plug-in cards with respect to input common.

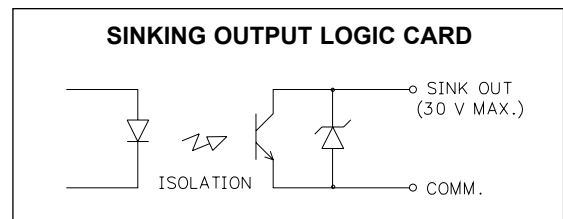
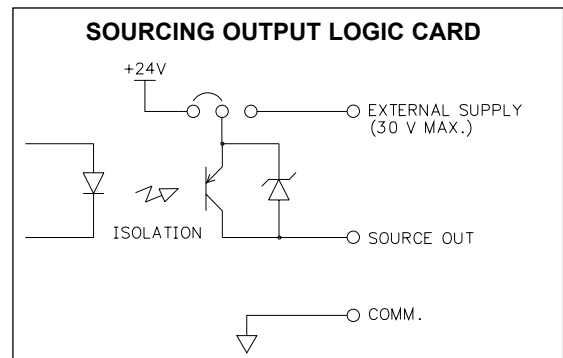
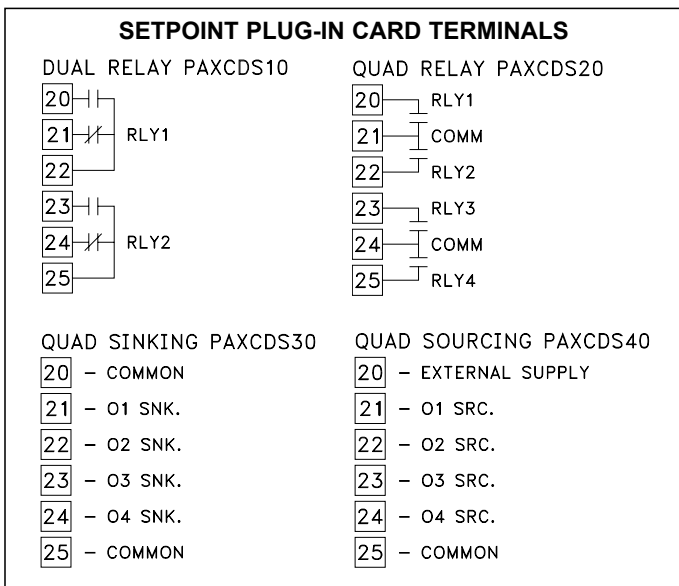
If you are wiring Input B, connect signal to Terminal 6 instead of 5, and set DIP switches 4, 5, and 6 to the positions shown for 1, 2, and 3.



Switch position is application dependent.

Shaded areas not recommended for counting applications.

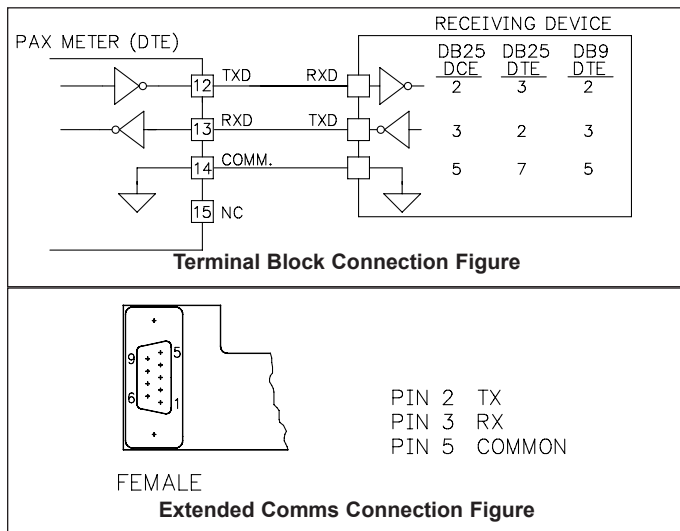
## 4.4 SETPOINT (ALARMS) WIRING





## 4.5 PAXI SERIAL COMMUNICATION WIRING

### RS232 Communications



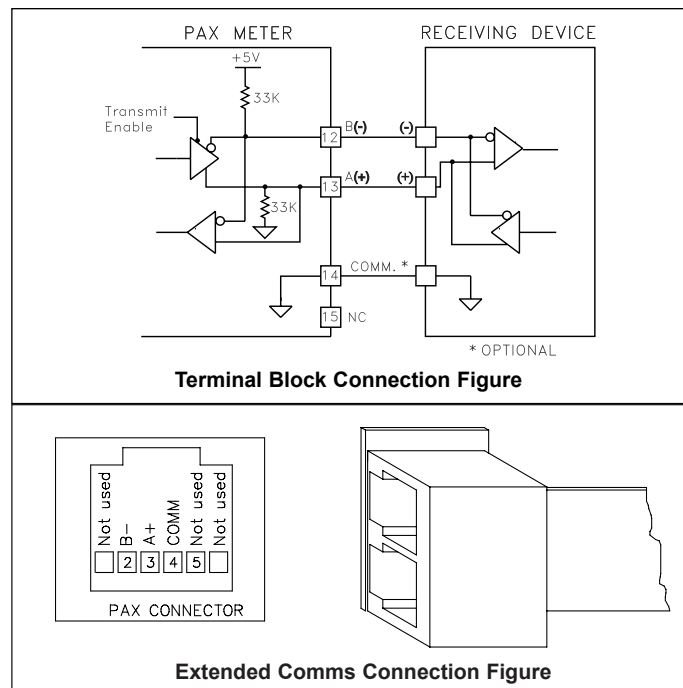
RS232 is intended to allow two devices to communicate over distances up to 50 feet. Data Terminal Equipment (DTE) transmits data on the Transmitted Data (TXD) line and receives data on the Received Data (RXD) line. Data Computer Equipment (DCE) receives data on the TXD line and transmits data on the RXD line. The PAX emulates a DTE. If the other device connected to the meter also emulates a DTE, the TXD and RXD lines must be interchanged for communications to take place. This is known as a null modem connection. Most printers emulate a DCE device while most computers emulate a DTE device.

Some devices cannot accept more than two or three characters in succession without a pause in between. In these cases, the meter employs a busy function.

As the meter begins to transmit data, the RXD line (RS232) is monitored to determine if the receiving device is "busy". The receiving device asserts that it is busy by setting the RXD line to a space condition (logic 0). The meter then suspends transmission until the RXD line is released by the receiving device.

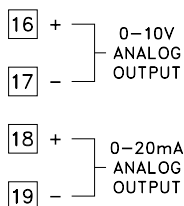
### RS485 Communications

The RS485 communication standard allows the connection of up to 32 devices on a single pair of wires, distances up to 4,000 ft. and data rates as high as 10M baud (the PAX is limited to 19.2k baud). The same pair of wires is used to both transmit and receive data. RS485 is therefore always half-duplex, that is, data cannot be received and transmitted simultaneously.

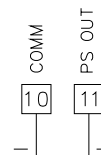


## 4.6 PAXI ANALOG OUTPUT WIRING

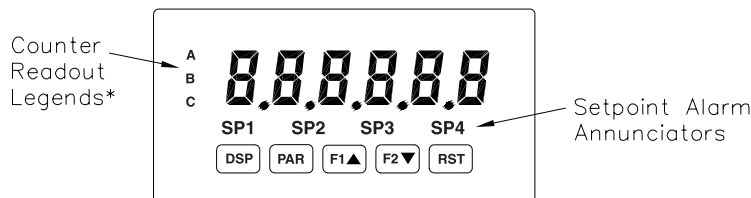
### ANALOG OPTION CARD FIELD TERMINALS



## 4.7 PAXI PRESCALER OUTPUT WIRING



# 5.0 REVIEWING THE FRONT BUTTONS AND DISPLAY



### KEY DISPLAY MODE OPERATION

- DSP** Index display through the selected displays.
- PAR** Access Programming Mode
- F1▲** Function key 1; hold for 3 seconds for Second Function 1 \*\*
- F2▼** Function key 2; hold for 3 seconds for Second Function 2 \*\*
- RST** Reset (Function key) \*\*\*

\* Counters B, and C are locked out in Factory Settings (PAXC and PAXI only).

\*\* Factory setting for the F1, and F2 keys is NO mode.

\*\*\* Factory setting for the RST key is **d5Pr 5t** (Reset Display).

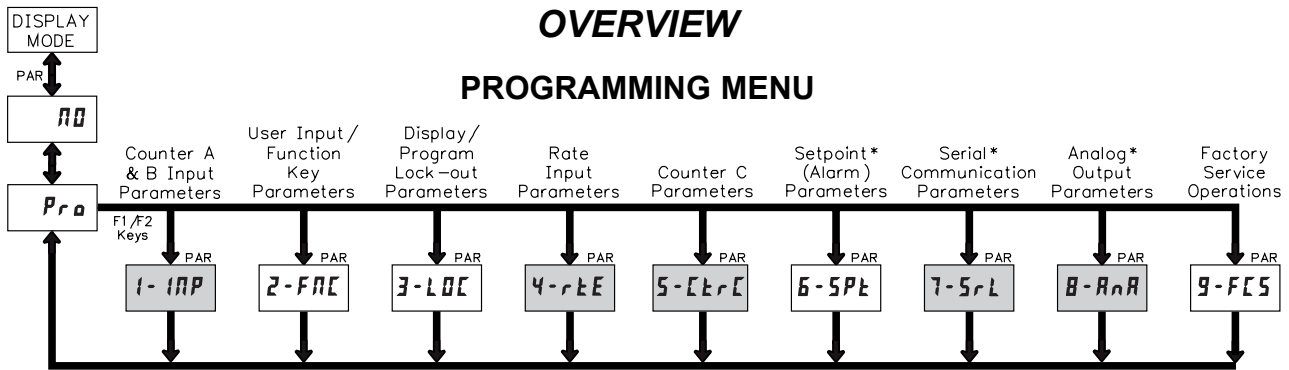
### PROGRAMMING MODE OPERATION

- Quit programming and return to Display Mode
- Store selected parameter and index to next parameter
- Increment selected parameter value or selections
- Decrement selected parameter value or selections
- Advances digit location in parameter values

# 6.0 PROGRAMMING THE METER

## OVERVIEW

### PROGRAMMING MENU



Shaded areas represent program access that is model dependent.

\* Only accessible with appropriate plug-in card.

### PROGRAMMING MODE ENTRY (PAR KEY)

The meter normally operates in the Display Mode. No parameters can be programmed in this mode. The Programming Mode is entered by pressing the **PAR** key. If it is not accessible then it is locked by either a security code, or a hardware lock.

Two types of programming modes are available. Quick Programming Mode permits only certain parameters to be viewed and/or modified. All meter functions continue to operate except the front panel keys change to Programming Mode Operations. Quick Programming Mode is configured in Module 3. Full Programming Mode permits all parameters to be viewed and modified. In this mode, incoming counts may not be recognized correctly, the front panel keys change to Programming Mode Operations and certain user input functions are disabled. Throughout this document, Programming Mode (without Quick in front) always refers to "Full" Programming.

### MODULE ENTRY (ARROW & PAR KEYS)

The Programming Menu is organized into nine modules. These modules group together parameters that are related in function. The display will alternate between **Pra** and the present module. The arrow keys (**F1▲** and **F2▼**) are used to select the desired module. The displayed module is entered by pressing the **PAR** key.

### MODULE MENU (PAR KEY)

Each module has a separate module menu (which is shown at the start of each module discussion). The **PAR** key is pressed to advance to a particular parameter to be changed, without changing the programming of preceding parameters. After completing a module, the display will return to **Pra**. Programming may continue by accessing additional modules.

### SELECTION / VALUE ENTRY (ARROW & PAR KEYS)

For each parameter, the display alternates between the present parameter and the selections/value for that parameter. The arrow keys (**F1▲** and **F2▼**) are used to move through the selections/values for that parameter. Pressing the **PAR** key, stores and activates the displayed selection/value. This also advances the meter to the next parameter.

For numeric values, the **RST** key may be used to select a specific digit to be changed. Once a digit is selected, the arrow keys are used to increment or decrement that digit to the desired number.

### PROGRAMMING MODE EXIT (DSP KEY or at PRA PAR KEY)

The Programming Mode is exited by pressing the **DSP** key (from anywhere in the Programming Mode) or the **PAR** key (with **Pra** displayed). This will commit any stored parameter changes to memory and return the meter to the Display Mode. If a parameter was just changed, the **PAR** key should be pressed to store the change before pressing the **DSP** key. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)

### PROGRAMMING TIPS

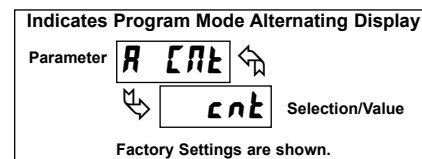
It is recommended to start with Module 1 for counting and Module 4 for rate. If lost or confused while programming, press the **DSP** key and start over. When programming is complete, it is recommended to record the parameter programming on the Parameter User Chart and lock out parameter programming with a user input or lock-out code.

### FACTORY SETTINGS

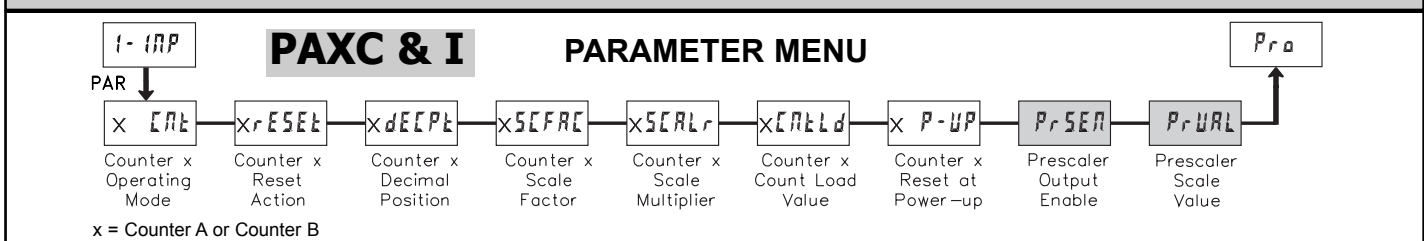
Factory Settings may be completely restored in Module 9. This is a good starting point for programming problems. Most parameters can be left at their Factory Settings without affecting basic start-up. These parameters are identified throughout the module explanations.

### ALTERNATING SELECTION DISPLAY

In the explanation of the modules, the following dual display with arrows will appear. This is used to illustrate the display alternating between the parameter on top and the parameter's Factory Setting on the bottom. In most cases, selections and values for the parameter will be listed on the right.

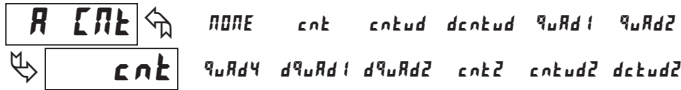


## 6.1 MODULE 1 - COUNT A & B INPUT PARAMETERS (1-1NP)



Module 1 is the programming for Counter A, Counter B and the Prescaler Output. Counter B parameters follow the Prescaler parameters. For maximum input frequency, the counters should be set to mode NONE and the Prescaler to NO when they are not in use. When set to NONE or NO, the remaining related parameters are not accessible. A corresponding annunciator indicates the counter being shown in the Display Mode. An Exchange Parameter Lists feature for scale factors and count load values is explained in Module 2.

## COUNTER A OPERATING MODE



Select the operating mode for Counter A.

SELECTION	MODE	DESCRIPTION
<b>NONE</b>		Does not count.
<b>cnt</b>	Count X1	Adds Input A falling edge.
<b>cntud</b>	Count X1 w/direction	Adds Input A falling edge if Input B is high. Subtracts Input A falling edge if Input B is low.
<b>dcntud</b>	Count X1 w/direction	Adds Input A falling edge if User 1 is high. Subtracts Input A falling edge if User 1 is low.
<b>Quad 1</b>	Quad X1	Adds Input A rising edge when Input B is high. Subtracts Input A falling edge when Input B is low.
<b>Quad 2</b>	Quad X2	Adds Input A rising edge when Input B is high and Input A falling edge when Input B is low. Subtracts Input A falling edge when Input B is high and Input A rising edge when Input B is low.
<b>Quad 4</b>	Quad X4	Adds Input A rising edge when Input B is high, Input A falling edge when Input B is low, Input B rising edge when Input A is low, and Input B falling edge when Input A is high.
<b>dQuad 1</b>	Quad X1	Adds Input A rising edge when User 1 is high. Subtracts Input A falling edge when User 1 is high.
<b>dQuad 2</b>	Quad X2	Adds Input A rising edge when User 1 is high and Input A falling edge when User 1 is low. Subtracts Input A falling edge when User 1 is high and Input A rising edge when User 1 is low.
<b>cnt2</b>	Count X2	Adds Input A rising and falling edges.
<b>cntud2</b>	Count X2 w/direction	Adds Input A rising and falling edges if Input B is high. Subtracts Input A rising and falling edge if Input B is low.
<b>dcntud2</b>	Count X2 w/direction	Adds Input A rising and falling edges if User 1 is high. Subtracts Input A rising and falling edge if User 1 is low.

## COUNTER A RESET ACTION



When Counter A is reset, it returns to zero or Counter A count load value. This reset action affects all Counter A resets, except the Setpoint Counter Auto Reset in Module 6.

## COUNTER A DECIMAL POSITION



This selects the decimal point position for Counter A and any setpoint value assigned to Counter A. The selection will also affect Counter A scale factor calculations.

## COUNTER A SCALE FACTOR



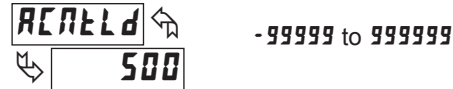
The number of input counts is multiplied by the scale factor and the scale multiplier to obtain the desired process value. A scale factor of 1.00000 will result in the display of the actual number of input counts. (Details on scaling calculations are explained at the end of this section.)

## COUNTER A SCALE MULTIPLIER \*



The number of input counts is multiplied by the scale multiplier and the scale factor to obtain the desired process value. A scale multiplier of 1 will result in only the scale factor affecting the display. (Details on scaling calculations are explained at the end of this section.)

## COUNTER A COUNT LOAD VALUE \*



When reset to count load action is selected, Counter A will reset to this value.

## COUNTER A RESET POWER-UP \*



Counter A may be programmed to reset at each meter power-up.

## PAXI: PRESCALER OUTPUT ENABLE \*



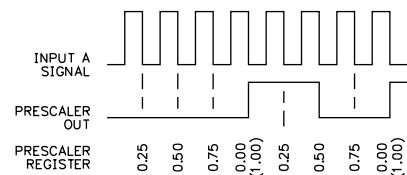
This enables the prescaler output. The prescaler output is useful for providing a lower frequency scaled pulse train to a PLC or another external counter. On each falling edge of Input A, the prescaler output register increments by the prescaler scale value (**P-URL**). When the register equals or exceeds 1.0000, a pulse is output and the register is lowered by 1.0000. The prescaler register is reset to zero whenever Counter A is reset (except for Setpoint Counter Auto Reset). (See Prescaler Output Figure.)

## PAXI: PRESCALER SCALE VALUE \*



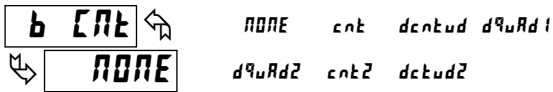
The prescaler output frequency is the Input A frequency times the prescaler scale value.

PRESCALER OUTPUT VALUE = 0.25



\* Factory Setting can be used without affecting basic start-up.

## COUNTER B OPERATING MODE



Select the operating mode for Counter B.

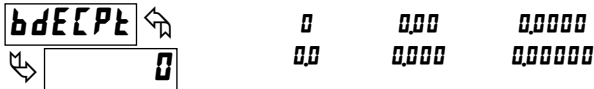
SELECTION	MODE	DESCRIPTION
<b>NONE</b>		Does not count.
<b>cnt</b>	Count X1	Adds Input B falling edge.
<b>dckud</b>	Count X1 w/direction	Adds Input B falling edge if User 2 is high. Subtracts Input B falling edge if User 2 is low.
<b>d9uAd1</b>	Quad X1	Adds Input B rising edge when User 2 is high. Subtracts Input B falling edge when User 2 is high.
<b>d9uAd2</b>	Quad X2	Adds Input B rising edge when User 2 is high and Input B falling edge when User 2 is low. Subtracts Input B falling edge when User 2 is high and Input B rising edge when User 2 is low.
<b>cnt2</b>	Count X2	Adds Input B rising and falling edges.
<b>dckud2</b>	Count X2 w/direction	Adds Input B rising and falling edges if User 2 is high. Subtracts Input B rising and falling edge if User 2 is low.

## COUNTER B RESET ACTION



When Counter B is reset, it returns to zero or Counter B count load value. This reset action affects all Counter B resets, except the Setpoint Counter Auto Reset Action in Module 6.

## COUNTER B DECIMAL POSITION



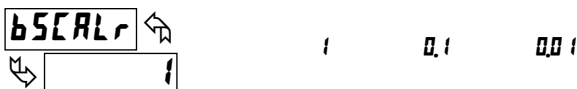
This selects the decimal point position for Counter B and any setpoint value assigned to Counter B. The selection will also affect Counter B scale factor calculations.

## COUNTER B SCALE FACTOR



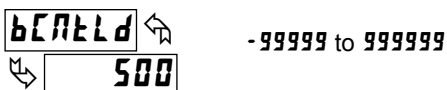
The number of input counts is multiplied by the scale factor and the scale multiplier to obtain the desired process value. A scale factor of 1.00000 will result in the display of the actual number of input counts. (Details on scaling calculations are explained at the end of this section.)

## COUNTER B SCALE MULTIPLIER \*



The number of input counts is multiplied by the scale multiplier and the scale factor to obtain the desired process value. A scale multiplier of 1 will result in only the scale factor affecting the display. (Details on scaling calculations are explained at the end of this section.)

## COUNTER B COUNT LOAD VALUE \*



When reset to count load action is selected, Counter B will reset to this value.

## COUNTER B RESET POWER-UP \*



Counter B may be programmed to reset at each meter power-up.

\* Factory Setting can be used without affecting basic start-up.

## 8 DIGIT COUNT VALUES

Any counter display value below -99999 or above 999999 (less decimal point) will consist of a two part display. This display alternates between the least 6 significant digits and the remaining most significant digits beginning with "BF" in the display. If the display exceeds  $\pm 99999999$  the display will roll to zero and continue counting. Outputs cannot be set to counter values above 6 digits. The annunciator, indicating the counter being displayed, will flash when the value is above 6 digits.

## SCALING CALCULATIONS

Each counter has the ability to scale an input signal to a desired display value. This is accomplished by the counter mode (x-**Cnt**), scale factor (x**SCFAC**), scale multiplier (x**SCALr**) and decimal point (x**dECPt**). The scale factor is calculated using:

$$SF (xSCFAC) = \frac{\text{Desired Display Decimal DDD}}{(\text{Number of pulses per 'single' unit} \times CM \times SM)}$$

Where:

Desired Display Decimal DDD	x <b>dECPt</b>	Counter Decimal Selection
1	0	None
10	0.0	Tenths
100	0.00	Hundredths
1000	0.000	Thousandths
10000	0.0000	Ten Thousandths
100000	0.00000	Hundred Thousandths

**Number of pulses per 'single' unit:** pulses per unit generated by the process (i.e. # of pulses per foot)

**CM:** Counter Mode(x-**Cnt**) times factor of the mode 1,2 or 4.

**SM:** Scale Multiplier (x**SCALr**) selection of 1, 0.1 or 0.01.

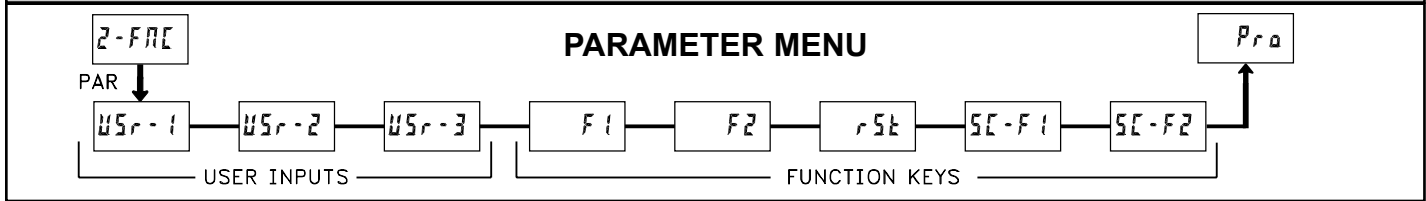
## Example:

- Show feet to the hundredths (0.00) with 100 pulses per foot:  
Scale Factor would be  $100 / (100 \times 1 \times 1) = 1$   
(In this case, the scale multiplier and counter mode factor are 1)
- Show feet with 120 pulses per foot: Scale Factor would be  $1 / (120 \times 1 \times 1) = 0.0083333$ . (In this case, the scale multiplier of 0.01 could be used:  $1 / (120 \times 1 \times 0.01) = 0.83333$  or show to hundredths (0.00):  $100 / (120 \times 1 \times 1) = 0.8333$ .)

## General Rules on Scaling

- It is recommended that, the scale factor be as close as possible to, but not exceeding 1.00000. This can be accomplished by increasing or decreasing the counter decimal point position, using the scale multiplier, or selecting a different count mode.
- To double the number of pulses per unit, use counter modes direction X2 or quad X2. To increase it by four times, use counter mode quad X4. Using these modes will decrease the maximum input frequency.
- A scale factor greater than 1.00000 will cause Counter display rounding. In this case, digit jumps could be caused by the internal count register rounding the display. The precision of a counter application cannot be improved by using a scale factor greater than 1.00000.
- The number of pulses per single unit must be greater than or equal to the DDD value for the scale factor to be less than or equal to one.
- Lowering the scale factor can be accomplished by lowering the counter decimal position. (Example: 100 (Hundredths)/10 pulses = 10.000 lowering to 10 (Tenths)/10 = 1.000.)

## 6.2 MODULE 2 - USER INPUT AND FRONT PANEL FUNCTION KEY PARAMETERS (2-FNC)



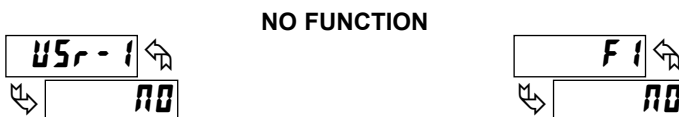
Module 2 is the programming for rear terminal user inputs and front panel function keys.

Three rear terminal user inputs are individually programmable to perform specific meter control functions. While in the Display Mode, the function is executed when the user input transitions to the active state. (Refer to the user input specifications for active state response times.) Certain user input functions are disabled in "full" Programming Mode.

Three front panel function **F1**, **F2** and **RST** keys are also individually programmable to perform specific meter control functions. While in the Display Mode, the primary function is executed when the key is pressed. Holding the **F1** and **F2** function keys for three seconds executes a secondary function. It is possible to program a secondary function without a primary function. The front panel key functions are disabled in both Programming Modes.

In most cases, if more than one user input and/or function key is programmed for the same function, the maintained (level trigger) actions will be performed while at least one of those user inputs or function keys are activated. The momentary (edge trigger) actions are performed every time any of those user inputs or function keys transition to the active state. All functions are available to both user inputs and function keys.

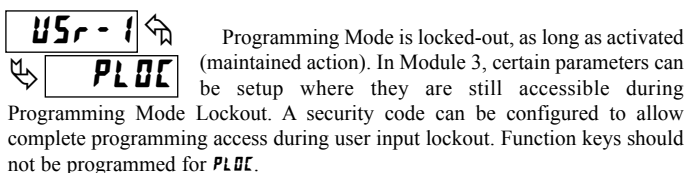
Some of the user functions have a sublist of parameters. The sublist is accessed when **PAR** is pressed at the listed function. The function will only be performed for the parameters entered as **YES**. If a user input or function key is configured for a function with a sublist, then that sublist will need to be scrolled through each time to access the following user inputs or function keys parameters.



With this selection, NO function is performed. This is the factory setting for all user inputs and function keys except the Reset (**RST**) Key.

**NOTE:** When a user input is used to accept a quad or directional input signal, then that user input should be programmed for NO function.

### PROGRAMMING MODE LOCK-OUT



When activated (momentary action), the display advances to the next display that is not locked out from the Display Mode.



When activated (momentary action), the shown display is reset. This is the factory setting for the Reset (**RST**) Key.

### EXCHANGE PARAMETER LISTS

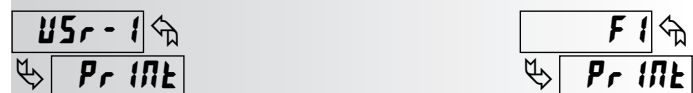


Two lists of values are available for **SP-1**, **SP-2**, **SP-3**, **SP-4**, **ASCFAc**, **bSCFAc**, **cSCFAc**, **ACnELd**, **BCnELd**, **CCnELd**. The two lists are named **L 15t-A** and **L 15t-b**. If a user input is used to select the list then **L 15t-A** is selected when the user input is not active and **L 15t-b** is selected when the user input is active, (maintained action). If a front panel key is used to select the list then the list will toggle for each key press, (momentary action). The meter will suspend ALL operations for approximately 1 msec. while the new values are loaded. The display will only indicate which list is active when the list is changed or when entering any Programming Mode.

To program the values for **L 15t-A** and **L 15t-b**, first complete the programming of all the parameters. Exit programming and switch to the other list. Re-enter programming and enter the values for **SP-1**, **SP-2**, **SP-3**, **SP-4**, **ASCFAc**, **bSCFAc**, **cSCFAc**, **ACnELd**, **BCnELd**, **CCnELd**. If any other parameters are changed then the other list values must be reprogrammed.

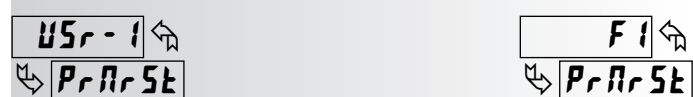
Shaded parameters do not apply to the PAXR.

### PAXI: PRINT REQUEST



The meter issues a block print through the serial port when activated. The data transmitted during the print request is configured in Module 7. If the user input is still active after the transmission is complete (about 100 msec.), an additional transmission will occur. Only one transmission will take place with each function key depression. This selection will only function when a serial communications Plug-in card is installed in the meter.

### PAXI: PRINT REQUEST AND RESET DISPLAYS



The meter issues a block print through the serial port when activated just like the Print Request function. In addition, when activated (momentary action), the meter performs a reset of the displays configured as **YES**. The print aspect of this action only functions when a serial communication plug-in card is installed. The reset action functions regardless.

DISPLAY	DESCRIPTION	FACTORY
<b>A</b> <b>CnE</b>	Counter A	<b>NO</b>
<b>b</b> <b>CnE</b>	Counter B	<b>NO</b>
<b>C</b> <b>CnE</b>	Counter C	<b>NO</b>
<b>H</b> <b>I</b>	Maximum	<b>NO</b>
<b>L</b> <b>O</b>	Minimum	<b>NO</b>

## MAINTAINED (LEVEL) RESET AND INHIBIT



The meter performs a reset and inhibits the displays configured as **YES**, as long as activated (maintained action).

DISPLAY	DESCRIPTION	FACTORY
A <b>CL</b>	Counter A	<b>NO</b>
b <b>CL</b>	Counter B	<b>NO</b>
c <b>CL</b>	Counter C	<b>NO</b>
H <b>I</b>	Maximum	<b>NO</b>
L <b>O</b>	Minimum	<b>NO</b>

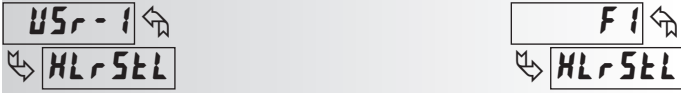
## DEACTIVATE SETPOINT MAINTAINED (LEVEL)



The meter deactivates the setpoints configured as **YES**, as long as activated (maintained action). This action only functions with a Setpoint card installed.

DISPLAY	DESCRIPTION	FACTORY
SP-1	Setpoint 1	<b>NO</b>
SP-2	Setpoint 2	<b>NO</b>
SP-3	Setpoint 3	<b>NO</b>
SP-4	Setpoint 4	<b>NO</b>

## PAXR: MAINTAINED (LEVEL) RESET AND INHIBIT



The meter performs a reset and inhibits the displays configured as **YES**, as long as activated (maintained action).

DISPLAY	DESCRIPTION	FACTORY
H <b>I</b>	Maximum	<b>NO</b>
L <b>O</b>	Minimum	<b>NO</b>

## DEACTIVATE SETPOINT MOMENTARY (EDGE)



When activated (momentary action), the meter deactivates the setpoints configured as **YES**. This action only functions with a Setpoint card installed.

DISPLAY	DESCRIPTION	FACTORY
SP-1	Setpoint 1	<b>NO</b>
SP-2	Setpoint 2	<b>NO</b>
SP-3	Setpoint 3	<b>NO</b>
SP-4	Setpoint 4	<b>NO</b>

## MOMENTARY (EDGE) RESET



When activated (momentary action), the meter resets the displays configured as **YES**. (Momentary resets improve max. input frequencies over maintained resets.)

DISPLAY	DESCRIPTION	FACTORY
A <b>CL</b>	Counter A	<b>NO</b>
b <b>CL</b>	Counter B	<b>NO</b>
c <b>CL</b>	Counter C	<b>NO</b>
H <b>I</b>	Maximum	<b>NO</b>
L <b>O</b>	Minimum	<b>NO</b>

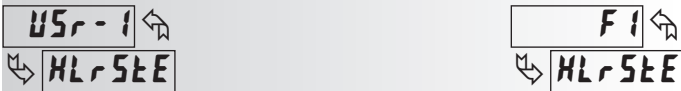
## HOLD SETPOINT STATE



The meter holds the state of the setpoints configured as **YES**, as long as activated (maintained action). This action only functions with a Setpoint plug-in card installed.

DISPLAY	DESCRIPTION	FACTORY
SP-1	Setpoint 1	<b>NO</b>
SP-2	Setpoint 2	<b>NO</b>
SP-3	Setpoint 3	<b>NO</b>
SP-4	Setpoint 4	<b>NO</b>

## PAXR: MOMENTARY (EDGE) RESET



When activated (momentary action), the meter resets the displays configured as **YES**. (Momentary resets improve max. input frequencies over maintained resets.)

DISPLAY	DESCRIPTION	FACTORY
H <b>I</b>	Maximum	<b>NO</b>
L <b>O</b>	Minimum	<b>NO</b>

## ACTIVATE SETPOINT MAINTAINED (LEVEL)



The meter activates the setpoints configured as **YES**, as long as activated (maintained action). This action only functions with a Setpoint card installed.

DISPLAY	DESCRIPTION	FACTORY
SP-1	Setpoint 1	<b>NO</b>
SP-2	Setpoint 2	<b>NO</b>
SP-3	Setpoint 3	<b>NO</b>
SP-4	Setpoint 4	<b>NO</b>

## INHIBIT



The meter inhibits the displays configured as **YES**, as long as activated (maintained action).

DISPLAY	DESCRIPTION	FACTORY
A <b>CL</b>	Counter A	<b>NO</b>
b <b>CL</b>	Counter B	<b>NO</b>
c <b>CL</b>	Counter C	<b>NO</b>
H <b>I</b>	Maximum	<b>NO</b>
L <b>O</b>	Minimum	<b>NO</b>

## ACTIVATE SETPOINT MOMENTARY (EDGE)



When activated (momentary action), the meter activates the setpoints configured as **YES**. This action only functions with a Setpoint card installed.

DISPLAY	DESCRIPTION	FACTORY
SP-1	Setpoint 1	<b>NO</b>
SP-2	Setpoint 2	<b>NO</b>
SP-3	Setpoint 3	<b>NO</b>
SP-4	Setpoint 4	<b>NO</b>

## STORE DISPLAY



The meter holds (freeze) the displays configured as **YES**, as long as activated (maintained action). Internally the counters and max. and min. values continue to update.

DISPLAY	DESCRIPTION	FACTORY
A <b>CL</b>	Counter A	<b>NO</b>
b <b>CL</b>	Counter B	<b>NO</b>
c <b>CL</b>	Counter C	<b>NO</b>
H <b>I</b>	Maximum	<b>NO</b>
L <b>O</b>	Minimum	<b>NO</b>

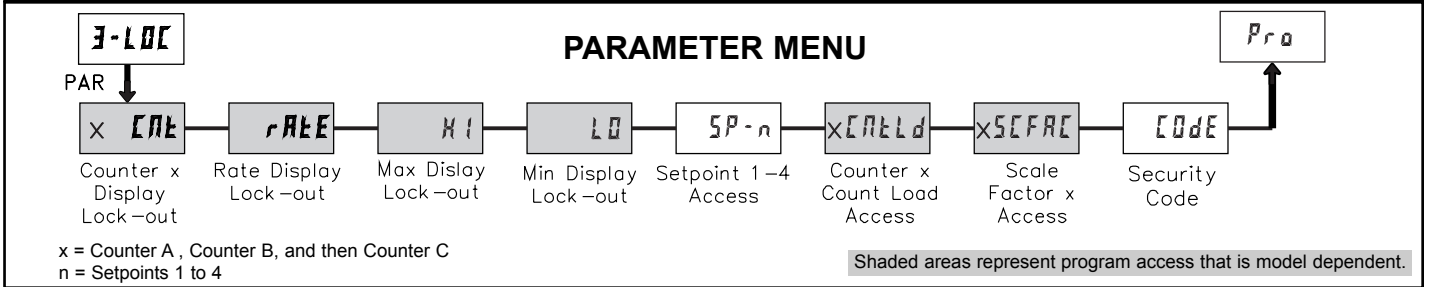
## CHANGE DISPLAY INTENSITY LEVEL



When activated (momentary action), the display intensity changes to the next intensity level (of 4). The four levels correspond to Display Intensity Level (**d-LEU**) settings of 0, 3, 8 & 15. The intensity level, when changed via the User Input/ Function Key, is not retained at power-down, unless Quick Programming or Full Programming mode is entered and exited. The meter will power-up at the last saved intensity level.



## 6.3 MODULE 3 - DISPLAY AND PROGRAM LOCK-OUT PARAMETERS (3-LOC)



Module 3 is the programming for Display lock-out and “Full” and “Quick” Program lock-out.

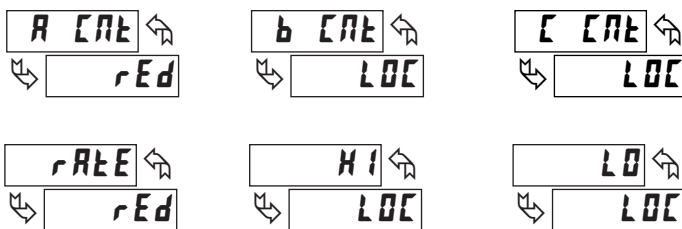
When in the Display Mode, the available displays can be read consecutively by repeatedly pressing the **DSP** key. An annunciator indicates the display being shown. These displays can be locked from being visible. It is recommended that the display be set to **LOC** when the corresponding function is not used.

SELECTION	DESCRIPTION
<b>rEd</b>	Visible in Display Mode
<b>LOC</b>	Not visible in Display Mode

“Full” Programming Mode permits all parameters to be viewed and modified. This Programming Mode can be locked with a security code and/or user input. When locked and the **PAR** key is pressed, the meter enters a Quick Programming Mode. In this mode, setpoint, count load and scale factor values can still be read and/or changed per the selections below. The Display Intensity Level (**d-LEU**) parameter also appears whenever Quick Programming Mode is enabled, and the security code is greater than zero.

SELECTION	DESCRIPTION
<b>rEd</b>	Visible but not changeable in Quick Programming Mode
<b>ENL</b>	Visible and changeable in Quick Programming Mode
<b>LOC</b>	Not visible in Quick Programming Mode

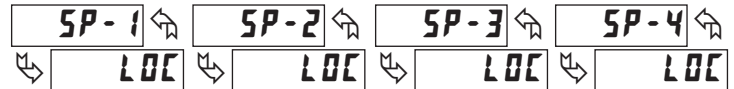
### COUNTER A B C DISPLAY LOCK-OUT \* RATE DISPLAY LOCK-OUT \* MAX. MIN. DISPLAY LOCK-OUT \*



These displays can be programmed for **LOC** or **rEd**.

Shaded areas are model dependent.

### SETPOINT 1 to 4 ACCESS LOCK-OUT \*



The setpoint displays can be programmed for **LOC**, **rEd**, or **ENL** (See the following table). Accessible only with the Setpoint Plug-in card installed.

### COUNT LOAD A B C ACCESS LOCK-OUT \*



These displays can be programmed for **LOC**, **rEd**, or **ENL**.

### SCALE FACTOR A B C ACCESS LOCK-OUT \*



The Scale Factor values can be programmed for **LOC**, **rEd**, or **ENL**.

### SECURITY CODE \*



Entry of a non-zero value will cause the prompt **CODE** to appear when trying to access the “Full” Programming Mode. Access will only be allowed after entering a matching security code or universal code of **222**. With this lock-out, a user input would not have to be configured for Program Lock-out. However, this lock-out is overridden by an inactive user input configured for Program Lock-out.

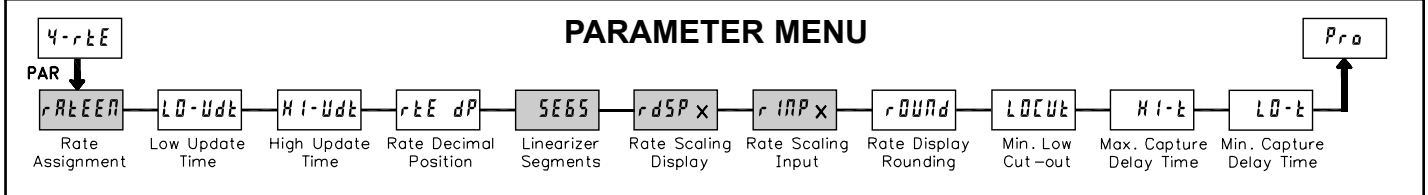
\* Factory Setting can be used without affecting basic start-up.

### PROGRAMMING MODE ACCESS

SECURITY CODE	USER INPUT CONFIGURED	USER INPUT STATE	WHEN PAR KEY IS PRESSED	“FULL” PROGRAMMING MODE ACCESS
0	not <b>PLdC</b>	—	“Full” Programming	Immediate access.
>0	not <b>PLdC</b>	—	Quick Programming w/Display Intensity	After Quick Programming with correct code # at <b>CODE</b> prompt.
>0	<b>PLdC</b>	Active	Quick Programming w/Display Intensity	After Quick Programming with correct code # at <b>CODE</b> prompt.
>0	<b>PLdC</b>	Not Active	“Full” Programming	Immediate access.
0	<b>PLdC</b>	Active	Quick Programming	No access
0	<b>PLdC</b>	Not Active	“Full” Programming	Immediate access.

Throughout this document, Programming Mode (without Quick in front) always refers to “Full” Programming (all meter parameters are accessible).

## 6.4 MODULE 4 - RATE INPUT PARAMETERS (4-rtE) - PAXR & I



Module 4 is the programming for the Rate parameters. For maximum input frequency, Rate assignment should be set to **no** when not in use. When set to **no**, the remaining related parameters are not accessible. The Rate value is shown with an annunciator of 'r' in the Display Mode.

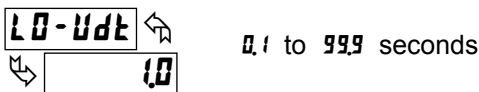
*Note: For PAXR, rINP is actually rEtE INP on the unit's display and rdSP is actually rEtEdSP on the unit's display.*

### PAXI: RATE ASSIGNMENT



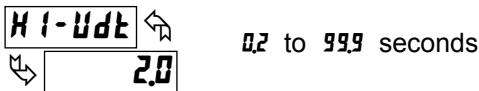
For measuring the rate (speed) of pulses on Input A, select **rRtE-A**. For Input B select **rRtE-B**. This assignment is independent of the counting modes.

### LOW UPDATE TIME (DISPLAY UPDATE) \*



The Low Update Time is the minimum amount of time between display updates for the Rate display. Values of 0.1 and 0.2 seconds will update the display correctly but may cause the display to appear unsteady. The factory setting of 1.0 will update the display every second minimum.

### HIGH UPDATE TIME (DISPLAY ZERO) \*



The High Update Time is the maximum amount of time before the Rate display is forced to zero. (For more explanation, refer to Input Frequency Calculation.) The High Update Time **must** be higher than the Low Update Time and higher than the desired slowest readable speed (one divided by pulses per second). The factory setting of 2.0, will force the display to zero for speeds below 0.5 Hz or a pulse every 2 seconds.

### RATE DECIMAL POSITION



This selects the decimal point position for Rate, Minimum and Maximum rate displays and any setpoint value assigned to these displays. This parameter does not affect rate scaling calculations.

### PAXI: LINEARIZER SEGMENTS



This parameter specifies the number of linear segments used for the Rate Scaling function. Each linear segment has two scaling points which define the upper and lower endpoints of the segment. The number of segments used depends on the linearity of the process and the display accuracy required as described below.

### Linear Application – 2 Scaling Points

Linear processes use a single segment (two scaling points) to provide a linear Rate display from 0 up to the maximum input frequency. For typical zero based frequency measurements (0 Hz = 0 on display), leave **SE65:0** (factory setting). For non-zero based 2 scaling point applications, set **SE65:1**, to enter both the zero segment (**rINP 0** & **rdSP 0**) and segment 1 (**rINP 1** & **rdSP 1**).

### Non-linear Application – Up to 10 Scaling Points

Non-linear processes may utilize up to nine segments (ten scaling points) to provide a piece-wise linear approximation representing the non-linear function. The Rate display will be linear throughout each individual segment (i.e. between sequential scaling points). Thus, the greater the number of segments, the greater the conformity accuracy. Several linearization equations are available in the SFPAX software.

### About Scaling Points

Each Scaling Point is specified by two programmable parameters: A desired Rate Display Value (**rdSP**) and a corresponding Rate Input Value (**rINP**). Scaling points are entered sequentially in ascending order of Rate Input Value.

Two scaling points must be programmed to define the upper and lower endpoints of the first linear segment. Setting **SE65:0**, automatically factory sets the first scaling point to 0.0 for typical single segment, zero based applications. When multiple segments are used, the upper scaling point for a given segment becomes the lower scaling point for the next sequential segment. Thus, for each additional segment used, only one additional scaling point must be programmed.

The following chart shows the Scaling Points, the corresponding Parameter mnemonics, and the Factory Default Settings for each point.

SEGMENT	SCALING POINT	DISPLAY PARAMETER	DISPLAY DEFAULT	INPUT PARAMETER	INPUT DEFAULT
	1	<b>rdSP 0</b>	000000	<b>rINP 0</b>	00000.0
1	2	<b>rdSP 1</b>	001000	<b>rINP 1</b>	01000.0
2	3	<b>rdSP 2</b>	002000	<b>rINP 2</b>	02000.0
3	4	<b>rdSP 3</b>	003000	<b>rINP 3</b>	03000.0
4	5	<b>rdSP 4</b>	004000	<b>rINP 4</b>	04000.0
5	6	<b>rdSP 5</b>	005000	<b>rINP 5</b>	05000.0
6	7	<b>rdSP 6</b>	006000	<b>rINP 6</b>	06000.0
7	8	<b>rdSP 7</b>	007000	<b>rINP 7</b>	07000.0
8	9	<b>rdSP 8</b>	008000	<b>rINP 8</b>	08000.0
9	10	<b>rdSP 9</b>	009000	<b>rINP 9</b>	09000.0

### PAXI: RATE DISPLAY VALUE FOR SCALING POINT 1



Confirm the Rate Display Value for the first Scaling Point is 0. This parameter is automatically set to 0 and does not appear when **SE65:0**. (See Note)

### PAXI: RATE INPUT VALUE FOR SCALING POINT 1



Confirm the Rate Input Value for the first Scaling Point is 0.0. (See Note)

*Note: For all linear and most non-linear applications, the Scaling Point 1 parameters (**rdSP 0** and **rINP 0**) should be set to 0 and 0.0 respectively. Consult the factory before using any non-zero values for Scaling Point 1. These parameters are automatically set to 0 and do not appear when **SE65:0**.*

### RATE DISPLAY VALUE FOR SCALING POINT 2



Enter the desired Rate Display Value for the second Scaling Point by using the arrow keys.

\* Factory Setting can be used without affecting basic start-up.

## RATE INPUT VALUE FOR SCALING POINT 2



Enter the corresponding Rate Input Value for the second Scaling Point by using the arrow keys. Rate Input values for scaling points can be entered by using the Key-in or the Applied method described below.

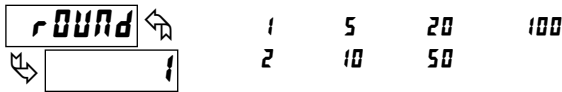
### Key-in Method:

Enter the Rate Input value (**r INP**) that corresponds to the entered Rate Display value (**rd5P**) by pressing the **F1** or **F2** keys. This value is always in pulses per second (Hz).

### Applied Method:

Apply an external rate signal to the appropriate input terminals. At the Rate Input Value (**r INP**) press and hold the **F1** and **F2** keys at the same time. The applied input frequency (in Hz) will appear on the display. (To verify correct reading wait for at least the length of the Low Update Time. Then press and hold the **F1** and **F2** keys at the same time again. The new value should be  $\pm 0.1\%$  of the previous entered value.) Press **PAR** to enter the displayed frequency as the Rate Input value. To prevent the displayed value from being entered, press **DSP**. This will take the meter out of Programming Mode and the previous Rate Input value will remain.

## RATE DISPLAY ROUND \*



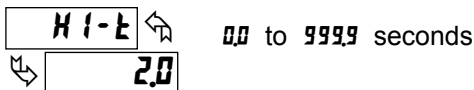
Rounding values other than one round the Rate display to the nearest increment selected (e.g. rounding of '5' causes 122 to round to 120 and 123 to round to 125). Rounding starts at the least significant digit of the Rate display.

## LOW CUT OUT \*



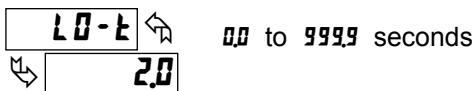
The Low Cut Out value forces the Rate display to zero when the Rate display falls below the value entered.

## MAXIMUM CAPTURE DELAY TIME \*



When the Rate value is above the present Maximum rate value for the entered amount of time, the meter will capture that Rate value as the new Maximum value. A delay time helps to avoid false captures of sudden short spikes. Maximum detection will only function if Rate is assigned to Input A or B. The Maximum rate value is shown with an annunciator of 'H' in the display and will continue to function independent of being displayed.

## MINIMUM CAPTURE DELAY TIME \*



When the Rate value is below the present Minimum rate value for the entered amount of time, the meter will capture that Rate value as the new Minimum value. A delay time helps to avoid false captures of sudden short spikes. Minimum detection will only function if Rate is assigned to Input A or B. The Minimum rate value is shown with an annunciator of 'L' in the display and will continue to function independent of being displayed.

## RATE DISPLAY EXCEEDED

If the rate of the input signal causes a display that exceeds the capacity of the Rate display (5 digits, 99999), then the display will indicate an overflow condition by showing "r 0L0L". During this overflow condition, the Minimum and Maximum rate values will stay at their values even during resets.

\* Factory Setting can be used without affecting basic start-up.

## RATE SCALING

To scale the Rate, enter a Scaling Display value with a corresponding Scaling Input value. (The Display and Input values can be entered by Key-in or Applied Methods.) These values are internally plotted to a Display value of 0 and Input value of 0 Hz. A linear relationship is formed between these points to yield a rate display value that corresponds to the incoming input signal rate. The PAXI and PAXR are capable of showing a rate display value for any linear process.

## KEY-IN SCALING METHOD CALCULATION

If a display value versus input signal (in pulses per second) is known, then those values can be entered into Scaling Display (**rd5Px**) and Scaling Input (**r INPx**). No further calculations are needed.

If only the number of pulses per 'single' unit (i.e. # of pulses per foot) is known, then it can be entered as the Scaling Input value and the Scaling Display value will be entered as the following:

RATE PER	DISPLAY ( <b>rd5Px</b> )	INPUT ( <b>r INPx</b> )
Second	1	# of pulses per unit
Minute	60	# of pulses per unit
Hour	3600	# of pulses per unit

### NOTES:

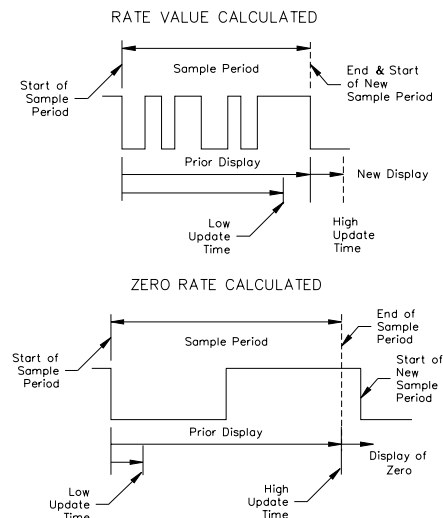
- If # of pulse per unit is less than 10, then multiply both Input and Display values by 10.
- If # of pulse per unit is less than 1, then multiply both Input and Display values by 100.
- If the Display value is raised or lowered, then Input value must be raised or lowered by the same proportion (i.e. Display value for per hour is entered by a third less (1200) then Input value is a third less of # of pulses per unit). The same is true if the Input value is raised or lowered, then Display value must be raised or lowered by the same proportion.
- Both values must be greater than 0.0.

### EXAMPLE:

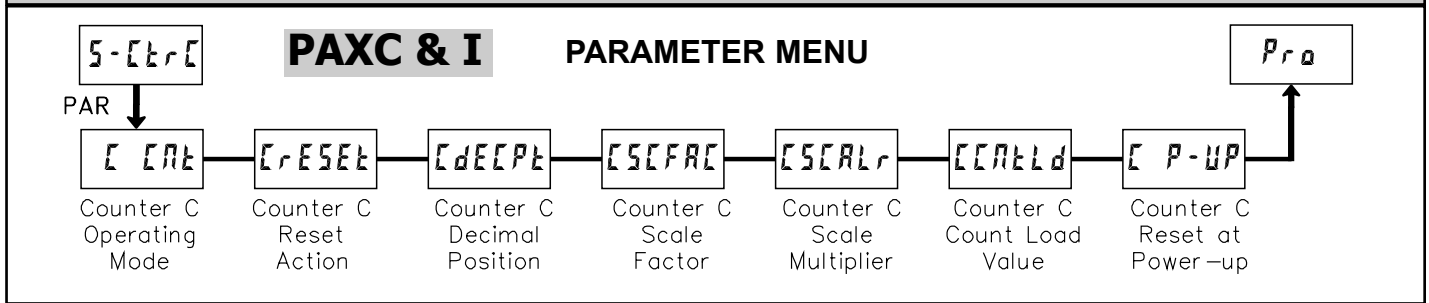
- With 15.1 pulses per foot, show feet per minute in tenths. Scaling Display = 60.0 Scaling Input = 15.1.
- With 0.25 pulses per gallon, show whole gallons per hour. (To have greater accuracy, multiply both Input and Display values by 10.) Scaling Display = 36000 Scaling Input = 2.5.

## INPUT FREQUENCY CALCULATION

The meter determines the input frequency by summing the number of falling edges received during a sample period of time. The sample period begins on the first falling edge. At this falling edge, the meter starts accumulating time towards Low Update and High Update values. Also, the meter starts accumulating the number of falling edges. When the time reaches the Low Update Time value, the meter looks for one more falling edge to end the sample period. If a falling edge occurs (before the High Update Time value is reached), the Rate display will update to the new value and the next sample period will start on the same edge. If the High Update Time value is reached (without receiving a falling edge after reaching Low Update Time), then the sample period will end but the Rate display will be forced to zero. The High Update Time value must be greater than the Low Update Time value. Both values must be greater than 0.0. The input frequency calculated during the sample period, is then shown as a Rate value determined by either scaling method.

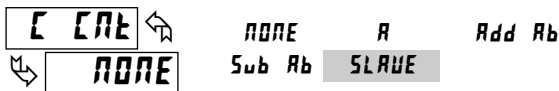


## 6.5 MODULE 5 - COUNTER C INPUT PARAMETERS (5-Enter)



Module 5 is the programming for Counter C. For maximum input frequency, the counter operating mode should be set to **none** when not in use. When set to **none** the remaining related parameters are not accessible. The C annunciator indicates that Counter C is being shown in the Display Mode. An Exchange Parameter List feature for scale factor and count load values is explained in Module 2.

### COUNTER C OPERATING MODE \*



Select the operating mode for Counter C.

**none** Does not count.

**A** Counter C counts the incoming pulses from Counter A input as per Counter A mode of operation. The signal is scaled only according to Counter C parameters.

**Add Ab** Counter C counts the incoming pulses from Counter A and B inputs as per Counter A and B modes of operation. The result is scaled only according to Counter C parameters. (Example: If Counter A is set for Count X1 mode and Counter B is set for Count X2 mode, then Counter C will increment by 1 for each pulse received on Input A and increment by 2 for each pulse received on Input B less any effects of scaling.)

**Sub Ab** Counter C counts the incoming pulses from Counter A and B inputs as per Counter A and B modes of operation and subtracts the B counts from the A counts. The result is scaled only according to Counter C parameters. (Example: If Counter A is set for Count X1 mode and Counter B is set for Count X2 mode, then Counter C will increment by 1 for each pulse received on Input A and decrement by 2 for each pulse received on Input B less any effects of scaling.)

*Note: When using Add Ab or Sub Ab, Counter A, B and C must all be reset at the same time for the math to be performed on the display values.*

**SLAVE** See Serial Communications for details.  
(PAXI only)

### COUNTER C RESET ACTION



When Counter C is reset, it returns to zero or Counter C count load value. This reset action affects all Counter C resets, except the Setpoint Counter Auto Reset Action in Module 6.

### COUNTER C DECIMAL POSITION



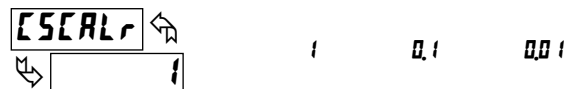
This selects the decimal point position for Counter C and any setpoint value assigned to Counter C. The selection will also affect Counter C scale factor calculations.

### COUNTER C SCALE FACTOR



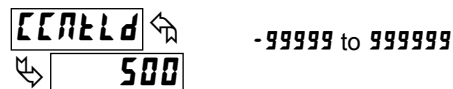
The number of input counts is multiplied by the scale factor and the scale multiplier to obtain the desired process value. A scale factor of 1.00000 will result in the display of the actual number of input counts. For **A** (Numeric transmissions) modes of operation, the input signal is scaled directly. For **Add Ab** and **Sub Ab** modes of operation, the math is performed on the input signals and then the result is scaled. To achieve correct results, both Input A and Input B must provide the same amount of pulses per unit of measurement. (Details on scaling calculations are explained at the end of Module 1 section.)

### COUNTER C SCALE MULTIPLIER



The number of input counts is multiplied by the scale multiplier and the scale factor to obtain the desired process value. A scale multiplier of 1 will result in only the scale factor affecting the display. (Details on scaling calculations are explained at the end of Module 1 section.)

### COUNTER C COUNT LOAD VALUE



When reset to count load action is selected, Counter C will reset to this value.

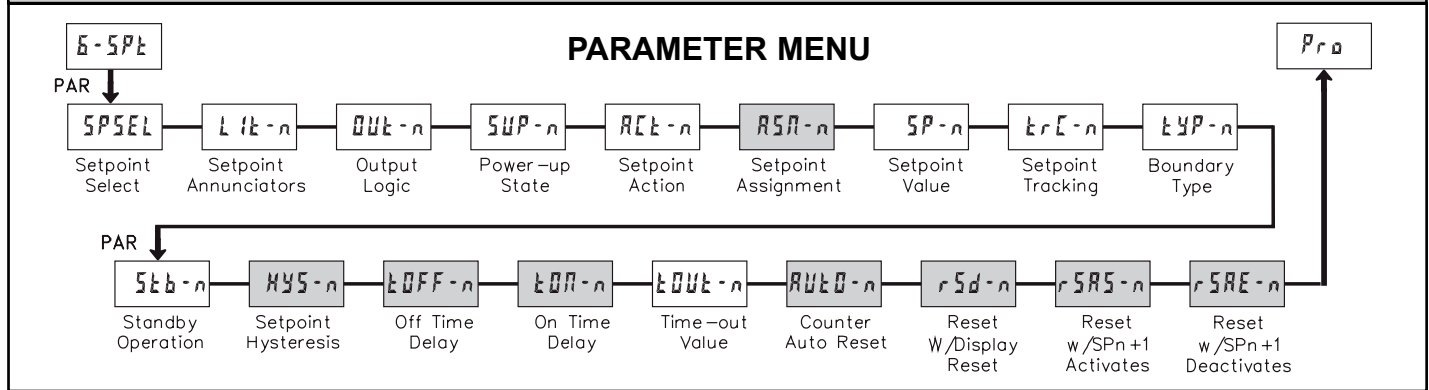
### COUNTER C RESET POWER-UP \*



Counter C may be programmed to reset at each meter power-up.

\* Factory Setting can be used without affecting basic start-up.

## 6.6 MODULE 6 - SETPOINT (ALARM) PARAMETERS (6-SPt)



Module 6 is the programming for the setpoint (alarms) output parameters. To have setpoint outputs, a setpoint Plug-in card needs to be installed into the PAX (see Ordering Information). Depending on the card installed, there will be two or four setpoint outputs available. This section replaces the bulletin that comes with the setpoint plug-in card. Please discard the separate literature when using the Plug-in card with the Digital PAX. For maximum input frequency, unused Setpoints should be configured for **OFF** action.

The setpoint assignment and the setpoint action determine certain setpoint feature availability. The chart below illustrates this.

### SETPOINT PARAMETER AVAILABILITY

PARAMETER	DESCRIPTION	RATE			COUNTER		
		TIMED OUT tOUT	BOUNDARY bOUND	LATCH LATCH	TIMED OUT tOUT	BOUNDARY bOUND	LATCH LATCH
Lk-n	Annunciators	Yes	Yes	Yes	Yes	Yes	Yes
Out-n	Output Logic	Yes	Yes	Yes	Yes	Yes	Yes
SUP-n	Power Up State	Yes	Yes	Yes	Yes	Yes	Yes
SP-n	Setpoint Value	Yes	Yes	Yes	Yes	Yes	Yes
Trk-n	Setpoint Tracking	Yes	Yes	Yes	Yes	Yes	Yes
Typ-n	Boundary Type	Yes	Yes	Yes	No	Yes	No
Stb-n	Standby Operation	Yes	Yes	Yes	No	Yes	No
HYS-n	Setpoint Hysteresis	No	Yes	No	No	No	No
tOFF-n	Setpoint Off Delay	No	Yes	No	No	No	No
tON-n	Setpoint On Delay	Yes	Yes	Yes	No	No	No
tOUT-n	Setpoint Time Out	Yes	No	No	Yes	No	No
RUTD-n	Counter Auto Reset	No	No	No	Yes	No	Yes
rSD-n	Reset With Display Reset	No	No	No	Yes	No	Yes
rRAS-n	Reset When SPn+1 Activates	No	No	No	Yes	No	Yes
rRAE-n	Reset When SPn+1 Deactivates	No	No	No	Yes	No	Yes

#### SETPOINT SELECT



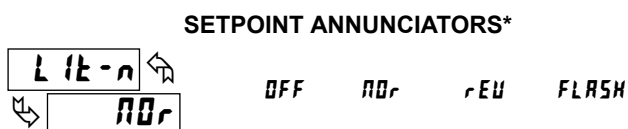
Select a setpoint (alarm output) to open the remaining module menu. (The “n” in the following parameters will reflect the chosen setpoint number.) After the chosen setpoint is programmed, the display will default to **SPSEL NO**. Select the next setpoint to be programmed and continue the sequence for each setpoint. Pressing **PAR** at **SPSEL NO** will exit Module 6.

#### SETPOINT OUTPUT LOGIC \*



Normal (**NO**) turns the output “on” when activated and “off” when deactivated. Reverse (**RE**) turns the output “off” when activated and “on” when deactivated.

#### SETPOINT POWER UP STATE \*



**OFF** disables the display of the setpoint annunciator. Normal (**NO**) displays the corresponding setpoint annunciator of an “on” alarm output. Reverse (**RE**) displays the corresponding setpoint annunciator of an “off” alarm output. **FLASH** flashes the display and the corresponding setpoint annunciator of an “on” alarm output.



**SAVE** will restore the output to the same state it was at before the meter was powered down. **ON** will activate the output at power up. **OFF** will deactivate the output at power up.

\* Factory Setting can be used without affecting basic start-up.

## SETPOINT ACTION

**ACT-n**  **OFF**  **OFF** **LATCH** **TIME** **BOUND**

**OFF:** When not using a setpoint, it should be set to **OFF** (no action).


### For Counter Assignments:


- LATCH** With Latch action, the setpoint output activates when the count value equals the setpoint value. The output remains active until reset. This action is not associated with Boundary types.
- BOUND** With boundary action, the setpoint output activates when the count value is greater than or equal to (for **LYP = HI**) or less than or equal to (for **LYP = LO**) the setpoint value. The setpoint output will deactivate when the count value is less than (for **LYP = HI**) or greater than (for **LYP = LO**) the setpoint value.
- TIME** With Timed Out action, the setpoint output activates when the count value equals the setpoint value and deactivates after the Time Out value. This action is not associated with Boundary types.

### For Rate Assignments:

- LATCH** With Latch action, the setpoint output activates when the rate value is equal to the setpoint value. The setpoint output remains active until reset. If after reset, the rate value is greater than or equal to (for **LYP = HI**) or less than or equal to (for **LYP = LO**) the setpoint value, the output will reactivate.
- BOUND** With Boundary action, the setpoint output activates when the rate value is greater than or equal to (for **LYP = HI**) or less than or equal to (for **LYP = LO**) the setpoint value. The setpoint output will deactivate (Auto reset) as determined by the hysteresis value.
- TIME** With Timed Out action, the setpoint output cycles when the rate value is greater than or equal to (for **LYP = HI**) or less than or equal to (for **LYP = LO**) the setpoint value. The Setpoint Time Out (**TIME-n**) and Setpoint On Delay (**SEOn-n**) values determine the cycling times.

## PAXC & I: SETPOINT ASSIGNMENT

**ASn-n**  **A** **CnE** **b** **CnE** **c** **CnE** **r** **ALe**

 **A** **CnE**

Select the display that the setpoint is to be assigned.

## SETPOINT VALUE

**SP-n**  **-99999 to 999999**

 **100**

Enter the desired setpoint value. Setpoint values can also be entered in the Quick Programming Mode when the setpoint is configured as **ENk** in Module 3. (See Module 2 for Exchange Parameter Lists explanation.)

## SETPOINT TRACKING \*

**trE-n**  **NO** **SP-1** **SP-2** **SP-3**

 **NO** **SP-4** **ACnELd** **bCnELd** **cCnELd**

If a selection other than NO is chosen, then the value of the setpoint being programmed ("n") will track the entered selection's value. Tracking means that when the selection's value is changed (in the Quick Programming Mode), the "n" setpoint value will also change (or follow) by the same amount.

## SETPOINT BOUNDARY TYPE

**LYP-n**  **HI** **LO**

 **HI**

**HI** activates the output when the assigned display value (**ACT-n**) equals or exceeds the setpoint value. **LO** activates the setpoint when the assigned display value is less than or equal to the setpoint.

## SETPOINT STANDBY OPERATION \*

**Stb-n**  **YES** **NO**

 **NO**

Selecting **YES** will disable low acting setpoints at a power up until the display value crosses into the alarm "off" area. Once in the alarm "off" area, the setpoint will function according to the configured setpoint parameters.

## PAXI & R: SETPOINT HYSTERESIS \*

**HY5-n**  **0 to 9999**

 **0**

The hysteresis value is added to (for **LYP = LO**), or subtracted from (for **LYP = HI**), the setpoint value to determine at what value to deactivate the associated setpoint output. Hysteresis is only available for setpoints assigned to the Rate with boundary action.

## PAXI & R: SETPOINT OFF DELAY \*

**EOFF-n**  **000 to 9999 seconds**

 **0.00**

This is the amount of time the Rate display must meet the setpoint deactivation requirements (below hysteresis for high acting and above hysteresis for low acting) before the setpoint's output deactivates.

## PAXI & R: SETPOINT ON DELAY \*

**EOOn-n**  **000 to 9999 seconds**

 **0.00**

This is the amount of time the Rate display must meet the setpoint activation requirements (below setpoint for **LYP = LO** and above setpoint for **LYP = HI**) before the setpoint's output activates. If the Rate Setpoint Action is Timed Out, this is the amount of time the output is off during the on / off output cycling.

## SETPOINT TIME OUT \*

**TIME-n**  **000 to 9999 seconds**

 **1.00**

If the setpoint action is Timed Out and the setpoint is assigned to Rate, then this is the amount of time the output is on during the on / off output cycling. If the setpoint action is Timed Out and the setpoint is assigned to Count, then this is the amount of time the output will activate once the count value equals the setpoint value.

## PAXC & I: COUNTER AUTO RESET \*

**AutO-n**  **NO** **ZE-ORAS** **CLdAS**

 **NO** **ZE-ORAE** **CLdAE**

This automatically resets the display value of the Setpoint Assignment (**ASn-n**) counter each time the setpoint value is reached. This reset may be different than the Counter's Reset Action (**xrESEk**) in Module 1 or 5.

SELECTION	ACTION
<b>NO</b>	No auto reset.
<b>ZE-ORAS</b>	Reset to zero at the start of output activation.
<b>CLdAS</b>	Reset to count load value at the start of output activation.
<b>ZE-ORAE</b>	Reset to zero at the end of output activation. ( <b>TIME</b> action only).
<b>CLdAE</b>	Reset to count load value at the end of output activation. ( <b>TIME</b> action only).

\* Factory Setting can be used without affecting basic start-up.



### PAXC & I: SETPOINT RESET WITH DISPLAY RESET \*

Select **YES**, so the setpoint output will deactivate (reset) when the Setpoint Assignment (**ASn-n**) counter display resets. The only exception is if the assigned counter is reset by a Counter Auto reset generated by another setpoint.

### PAXC & I: SETPOINT RESET WHEN SPn+1 ACTIVATES \*

Select **YES**, so the setpoint output will deactivate (reset) when SPn +1 activates. (Example: SP1 deactivates when SP2 activates and SP4 when SP1 activates.) The last setpoint will wrap around to the first.

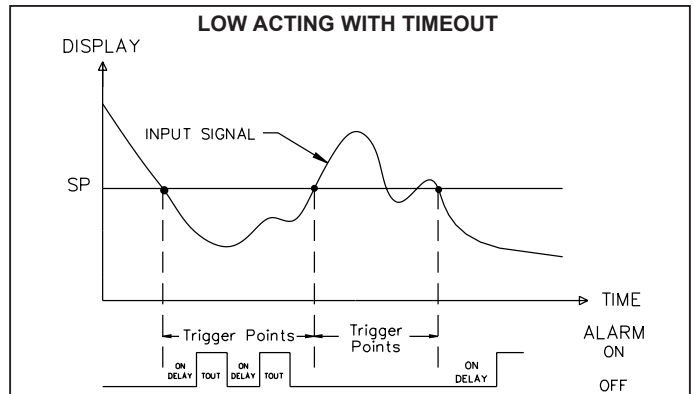
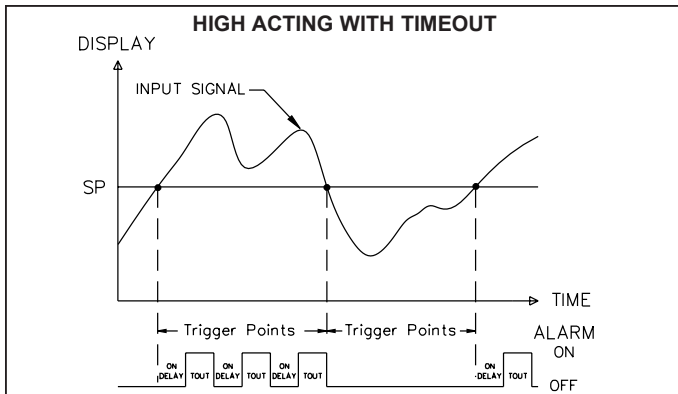
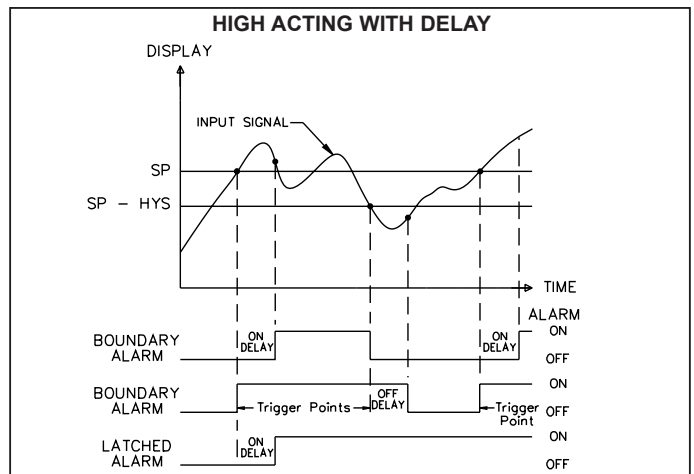
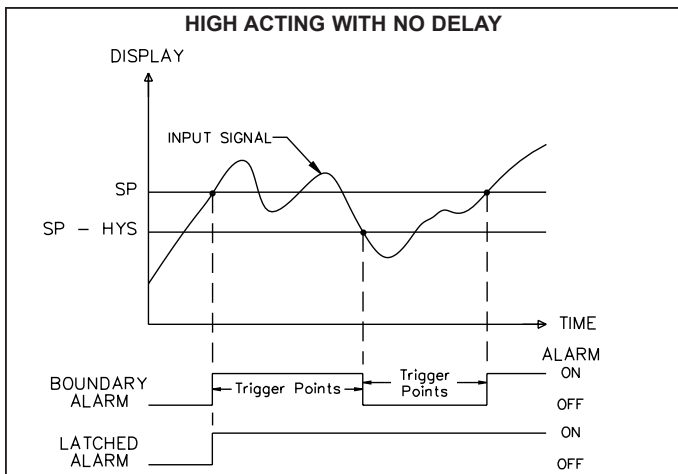
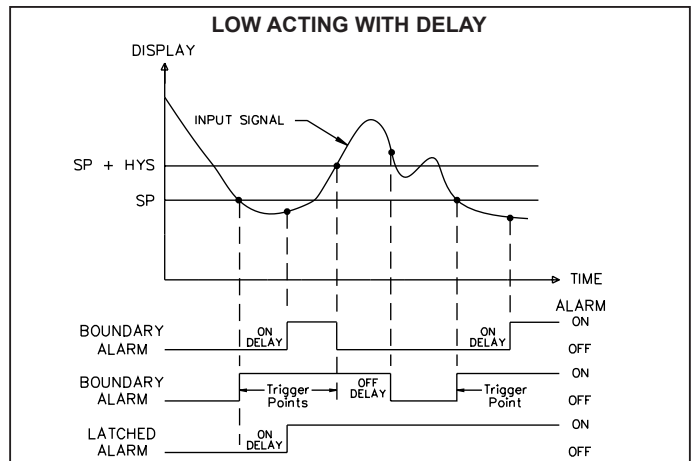
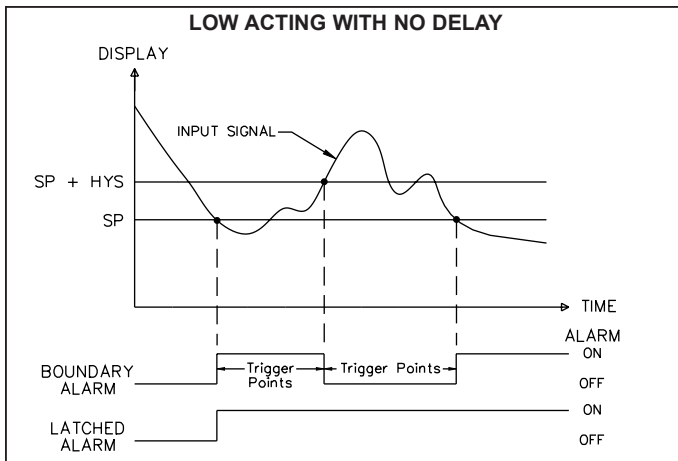
### PAXC & I: SETPOINT RESET WHEN SPn+1 DEACTIVATES \*

Select **YES**, so the setpoint output will deactivate (reset) when SPn +1 activates and then times out (deactivates). This function may only be used if the SPn+1 is programmed for Setpoint Action of **timeout**. (Example SP1 deactivates when SP2 is activated and then times out.) The last setpoint will wrap around to the first.

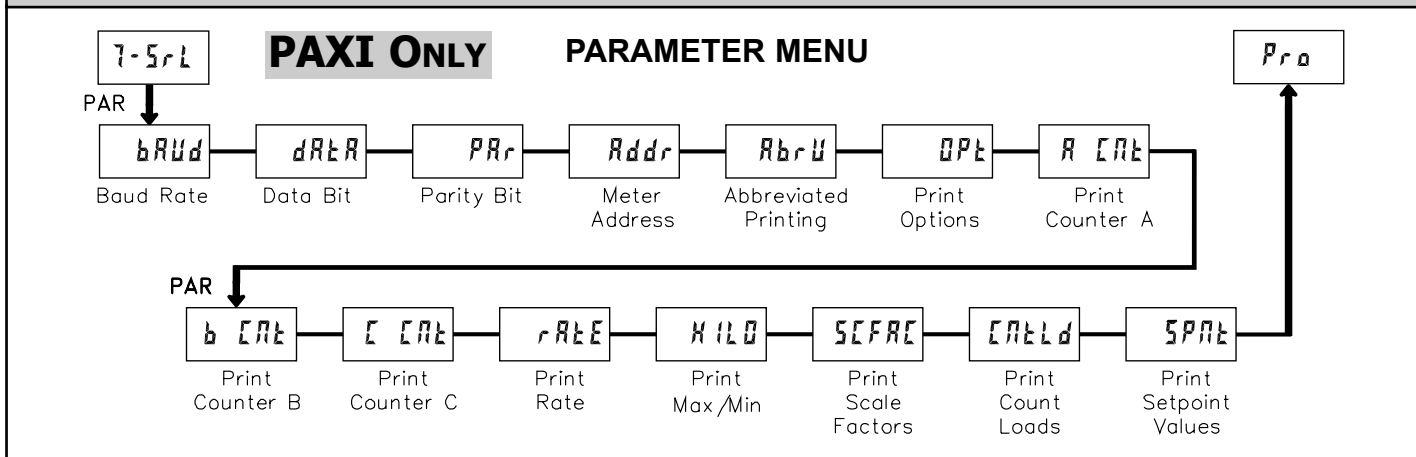
\* Factory Setting can be used without affecting basic start-up.

## PAXR & I: SETPOINT (ALARM) FIGURES FOR RATE

(For Reverse Action, The Alarm state is opposite.)



## 6.7 MODULE 7 - SERIAL COMMUNICATIONS PARAMETERS (7-5rL)



Module 7 is the programming module for the Serial Communications Parameters. These parameters are used to match the serial settings of the PAXI with those of the host computer or other serial device, such as a terminal or printer. This programming module can only be accessed if an RS232 or RS485 Serial Communications card is installed.

This section also includes an explanation of the commands and formatting required for communicating with the PAXI. In order to establish serial communications, the user must have host software that can send and receive ASCII characters. Red Lion's SFPAX software can be used for configuring the PAXI (See Ordering Information). For serial hardware and wiring details, refer to section 4.5 Serial Communication Wiring.

*This section replaces the bulletin shipped with the RS232 and RS485 serial communications plug-in cards. Discard the separate bulletin when using those serial plug-in cards with the PAXI. Also, this section does NOT apply to the DeviceNet, Modbus, or Profibus-DP communication cards. For details on the operation of the Fieldbus cards, refer to the bulletin shipped with each card.*

**BAUD RATE**

**bAUD** **300** **600** **1200** **2400**  
**9600** **4800** **9600** **19200**

Set the baud rate to match the other serial communications equipment on the serial link. Normally, the baud rate is set to the highest value that all the serial equipment are capable of transmitting and receiving.

**DATA BIT**

**dRtR** **7** **8**  
**7**

Select either 7 or 8 bit data word lengths. Set the word length to match the other serial communications equipment on the serial link.

**PARITY BIT**

**PRr** **NO** **Odd** **EVEN**  
**Odd**

Set the parity bit to match that of the other serial communications equipment on the serial link. The meter ignores the parity when receiving data and sets the parity bit for outgoing data. If no parity is selected with 7 bit word length, an additional stop bit is used to force the frame size to 10 bits.

### METER UNIT ADDRESS

**Rddr** **00** to **99**  
**00**

Enter the serial meter (node) address. With a single unit, an address is not needed and a value of zero can be used. With multiple units (RS485 applications), a unique 2 digit address number must be assigned to each meter.

### ABBREVIATED PRINTING

**RbrU** **YES** **NO**  
**NO**

Select **NO** for full print or Command T transmissions (meter address, parameter data and mnemonics) or **YES** for abbreviated print transmissions (parameter data only). This will affect all the parameters selected in the print options. (If the meter address is 00, it will not be sent during a full transmission.)

### PRINT OPTIONS

**OPT** **YES** **NO**  
**NO**

**YES** - Enters the sub-menu to select the meter parameters to appear during a print request. For each parameter in the sub-menu, select **YES** for that parameter information to be sent during a print request or **NO** for that parameter information not to be sent. A print request is sometimes referred to as a block print because more than one parameter information (meter address, parameter data and mnemonics) can be sent to a printer or computer as a block.

PARAMETER	DESCRIPTION	FACTORY	MNEMONIC
<b>A Cnt</b>	Counter A	<b>YES</b>	CTA
<b>b Cnt</b>	Counter B	<b>NO</b>	CTB
<b>C Cnt</b>	Counter C	<b>NO</b>	CTC
<b>rRtE</b>	Rate	<b>NO</b>	RTE
<b>M ILO</b>	Max. & Min.	<b>NO</b>	MIN MAX
<b>SCFAC</b>	A B C Scale Factors	<b>NO</b>	SFA SFB SFC
<b>CntLD</b>	A B C Count Load	<b>NO</b>	LDA LDB LDC
<b>SPnt</b>	1 2 3 4 Setpoints *	<b>NO</b>	SP1 SP2 SP3 SP4

\*Setpoints are plug-in card dependent.

## SENDING SERIAL COMMANDS AND DATA

When sending commands to the meter, a string containing at least one command character must be constructed. A command string consists of a command character, a value identifier, numerical data (if writing data to the meter) followed by a the command terminator character \* or \$. The <CR> is also available as a terminator when Counter C is in the SLAVE mode.

### Command Chart

Command	Description	Notes
N	Node (Meter) Address Specifier	Address a specific meter. Must be followed by <b>two digit</b> node address. Not required when address = 00.
T	Transmit Value (read)	Read a register from the meter. Must be followed by register ID character.
V	Value change (write)	Write to register of the meter. Must be followed by register ID character and numeric data.
R	Reset	Reset a register or output. Must be followed by register ID character
P	Block Print Request (read)	Initiates a block print output. Registers are defined in programming.

### Command String Construction

The command string must be constructed in a specific sequence. The meter does not respond with an error message to invalid commands. The following procedure details construction of a command string:

1. The first characters consist of the Node Address Specifier (N) followed by a 2 character address number. The address number of the meter is programmable. If the node address is 0, this command and the node address itself may be omitted. This is the only command that may be used in conjunction with other commands.
2. After the optional address specifier, the next character is the command character.
3. The next character is the Register ID. This identifies the register that the command affects. The P command does not require a Register ID character. It prints according to the selections made in print options.
4. If constructing a value change command (writing data), the numeric data is sent next.
5. All command strings must be terminated with the string termination characters \*, \$ or when Counter C is set for slave mode <CR>. The meter does not begin processing the command string until this character is received. See Timing Diagram figure for differences between terminating characters.

### Register Identification Chart

ID	VALUE DESCRIPTION	REGISTER NAME <sup>1</sup>	COMMAND <sup>2</sup>	TRANSMIT DETAILS <sup>3</sup>
A	Count A	CTA	T, V, R	6 digit (V), 8 digit (T)
B	Count B	CTB	T, V, R	6 digit (V), 8 digit (T)
C	Count C	CTC	T, V, R	6 digit (V), 8 digit (T)
D	Rate	RTE	T, V	5 digit, positive only
E	Min	MIN	T, V, R	5 digit, positive only
F	Max	MAX	T, V, R	5 digit, positive only
G	Scale Factor A	SFA	T, V	6 digit, positive only
H	Scale Factor B	SFB	T, V	6 digit, positive only
I	Scale Factor C	SFC	T, V	6 digit, positive only
J	Count Load A	LDA	T, V	5 negative / 6 positive
K	Count Load B	LDB	T, V	5 negative / 6 positive
L	Count Load C	LDC	T, V	5 negative / 6 positive
M	Setpoint 1	SP1	T, V, R	5 negative / 6 positive
O	Setpoint 2	SP2	T, V, R	5 negative / 6 positive
Q	Setpoint 3	SP3	T, V, R	5 negative / 6 positive
S	Setpoint 4	SP4	T, V, R	5 negative / 6 positive
U	Auto/Manual Register	MMR	T, V	0 - auto, 1 - manual
W	Analog Output Register	AOR	T, V	0 - 4095 normalized
X	Setpoint Register	SOR	T, V	0 - not active, 1 - active

1. Register Names are also used as Register Mnemonics during full transmission.
2. The registers associated with the P command are set up in Print Options (Module 7).
3. Unless otherwise specified, the Transmit Details apply to both T and V Commands.

### Command String Examples:

1. Address = 17, Write 350 to Setpoint 1  
String: N17VM350\$
2. Address = 5, Read Count A value, response time of 50 - 100 msec. min.  
String: N05TA\*
3. Address = 0, Reset Setpoint 4 output  
String: RS\*

### Transmitting Data To the Meter

Numeric data sent to the meter must be limited to Transmit Details listed in the Register Identification Chart. Leading zeros are ignored. Negative numbers must have a minus sign. The meter ignores any decimal point and conforms the number to the scaled resolution. (ie. The meter's scaled decimal point position is set for 0.0 and 25 is written to a register. The value of the register is now 2.5. In this case, write a value of 250 to equal 25.0).

*Note: Since the meter does not issue a reply to value change commands, follow with a transmit value command for readback verification.*

### Transmitting Data From the Meter

Data is transmitted from the meter in response to either a transmit command (T), a print block command (P) or User Function print request. The response from the meter is either a full field transmission or an abbreviated transmission. The meter response is established in Module 7.

### Full Transmission

Byte	Description
1, 2	2 byte Node (Meter) Address field [00-99]
3	<SP> (Space)
4-6	3 byte Register Mnemonic field
7-18	12 byte numeric data field: 10 bytes for number, one byte for sign, one byte for decimal point
19	<CR> (Carriage return)
20	<LF> (Line feed)
21	<SP> (Space)*
22	<CR> (Carriage return)*
23	<LF> (Line feed)*

\* These characters only appear in the last line of a block print.

The first two characters transmitted (bytes 1 and 2) are the unit address. If the address assigned is 00, two spaces are substituted. A space (byte 3) follows the unit address field. The next three characters (bytes 4 to 6) are the register mnemonic. The numeric data is transmitted next.

The numeric field (bytes 7 to 18) is 12 characters long. When the requested value exceeds eight digits for count values or five digits for rate values, an \* (used as an overflow character) replaces the space in byte 7. Byte 8 is always a space. The remaining ten positions of this field (bytes 9 to 18) consist of a minus sign (for negative values), a floating decimal point (if applicable), and eight positions for the requested value. The data within bytes 9 to 18 is right-aligned with leading spaces for any unfilled positions.

The end of the response string is terminated with <CR> (byte 19), and <LF> (byte 20). When a block print is finished, an extra <SP> (byte 21), <CR> (byte 22), and <LF> (byte 23) are used to provide separation between the transmissions.

### Abbreviated Transmission

Byte	Description
1-12	12 byte data field, 10 bytes for number, one byte for sign, one byte for decimal point
13	<CR> (Carriage return)
14	<LF> (Line feed)
15	<SP> (Space)*
16	<CR> (Carriage return)*
17	<LF> (Line feed)*

\* These characters only appear in the last line of a block print.

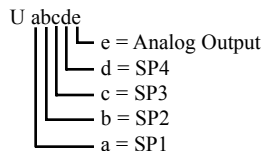
The abbreviated response suppresses the address and register mnemonics, leaving only the numeric part of the response.

### Meter Response Examples:

1. Address = 17, full field response, Count A = 875  
17 CTA 875 <CR><LF>
2. Address = 0, full field response, Setpoint 2 = -250.5  
SP2 -250.5<CR><LF>
3. Address = 0, abbreviated response, Setpoint 2 = 250, last line of block print  
250<CR><LF><SP><CR><LF>

### Auto/Manual Mode Register (MMR) ID: U

This register sets the controlling mode for the outputs. In Auto Mode (0) the meter controls the setpoint and analog output. In Manual Mode (1) the outputs are defined by the registers SOR and AOR. When transferring from auto mode to manual mode, the meter holds the last output value (until the register is changed by a write). Each output may be independently changed to auto or manual. In a write command string (VU), any character besides 0 or 1 in a field will not change the corresponding output mode.



**Example:** VU00011 places SP4 and Analog in manual.

### Analog Output Register (AOR) ID: W

This register stores the present signal value of the analog output. The range of values of this register is 0 to 4095, which corresponds to the analog output range per the following chart:

Register Value	Output Signal*		
	0-20 mA	4-20 mA	0-10V
0	0.000	4.000	0.000
1	0.005	4.004	0.0025
2047	10.000	12.000	5.000
4094	19.995	19.996	9.9975
4095	20.000	20.000	10.000

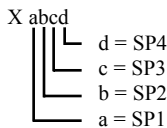
*\*Due to the absolute accuracy rating and resolution of the output card, the actual output signal may differ 0.15% FS from the table values. The output signal corresponds to the range selected (0-20 mA, 4-20 mA or 0-10 V).*

Writing to this register (VW) while the analog output is in the Manual Mode causes the output signal level to update immediately to the value sent. While in the Automatic Mode, this register may be written to, but it has no effect until the analog output is placed in the manual mode. When in the Automatic Mode, the meter controls the analog output signal level. Reading from this register (TW) will show the present value of the analog output signal.

**Example:** VW2047 will result in an output of 10.000 mA, 12.000 mA or 5.000V depending on the range selected.

### Setpoint Output Register (SOR) ID: X

This register stores the states of the setpoint outputs. Reading from this register (TX) will show the present state of all the setpoint outputs. A "0" in the setpoint location means the output is off and a "1" means the output is on.



In Automatic Mode, the meter controls the setpoint output state. In Manual Mode, writing to this register (VX) will change the output state. Sending any character besides 0 or 1 in a field or if the corresponding output was not first in manual mode, the corresponding output value will not change. (It is not necessary to send least significant 0s.)

**Example:** VX10 will result in output 1 on and output 2 off.

## COUNTER C SLAVE COMMUNICATIONS

Counter C may be programmed for **SLAVE**, to act as a serial slave display. By doing this, the carriage return <CR> is added as a valid command terminator character for all serial command strings. The <CR> as a terminator may be very useful for standard serial commands, even if Counter C is never displayed or sent a slave message. The \$ terminator should not be used in the slave mode. If numeric values are not to be saved to EPROM then send the value as a literal transmission with <CR> terminator.

The Counter C slave display is right aligned. It has a capacity of displaying six characters. When less than six characters are received, blank spaces will be placed in front of the characters. If more than six characters are sent, then only the last six are displayed. The meter has a 192 character buffer for the slave display. If more than 192 characters are sent, the additional characters are discarded until a terminator is received. Counter C processes numeric and literal transmissions differently.

### Numeric Transmissions

When a string that does not begin with #, T, V, P or R is received, the meter processes it as a Numeric transmission. In this case, only the recognized numbers and punctuation are displayed. All other characters in the string are discarded. If a negative sign appears anywhere in the string the resulting number will be negative. Only the most significant decimal point is retained. If no numerical characters are received, then the numeric value will be zero. The numeric display can be used for setpoint (boundary action only) and analog output functions. When using this display for setpoint and analog output values, the decimal point position must match the programming entered through the front panel. The numeric value is retained in Counter C memory until another Numeric transmission is received.

Recognized Numbers = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9  
Recognized Punctuation = period, comma, minus

### Literal Transmissions

When a string that begins with # is received, the meter processes it as a Literal transmission. In this case, any unrecognized characters will be replaced with a space. A Literal display will replace a Numeric value in the Counter C display. However, it will not remove a previous Numeric value from Counter C memory or prevent the Counter C outputs from functioning with the Numeric value. Literal transmissions are only possible when using RS232 or RS485 cards.

Recognized Characters = a, b, c, d, e, f, g, h, i, j, l, n, o, p, q, r, s, t, u, y, z (in upper or lower case)  
Recognized Numbers = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9  
Recognized Punctuation = period, comma, minus, blank

## COMMAND RESPONSE TIME

The meter can only receive data or transmit data at any one time (half-duplex operation). During RS232 transmissions, the meter ignores commands while transmitting data, but instead uses RXD as a busy signal. When sending commands and data to the meter, a delay must be imposed before sending another command. This allows enough time for the meter to process the command and prepare for the next command.

At the start of the time interval  $t_1$ , the computer program prints or writes the string to the com port, thus initiating a transmission. During  $t_1$ , the command characters are under transmission and at the end of this period, the command terminating character (\*, \$ or slave only <CR>) is received by the meter. The time duration of  $t_1$  is dependent on the number of characters and baud rate of the channel.

$$t_1 = (10 \text{ times the \# of characters}) / \text{baud rate}$$

At the start of time interval  $t_2$ , the meter starts the interpretation of the command and when complete, performs the command function. This time interval  $t_2$  varies (See Timing Diagrams). If no response from the meter is expected, the meter is ready to accept another command.

If the meter is to reply with data, the time interval  $t_2$  is controlled by the use of the command terminating character. The '\*' or '<CR>' terminating character results in a response time window of 50 msec. minimum and 100 msec. maximum. This allows sufficient time for the release of the sending driver on the RS485 bus. Terminating the command line with '\$' results in a response time window ( $t_2$ ) of 2 msec. minimum and 50 msec. maximum. The faster response time of this terminating character requires that sending drivers release within 2 msec. after the terminating character is received.

At the beginning of time interval  $t_3$ , the meter responds with the first character of the reply. As with  $t_1$ , the time duration of  $t_3$  is dependent on the number of characters and baud rate of the channel. At the end of  $t_3$ , the meter is ready to receive the next command.

$$t_3 = (10 \text{ times the \# of characters}) / \text{baud rate}$$

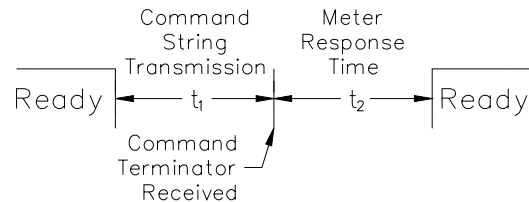
The maximum serial throughput of the meter is limited to the sum of the times  $t_1$ ,  $t_2$  and  $t_3$ .

## SERIAL TIMING

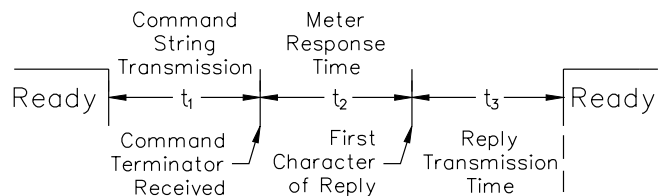
COMMAND	COMMENT	PROCESS TIME ( $t_2$ )
	Numeric Slave	2-50 msec.
R	Reset	2-50 msec.
#	Literal	2-50 msec.
V	Write	100-200 msec.
T	Transmit	2-50 msec. for \$ 50-100 msec. for * and <CR>
P	Print	2-50 msec. for \$ 50-100 msec. for * and <CR>

### Timing Diagrams

#### NO REPLY FROM METER



#### RESPONSE FROM METER



## COMMUNICATION FORMAT

Data is transferred from the meter through a serial communication channel. In serial communications, the voltage is switched between a high and low level at a predetermined rate (baud rate) using ASCII encoding. The receiving device reads the voltage levels at the same intervals and then translates the switched levels back to a character.

The voltage level conventions depend on the interface standard. The table lists the voltage levels for each standard.

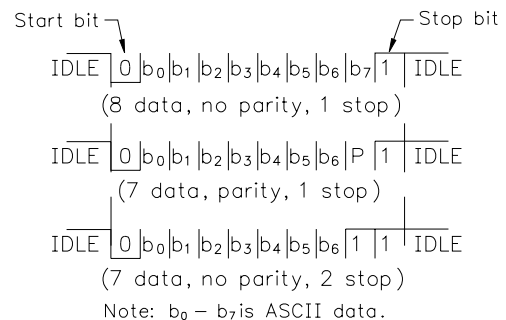
LOGIC	INTERFACE STATE	RS232*	RS485*
1	mark (idle)	TXD,RXD; -3 to -15 V	a-b < -200 mV
0	space (active)	TXD,RXD; +3 to +15 V	a-b > +200 mV

\* Voltage levels at the Receiver

Data is transmitted one byte at a time with a variable idle period between characters (0 to ∞). Each ASCII character is "framed" with a beginning start bit, an optional parity bit and one or more ending stop bits. The data format and baud rate must match that of other equipment in order for communication to take place. The figures list the data formats employed by the meter.

### Start bit and Data bits

Data transmission always begins with the start bit. The start bit signals the receiving device to prepare for reception of data. One bit period later, the least significant bit of the ASCII encoded character is transmitted, followed by the remaining data bits. The receiving device then reads each bit position as they are transmitted.



Character Frame Figure

### Parity bit

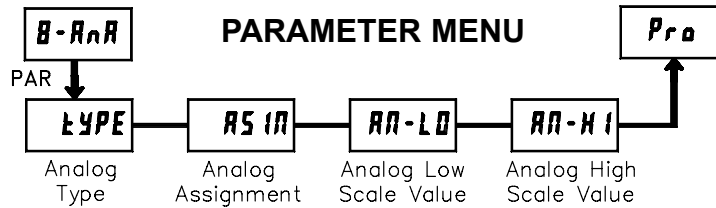
After the data bits, the parity bit is sent. The transmitter sets the parity bit to a zero or a one, so that the total number of ones contained in the transmission (including the parity bit) is either even or odd. This bit is used by the receiver to detect errors that may occur to an odd number of bits in the transmission. However, a single parity bit cannot detect errors that may occur to an even number of bits. Given this limitation, the parity bit is often ignored by the receiving device. The PAX meter ignores the parity bit of incoming data and sets the parity bit to odd, even or none (mark parity) for outgoing data.

### Stop bit

The last character transmitted is the stop bit. The stop bit provides a single bit period pause to allow the receiver to prepare to re-synchronize to the start of a new transmission (start bit of next byte). The receiver then continuously looks for the occurrence of the start bit. If 7 data bits and no parity is selected, then 2 stop bits are sent from the PAXI.

## 6.8 MODULE 8 - ANALOG OUTPUT PARAMETERS (8-ANA)

### PAXI ONLY



Module 8 is the programming for the analog output parameters. To have an analog output signal, an analog output plug-in card needs to be installed (See Ordering Information). This section replaces the bulletin that comes with the analog plug-in card. Please discard the separate literature when using the plug-in card with the PAXI.

#### ANALOG TYPE



SELECTION	RANGE
0-20	0 to 20 mA
4-20	4 to 20 mA
0-10	0 to 10 V

Enter the analog output type. For voltage output use terminals 16 and 17. For current output use terminals 18 and 19. Only one range can be used at a time.

#### ANALOG ASSIGNMENT

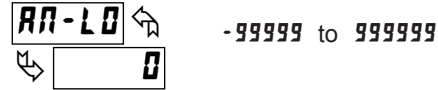


A Cnt	b Cnt	c Cnt
rate	LO	HI

Select the display that the analog output is to follow:

A Cnt = Counter A Value	rate = Rate Value
b Cnt = Counter B Value	LO = Minimum Value
c Cnt = Counter C Value	HI = Maximum Value

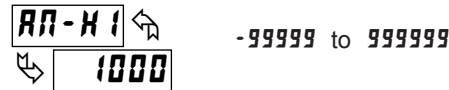
#### ANALOG LOW SCALE VALUE



Enter the display value within the selected Analog Assignment that corresponds to the low limit of the type selected.

The decimal point is determined by the decimal point setting of the assigned counter or rate. The scale value can not be set to read values with more than 6 digits. Reverse acting output is possible by reversing the scaling values.

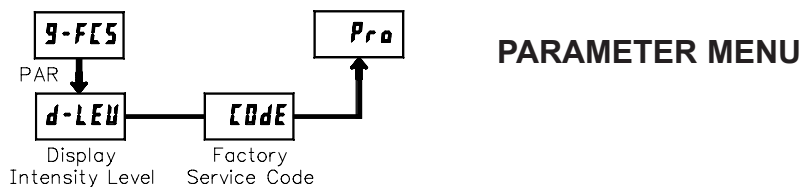
#### ANALOG HIGH SCALE VALUE



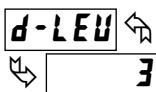
Enter the display value within the selected Analog Assignment that corresponds to the high limit of the type selected.

The decimal point is determined by the decimal point setting of the assigned counter or rate. The scale value can not be set to read values with more than 6 digits. Reverse acting output is possible by reversing the scaling values.

## 6.9 MODULE 9 - FACTORY SERVICE OPERATIONS (9-FCS)



#### DISPLAY INTENSITY LEVEL



Enter the desired Display Intensity Level (0-15) by using the arrow keys. The display will actively dim or brighten as the levels are changed. This parameter also appears in Quick Programming Mode when enabled.

#### RESTORE FACTORY DEFAULTS



Use the arrow keys to display **CODE 66** and press **PAR**. The meter will display **reset** and then returns to **CODE 50**. Press **DSP** key to return to the Display Mode. This will overwrite all user settings with the factory settings.

Pressing the **PAR** and **DSP** keys at the same time on power-up will load the factory settings and display **Err4**. This allows operation in the event of a memory failure or corrupted data. Immediately press **RST** key and reprogram the meter. If the meter is powered down again before pressing the **RST** key, the existing dynamic data will not be overwritten.



## PAXI: CALIBRATION



The only item in the PAXI meter that can be calibrated is the Analog Output. The Count A and B values are scaled using the parameters in Module 1, Counter C value is scaled using Module 5 and the Rate value is scaled using Module 4. If the meter appears to be indicating incorrectly or inaccurately, refer to the Troubleshooting section.

When Analog Out recalibration is required (generally every 2 years), it should be performed by qualified technicians using appropriate equipment. Calibration does not change any user programmed parameters.

Calibration may be aborted by disconnecting power to the meter before exiting Module 9. In this case, the existing calibration settings remain in effect.

*Note: Allow a 30 minute warm-up period before starting calibration.*

## Analog Output Card Calibration

Before starting, verify that a precision meter with an accuracy of 0.05% or better (voltmeter for voltage output and/or current meter for current output) is connected and ready. Then perform the following procedure:

1. Use the arrow keys to display **CODE 48** and press **PAR**.
2. **ANL OUT** is displayed. Use the arrow keys to select **YES** and press **PAR**.
3. Using the chart below, step through the five selections to be calibrated. At each prompt, use the PAXI arrow keys to adjust the output so that the external meter display matches the selection being calibrated. When the external reading matches, or if the range is not being calibrated, press **PAR**.

SELECTION	EXTERNAL METER	ACTION
<b>0.0_A</b>	0.00	Adjust if necessary, press <b>PAR</b>
<b>4.0_A</b>	4.00	Adjust if necessary, press <b>PAR</b>
<b>20.0_A</b>	20.00	Adjust if necessary, press <b>PAR</b>
<b>0.0_u</b>	0.00	Adjust if necessary, press <b>PAR</b>
<b>10.0_u</b>	10.00	Adjust if necessary, press <b>PAR</b>

4. When **CODE 50** appears, press **PAR** twice and remove the external meters.

## TROUBLESHOOTING

For further assistance, contact technical support at the appropriate company numbers listed.

PROBLEM	REMEDIES
<b>NO DISPLAY</b>	<b>CHECK:</b> Power level, power connections
<b>PROGRAM LOCKED-OUT</b>	<b>CHECK:</b> Active (lock-out) user input <b>ENTER:</b> Security code requested
<b>CERTAIN DISPLAYS ARE LOCKED OUT</b>	<b>CHECK:</b> Module 3 programming
<b>INCORRECT DISPLAY VALUE or NOT COUNTING</b>	<b>CHECK:</b> Input wiring, DIP switch setting, input programming, scale factor calculation, input signal level, user input jumper, lower input signal frequency
<b>USER INPUT NOT WORKING CORRECTLY</b>	<b>CHECK:</b> User input wiring, user input jumper, user input being used for signal, Module 2
<b>OUTPUT DOES NOT WORK</b>	<b>CHECK:</b> Corresponding plug-in card installation, output configuration, output wiring
<b>JITTERY DISPLAY</b>	<b>CHECK:</b> Wiring is per EMC installation guidelines, input signal frequency, signal quality, scaling, update time, DIP switch setting
<b>"r 0.00" RATE</b>	<b>CHECK:</b> Lower input signal frequency, reduce rate scaling
<b>MODULES or PARAMETERS NOT ACCESSIBLE</b>	<b>CHECK:</b> Corresponding plug-in card installation, related controlling parameter selected
<b>ERROR CODE (Err 1-4)</b>	<b>PRESS:</b> Reset key (if unable to clear contact factory.)
<b>SERIAL COMMUNICATIONS</b>	<b>CHECK:</b> Wiring, connections, meter and host settings

Shaded areas are model dependent.

# PARAMETER VALUE CHART

## PAX Model Number \_\_\_\_\_

Programmer \_\_\_\_\_ Date \_\_\_\_\_  
Meter# \_\_\_\_\_ Security Code \_\_\_\_\_

### 1- INP Counter A & B Input Parameters - PAXC & I only

DISPLAY	PARAMETER	FACTORY SETTING	USER SETTING
<b>A CNt</b>	COUNTER A OPERATING MODE	<b>cnt</b>	_____
<b>ArESEt</b>	COUNTER A RESET ACTION	<b>2Er0</b>	_____
<b>AdECPt</b>	COUNTER A DECIMAL POSITION	<b>0</b>	_____
<b>ASCFAC</b>	COUNTER A SCALE FACTOR (A)	<b>100000</b>	_____
	COUNTER A SCALE FACTOR (B) *	<b>100000</b>	_____
<b>ASCLr</b>	COUNTER A SCALE MULTIPLIER	<b>1</b>	_____
<b>ACntLd</b>	COUNTER A COUNT LOAD VALUE (A)	<b>500</b>	_____
	COUNTER A COUNT LOAD VALUE (B)*	<b>500</b>	_____
<b>A P-UP</b>	COUNTER A RESET POWER-UP	<b>NO</b>	_____
<b>PrSEN</b>	PRESALER OUTPUT ENABLE	<b>NO</b>	_____
<b>PrVAL</b>	PRESALER SCALE VALUE	<b>10000</b>	_____
<b>b CNt</b>	COUNTER B OPERATING MODE	<b>none</b>	_____
<b>brESEt</b>	COUNTER B RESET ACTION	<b>2Er0</b>	_____
<b>bdECPt</b>	COUNTER B DECIMAL POSITION	<b>0</b>	_____
<b>bSCFAC</b>	COUNTER B SCALE FACTOR (A)	<b>100000</b>	_____
	COUNTER B SCALE FACTOR (B)*	<b>100000</b>	_____
<b>bSCLr</b>	COUNTER B SCALE MULTIPLIER	<b>1</b>	_____
<b>bCntLd</b>	COUNTER B COUNT LOAD VALUE (A)	<b>500</b>	_____
	COUNTER B COUNT LOAD VALUE (B)*	<b>500</b>	_____
<b>b P-UP</b>	COUNTER B RESET POWER-UP	<b>NO</b>	_____

\* See Module 2, Exchanging Parameter Lists, for details on programming this value.

Shaded areas are model dependent.

### 2-Fnc User Input and Function Key Parameters

DISPLAY	PARAMETER	FACTORY SETTING	USER SETTING
<b>USr-1</b>	USER INPUT 1	<b>NO</b>	_____
<b>USr-2</b>	USER INPUT 2	<b>NO</b>	_____
<b>USr-3</b>	USER INPUT 3	<b>NO</b>	_____
<b>F1</b>	FUNCTION KEY 1	<b>NO</b>	_____
<b>F2</b>	FUNCTION KEY 2	<b>NO</b>	_____
<b>rSt</b>	RESET KEY	<b>dSPrSt</b>	_____
<b>Sc-F1</b>	2nd FUNCTION KEY 1	<b>NO</b>	_____
<b>Sc-F2</b>	2nd FUNCTION KEY 2	<b>NO</b>	_____

### 3-LOC Display and Program Lockout Parameters

DISPLAY	PARAMETER	FACTORY SETTING	USER SETTING
<b>A CNt</b>	COUNTER A DISPLAY LOCK-OUT	<b>rEd</b>	_____
<b>b CNt</b>	COUNTER B DISPLAY LOCK-OUT	<b>LOC</b>	_____
<b>C CNt</b>	COUNTER C DISPLAY LOCK-OUT	<b>LOC</b>	_____
<b>rAtE</b>	RATE DISPLAY LOCK-OUT	<b>rEd</b>	_____
<b>H1</b>	MAX DISPLAY LOCK-OUT	<b>LOC</b>	_____
<b>L0</b>	MIN DISPLAY LOCK-OUT	<b>LOC</b>	_____
<b>SP-1</b>	SETPOINT 1 ACCESS LOCK-OUT	<b>LOC</b>	_____
<b>SP-2</b>	SETPOINT 2 ACCESS LOCK-OUT	<b>LOC</b>	_____
<b>SP-3</b>	SETPOINT 3 ACCESS LOCK-OUT	<b>LOC</b>	_____
<b>SP-4</b>	SETPOINT 4 ACCESS LOCK-OUT	<b>LOC</b>	_____
<b>ACntLd</b>	COUNT LOAD A ACCESS	<b>LOC</b>	_____
<b>bCntLd</b>	COUNT LOAD B ACCESS	<b>LOC</b>	_____
<b>CNtLd</b>	COUNT LOAD C ACCESS	<b>LOC</b>	_____
<b>ASCFAC</b>	SCALE FACTOR A ACCESS	<b>ENt</b>	_____
<b>bSCFAC</b>	SCALE FACTOR B ACCESS	<b>LOC</b>	_____
<b>CSCFAC</b>	SCALE FACTOR C ACCESS	<b>LOC</b>	_____
<b>COdE</b>	SECURITY CODE	<b>0</b>	_____

Shaded areas are model dependent.

### 4-rtE Rate Input Parameters - PAXI & R only

DISPLAY	PARAMETER	FACTORY SETTING	USER SETTING
<b>rAtEEN</b>	RATE ASSIGNMENT	<b>rAtE-R</b>	_____
<b>L0-Udt</b>	LOW UPDATE TIME	<b>10</b>	_____
<b>H1-Udt</b>	HIGH UPDATE TIME	<b>20</b>	_____
<b>rtE dP</b>	RATE DECIMAL POINT	<b>0</b>	_____
<b>SEGS</b>	LINEARIZER SEGMENTS	<b>0</b>	_____
<b>r dSP 0</b>	SCALING PT. 1 - DISPLAY VALUE	<b>0</b>	_____
<b>r INP 0</b>	SCALING PT. 1 - INPUT VALUE	<b>00</b>	_____
<b>r dSP 1</b>	SCALING PT. 2 - DISPLAY VALUE	<b>1000</b>	_____
<b>r INP 1</b>	SCALING PT. 2 - INPUT VALUE	<b>10000</b>	_____
<b>r dSP 2</b>	SCALING PT. 3 - DISPLAY VALUE	<b>2000</b>	_____
<b>r INP 2</b>	SCALING PT. 3 - INPUT VALUE	<b>20000</b>	_____
<b>r dSP 3</b>	SCALING PT. 4 - DISPLAY VALUE	<b>3000</b>	_____
<b>r INP 3</b>	SCALING PT. 4 - INPUT VALUE	<b>30000</b>	_____
<b>r dSP 4</b>	SCALING PT. 5 - DISPLAY VALUE	<b>4000</b>	_____
<b>r INP 4</b>	SCALING PT. 5 - INPUT VALUE	<b>40000</b>	_____
<b>r dSP 5</b>	SCALING PT. 6 - DISPLAY VALUE	<b>5000</b>	_____
<b>r INP 5</b>	SCALING PT. 6 - INPUT VALUE	<b>50000</b>	_____
<b>r dSP 6</b>	SCALING PT. 7 - DISPLAY VALUE	<b>6000</b>	_____
<b>r INP 6</b>	SCALING PT. 7 - INPUT VALUE	<b>60000</b>	_____
<b>r dSP 7</b>	SCALING PT. 8 - DISPLAY VALUE	<b>7000</b>	_____
<b>r INP 7</b>	SCALING PT. 8 - INPUT VALUE	<b>70000</b>	_____
<b>r dSP 8</b>	SCALING PT. 9 - DISPLAY VALUE	<b>8000</b>	_____
<b>r INP 8</b>	SCALING PT. 9 - INPUT VALUE	<b>80000</b>	_____
<b>r dSP 9</b>	SCALING PT. 10 - DISPLAY VALUE	<b>9000</b>	_____
<b>r INP 9</b>	SCALING PT. 10 - INPUT VALUE	<b>90000</b>	_____
<b>rOUNd</b>	RATE DISPLAY ROUNDING	<b>1</b>	_____
<b>LOCut</b>	MINIMUM LOW CUT OUT	<b>0</b>	_____
<b>H1-t</b>	MAX CAPTURE DELAY TIME	<b>20</b>	_____
<b>L0-t</b>	MIN CAPTURE DELAY TIME	<b>20</b>	_____

Shaded areas are model dependent.

### 5-CtC Counter C Input Parameters - PAXC & I only

DISPLAY	PARAMETER	FACTORY SETTING	USER SETTING
<b>C CNt</b>	COUNTER C OPERATING MODE	<b>none</b>	_____
<b>CrESEt</b>	COUNTER C RESET ACTION	<b>2Er0</b>	_____
<b>CdECPt</b>	COUNTER C DECIMAL POSITION	<b>0</b>	_____
<b>CSCFAC</b>	COUNTER C SCALE FACTOR (A)	<b>100000</b>	_____
	COUNTER C SCALE FACTOR (B)*	<b>100000</b>	_____
<b>CSCCLr</b>	COUNTER C SCALE MULTIPLIER	<b>1</b>	_____
<b>CNtLd</b>	COUNTER C COUNT LOAD VALUE (A)	<b>500</b>	_____
	COUNTER C COUNT LOAD VALUE (B)*	<b>500</b>	_____
<b>C P-UP</b>	COUNTER C RESET POWER-UP	<b>NO</b>	_____

\* See Module 2, Exchanging Parameter Lists, for details on programming this value.

**6 - SPt Setpoint (Alarm) Parameters**

		SP-1		SP-2		SP-3		SP-4	
DISPLAY	PARAMETER	FACTORY SETTING	USER SETTING	FACTORY SETTING	USER SETTING	FACTORY SETTING	USER SETTING	FACTORY SETTING	USER SETTING
LIt-n	SETPOINT ANNUNCIATORS	NO		NO		NO		NO	
OUT-n	SETPOINT OUTPUT LOGIC	NO		NO		NO		NO	
SUP-n	SETPOINT POWER UP STATE	OFF		OFF		OFF		OFF	
ACT-n	SETPOINT ACTION	OFF		OFF		OFF		OFF	
ASN-n	SETPOINT ASSIGNMENT	A Cn		A Cn		A Cn		A Cn	
SP-n	SETPOINT VALUE (A)	100		100		100		100	
	SETPOINT VALUE (B)*	100		100		100		100	
trC-n	SETPOINT TRACKING	NO		NO		NO		NO	
YP-n	SETPOINT BOUNDARY TYPE	H I		H I		H I		H I	
Stb-n	STANDBY OPERATION	NO		NO		NO		NO	
HYS-n	SETPOINT HYSTERESIS (rate)	0		0		0		0	
tOFF-n	SETPOINT OFF DELAY	0.00		0.00		0.00		0.00	
tON-n	SETPOINT ON DELAY	0.00		0.00		0.00		0.00	
tOUT-n	SETPOINT TIME OUT	1.00		1.00		1.00		1.00	
RUt0-n	COUNTER AUTO RESET ACTION	NO		NO		NO		NO	
rSd-n	SETPOINT RESET WITH DISPLAY	NO		NO		NO		NO	
rRAS-n	RESET WHEN SPn+1 ACTIVATES	NO		NO		NO		NO	
rSRE-n	RESET WHEN SPn+1 DEACTIVATES	NO		NO		NO		NO	

\* See Module 2, *Exchanging Parameter Lists*, for details on programming this value.

Shaded areas are model dependent.

**7 - 5rL Serial Communication Parameters - PAXI only**

DISPLAY	PARAMETER	FACTORY SETTING	USER SETTING
bAUD	BAUD RATE	9600	
dAtA	DATA BIT	7	
PAR	PARITY BIT	Odd	
Addr	METER ADDRESS	00	
Abv	ABBREVIATED PRINTING	NO	
A Cn	PRINT COUNTER A	YES	
b Cn	PRINT COUNTER B	NO	
C Cn	PRINT COUNTER C	NO	
rAtE	PRINT RATE	NO	
HiLo	PRINT MAX & MIN	NO	
SCFA	PRINT SCALE FACTORS	NO	
CnLd	PRINT COUNT LOAD VALUES	NO	
SPn	PRINT SETPOINT VALUES	NO	

**8 - Ana Analog Output Parameters - PAXI only**

DISPLAY	PARAMETER	FACTORY SETTING	USER SETTING
tYPE	ANALOG TYPE	4-20	
AS n	ANALOG ASSIGNMENT	rAtE	
An-Lo	ANALOG LOW SCALE VALUE	0	
An-Hi	ANALOG HIGH SCALE VALUE	1000	

**9 - FLS Factory Service Parameters**

DISPLAY	PARAMETER	FACTORY SETTING	USER SETTING
d-LEU	DISPLAY INTENSITY LEVEL	3	

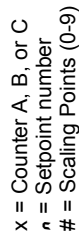
**LIMITED WARRANTY**

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company's liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company's option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company's products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.

**Pr. 8**



## INTERNATIONAL HEADQUARTERS

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## EUROPEAN HEADQUARTERS

892 Plymouth Road, Slough, Berkshire SL1 4LP  
ENGLAND +44 1753 696888 FAX: +44 1753 696339

## DITAK 3A - THE COST-EFFECTIVE WAY TO GET DIGITAL ACCURACY FOR MACHINE SPEED & PRODUCTION RATE INDICATION

- 4-DIGIT, 0.43" (11 mm) LED DISPLAY
- 0.1% ACCURACY
- 1-SECOND TIME-BASE
- PROGRAMMABLE INPUT CIRCUIT ACCEPTS OUTPUTS FROM A WIDE VARIETY OF SENSORS



### DESCRIPTION

The DITAK 3A provides a very economical means for obtaining high performance speed or rate readout on any machine or process. It is a natural choice for O.E.M. applications as well as for equipping existing machines or retrofitting older equipment in the users plant. The DITAK 3A uses circuit technology proven in tens of thousands of successful field applications. It's programmable input circuit allows it to be used with a wide variety of inputs and its simplicity of design makes it very easy to install and use.

The unit has a fixed 1-second time-base that is derived from the A.C. power-line and provides readings accurate to  $\pm 0.1\%$  (A program switch on the rear selects 50/60 Hz operation). A 1-second display update time provides optimum readability.

The fixed, 1-second time-base requires that input pulse rates be properly scaled to produce a direct readout. If the rate measurement is on a 1-second basis, such as strokes-per-second or inches-per-second, then one input pulse per stroke or per inch will result in direct readout. If the rate measurement is on a minute basis (ft/min, gallons/min, revolutions/min), then 60 pulses per unit-of-measurement are required for direct readout.

### SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

### SPECIFICATIONS

- PRIMARY SUPPLY VOLTAGE:** Available in two voltage ratings, 50/60 Hz (See Ordering Information). Allowable supply voltage variation  $\pm 10\%$ . Input power 5 VA.  
Note: These units cannot be operated from +12 VDC.
- SENSOR OUTPUT POWER:** +12 VDC  $\pm 15\%$ , 120 mA max.

### 3. ENVIRONMENTAL CONDITIONS:

**Operating Temperature:** -20 to 50°C

**Storage Temperature:** -40 to 80°C

**Operating and Storage Humidity:** 85% max. (non-condensing) from 0°C to 50°C.

**Altitude:** Up to 2000 meters

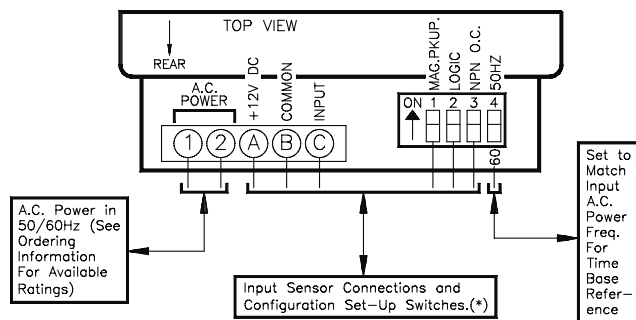
### 4. INPUT SENSITIVITY & RATINGS: \*

**5. CONSTRUCTION:** Steel Case, Aluminum Bezel, Aluminum Front Panel with Polycarbonate Overlay, Black Epoxy Paint Finish. Connections on rear via screw terminal strips with clamp-type pressure plates that accept stripped wires without lugs.

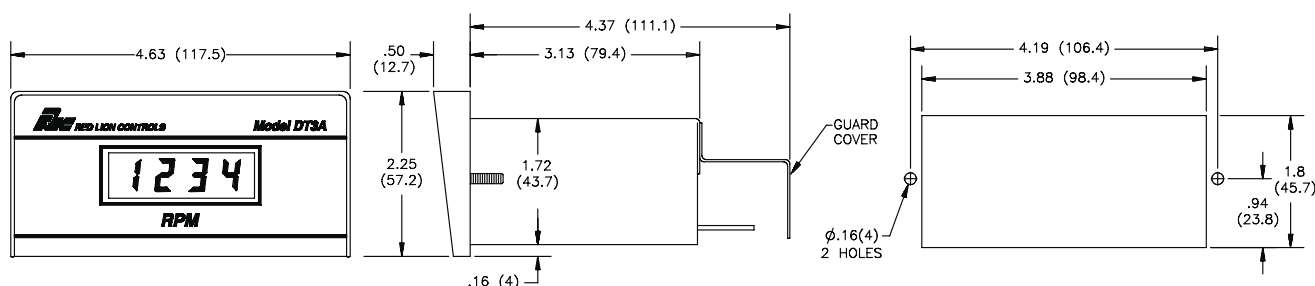
**6. WEIGHT:** 1.2 lbs (0.54 Kg)

\* - See Ditak 3A & 3D Sensor Input Connections & Input Configuration Switch Set-up section.

### DITAK 3A CONNECTIONS AND INPUT SET-UP

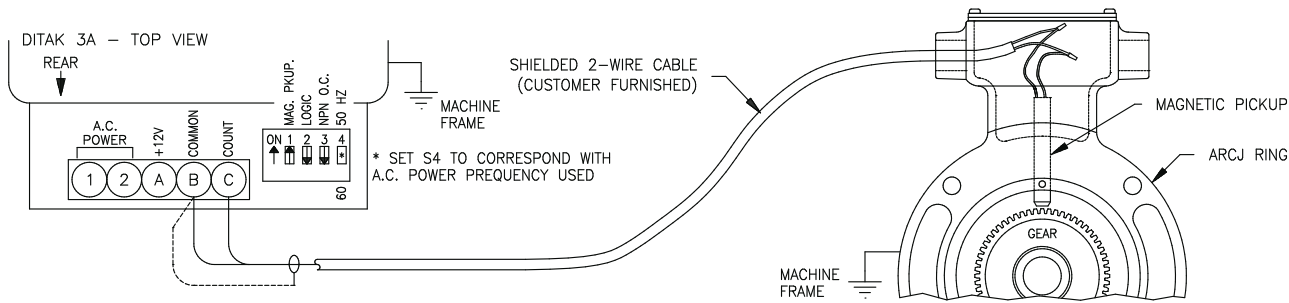


### DIMENSIONS "In inches (mm)"



DITAK 3A TYPICAL APPLICATIONS

1. MOTOR RPM READOUT USING ARCJ NEMA C-FLANGE ADAPTER KIT



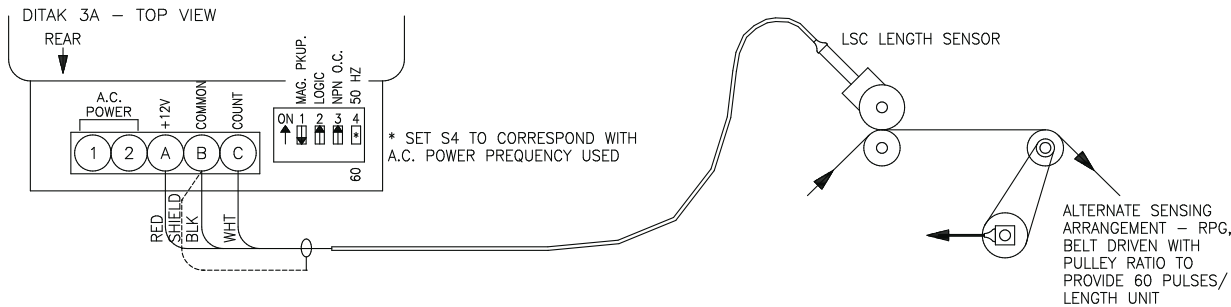
Readout of motor or shaft RPM is one of the most popular applications of the DITAK 3A, since it is usually quite simple to locate a 60-tooth sensing gear on the shaft to be monitored.

In this example, an ARCJ adapter ring kit is used to develop the input signal. The ARCJ kit includes the adapter ring, magnetic pickup, and a 60-

tooth sensing gear. It can be mounted directly on a NEMA-C flange motor face or between the motor and a mating flange on a gear reducer. (For more information, see Sensor Section of the Catalog.)

Signal connection between the DITAK 3A and the magnetic pickup of the ARCJ ring is via a 2-wire shielded cable.

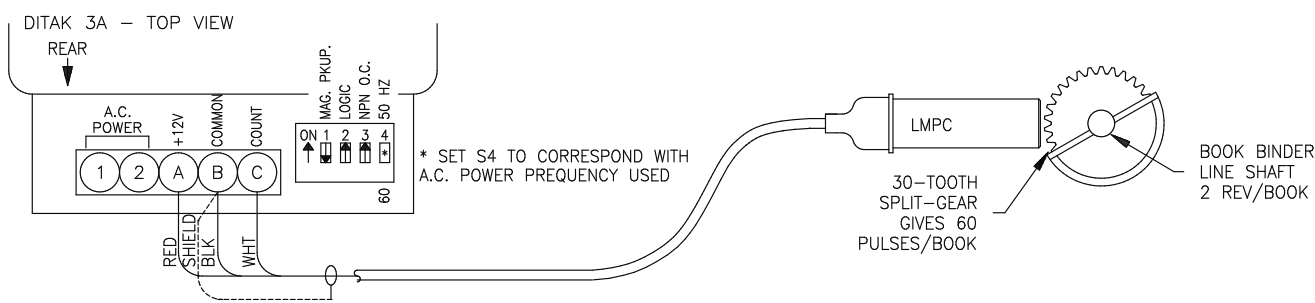
2. READING LINEAR SPEED IN FEET/MIN, INCHES/MIN, METERS/MIN, ETC.



Rate measurement of units having a time based in minutes (*gallons/ min, feet/min, etc.*) is easily accomplished, with the fixed, 1-second, up-date time of the DITAK 3A, if the sensor arrangement yields 60 pulses/ unit-of-measure. Shown above is a typical application involving material length measurement. LSC Length Sensors are available with outputs of 60 pulses/ft,

60 pulses/yard, and 60 pulses/ meter, specifically for this type of application. As an alternate, an RPG can be belt driven from an idler roll shaft to provide the same information rate. (See Sensor Section of the Catalog for more information on LSC, RPG, and other sensors.)

3. OBTAINING 60 PULSES/UNIT INFORMATION RATE FROM LINE SHAFT



Many machines have a line shaft or an intermediate drive member that runs at some integral speed related to the product being produced. In this example, a book-binding machine is driven by a line shaft that makes 2 revolutions for each book produced. The desired rate readout is in Books/Min. To use the

DITAK 3A with its 1-second time base, an information rate of 60 pulses/book is required. As shown above, this is easily accomplished by sensing a 30-tooth gear mounted on the line shaft with an LMPC sensor.

TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES	
		230 VAC	115 VAC
DT3A	4-Digit Tach. 1-Sec. T.B.	DT3A0410	DT3A0400

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.



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## EUROPEAN HEADQUARTERS

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## DITAK 3D - 5-DIGIT RATE INDICATION, PROGRAMMABLE ADAPTABILITY TO ACCOMMODATE VIRTUALLY ANY RATE MEASURING NEED

- 5-DIGIT, 0.43" (11 mm) LED DISPLAY
- CRYSTAL-CONTROLLED TIME-BASE PROGRAMMABLE UP TO 32 SECONDS, PROVIDES DIRECT-READING FOR ANY RATE UNITS
- 0.01% ACCURACY
- PROGRAMMABLE DECIMAL POINTS
- SELECTABLE FREQUENCY DOUBLING
- PROGRAMMABLE INPUT CIRCUIT ACCEPTS OUTPUTS FROM A WIDE VARIETY OF SENSORS



## DESCRIPTION

The DITAK 3D provides versatility and flexibility. Based on circuit designs and technology, this unit is field-proven for reliability in tens of thousands of actual in-plant installations.

The key to adaptability in rate measurement, lies in the ability to scale for direct readout in terms of the units being measured. Whether a machine produces bottles, cloth, wire, or beverage mix, operation is enhanced when the rate readout is expressed directly in bottles/min, feet/min, gallons/hour, or whatever units are customarily used in plant operation. The DITAK 3D provides this capability through its settable time base, programmable decimal points and frequency doubling function.

## SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

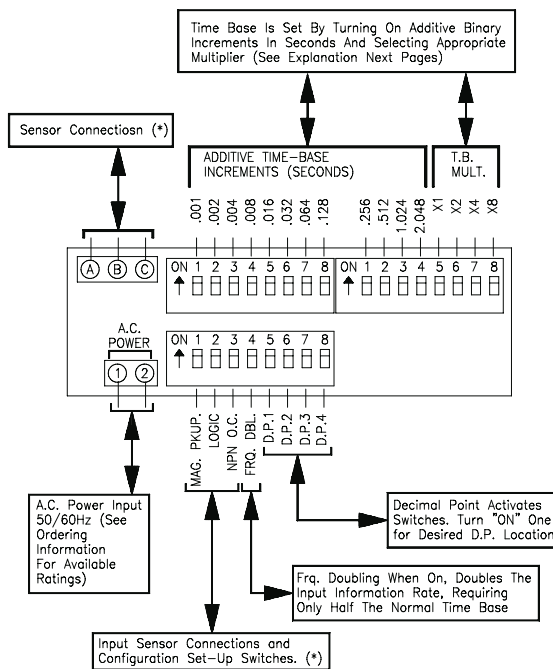
## SPECIFICATIONS

- PRIMARY SUPPLY VOLTAGE:** Available in two voltage ratings, 50/60 Hz (See Ordering Information). Allowable supply voltage variation  $\pm 10\%$ . Input power 5 VA.  
*Note: These units can also be operated from +12 VDC  $\pm 15\%$  power supplies or batteries, (+) connected to Term. "A" and (-) to "B". Max. current drain from +12 VDC supply is 350 mA.*
- SENSOR OUTPUT POWER:** +12 VDC  $\pm 15\%$ , 75 mA max.
- ENVIRONMENTAL CONDITIONS:**  
**Operating Temperature:** -20 to 50°C  
**Storage Temperature:** -40 to 80°C  
**Operating and Storage Humidity:** 85% max. (non-condensing) from 0°C to 50°C.  
**Altitude:** Up to 2000 meters
- INPUT SENSITIVITY & RATINGS: (\*)**
- CONSTRUCTION:** Steel Case, Aluminum Bezel, Aluminum Front Panel with Polycarbonate Overlay, Black Epoxy Paint Finish. Connections on rear

via screw terminal strips with clamp-type pressure plates that accept stripped wires without lugs.

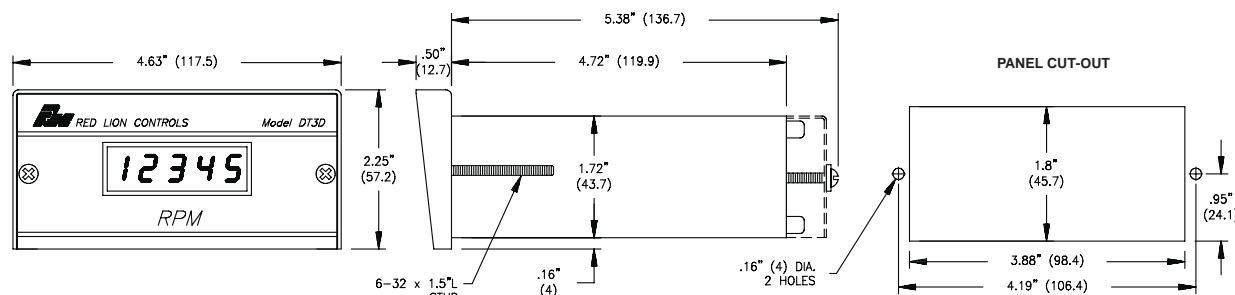
6. **WEIGHT:** 1.5 lbs. (0.68 Kg)

## DITAK 3D CONNECTIONS & PROGRAMMING SWITCHES



\* - See Ditak 3A & 3D Sensor Input Connections & Input Configuration Switch Set-up section.

## DIMENSIONS "In inches (mm)"



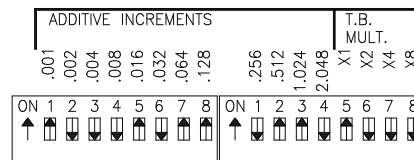
## DITAK 3D TIME BASE SETTING PROCEDURE

The Time Base is set by adding 12 binary increments from 0.001 second to 2.048 seconds. This is done by setting the switch for each increment to be added to the "ON" (UP) position. To determine the increments required, use the following procedure.

Start by selecting the first increment which is greater than half the desired time base and add subsequent increments that are more than half the difference needed.

**EXAMPLE:** A Time Base of 1.745 seconds is set as follows.

Start with	1.024	(1.745 - 1.024 = 0.721 sec needed)
Add	0.512	
	Total	1.536 (1.745 - 1.536 = 0.209 sec needed)
Add	0.128	
	Total	1.664 (1.745 - 1.664 = 0.081 sec needed)
Add	0.064	
	Total	1.728 (1.745 - 1.728 = 0.017 sec needed)
Add	0.016	
	Total	1.744 (1.745 - 1.744 = 0.001 sec needed)
Add	0.001	
	Total	1.745 seconds, Desired Time Base



Switches set-up for a 1.745 sec. time-base per example

For Time Bases, greater than 4.095 seconds but less than 8.190 seconds, set up ½ the required Time Base as above and set the X2 multiplier to on. For Time Bases greater than 8.190 seconds but less than 16.380 seconds, set up ¼ the required Time Base and set the X4 multiplier switch on. Use the same procedure to multiply X8 for Time Bases up to 32.76 seconds.

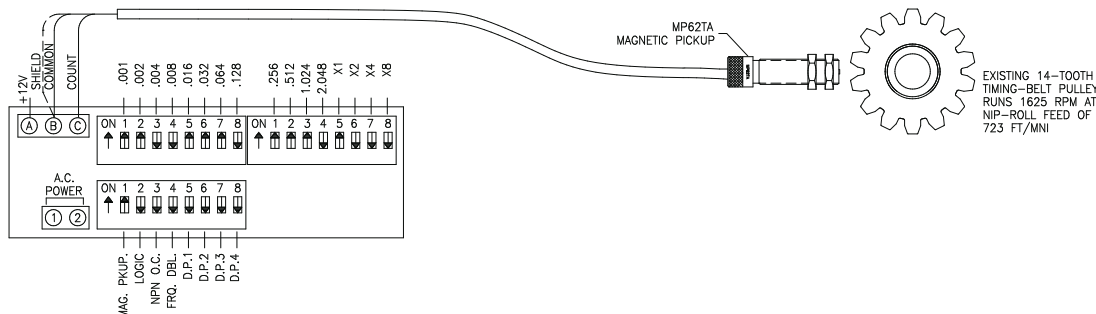
At least one of the four Time Base Multiplier Switches must be "ON" (UP) for operation. If more than one is "ON", the unit will not function properly. When the Time Base is less than 4.095 seconds, X1 multiplier switch must be turned "ON".

*Note: Turning "ON" the FREQUENCY DOUBLING FUNCTION will decrease the required Time Base to ½ the time normally required.*

*Turning "ON" the Decimal Point switches will increase the required time base by multiples of ten.*

## DITAK 3D TYPICAL APPLICATIONS

### 1. USING EXISTING MACHINE GEAR OR SPROCKET FOR SIGNAL GENERATION & CALCULATING TIME BASE FOR DIRECT READOUT



In this example an existing timing belt pulley, in the drive train of a set of nip-rolls, is used to excite an inexpensive magnetic pickup. Direct readout is obtained by setting the time base to a period in which the number of teeth passing the pickup is numerically equal to the desired readout number. This can be worked out in logical steps as shown in the example below, but in this case the formula at right can also be used:

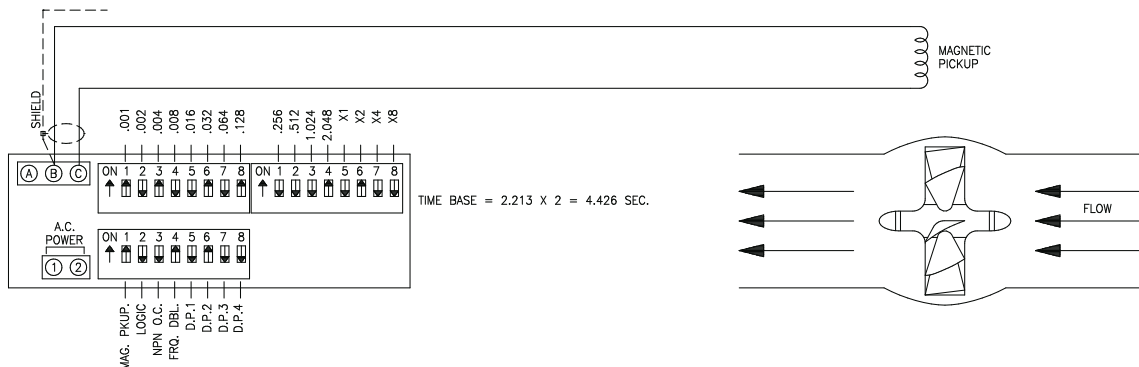
$$\text{Time Base (seconds)} = \frac{60 \times (\text{Numerical Readout Desired}) \times \text{DDP}}{(\text{Pulses per rev.}) \times (\text{RPM of gear})}$$

DDP = Display Decimal Point

$$\begin{aligned} 0 &= 1 \\ 0.0 &= 10 = \text{D.P.1 "ON" up} \\ 0.00 &= 100 = \text{D.P.2 "ON" up} \\ &= \frac{60 \times 723 \text{ ft/min} \times 1}{14 \text{ PPR} \times 1625 \text{ RPM}} = 1.907 \text{ sec.} \end{aligned}$$

The procedure for setting the additive time increments to obtain this time base is shown above. *Note: The time base can be halved if FREQUENCY DOUBLING is used.*

### 2. DETERMINING TIME BASE IN A FLOW RATE APPLICATION



A turbine type flow meter uses a magnetic pickup to sense passing turbine blades, and has a calibration factor of 677.8 pulses/gallon of fluid passing through. It is to be used with a DITAK 3D to read directly in gallons/min in 1/100ths at flow rates to 50 GPM. The following logical steps can be used to determine the time base setting required for direct reading:

At 50 GPM, output pulses will be -  
50 GPM x 677.8 pulses/gallon = 33890 pulses/min.

At this flow rate the desired reading is 50.00 GPM. Set D.P.2 switch "ON" and use Display Decimal Point value of 100.

$$\text{Time Base (seconds)} = \frac{60 \times 50.00 \text{ GPM} \times 100 (\text{DDP})}{33,890 \text{ pulses per minute}} = 8.852 \text{ sec.}$$

If frequency doubling is used, this time base can be further divided by 2, or 8.852/2 = 4.426 seconds.

Since this is a longer time than can be achieved by adding binary increments alone (with X1 multiplier) it will be necessary to set the time base at ½ the desired value and then turn "ON" the X2 multiplier switch.

$$4.426 = 2.213 (\text{Binary Setting}) \times 2 (\text{multiplier setting})$$

## ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBERS FOR AVAILABLE SUPPLY VOLTAGES	
		230 VAC	115 VAC
DT3D	5-Digit Programmable Tach.	DT3D0510	DT3D0500

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

## TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

# DITAK 3A & 3D - DIGITAL RATE INDICATORS FOR ACCURATE, CONVENIENT & ECONOMICAL SPEED READOUT IN PRODUCTION, LABORATORY, MAINTENANCE, & FIELD APPLICATIONS



**RPM**



**GALLONS/HR**



**FEET/MIN**



**STROKES/MIN**



**IMPRESSIONS/HR**



**CFM**



**BOTTLES/MIN**



**KHZ**



**LITRES/MIN**



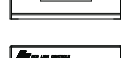
**LBS/MIN**



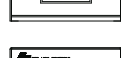
**INCHES/SEC**



**MPH**



**CC/SEC**



**GPM**

Speed is one of the most fundamental measurement parameters in industry today. It is important not only for measuring production rate, but also for optimizing operations, improving efficiency, problem diagnosis, and performance measurement.

RLC's new DITAK 3A and 3D are easily adaptable to virtually any industrial speed measuring application. They provide superior accuracy, direct reading flexibility, and trouble-free reliability at a super-competitive price.

Whether you need rate indication for your own in-plant equipment, or you manufacture equipment that requires rate measuring instrumentation, check out the benefits of the new DITAK 3A and 3D.

## HOW DIGITAL RATE MEASUREMENT WORKS!

A DITAK Rate Indicator (Tachometer) includes an electronic counter, a precision time-reference circuit, a readout display, a power supply and the necessary coordination circuitry for proper operation. It measures speed by following the same procedure that would be used manually, i.e. it accumulates a count of events for a specified time period. Unlike manual speed measurement however, it is capable of very high speed operation, it automatically takes care of the mathematics, and it operates on a continuous recycle basis, displaying the count it received during the last measuring time interval while it is internally accumulating new counts for the preset interval. At the end of each interval the display is instantly updated with the latest time-interval-count for fast, easy readout.

## SCALING FOR DIRECT READING

At first glance, the process of scaling to get direct readout on a rate indicator, may seem a bit involved. But, from the DITAK 3A and 3D examples given on the following pages it is obvious that scaling is nothing more than a simple exercise in elementary logic. With the DITAK 3A, scaling is simply a matter of determining a sensor arrangement to generate the number of counts in one second that is equal to the desired readout.

The DITAK 3D offers another degree of scaling freedom via its precision, adjustable, time-base and by the frequency doubling function. These features facilitate sensing from existing gear or sprocket teeth that move in a fixed but arbitrary relationship to the desired readout.

Ideal measuring time intervals (time-base, or up-date times) for the human observer may vary depending on the application. Where the operator is using the rate indicator to set machine speed, the ideal time base is between one and five seconds. Shorter time base can be annoying to the human operator due to the rapid update. Longer time base periods can make it awkward to set machine speed since it takes too long to observe the effect of each new speed-change input. However, for simple monitoring applications a time-base of 20 or 30 seconds may be entirely adequate and in some cases even desirable.

OUT OUT APPROPRIATE LEGEND, PEEL OFF ADHESIVE BACKING, APPLY OVER TOP OF "RPM" LEGEND ON WINDOW			
<b>BPS</b>	<b>IPS</b>	<b>IPH</b>	<b>MPM</b>
<b>CPS</b>	<b>CPH</b>	<b>IPM</b>	<b>GPM</b>
<b>FPS</b>	<b>FPH</b>	<b>BPM</b>	<b>YPM</b>
<b>YPS</b>	<b>YPH</b>	<b>CPM</b>	<b>RPS</b>
<b>MPS</b>	<b>MPH</b>	<b>FPM</b>	<b>LPM</b>

## CUSTOMIZED UNITS LABELS

All DITAKS are shipped with a metalized mylar label, containing legends for 20 different rate units. Simply cut-out the desired units legend, remove the backing, and stick over the RPM legend on the DITAK front panel.

# DITAK 3A & DITAK 3D

## SENSOR INPUT CONNECTIONS & INPUT CONFIGURATION SWITCH SET-UP

Rate indicators frequently use magnetic pickups for input devices, while contact input is never used due to speed and contact bounce limitations. Consequently there are basic differences between counter and rate-indicator input circuits.

DITAK 3A and 3D both use the input circuit shown on the right. Like the SC Counter input circuit, a Schmidt trigger amplifier is also used here. However, in this circuit, the hysteresis level is quite small and the bias levels are significantly different to accommodate both magnetic pickup input as well as the +5 V and higher logic levels.

The individual functions of the input configuration switches are:

**S1 - ON [MAG.PKUP.]:** Connects a 0.1  $\mu$ F damping input capacitor from input to common. This capacitor is used only with magnetic pickup inputs and serves to filter out high-frequency noise. S1 should be set in the OFF position when using inputs other than magnetic pickups.

**S2 - ON [LOGIC]:** Sets the bias reference so that input logic signals trigger count pulses as they cross a level of approximately +1.3 V.

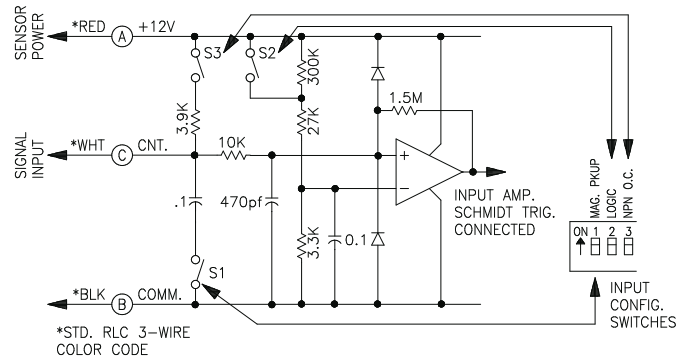
**OFF:** Sets the bias reference so that a signal of 150 mV or more will trigger count pulses. This provides the sensitivity required for low speed magnetic pickup inputs.

*Note: Hysteresis for both S2 "ON" and "OFF" conditions is about 25 mV. This means the difference between  $V_{IL}$  and  $V_{IH}$  with logic inputs (S2) is almost insignificant and only a very small signal swing about the 1.3 V bias level will trigger the input.*

**S3 - ON [NPN O.C.]:** Connects a 3.9 K $\Omega$  pull-up load resistor for sensors or circuits with current sink output. Sensor output must sink 4 mA @  $V_{OL}$  of 1 V or less.

## OTHER CHARACTERISTICS & SPECIFICATIONS

**Maximum Input Voltage & Current:** When the input (Term. "C") is driven from external signal voltages, maximum voltage swing is  $\pm 50$  V peak. Input voltage can be dropped by an external series resistance that limits input current to  $\pm 5$  mA. (These ratings for S1 & S2 ON/OFF, S3 OFF.)



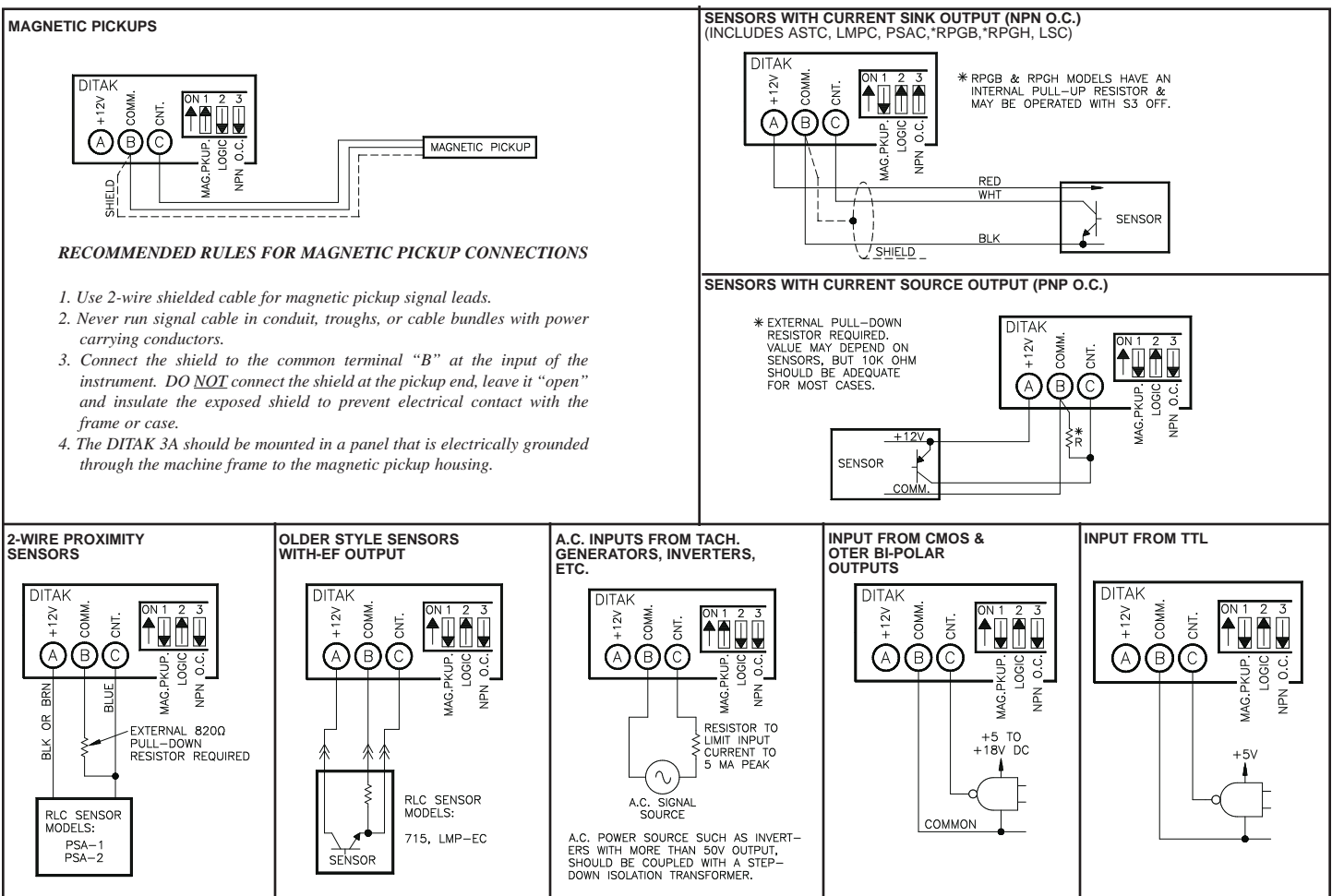
**Maximum Operating Freq.:** 10 KHz, with minimum pulse width "ON" and "OFF" times of 50  $\mu$ sec.

**Input Impedance:** With S1 and S3 "OFF", the resistive input impedance exceeds 1 Megohm, as long as Terminal "C" input voltage is between zero and +12 VDC. Beyond these levels the high and low clamping diodes come into play.

**Paralleling With SC Counter Inputs:** DITAKS may be parallel connected with SC Counters to operate from a common Current Sink or Source Sensor, by connecting "A", "B" and "C" terminals in common. S3 (NPN O.C.) on the DITAK should be turned "OFF" since pull-up or pull-down resistors are already present in the counter. The DITAK will not add appreciable sensor loads with this arrangement.

*Note: DITAKS cannot be operated in parallel with SC Counters when count-switch or 2-wire proximity sensors are used.*

## CONNECTIONS & CONFIGURATION SWITCH SET-UPS FOR VARIOUS SENSOR OUTPUTS



## **DITAK 5 - THE ACCURATE, ECONOMIC & EASY WAY TO MEASURE RPM, GPM, FPM . . . INDICATE PRODUCTION RATE & DISPLAY FREQUENCY**



### **SELF POWERED SIMPLICITY**

The ultra-low power consumption of the Ditak 5 (60 microwatts) opens up vast new application possibilities. In a great many cases the pulse signal source itself has sufficient power content to operate the unit. Alternatively, the Ditak 5 can be equipped with batteries, or power can be supplied from an external source.

### **ACCURACY**

0.1% crystal controlled accuracy with digital readout provides speed measuring precision at a low cost.

### **SEALED FRONT, RUGGED CONSTRUCTION**

Housed in a die-cast metal case, designed for NEMA 4/IP65, the unit can be mounted in tough, industrial environments and withstand oil or water spray. Micro-assembly construction provides high shock and vibration resistance.

### **VERSATILITY**

Ideal for portable and/or fixed in-plant use. Operates with +5 Volt CMOS and TTL circuit outputs and is adaptable to electronic sensor outputs.

## **ADVANTAGES OF MICRO-ELECTRONICS**

The Ditak 5 is a state-of the art rate measuring instrument. Its superior performance/cost ratio sets a new benchmark for the industry. This is made possible by the technology of micro-electronics.

Micro-electronics concentrates as much circuitry as possible into a few monolithic LSI chips. The Ditak 5 utilizes two of these custom chips to encompass more than 99.9% of the required circuit components. These chips are bonded to a substrate carrier and the microscopic electrical connections are made by ultrasonically wire-bonding the chip pads to the gold plated conductors on the substrate. Inter-connections of separate assemblies and components such as the LCD and batteries are accomplished by elastomeric connectors.

### **RELIABILITY**

Large scale integration achieves the ultimate in circuit reliability. The Ditak 5's miniature size provides high immunity to shock and vibration damage. Elastomeric (internal and battery) connections provide gas-tight, corrosion-proof, sealed contacts for trouble free operation.

### **SMALL SIZE**

Micro-electronics allows the display to become the primary determinant of size which means cost savings in panel-shape, weight, power consumption, and functional simplicity.

### **BEST PERFORMANCE/COST RATIO**

Micro-electronics is inherently a highly automated technique which provides the quality, performance, and features needed at a very low cost.

## **DESCRIPTION OF OPERATION**

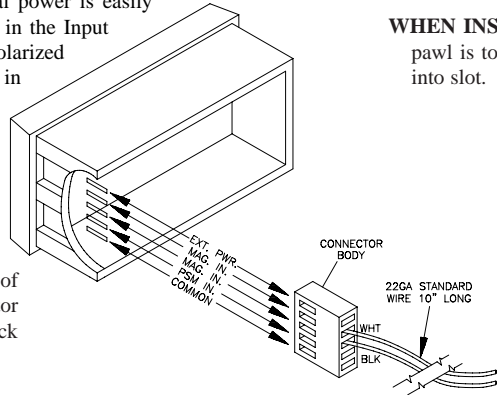
The Ditak 5 is a combination of a precision counter and a crystal controlled 1-second time base, with liquid crystal display. In operation, the electronic counter accumulates incoming pulses for a period of exactly one second. At the end of this period, the count is transferred and latched on the display. Immediately after transferring the count to the display, the internal counter is reset to zero and begins accumulating a new count. Consequently, the display is updated once a second, and the readout at any one time is the numerical value of the number of counts received in the previous 1-second interval.

The Ditak 5 is basically a frequency measuring device and can be used for direct Hz readout. Many industrial rate parameters, however, are expressed in terms of minutes (gallons/min., feet/min., revolutions/min., etc.) Counting these units for a full minute before presenting a readout takes too much time and is therefore impractical. By using a sensor arrangement that delivers 60 pulses/unit of measure (such as a 60 tooth gear to generate 60 PPR for RPM indication), the Ditak 5 will read out directly in the desired units with a convenient 1-second update time.

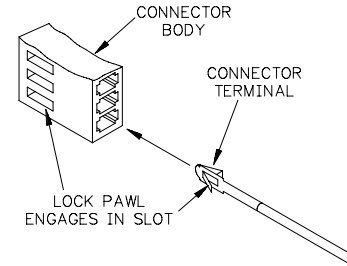


## APPLICATION FLEXIBILITY VIA RECONNECT OPTIONS

Selection of desired inputs and external power is easily done by adding or moving terminal leads in the Input Connector Body. The connector body is polarized to prevent incorrect insertion, and locked in place by the battery cover to avoid accidental disengagement. Connectors are supplied with the 2 leads installed as shown below. A spare blue lead is supplied in the hardware pack.



**WHEN INSERTING TERMINAL** into connector body, make sure the lock pawl is toward the slot in the body. Push terminal in until lock pawl snaps into slot.



Connector Body, MOLEX P/N 2201-2051  
Connector Term, MOLEX P/N 08-50-0114

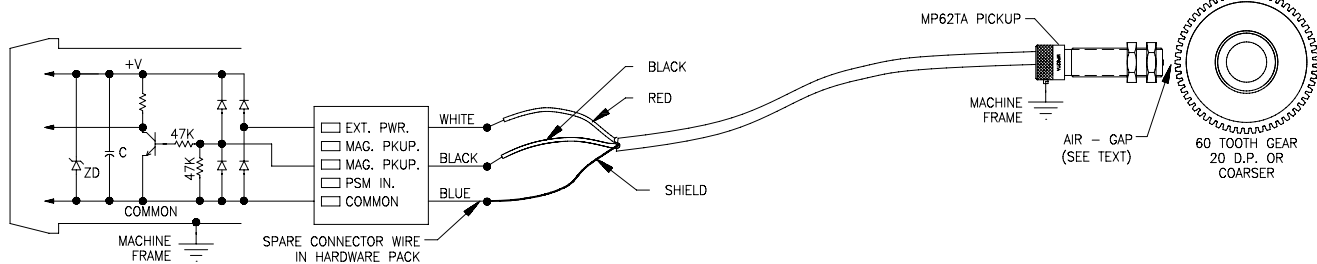
**TO REMOVE TERMINAL**, insert blade of a small screwdriver into slot of connector body, and gently push in to disengage lock pawl. Pull terminal out.

## TYPICAL APPLICATIONS

### SELF-POWERED FROM MAGNETIC PICKUP SIGNAL (Using MP62TA magnetic pickup, or ARCJ ring pickup kits)

In this application the Magnetic Pickup supplies both the signal and operating power for the unit. A diode bridge in the Ditak 5 rectifies the A.C. waveform generated by the magnetic pickup to develop the +V operating voltage. The half wave component of this A.C. is applied to the base of the input transistor to generate count pulses. The Zener Diode (ZD) clamps +V to 6.2 V maximum.

With an MP62TA Magnetic Pickup, a 60-tooth 20 D.P. Gear, and an air gap of 0.005", the pickup will begin to develop sufficient voltage to power the Ditak 5 (about 3.5 V peak) at a speed of 175 to 200 RPM. See Magnetic Pickup and ARCJ Ring Kit tables for typical minimum speed parameters of various sizes of Magnetic Pickups and ARCJ Rings.

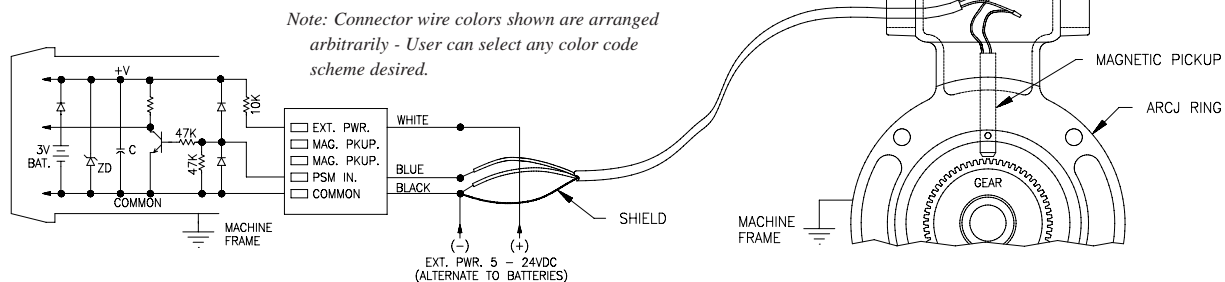


### MAGNETIC PICKUP SIGNAL INPUT WITH BATTERY OR EXTERNAL POWER (For extended low speed performance)

Using batteries or an external source to supply power to the Ditak 5, allows the magnetic pickup to be used only as a signal source at low speed. By relocating the connector terminal wires as shown above, the magnetic pickup voltage is applied directly to the transistor input and a signal level of only 0.7 Volts peak is needed for operation. This reduces minimum operating speed to about 25% of the level required for self-powered operation (See Mag. PkUp.

and ARCJ Ring tables).

When batteries are used, current is drawn from the battery only during low speed operation. At high speeds the half-wave rectified magnetic pickup voltage exceeds the battery voltage and the unit again becomes self-powered, to extend battery life. (Nominal battery life, without the high speed power contribution of the magnetic pickup is 3 to 3.5 years).



### NOTES ON MAGNETIC PICKUPS

1. Magnetic Pickups generate voltage proportional to the size and speed of passing gear teeth, and inversely proportional to air-gap.
2. Sensing gears used with Magnetic Pickups should run as true as possible. Eccentricity and wobble causes voltage fluctuations that can produce observable display "flicker" at low speeds when pickup power is being used to operate the Ditak 5.
3. Shielded cable is recommended when using magnetic pickups. Connect the shield to the COMMON input pin of the Ditak 5 (A spare BLUE terminal wire in the hardware package may be used to bring out COMMON). Leave the shield unconnected at the sensor end (MP62TA is supplied with shielded

cable, open at the pickup end). The Ditak 5 case should be mounted in a panel which is electrically grounded through the machine frame to the pickup housing of the ARCJ Ring motor.

4. Magnetic Pickups have a highly inductive output impedance which limits output voltage and current to a safe level when clamped by the internal zener diode in the Ditak 5. Signal sources with peak voltage in excess of 6 Volts, and having low output impedance, may develop sufficient power to damage the internal zener diode if connected directly. With this type of signal source, use a current limiting resistor as shown in the following application.

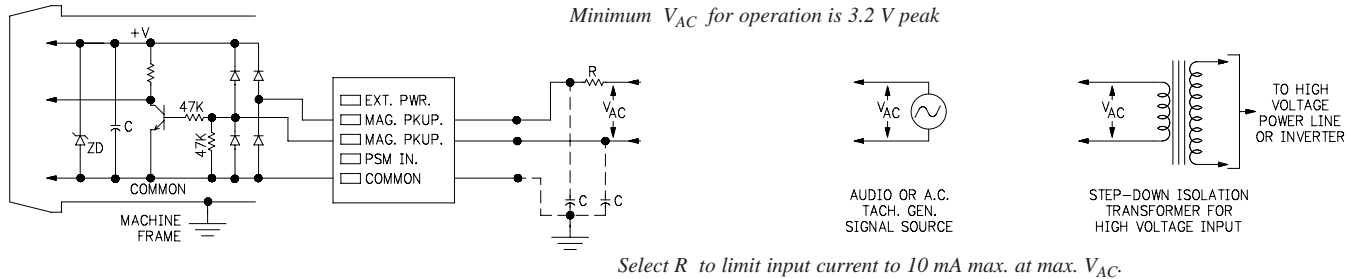


## TYPICAL APPLICATIONS (Cont'd)

### VARIABLE FREQUENCY A.C. INPUTS, SIGNAL SOURCE POWERED

A.C. Signal Sources can be used to operate the Ditak 5 via the Magnetic Pickup Input without batteries or external D.C. power, down to 7 or 8 Hz signal frequency. However, unlike magnetic pickups most A.C. signal sources have low output impedance and require a current limiting resistor if the peak voltage exceeds 6 volts.

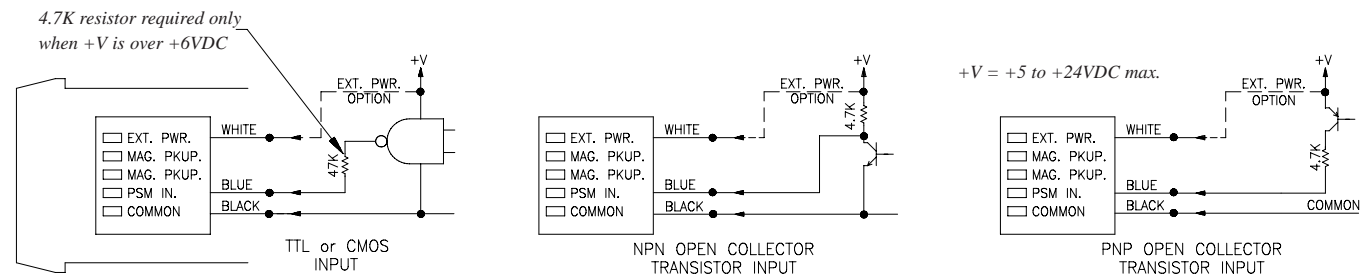
Capacitors shown connected to COMMON by dotted lines may be required when A.C. voltage supply is "noisy". Capacitor values depend on existing conditions but values from 0.01 to 0.1  $\mu\text{f}$  are usually effective. An isolation step-down transformer should always be used when power line or high voltage inverter lines and being monitored.



### LOGIC PULSE INPUTS FROM OTHER CIRCUITS & SENSORS

The Ditak 5 easily adapts to a wide variety of pulse signal inputs. The only restriction that must be kept in mind is that a current limiting resistor must be used in series with the input applied to "PSM IN" if the input signal voltage exceeds +6 Volts peak (Limit input current to 10 mA peak). With square wave inputs (50% duty cycle), at frequencies of 15 Hz and above, the Ditak 5 will

operate directly from the power delivered by the signal itself without batteries or external power applied. If the signal is a narrow positive going pulse, or if operation below 15 Hz is required, either external power should be connected as shown, or batteries should be installed.



**USE THE DITAK 5 WITH THE MODEL PSMA POWER SUPPLY & INTERFACE MODULE, OR WITH CONVENIENT ELECTRONIC SENSORS FOR EASY APPLICATION TO YOUR SPECIAL RATE MEASURING PROBLEM.**

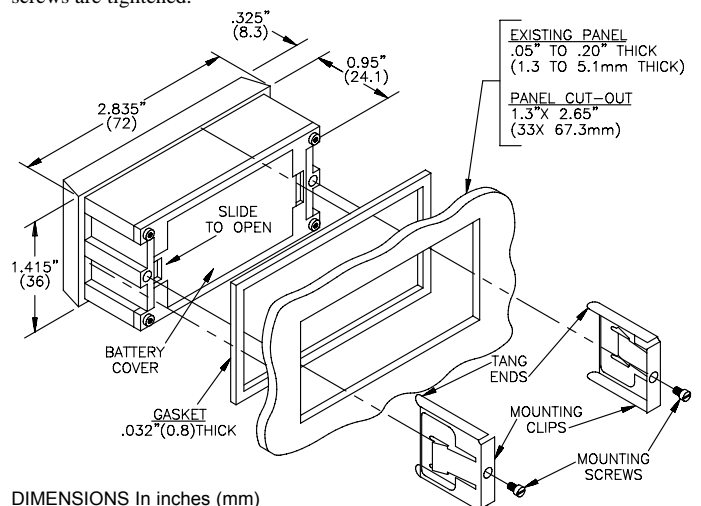
## SPECIFICATIONS

- DISPLAY:** 4-digit LCD, 0.35" (9 mm) high
- POWER SOURCE:** Operates from any one of the following:
  - Signal Source Powered:** A.C. or square wave signal inputs with min. peak voltage of 3.5 V @ 150  $\mu\text{A}$  and min. frequency of 15 Hz will operate the DITAK 5 without batteries or external power.
  - Battery Powered:** 2, 1.5 V N-type Alkaline Cells can be inserted if conditions for signal source power cannot be met. Nominal battery life is 3 to 5 years depending on operating conditions.
  - External Power Input:** Operates from external power sources ranging from +5 VDC @ 35  $\mu\text{A}$  to +24 VDC @ 1.8 mA.
- TIME BASE:** 1-second measuring and display up-date interval. Crystal controlled to +0.1%, +1 digit accuracy.
- INPUTS:** Accepts A.C. ( $\pm$  polarity swing) signals, or logic pulse inputs. Min. sensitivity when using batteries or external power is 0.7 V peak. Min. sensitivity when self-powered is 3.5 V peak. (See POWER SOURCE, above). Input signal voltages over 6 V peak, require external series resistor to limit input current to 10 mA max.
- MAXIMUM INPUT FREQUENCY:** 10 KHz, 50  $\mu\text{sec}$  min. pulse width.
- OPERATING TEMPERATURE RANGE:** 0° to 50°C (32° to 122°F)
- STORAGE TEMPERATURE RANGE:** 20° to 60°C (-4° to +140°F)
- WEIGHT:** 5.1 oz. (146 g)

## DIMENSIONS & INSTALLATION

After cutting the opening in panel, slide the panel gasket over the rear of the case to the back of the bezel. Then slide the case through the panel cut-out. Install mounting clips on each side of counter body with mounting screws.

Make sure the side rails of the clips fit into the recesses in the side of the case so that the "Tang Ends" wedge between the panel opening and body as the screws are tightened.

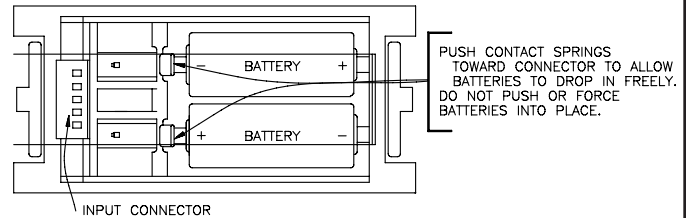


DIMENSIONS In inches (mm)

## BATTERY COVER REMOVAL & BATTERY INSERTION

Slide battery cover to the left until the right hand lip disengages and pops out. To reinstall cover, insert left hand lips into case first, push cover to the left until right hand lip drops down and cover snaps back into place. Install batteries as shown at right observing proper polarity.

*Note: Push battery spring clips to the left (toward connector) to completely free the batteries when removing or installing batteries. Conductive rubber battery contacts can be torn from their retaining pins if batteries are forced in.*



*Note: Use only Alkaline "N" cells.*

## ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
DT5	Ditak 5 Electronic Tachometer	DT500000
BNA	"N" Type Alkaline Batteries (Note 1)	BNA00000
HWK2	Spare Hardware Kit (Note 2)	HWK20000
ICA	Spare Input Connector & Terminal Wires (Note 3)	ICA00000

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

## NOTES

1. Batteries **NOT** supplied with Ditak 5, order separately, 2 required per unit.
2. Ditak 5 supplied with one hardware kit, includes 2 mounting clips and screws, panel gasket, 2 wire nuts and blue terminal wire.
3. Ditak 5 supplied with connector body and black and white terminal wires. Kit ICA includes connector body and one each of black, white, blue, and yellow terminal wires.

## ACCESSORY MAG. PICKUPS & NEMA "C" FLANGE ADAPTER KITS FOR USE WITH DITAK 5

### ORDERING INFORMATION FOR MAGNETIC PICKUPS

MODEL NO.	DIMENSIONS	TYPICAL MINIMUM SPEEDS FOR OPERATION WITH DITAK 5		PART NUMBER
		SELF POWERED (See Note 1 & 3)	BAT. OR EXT. PWR. (See Note 2 & 3)	
MP-25TA		NOT Recommended	500 RPM	MP25TA00
MP-37TA		800 RPM	240 RPM	MP37TA00
MP-37CA		800 RPM	240 RPM	MP37CA00
MP-62TA		200 RPM	60 RPM	MP62TA00
MP-62TB		450 RPM	150 RPM	MP62TB00
—	SENSING GEAR, 60-TOOTH, 20 D.P. 3.1" DIA., 0.375" BORE, 0.875" WIDE WITH HUB	N/A	N/A	0970375

## MODEL ARCJ - NEMA "C" FLANGE MOUNTED MAGNETIC PICKUP KITS (Kits include Adapter Ring, Mag. Pickup, Gear, & Mounting Bolts)

### ORDERING INFORMATION

MODEL NO.	MOTOR FRAME SIZE	TYPICAL MINIMUM SPEEDS FOR OPERATION WITH DITAK 5		PART NUMBER
		SELF POWERED (See Note 1 & 3)	BAT. OR EXT. PWR. (See Note 2 & 3)	
ARCJ-1A	56C	700 RPM	240 RPM	ARCJ1A00
ARCJ-1B	143TC, 145TC, 182C, 184C	700 RPM	240 RPM	ARCJ1B00
ARCJ-2A	182TC, 184TC, 213C, 215C, 245C	400 RPM	120 RPM	ARCJ2A00
ARCJ-2B	213TC, 215TC, 254UC, 256UC	400 RPM	120 RPM	ARCJ2B00
ARCJ-2C	254TC, 256TC	400 RPM	120 RPM	ARCJ2C00

## NOTES

1. Pickup connected to Magnetic pickup input terminals of Ditak 5 for self-powered operation. (See applications, previous page)
2. Pickup connected to PSM-IN and COMMON terminals for battery or EXT POWER operation. (See applications, previous page)
3. All pickups tested with 60 tooth 20 D.P. gear, 0.005" air gap.

## DITAK 6 - ADJUSTABLE TIMEBASE 4-DIGIT TACHOMETER



- ADJUSTABLE TIMEBASE FROM 4 MSEC TO 32 SEC
- SELECTABLE DECIMAL POINTS
- REPLACEABLE LITHIUM BATTERY PROVIDES UP TO 5 YEARS OF CONTINUOUS OPERATION (Battery included)
- RUGGED, SEALED FRONT PANEL CONSTRUCTION (NEMA 4/IP65)
- ACCEPTS MAGNETIC OR LOGIC TYPE INPUTS
- WIDE TEMPERATURE RANGE [-30° to +75°C]

### DESCRIPTION

The DT6 is a self-powered tachometer which features the ability to select the desired Timebase by simply setting the appropriate DIP switches on the rear of the unit. It also features a 4-digit LCD display with selectable decimal points. The DT6 is powered by an internal 3.0 V lithium battery which is field replaceable.

Like other Micro-Line products, the DT6 combines the use of a custom CMOS LSI counter chip and custom Timebase gate array. These chips are mounted on a gold-plated substrate and electrically connected by ultrasonic wirebonding. Internal electrical interface connections use elastomeric contacts to provide a gas-tight, corrosion resistant connection. Using the latest in Micro-Electronic assembly and manufacturing techniques provides units with reliability and dependability required for industrial service. The DT6 has a metal die-cast front bezel that is sealed and meets NEMA 4 specifications for wash-down and/or dusty environments, when properly installed.

### SPECIFICATIONS

1. **DISPLAY:** 4-Digit LCD, 0.35" (9mm) high digits.
2. **POWER SOURCE:** Internal 3.0 V lithium battery to provide up to 5 years of continuous service. For replacement procedure, refer to the illustration. The DT6 also receives power from a logic or magnetic input signal with a min. peak voltage of 4.0 V, which will serve to extend the battery life.
3. **SIGNAL INPUT:** \* 0-10 KHz from a magnetic or bi-polar output (with a 50% duty cycle). Min. input sensitivity is 0.7 V. Input signal voltages over 6 V peak require an external series resistor to limit the input current to 10 mA max.
4. **TIMEBASE:** Adjustable in 1/256 sec. (3.906 msec) increments via DIP switches located under the rear cover. Timebase ranges from 3.906 msec to 31.996 sec; 0.05% accuracy.

5. **OPERATING TEMPERATURE RANGE:** -30° to +75°C

6. **WEIGHT:** 5.1 oz (146 g)

\* **Caution:** The case of the DT6 is electrically connected to signal common.

### ELECTRICAL CONNECTIONS

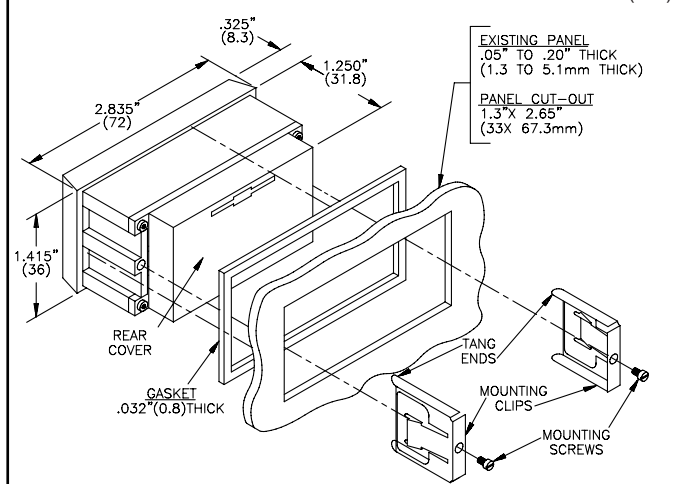
Since the DT6 is self powered, only two electrical connections are required. These connections are made utilizing a 2 position terminal block, located at the rear of the unit. Refer to the procedures below when connecting the DT6 to the signal source.

1. Use 2-wire shielded cable for sensor signal leads.
2. Never run signal cable in conduit, troughs, or cable bundles with power carrying conductors.
3. Connect the shield to the "COMM." terminal at the input of the instrument. Do NOT connect the shield at the pickup end, leave it "open" and insulate the exposed shield to prevent electrical contact with the frame or case. (Shielded cable, supplied on some RLC magnetic pickups, has open shield on pickup end.)
4. The DT6 should be mounted in a panel that is electrically grounded through the machine frame to the magnetic pickup housing.

### DIMENSIONS & INSTALLATION

The Model DT6 should be mounted in a panel grounded to the machine frame. After cutting the opening in the panel, slide the panel gasket over the rear of the tachometer body to the back of the bezel. Then slide the tachometer through the panel cut-out. Install mounting clips on each side of the tachometer body with mounting screws. Make sure the side rails of the clips fit into the recesses in the side of the tachometer body so that the "tang ends" wedge between the panel opening and the body as the screws are tightened.

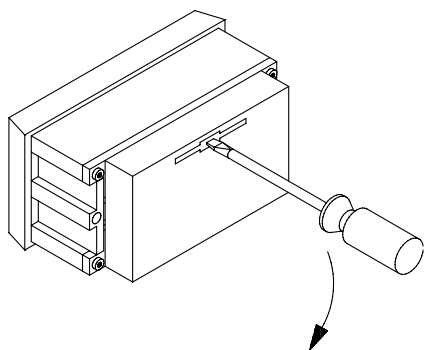
DIMENSIONS: In inches (mm)



Warning: Lithium battery may explode if incinerated.

### BATTERY INSTALLATION

1. Remove rear cover by placing screwdriver in the slot and gently pushing downward (See drawing below).
2. When replacing battery, observe proper polarity as shown in the Application drawing.
3. Allow 32 seconds for the first update to occur after battery replacement.



## REAR PANEL DIP SWITCHES

When viewing the DT6 from the rear of the unit, there are two banks of 8 DIP switches located along the top edge of the PC board. The bank to the left is labeled "SWA" and the bank to the right is labeled "SWB". All of the "SWA" switches and 5 of the "SWB" switches are used to select the desired Timebase. The remaining switches of "SWB" are used to select "FREQUENCY DOUBLING" and "DECIMAL POINT".

## TIMEBASE SELECTION

The DT6 has a Timebase selection range of approximately 4 msec to 32 sec. For the minimum Timebase setting, SWA 1 is set in the "ON" position. For the maximum Timebase setting, all the Timebase switches are set to the "ON" position. Therefore, a specific Timebase setting is achieved by adding the appropriate individual Timebase increments.

The Timebase increment total is computed according to the following formula:

$$\text{TIMEBASE INCREMENT TOTAL (TBIT)} = \frac{\text{D.R.} \times \text{D.D.P.} \times 15,360}{\text{RPM} \times \text{PPR}}$$

### WHERE:

D.R. = Desired Reading  
D.D.P. = Display Decimal Point  
RPM = Revolutions Per Minute  
PPR = Pulses Per Revolution

### D.D.P.:

0 = 1 The Display Decimal Point (D.D.P.) is  
0.0 = 10 determined by the desired decimal  
0.00 = 100 point placement in the readout.

SWITCH	TIMEBASE INCREMENTS	SWITCH	TIMEBASE INCREMENTS
SWA 1	1	SWB 1	256
SWA 2	2	SWB 2	512
SWA 3	4	SWB 3	1024
SWA 4	8	SWB 4	2048
SWA 5	16	SWB 5	4096
SWA 6	32		
SWA 7	64		
SWA 8	128		

Example: Find the appropriate DIP switch setting for a desired display reading with a fixed shaft speed.

DESIRED READOUT (D.R.) = 250.0  
REVOLUTIONS PER MINUTE (RPM) = 1250  
PULSES PER REVOLUTION (PPR) = 50

$$\text{TBIT} = \frac{250.0 \times 10 \times 15,360}{1250 \text{ RPM} \times 50 \text{ PPR}} = \frac{38,400,000}{62,500} = 614.4$$

TBIT = 614 (round off to the nearest whole number)

TBIT = 614			
DIP SWB 2	- 512	Needed	= 102
DIP SWA 7	- 64	Needed	= 38
DIP SWA 6	- 32	Needed	= 6
DIP SWA 3	- 4	Needed	= 2
DIP SWA 2	- 2	Needed	= 0

As shown above, DIP switches SWA 2, 3, 6, 7, and SWB 2 are all set to "ON". If it is desired to know what the approximate Timebase is in seconds, multiply:

$$614 \times 0.004 = 2.456 \text{ sec.}$$

## FREQUENCY DOUBLING

DIP switch SWB-6 is the "Frequency Doubling Disable" switch. When it is in the "ON" position, frequency doubling is disabled. When it is in the "OFF" position, twice the number of input pulses are registered in the unit. This doubling of the input rate allows the Timebase Increment Total to be halved, thus allowing a faster update time for a given display value.

SWB-6 ON "↑"  
FRQ. DBL. DIS. (X1)

SWB-6 OFF "↓"  
FRQ. DBL. (X2)

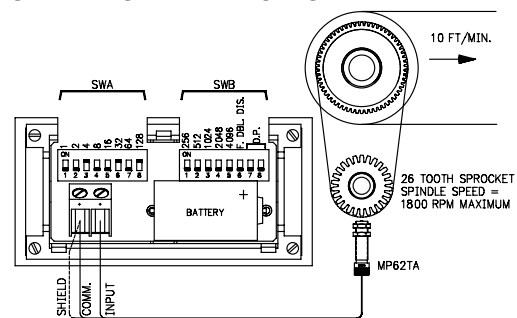
## DECIMAL POINT SELECTION

The selection of Decimal Point is accomplished by DIP switches SWB 7 and SWB 8. The table at right shows what combinations of switches is needed to obtain the desired decimal point location. The DT6 always has leading zero blanking. Note: D.P. will change only at the normal display update times.

SWB 7	SWB 8	D.P. LOCATION
↑	↑	factory test mode
↑	↓	0
↓	↑	0.0
↓	↓	0.00

## TYPICAL APPLICATION

### CONVEYOR BELT SPEED INDICATOR



The rate of a conveyor belt used to carry PC Boards through an Infra-Red soldering chamber is variable from 0 to 10 feet per minute. The rate must be adjusted depending on the size of the boards being soldered. The display of the rate indicator must read in hundredths of a foot per minute.

The belt is driven by a chain and sprocket. A 26-tooth sprocket is mounted onto the shaft of a variable speed motor. A speed of 1800 RPM will produce a belt speed of 10 ft/min. A magnetic sensor is used to monitor the speed of this sprocket.

The DT6 can be used to display the belt speed in this application. The signal input of the sensor is connected to the DT6 "INPUT" terminal. Common and the shield of the sensor are connected to the DT6 "COMM." terminal. The Timebase setting can be determined by using the formula.

DESIRED READING, = 10.00  
MAX RPM OF SHAFT, = 1800  
PULSES PER REVOLUTION, = 26  
DISPLAY DECIMAL POINT, = 100

$$\text{TBIT} = \frac{\text{D.R.} \times \text{D.D.P.} \times 15,360}{\text{RPM} \times \text{PPR}}$$

$$\text{TBIT} = \frac{10.00 \times 100 \times 15,360}{1800 \times 26} = \frac{15,360,000}{46,800}$$

$$= 328.2 = 328$$

TBIT = 328

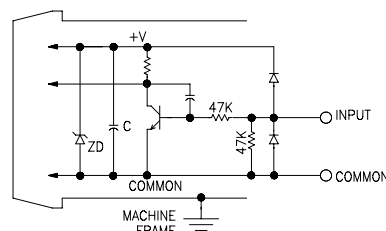
DIP SWB 1	- 256	Needed	= 72
DIP SWA 7	- 64	Needed	= 8
DIP SWA 4	- 8	Needed	= 0

With the above DIP switch settings, the Timebase would be approximately 1.3 sec (328 x 0.004 = 1.312). To reduce the update time, the "Frequency Doubling Disable" switch can be set to the "OFF" position. Then only half the Timebase will be necessary.

$$\text{TBIT} = \frac{328}{2} = 164$$

DIP SWA 8	- 128	Needed	= 36
DIP SWA 6	- 32	Needed	= 4
DIP SWA 3	- 4	Needed	= 0
DIP SWB 6	- OFF	Frequency Doubling	
DIP SWB 7,8	- OFF	0.00 Decimal Point Position	

### SIMPLIFIED SCHEMATIC OF DT6 INPUT CIRCUIT



## ORDERING INFORMATION

\*Battery Included

MODEL NO.	DESCRIPTION	PART NUMBER
*DT6	Adjustable Timebase Tachometer	DT600000
BNL	3V Lithium Battery	BNL000000

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.



## DITAK 7 - ADJUSTABLE TIMEBASE 5-DIGIT RATE INDICATOR

- LCD, POSITIVE REFLECTIVE OR NEGATIVE TRANSMISSIVE WITH YELLOW/GREEN OR RED BACKLIGHTING
- 0.6 INCH (15.2mm) HIGH DIGITS
- ADJUSTABLE TIMEBASE FROM 4 MSEC TO 32 SEC
- SELECTABLE DECIMAL POINTS
- REPLACEABLE LITHIUM BATTERY PROVIDES UP TO 5 YEARS OF CONTINUOUS OPERATION (Battery included)
- NEMA 4X/IP65 SEALED FRONT PANEL BEZEL
- ACCEPTS MAGNETIC OR LOGIC TYPE SIGNAL INPUTS
- WIRE CONNECTIONS MADE VIA SCREW CLAMP TYPE TERMINALS



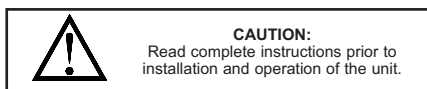
### DESCRIPTION

The Ditak 7 is a self-powered rate indicator which features selectable Timebase Increments by setting the appropriate DIP switches on the rear of the unit. The internal plug-in 3.0 VDC lithium battery, requires NO soldering, making it easily replaceable in the field. It has a 5-digit LCD display with 0.6 inch (15.2 mm) high digits and a DIP switch selectable decimal point. The displays are available in positive image reflective (black digits, reflective background) or negative image transmissive (illuminated digits, dark background) with red or yellow/green backlighting. Backlight version units require power from an external 9 to 28 VDC supply.

Like other Micro-Line products, the Ditak 7 combines the use of a custom CMOS LSI counter chip and custom timebase gate array. These chips are mounted on a gold-plated substrate and electrically connected by ultrasonic wire-bonding. Internal electrical interface connections use elastomeric contacts to provide a gas-tight, corrosion resistant connection. Use of the latest in Micro-Electronic assembly and manufacturing techniques provides units with reliability and dependability required for industrial applications.

The unit is constructed of a lightweight, high impact plastic case with a clear viewing window. The sealed front panel meets NEMA 4X/IP65 specifications for wash-down and/or dusty environments, when properly installed. A Ditak 7 unit can be mounted in the same panel cut-out as the earlier Ditak 5 & 6 series units.

The optional Micro Line/Sensor Power Supply (MLPS0000) is designed to attach to the rear of an installed Ditak 7. The optional supply can be powered from either a 115 or 230 VAC source, and can provide power for the backlighting of a unit and a sensor.



### SAFETY SUMMARY

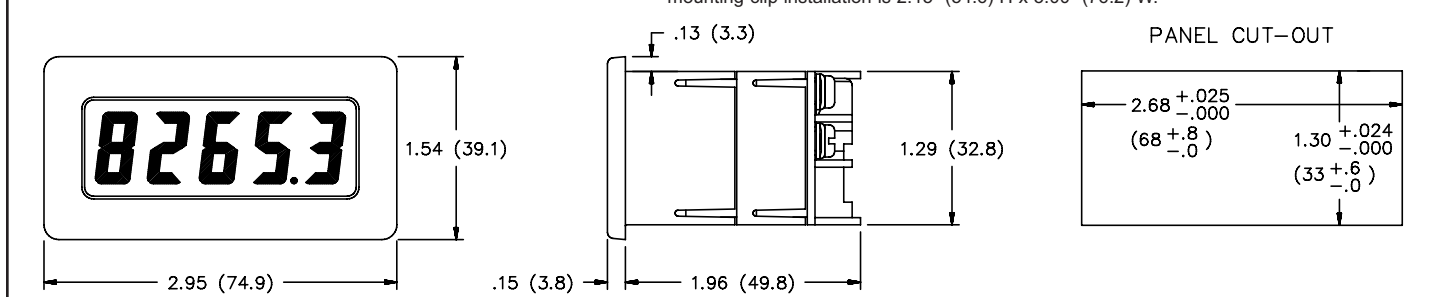
All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

### SPECIFICATIONS

1. **DISPLAY:** 5-Digit LCD, 0.6" (15.2 mm) high digits.
2. **POWER SOURCE:** Internal 3.0 V lithium battery provides up to 5 years of continuous service (battery life is dependent upon usage). For replacement procedure, refer to battery installation figure. The Ditak 7 can also receive power at Terminal 3 (INP) from a logic or magnetic signal with a minimum peak voltage of 4.0 V, which will serve to extend the battery life. Must use the MLPS or a Class 2 or SELV rated power supply.
3. **BACKLIGHT POWER REQUIREMENTS:** 9 to 28 VDC @ 35 mA. Above 26 VDC, derate operating temperature to 50°C.
4. **SIGNAL INPUT:** 0 to 10 KHz from a magnetic or bi-polar output (with a 50% duty cycle). Min. input sensitivity is 0.9 V. Max. input = 28 VDC.
5. **TIMEBASE:** Adjustable in 1/256 sec (3.906 msec) increments via DIP switches located at the rear of the unit. Timebase ranges from 3.906 msec to 31.996 sec; 0.05% accuracy.
6. **ENVIRONMENTAL CONDITIONS:**
  - Operating Temperature:** 0 to 60°C (Above 50°C derate backlight operating voltage to 26 VDC max.)
  - Storage Temperature:** -40 to 80°C
  - Operating and Storage Humidity:** 85% max. (non-condensing) from 0°C to 60°C.
  - Altitude:** Up to 2000 meters
7. **CONSTRUCTION:** High impact plastic case with clear viewing window (Panel gasket and mounting clip included). Installation Category I, Pollution Degree 2.

### DIMENSIONS "In inches (mm)"

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.15" (54.6) H x 3.00" (76.2) W.



## SPECIFICATIONS (Cont'd)

### 8. CERTIFICATIONS AND COMPLIANCES:

#### EMC EMISSIONS:

Meets EN 50081-1: Residential, Commercial, and Light Industry  
CISPR 11 Radiated and conducted emissions

#### EMC IMMUNITY:

Meets EN 50082-2: Industrial Environment.  
ENV 50140 - Radio-frequency radiated electromagnetic field  
ENV 50141 - Radio-frequency conducted electromagnetic field <sup>1 & 2</sup>  
EN 61000-4-2 - Electrostatic discharge (ESD)  
EN 61000-4-4 - Electrical fast transient/burst (EFT)  
EN 61000-4-8 - Power frequency magnetic field

#### Notes:

##### 1. RF Conducted Immunity I/O lines

Cable shield connected to earth ground at both ends.

##### 2. RF Conducted Power lines

At 10 V rms, from 24 to 65 MHz, rate display value varies.

a. At 8 V rms unit operates normally.

b. At 10 V rms, use of a line filter (LFIL0000) or one ferrite suppression core on power lines enables normal unit operation.

Refer to the EMC Installation Guidelines section of this bulletin for additional information.

### 9. WEIGHT: 3.3 oz (93.5 g)

## EMC INSTALLATION GUIDELINES

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the unit may be different for various installations. In extremely high EMI environments, additional measures may be needed. Cable length, routing and shield termination are very important and can mean the difference between a successful or a troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
  - a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
  - b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
  - c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.
2. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
3. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

Ferrite Suppression Cores for signal and control cables:

Fair-Rite # 0443167251 (RLC #FCOR0000)

TDK # ZCAT3035-1330A

Steward #28B2029-0A0

Line Filters for input power cables:

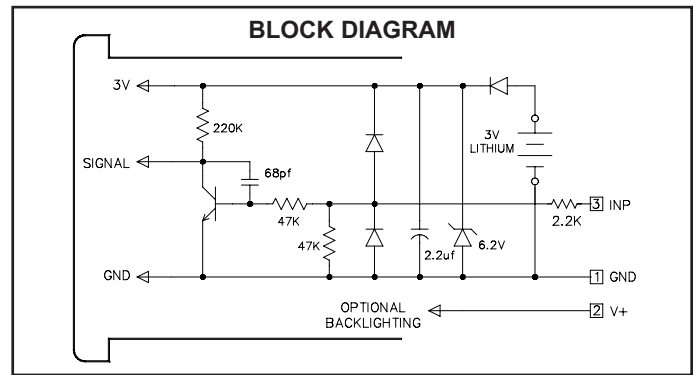
Schaffner # FN610-1/07 (RLC #LFIL0000)

Schaffner # FN670-1.8/07

Corcom #1VR3

**Note:** Reference manufacturer's instructions when installing a line filter.

5. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.



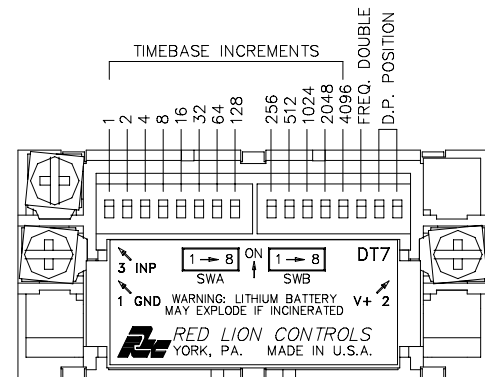
## WIRING CONNECTIONS

The electrical connections are made via rear screw-clamp terminals located on the back of the unit. All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker. When wiring the unit, use the label to identify the wire position with the proper function. Strip the wire, leaving approximately 1/4" bare wire exposed (stranded wires should be tinned with solder). Insert the wire into the screw-clamp terminal and tighten the screw until the wire is clamped tightly. Each terminal can accept up to two #14 AWG wires.

The backlighting for a backlight version unit is powered between Terminal 2 (V+) and Terminal 1 (GND).

## REAR PANEL DIP SWITCHES

When viewing the Ditak 7 from the rear, there are two banks of DIP switches, with eight switches per bank, located along the top edge of the PC board. The bank to the left is labeled SWA and the bank to the right is labeled SWB. All of the SWA switches and five of the SWB switches are used to select the desired Timebase. The remaining switches of SWB are used to select Frequency Doubling and the Decimal Point position.



**Note:** The model DT700000 will NOT have a screw terminal installed at Terminal 2 (V+), since it is NOT required for operation, and is not internally connected. The DT700M00 uses the V+ screw terminal to mount the MLPS power supply. It is not internally connected to the unit.

**WARNING:** Lithium battery may explode if incinerated.



## TIMEBASE SELECTION

The Ditak 7 has a Timebase selection range from 4 msec to 32 sec. SWA 1 is set to the "ON" position for the minimum Timebase setting. SWA 1 through SWB 5 are set to the "ON" position for the maximum Timebase setting. A specific Timebase setting is achieved by adding the appropriate individual Timebase increments. The Timebase increment total is computed according to the following formula:

$$\text{TIMEBASE INCREMENT TOTAL (TBIT)} = \frac{\text{DR} \times \text{DDP} \times 15,360}{\text{RPM} \times \text{PPR}}$$

### WHERE:

DR = Desired Reading  
DDP = Display Decimal Point  
RPM = Revolutions Per Minute  
PPR = Pulses Per Revolution

**DDP:** Use one of the following numbers in the above formula for the display decimal point (DDP) position.

0 = 1  
0.0 = 10  
0.00 = 100

SWITCH	TIMEBASE INCREMENTS	SWITCH	TIMEBASE INCREMENTS
SWA 1	1	SWB 1	256
SWA 2	2	SWB 2	512
SWA 3	4	SWB 3	1024
SWA 4	8	SWB 4	2048
SWA 5	16	SWB 5	4096
SWA 6	32		
SWA 7	64		
SWA 8	128		

**Example:** Find the appropriate Timebase DIP switch setting for a desired display decimal point position of 0.0 reading with a fixed shaft speed.

$$\text{TIMEBASE INCREMENT TOTAL (TBIT)} = \frac{\text{DR} \times \text{DDP} \times 15,360}{\text{RPM} \times \text{PPR}}$$

Desired Readout (DR) = 250.0  
Revolutions Per Minute (RPM) = 1250  
Pulses Per Revolution (PPR) = 50

$$\text{TBIT} = \frac{250.0 \times 10 \times 15,360}{1250 \times 50} = \frac{38,400,000}{62,500} = 614.4$$

TBIT = 614 {round to the nearest whole number}

TBIT = 614

DIP SWB 2	-	<u>512</u>	
		102	- Needed
DIP SWA 7	-	<u>64</u>	
		38	- Needed
DIP SWA 6	-	<u>32</u>	
		6	- Needed
DIP SWA 3	-	<u>4</u>	
		2	- Needed
DIP SWA 2	-	<u>2</u>	
		0	- Needed

DIP switches SWA 2, 3, 6, 7, and SWB 2 are all set to the "ON" position for a Timebase Increment Total of 614. If it is desired to know what the approximate Timebase is in seconds, use the following formula:

TBIT x 0.004 = Time in seconds  
614 x 0.004 = 2.456 sec.

## FREQUENCY DOUBLING

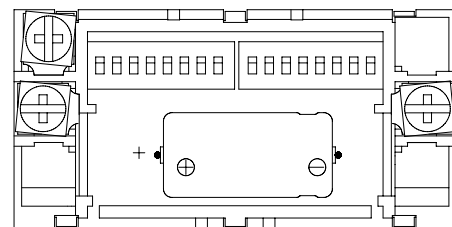
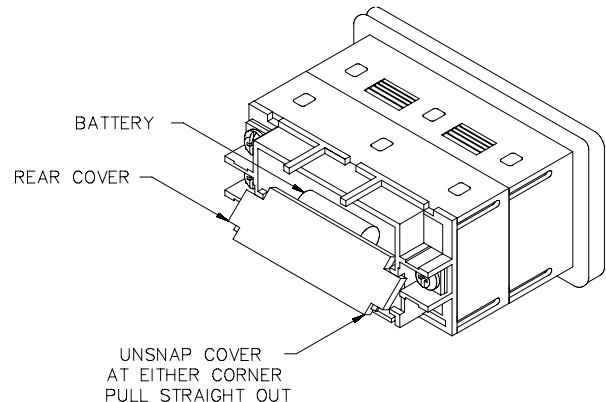
DIP switch SWB 6 is the "Frequency Doubling" switch. When it is in the "ON" position, frequency doubling is disabled. When set to the "OFF" position, it is enabled and twice the number of input pulses are registered in the unit. This doubling of the input rate allows the Timebase Increment Total to be halved, thus allowing a faster update time for a given display value.

$$\frac{\text{SWB 6 ON}}{\text{FRQ. DBL. DIS. (X1)}}$$

$$\frac{\text{SWB 6 OFF}}{\text{FRQ. DBL. (X2)}}$$

## BATTERY INSTALLATION

1. To remove battery cover, unsnap at either of the lower rear corners and pull cover straight out (refer to drawing below).
2. Remove the plug-in battery and replace with an RLC battery (BNL00000). Observe proper polarity when replacing battery as shown in the drawing.
3. Allow 32 seconds for the first update to occur after battery is replaced.



## DECIMAL POINT SELECTION

The selection of Decimal Point is accomplished by DIP switches SWB 7 and SWB 8. The table shows what combinations of switches are needed to obtain the desired decimal point location. The Ditak 7 always has leading zero blanking.

SWB 7	SWB 8	D.P. LOCATION
ON	ON	Factory test mode
ON	OFF	0
OFF	ON	0.0
OFF	OFF	0.00

*Note: The Decimal Point position will take effect when the display updates.*

## TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

## INSTALLATION ENVIRONMENT

The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents.

Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

## INSTALLATION

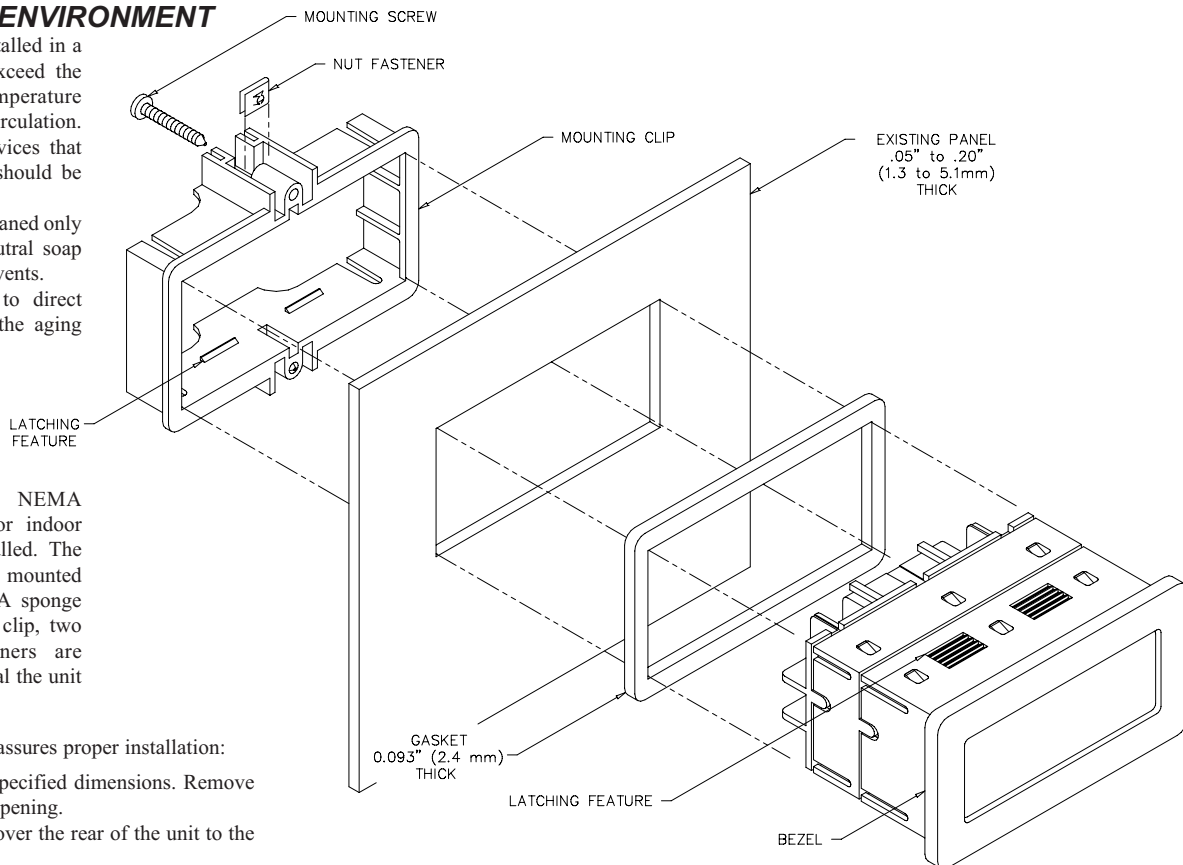
The Ditak 7 meets NEMA 4X/IP65 requirements for indoor use, when properly installed. The units are intended to be mounted into an enclosed panel. A sponge rubber gasket, mounting clip, two screws, and nut fasteners are provided to install and seal the unit in the panel cut-out.

The following procedure assures proper installation:

1. Cut panel opening to specified dimensions. Remove burrs and clean panel opening.
2. Slide the panel gasket over the rear of the unit to the back of the bezel.
3. Slide nut fastener into slot on mounting clip and then insert mounting screw through nut on both sides of mounting clip. Tip of mounting screw should NOT project through hole on clip.
4. Install Ditak unit through panel cut-out.
5. Slide mounting clip over rear of unit until clip is against back of panel. The mounting clip and Ditak housing have a latching feature to hold the unit in place until tightened.

*Note: Hold the Ditak front bezel in place when sliding the mounting clip into position.*

6. Alternately tighten each mounting screw to ensure uniform gasket pressure. Visually inspect the gasket for proper seal. The gasket should be compressed approximately 75 to 80% of its original thickness.
7. If the gasket is not adequately compressed and the mounting screws cannot be tightened any further, loosen mounting screws and insure that the clip is latched as close as possible to the panel.
8. Repeat step #6 for tightening the mounting screws.



## TYPICAL APPLICATION

### CONVEYOR BELT SPEED INDICATOR

It is desired to display the rate of a conveyor belt used to carry PC Boards through an Infared soldering chamber that is variable from 0 to 10 feet per minute. The rate must be adjusted depending on the size of the boards being soldered. The display of the rate indicator must read in hundredths of a foot per minute. The belt is driven by a chain and sprocket. A 26-tooth sprocket is mounted onto the shaft of a variable speed motor. A speed of 1800 RPM will produce a belt speed of 10 ft/min. A magnetic sensor is used to monitor the speed of this sprocket. The Ditak 7 can be used to display the belt speed in this application. The signal input of the sensor is connected to the Ditak 7 Terminal 3 (INP). The sensor common and shield are connected to the Ditak 7 Terminal 1 (GND). The Timebase setting is to be determined by using the formula.

$$\text{TIMEBASE INCREMENT TOTAL (TBIT)} = \frac{\text{DR} \times \text{DDP} \times 15,360}{\text{RPM} \times \text{PPR}}$$

Desired Reading = 10.00  
 MAX RPM Of Shaft = 1800  
 Pulses Per Revolution = 26  
 Display Decimal Point = 100

$$\text{TBIT} = \frac{10.00 \times 100 \times 15,360}{1800 \times 26} = \frac{15,360,000}{46,800} = 328.2$$

TBIT = 328 {round to the nearest whole number}

TBIT = 328

DIP SWB 1 -  $\frac{256}{72}$  - Needed  
 DIP SWA 7 -  $\frac{64}{8}$  - Needed  
 DIP SWA 4 -  $\frac{8}{0}$  - Needed

With these DIP switch settings, the Timebase would be approximately 1.3 sec ( $328 \times 0.004 = 1.312$ ). To reduce the display update time, the "Frequency Doubling" switch can be enabled (set to the "OFF" position). Therefore, only half the Timebase will be necessary ( $164 \times 0.004 = 0.656$  sec.).

$$\text{TBIT} = \frac{328}{2} = 164$$

$$\text{TBIT} = 164$$

DIP SWA 8 -  $\frac{128}{36}$  - Needed  
 DIP SWA 6 -  $\frac{32}{4}$  - Needed  
 DIP SWA 3 -  $\frac{4}{0}$  - Needed  
 DIP SWB 6 - OFF - Frequency Doubling Enabled  
 DIP SWB 7,8 - OFF - 0.00 Decimal Point Position

## ORDERING INFORMATION

Note: Unit shipped with battery installed.

MODEL NO.	DESCRIPTION	PART NUMBER
DT7	Adjustable Timebase Tachometer	DT700000
	Adjustable Timebase Tachometer with Yellow/Green Backlighting	DT700010
	Adjustable Timebase Tachometer with Red Backlighting	DT700020
	Adjustable Timebase Tachometer with V+ Terminal	DT700M00
BNL	3V Lithium Battery	BNL00000
MLPS	Micro Line Sensor/Power Supply	MLPS0000
For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.		