DCS 107 Rev. A
6/90

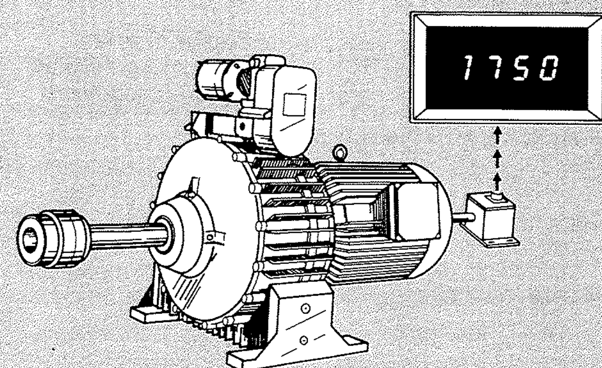
Field Programmable Ratemeter

DRIVE CONTROL SYSTEMS **FPR-4500**

A Unit of ELECTRO-SENSORS, INC.

Features:

- ▶ 4½ Digit LED Display
- ▶ Field Programmable for Rate RPM, FPM, etc.
- ▶ Frequency Doubling
- ▶ Compact DIN Enclosure
- ▶ Interfaces with High or Low Level Sensors



Description:

The FPR 4500 was designed to be a field programmable tachometer/ratemeter suitable as a stand alone indicator using various types of sensors which include Hall Effect, Proximity, Magnetic, Optical Encoder, etc. or as a slave indicator monitoring the same sensor pulses feeding one of our closed loop digital motor controls.

The FPR-4500 has a 4½ digit LED display making it ideal for high speed monitoring applications or for slower speed applications requiring resolution to fractions of RPM.

Calibrating the FPR-4500 involves using a simple formula to arrive at a calibration number which tailors the incoming pulses to your desired display readout. This calibration number is set into four rotary BCD switches and two binary DIP Switches.

Decimal point selections are made using a four position DIP switch located on the display board behind the filter and bezel on the face of the unit.

Input power is 115 Vac standard with 220 Vac, 12 Vdc, and 24 Vdc optional.

All wiring connections are performed on a seven position removeable terminal strip located at the rear of the unit.

The FPR-4500 is housed in a universally acceptable DIN panel mount enclosure.

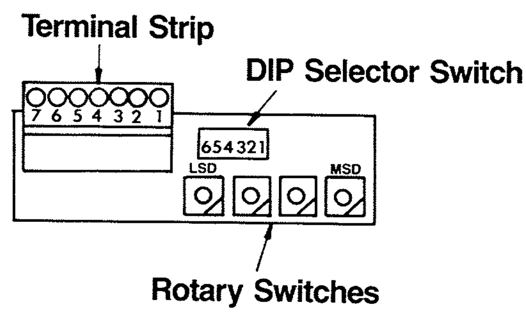
WIRING CONNECTIONS
Input Power:

		115 Vac	230 Vac	12 or 24 Vdc
Terminal	1	Hot	L1	Positive (+)
	2	Neutral	L2	Negative (−)
	3	Earth Ground	Earth Ground	N/A

Sensor Input:

Terminal	4	Sensor Supply (+)
	5	Primary Sensor Input
	6	Sensor Ground & Shield
	7	Secondary Sensor Input*

Terminal Connections and Switch Locations:



*Most sensors typically used for speed monitoring purposes produce a single pulsed output. This signal output should always be connected to the Primary Sensor Input, Terminal 5. The FPR-4500 possesses a Secondary Sensor Input (Terminal 7) which enables a customer using quadrature output sensors, typically optical encoders or Hall Effect Sensors, to utilize the additional output. When connected to terminal 7, the FPR-4500 automatically sums the two input lines together thus doubling the input frequency and cutting the update time in half. Closing switch #3 on the back of our unit will also provide frequency doubling when using a single channel sensor or frequency quadrupling when using quadrature output sensors. These special features become very valuable when the Desired Display to Input Frequency ratios result in an unacceptably long update time.

NOTE: *When using the frequency doubling or the Secondary Sensor Input capability, the calibration number (K) will have to be recalculated using the new input frequencies.*

Calibration Procedure:

Calibrating the FPR-4500 requires calculating a calibration number (K) using a simple formula and loading this number into four rotary BCD switches and two binary DIP switches. The four most significant digits of the "K" number are dialed into the four rotary switches at the rear of the unit. Switches 4 and 5 located on the 6 position DIP switch bank also at the rear, are used to select the proper multiplier for completing your "K" number. On occasion, rounding off the four most significant numbers may be required. Use this formula for calculating your "K" numbers. A formula for determining the sensor input frequency is also shown for your convenience.

$$K = \frac{\text{Desired Display}}{\text{Input Frequency}} \times 1{,}000{,}000$$

Note: *When determining your desired display, treat any decimal places as whole numbers. Our decimal point is passive so it has no bearing on actual calibration.*

$$\text{Input Frequency} = \frac{\text{RPM} \times \#\text{ of pulses/rev.}}{60}$$

"K" Number Multiplier Selection

SW4	SW5	Multiplier
ON	ON	x 10
OFF	ON	x 100
ON	OFF	x 1000
OFF	OFF	x 10,000

Update Time:

Once you've determined your Desired Display and Input Frequency you can calculate what your display update time will be.

$$\text{Update Time (seconds)} = \frac{\text{Desired Display}}{\text{Input Frequency}}$$

Usually update times from .5 to 3 seconds are the most desirable. If your calculated update time is undesirably long, the use of a higher resolution sensor such as a rotary shaft optical encoder is required. With this type of sensor, we can select the proper number of pulses to provide you with your desired update time. If your Desired Display provides resolution to tenths or hundredths, removing one digit of resolution (Least Significant Digit) wil reduce your update time by a factor of 10.

Examples:

The first step in calibrating the FPR-4500 is to determine the input frequency of pulses generated by the sensor. The following formula performs that calculation.

$$\text{Input Frequency (Hz)} = \frac{\text{RPM} \times \#\text{ of pulses/rev.}}{60}$$

If your sensor is a rotary shaft optical encoder generating 100 pulses/rev. and the nominal speed is 1500 RPM, your input frequency would be 2500 Hz.

$$2500\text{ Hz} = \frac{1500 \times 100}{60}$$

The second step is to calculate a calibration number that will tailor your input frequency to your desired display. Using the 2500 Hz frequency previously calculated and desiring a direct RPM readout without any decimal places (1500), the following formula will give the calibration number.

$$\text{Calibration \# (K)} = \frac{\text{Desired Display}}{\text{Input Frequency}} \times 1{,}000{,}000$$

$$K = \frac{1500}{2500} \times 1{,}000{,}000$$

$$K = 600{,}000$$

Since we can only dial four numbers into our four rotary switches, we always select the 4 most significant numbers. Dial 6000 into the four rotary switches and use the x100 multiplier selection using switches 4 and 5. Switch 4 off and switch 5 on.

Your update time for this example is:

$$\text{Update time (seconds)} = \frac{1500}{2500}$$

$$\text{Update time} = .6\text{ seconds}$$

If the 1500 RPM in the previous example was the equivalent of 500 feet/minute of a conveyor belt and a FPM readout accurate to 1/10 feet was desired, the calibration number would be calculated in the following manner.

$$K = \frac{5000}{2500} \times 1{,}000{,}000$$

$$K = 2{,}000{,}000$$

You would dial 2000 into the rotary switches and use the X1000 multiplier (Sw 4 on, Sw 5 off). To illuminate the decimal light, turn on switch 4 located on the display board located behind the filter and bezel on the face of the unit.

Your update time for this example is:

$$\text{Update time (seconds)} = \frac{5000}{2500}$$

$$\text{Update time} = 2\text{ seconds}$$

Decimal Point Select

This four position DIP switch is located in the left corner of the display board behind the front faceplate.

Switch 1 "ON"	X.XXXX
2 "ON"	XX.XXX
3 "ON"	XXX.XX
4 "ON"	XXXX.X

Sensor/Output Circuit Chart

	SW1	SW2	SW6
NPN Open Collector	off	off	on
PNP Open Collector	on	off	off
Magnetic Sensor	on	on	off
Logic Level Output	off	off	off

Input Configuration Switch Set-Up

The input circuit of the FPR-4500 can be configured to interface with existing sensors with various types of outputs. Switches 1, 2, and 6 on the DIP switch bank at the rear of the unit are used for this purpose. The following explains the function of all of the switches.

Switch #1 "ON" for current sourcing sensors (PNP)
"OFF" for current sinking sensors (NPN)

Switch #2 "ON" for low level input (magnetic sensor)
"OFF" for high level input (logic)

Switch #3 "ON" for frequency doubling (sensor must have a 50% duty cycle)

Switch #4 Multiplier select used for initial calibration.

Switch #5 Multiplier select used for initial calibration.

Switch #6 "ON" provides 4.4K ohm internal pull-up resistor.
"OFF" removes 4.4K ohm internal pull-up resistor (used when paralleling with other equipment with signals of different voltage levels).

Field Programmable Rate Meter, General Specifications:

Power:

Voltage	115 Vac ± 10% standard 230 Vac ± 10% optional 12 or 24 Vdc optional
Frequency	50-60 Hz
Wattage	115 or 230 Vac, 4.6 VA 12 or 24 Vdc, 300 mA

Input Signal:

Type	NPN, PNP, low level
Amplitude	High level input: 3 volts min., 50 volts max. Low level input: .5 volts p-p zero crossing.
Frequency	20 KHz max. (consult factory for higher range)
Impedence	NPN output 4.4 K ohms PNP output 2.2 K ohms
Waveform	Square, Triangle, Sine
Pulse Width	20 micro sec. minimum

Hysteresis	High level input 1 volt Low level input .12 volt
Sensor Supply Voltage	11-16 Vdc unregulated @ 50 mA standard 5 Vdc regulated @ 50 mA optional (factory jumper)

Display:

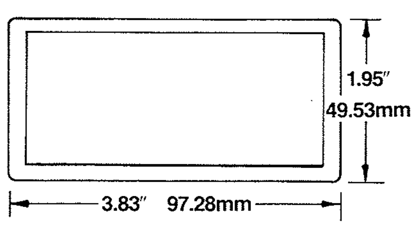
Type	Segmented LED, .43″ character height
Number of Digits	4½ (19999)
Decimal Point	Passive (switch selectable)

Environmental:

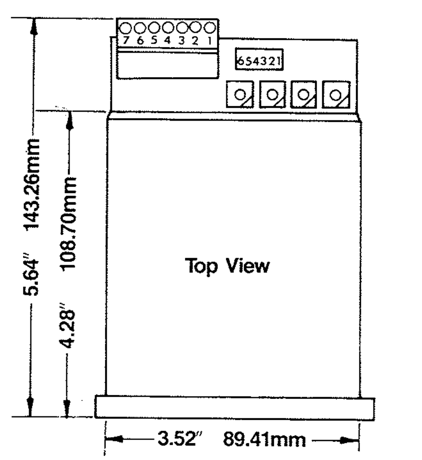
Enclosure Material	Noryl SE1 Flame Retardant Plastic
Operating Temperature	0°C to 70°C
Storage Temperature	−55″ to 70°C

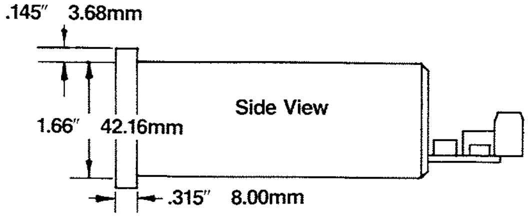
Specifications Subject to Change Without Notice

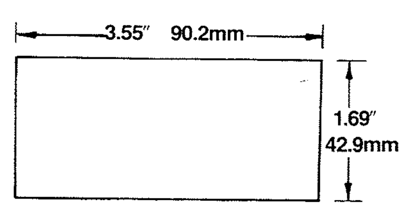
Dimensional Drawings:
Dimensions in Inches and MM



Front View







Panel Cut Out