**GENERAL INTRODUCTION**

This version of the TACH1V5 utilises a new algorithm that is capable of measuring speeds of up to 600,000 rpm. It has programmable reset and update times. Several programmable hardware features have also been included to enable the TACH1V5 to interface to various different types of sensor. The program is safely retained in Electrically Alterable ROM which is more reliable than battery backed CMOS RAM. An attempt has been made to simplify the programming by using one pushbutton only and easier calibration setup. The setup is done using a modly rather than start from scratch method so that simply changing one preset can be achieved very quickly.

An alpha-numeric message sequence at power-on displays the type of function selected and any diagnostics errors detected.

The TACH1V5 can operate either as a TACHOMETER or a TIMER with both following the having the following programmable features:

- display scaling factor
- fixed update time from 0.1 to 99.9 secs
- reset time from 0.1 to 99.9 secs
- three decimal point positions
- overspeed indication
- minutes & secs or minutes & decimal of minute display

**INSTALLATION - GUIDELINES**

To ensure reliable and trouble free operation of the TACH1V5 the following guidelines should be strictly observed.

Failure to do so may cause noise to be injected on to the input signal producing an unreliable, unstable display reading.

In the guidelines stated NOISY CABLES refers to ANY cables that carry MAINS OR are connected to highly inductive loads such as CONTACTORS, RELAYS, DC DRIVES etc.

| DO NOT RUN THE SENSOR cable, including the supply connections, WITH NOISY CABLES. |
| DO NOT RUN NOISY CABLES within 2" AROUND THE TACH1V5 |
| DO NOT MOUNT THE TACH1V5 IN CLOSE proximity TO highly INDUCTIVE LOADS |
| DO PROVIDE A CLEAN SUPPLY to the TACH1V5 if possible |
| DO USE multi SCREENED CABLE to the sensor if RATES of OVER 2000 P.P.M are to be measured OR ALWAYS for a RELUCTANCE SENSOR. THE SCREEN should be connected TO the EARTH terminal on the TACH1V5 with ALL other sensor CONNECTIONS including 0V INSIDE the SCREEN. |

**INSTALLATION - RELUCTANCE SENSOR**

To configure the TACH1V5 for use with a reluctance sensor the internal slide switch S1 must be accessed by removing the TACH1V5 electronics from its DIN housing. To do this first unscrew the Printed Circuit Board retaining screw on the bottom of the unit and then prise off the rear panel by pushing down gently on each of four panel retaining clips in turn. The electronics assembly can then be slid from the housing. To do this first unscrew the Printed Circuit Board retaining screw on the bottom of the unit and then prise off the rear panel by pushing down gently on each of four panel retaining clips in turn. The electronics assembly can then be slid from the housing until the switch...

**DESCRIPTION**

The TACH1V5 can operate either as a TACHOMETER or a TIMER with both following the having the following programmable features:

- display scaling factor
- fixed update time from 0.1 to 99.9 secs
- reset time from 0.1 to 99.9 secs
- three decimal point positions
- overspeed indication
- minutes & secs or minutes & decimal of minute display

**TECHNICAL INFORMATION - MAINS VERSIONS**

Supply In  110 / 240 V AC +10 -15% 3VA MAX UNFUSED
Supply Out - Not protected against s/c or overload
Nominal 13.9 V DC at No Load 0.4V ac ripple
10.6 V DC at Load of 90mA 0.8V ac ripple
12.2 V DC at Load of 45mA 0.6V ac ripple

Connections ( also shown by a label on rear panel):  
M  Neutral  1  1
A  110 V  2
I  240 V  3
N  Earth  4
S

Sensor Supply Output  
0V  5
12 V  6
No Connection  7
Sensor Input  8

**Input Details**

| IN1 - Counter Input |
| NPN |
| active :-  5.0 V  |
| hi  8.0V 55% x "- 3.9 K ohms to > 12 V |
| PNP |
| active:-  7.9 V 54% |
| hi  5.4 V 37% |
| impedance 7.8 K ohms to 0 V |
| RELUCTANCE |
| active:-  10 V |
| impedance 7.8 K ohms to 0 V |

**FILTER**

- based on 50/50 duty cycle a square wave
  lo speed lower than 30 Hz
  hi speed lower than 10 KHz

Accuracy   
based on quartz crystal +0.1% of scale
  temp stability 50 ppm/degreeC
PROGRAMMING - PRESET DETAILS

SP's are the means by which values are entered into the TACH1V5 and are shown as SP-01 (for example) when in the EDIT MODE. Valid SP values run from SP-01 to SP-19 and the TACH1V5 will exit from the EDIT mode if a value outside of these is entered. There is a list at the end of the manual detailing the function for each SP number.

SP-01 sets the application that you wish to run, automatically resetting the various decimal points throughout the TACH1V5 to help ensure that the correct calibration and overspeed values can be entered. The values required are: 00000 for the TACHOMETER or 00001 for the TIMER.

When the TIMER is selected it is automatically set to read in minutes and seconds but this can be overwritten to read in 1/100 of minutes if required by setting the 3rd digit of SP-01 to 1 ie SP-01 becomes 00101

SP-02 is the SCALE RATIO which is calculated from the input RATE in pulses per minute and it's corresponding DISPLAY value. The calculation and method differs slightly for the two applications.

For the TACHOMETER

Calculate the SCALE RATIO keeping any decimal portion of the input RATE and the required DISPLAY value.

SCALE RATIO = DISPLAY/RATE

and for the TIMER

Adjust the DISPLAY value so that it reads in 1/10ths of a minute eg 20 minutes becomes 20.0
15 minutes 30 seconds becomes 15.5 etc
Calculate the SCALE RATIO

SCALE RATIO = DISPLAY/RATE

SP-03 is the MEASUREMENT period over which the TACH1V5 attempts to take its measurement, basically setting the display update time and stability. However, if the period of the input RATE is greater than this value then the cycle will be completed on receipt of the next pulse after the preset time has elapsed.

SP-04 is the RESET period timer that determines when input pulse RATE is effectively 0. This is selected to suit the application and as an example the default value of 2.5 seconds causes the display to show 0 when the incoming pulse rate drops below 24 ppm. Entering a value of 60.0 would allow a display reading down to 1 ppm.

PROGRAMMING - PRESET ALLOCATIONS

| SP  | Function          | X | X | X | X | X | ^ | ^ | ^ | ^ | ^ | ^ | ^ | ^ | ^ | ^ | ^ | ^ | ^ |
| 01  | Tachometer        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 02  | Ratio             |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 03  | Period            |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 04  | Reset             |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 05  | Decimal Point     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 06  | Overspeed hi      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 07  | Overspeed lo      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 08  | Sensor Type       |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

SP-05 is used to force a decimal point, if any, on to the final measurement display. There are only three positions available on the 1st, 2nd and 3rd digits. Entering a value of 0 disables the decimal point.

SP-10 and SP-11 combine to provide detection and indication of an overspeed condition with hysteresis. When the speed equals or rises above the value in SP-10, the message +HI- is shown on the display until the speed equals or falls below the value in SP-11 at which point the display reverts to showing the measured value. The use of the two SP's in this manner prevents the display from alternating between +HI- and measurement display should the incoming pulse rate be fluctuating.

SP-16 is slightly different in that each digit within it is a binary switch having the values 0 or 1 (ie OFF or ON) toggling from 0 to 1 to 0 etc at each press of the switch.

The 1st digit selects the type of input for the sensor:- mainly 0= npn and 1 = pnp. This MUST be set to 1 if a reluctance sensor is going to be used (see the section on RELUCTANCE SENSOR INPUT). The 2nd digit selects the input filter speed normally set at 0 for solid state sensors but MUST be set to 1 if a contact closure input (eg a Reed switch or a flowmeter) is being used.

PROGRAMMING - HOW'S IT DONE

This is performed using the programming switch which can be accessed via the small hole at the bottom left hand side of the unit when viewed from the front. Note that this switch is not labelled since it is the only one and cannot be confused with any other. A small tool is provided for depressing the switch through the enclosure sidewall.

When the programming mode is selected the TACH1V5 prompts the programmer to enter an SP number and the SP value can then be modified if required. The TACH1V5 highlights numbers on the display which are adjusted using the switch. To be able to program the TACH1V5, it must be put into EDIT MODE.

TECHNICAL DETAILS - DC Version

Supply In 10 to 30 Volts DC @ 200 mA with no sensor load.
Supply Out - based on input voltage but is regulated to 12 volts. Power rating of the internal regulator is 1/4 Watt, hence for the maximum current output for an input 30 Volts it is 0.25x(30-12)= 12 mA OR at 12 Volts input 0.25/(12-12)= 0.25 mA.

If sensors are to be supplied from an external supply greater than 12 volts, NP=PNP sensors should be used. If this is not possible a series current limiting resistor of 470 ohms 1/2 Watt should be fitted.

Connections (also shown by a label on rear panel)
- 0 Volts 1
- No connection 2
- 10 to 30V dc in 3
- Earth 4

Sensor Supply Output
- 0V 5
- 12V 6
- No Connection 7
- Sensor Input 8

Input Details

IN1 = Counter Input 1
NP= NPN 34% x Supply Out
55% x impedance 3.9 K ohms to + 12 V
PNP 54% x Supply Out
37% x impedance 7.8 K ohms to 0 V
RELIANCE active 10mV
impedance 7.8 K ohms to 0 V
FILTER - based on 50/50 duty le a square wave
hi speed lower than 30 Hz
hi speed lower than 10 Khz
Accuracy based on quartz crystal +0.1% of scale
temp stability 50 ppm/degreeC
**PROGRAMMING - EXAMPLES**

**Application**
- Tachometer

**Sensor Type**
- Inductive - 3 wire NPN

**Detecting**
- Stud on a shaft

**Max Input Rate**
- 5000 pulse per min

**Display Required**
- 5000

**Over Speed Display**
- Off

**Indicate 0 below**
- 20ppm

**Min. Update Time**
- 0.5 seconds

**Program Sequence**

<table>
<thead>
<tr>
<th>Step</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Calculate the Scale Ratio for SP-02</td>
</tr>
<tr>
<td></td>
<td>No modifications are required to the display value because it has no decimal point</td>
</tr>
<tr>
<td></td>
<td>Hence:</td>
</tr>
</tbody>
</table>
|      | \[
|      | \text{DISPLAY} = \frac{5000}{\text{RATE}} \\
|      | \text{SCALE RATIO} = \frac{\text{DISPLAY}}{\text{RATE}} \\
|      | = \frac{5000}{5000} \\
|      | = 1 \\
|      | \& adjust to 5 digits with decimal point |
|      | \text{SP-02} = 0.1000 |
| 2    | Convert the Reset time from ppm to seconds for SP-04 |
|      | \text{RESET TIME} = \frac{60}{\text{RATE}} = \frac{60}{1} = 60 seconds |
|      | \& adjust to 5 digits with decimal point |
|      | \text{SP-04} = 00000 |

**Comments**
- Since this is a medium speed application we recommend that the sensor connections be run in screened cable.

**Application**
- Oven Timer in Minutes and Seconds

**Sensor Type**
- PNP Inductive Sensor on Conveyor Drive Maximum

**Input Rate**
- 6 pulse per minute

**Display Required**
- 25 minutes 25 seconds

**Overspeed Display**
- Off

**Indicate 0 below**
- 1 pulse per minute

**Min. Update Time**
- 15 seconds

**Program Sequence**

<table>
<thead>
<tr>
<th>Step</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Calculate the Scale Ratio for SP-02</td>
</tr>
<tr>
<td></td>
<td>No modifications are required to the display value because it has no decimal point</td>
</tr>
<tr>
<td></td>
<td>Hence:</td>
</tr>
</tbody>
</table>
|      | \[
|      | \text{DISPLAY} = \frac{25.0}{\text{RATE}} \\
|      | \text{SCALE RATIO} = \frac{\text{DISPLAY}}{\text{RATE}} \\
|      | = \frac{25.0}{25} = 1 \\
|      | \& adjust to five digits with decimal point |
|      | \text{SP-02} = 01.000 |
| 2    | Convert the Reset time from ppm to seconds for SP-04 |
|      | \text{RESET TIME} = \frac{60}{\text{RATE}} = \frac{60}{2} = 30 seconds |
|      | \& adjust to 5 digits with decimal point added |
|      | \text{SP-04} = 00030.0 |

**Program Sequence**

<table>
<thead>
<tr>
<th>Step</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Calculate the Scale Ratio for SP-02</td>
</tr>
<tr>
<td></td>
<td>No modifications are required to the display value because it has no decimal point</td>
</tr>
<tr>
<td></td>
<td>Hence:</td>
</tr>
</tbody>
</table>
|      | \[
|      | \text{DISPLAY} = \frac{25.0}{\text{RATE}} \\
|      | \text{SCALE RATIO} = \frac{\text{DISPLAY}}{\text{RATE}} \\
|      | = \frac{25.0}{25} = 1 \\
|      | \& adjust to five digits with decimal point added |
|      | \text{SP-04} = 00030.0 |

**Comments**
- Since the input is a contact closure you could select either an npn or pnp. We would suggest however that the npn is used due to it’s lower impedance. The filter must be set to low speed to eliminate the contact bounce.

Hence \text{SP-04} = 00010

<table>
<thead>
<tr>
<th>Step</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Calculate the Scale Ratio for SP-04</td>
</tr>
</tbody>
</table>
|      | \text{SCALE RATIO} = \frac{\text{DISPLAY X RATE}}{60} \\
|      | = \frac{25.4 \times 6}{60} = 2.54 |
|      | \& SP-04 = 152.4 |

**Comments**
- As the input on this is very slow the low speed filter could be used to prevent electrical noise from creeping into the signal even though this is a solid state sensor.

Note that as soon as the Timer is selected, the decimal points in the Scale Factor SP-02, final display Decimal Point Position SP-05 and the overspeed presets SP-10/SP-11 are automatically set. These can be over-written to produce obscure scaling if required.
SENSOR CONNECTIONS FOR TACH1V5

NPN Input. SP16=XX00 S1=1

3 wire sensor
+12v
signal
6
8

4 wire sensor
+12v
signal
6
8

open collector
signal
0v
6
8

contact SP16=XX10
signal
0v
6
8

Reset Input
(NPN/contact closure only.)
Slow speed = 30Hz

3 wire sensor
+12v
signal
6
8

4 wire sensor
+12v
signal
6
8

open collector
signal
0v
6
8

contact SP16=XX11
signal
+12v
6
8

reluctance sensor
signal (+)
com. (-)
8
5