4B TACHOMETER (TACH1V5) OPERATING MANUAL

INDEX

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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 modify rather than start from scratch method so that simply changing one preset can be acheived 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 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 inluding 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 eletronics from it's 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 enclosure until the switch **S1** can be seen. In normal use this will be set to position 1 but MUST be moved to position 0. The TACH1V5 should then be reassembled in the reverse order. On programming the TACH1V5, the preset **SP-16** MUST be set to 0001 to enable the reluctance proxi input.

PROGRAMMING - MODIFYING THE PRESET'S

Before attempting to program the TACH1V5 you should be familiar with the SP's and should have close to hand the relevant values that you wish to enter since the edit mode sequences automatically.

The edit mode is entered by pressing the switch with the power off and then applying power at which time the Software Issue Number will be displayed for one second. The message **SP-01** will then be displayed with 1 highlighted indicating that this can be adjusted. Using the switch, increment this number to select the 1st part of the SP number that you wish to edit . The number will eventually scroll around to 0 so that you can start again if necessary. Approximately four seconds after the last switch depression the 2nd part of the SP number will be highlighted so again select the 2nd part of the SP number you require. The value of the SP number that you selected will be displayed after about four seconds with the least significant digit (the digit at the right hand end) highlighted , ready for you to adjust. The TACH1V5 will scroll from right to left across all five digits giving you the opportunity to adjust each one in turn. When all five digits have been highlighted, the TACH1V5 will revert to displaying the SP number, automatically incrementing to the next one up.

If you do not wish to alter a particular digit simply leave the switch alone and the next digit left will be highlighted after four secs. Entering an SP number of 20 causes the TACH1V5 to exit from EDIT mode and the program will be stored in the non volatile memory. If there is any error in storing the program, the message EAr 1 will be displayed and the TACH1V5 will lockout to prevent it from running with an incorrect program. Your supplier should be contacted if this occurrs.

PROGRAM - FACTORY SETTINGS

The unit is supplied with the following settings:-

SP-01	00000	Tachometer
SP-02	01.000	1:1 Scale Ratio
SP-03	0000.5	0.5 second Measurement Period
SP-04	0002.5	2.5 second Reset Time
SP-05	00000	Decimal Point Off
SP-10	00000	Overspeed Indication Disabled
SP-11	00000	
SP-16	00010	npn sensor, speed less than 30 Hz

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
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 :- lo 5.0 V 34% x Supply Out
hi 8.0V 55% x "
impedance 3.9 K ohms to + 12 V

PNP
active:- hi 7.9 V 54%
lo 5.4 V 37%
impedance 7.8 K ohms to 0 V

RELUCTANCE
active:- hi 10mV
impedance 7.8 K ohms to 0 V

FILTER - based on 50/50 duty ie 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 presetting 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 X RATE

SP-03 is the MEASUREMENT period over which the TACH1V5 attempts to takes it 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.

SP-05 is used to force a decimal point, if any, on to the final measurement display. There are only three positions avalaible 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 hysterisis. 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 on a flowmeter) is going to be 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 depessing 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 Volt is 0.25/(30-12+2)
= 12 mA OR at 12 Volts input 0.25/(12-12+2)
= 125 mA.
If sensors are to be supplied from an external supply greater than 12 volts, NPN sensors should be used. If this is 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
12 V	6
No Connection	7
Sensor Input	8

Input Details

IN1 = Counter Input 1
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
RELUCTANCE
active hi 10mV
impedance 7.8 K ohms to 0 V
FILTER - based on 50/50 duty ie 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 ALLOCATIONS

SP - 01 = Function= X X X X X

^ ^ ^	0 Tachometer
^ ^ ↑	1 Timer
^ ↑	Not used
^	0 Timer Min/Secs
↑	1 Timer Min 1/100

SP - 02 = Scale Ratio = _____ 0.001 to 99.999 for a Tachometer
000.1 to 250.0 for a Timer

SP - 03 = Period = _____ 0.1 to 99.9 seconds

SP - 04 = Reset = _____ 0.1 to 99.9 seconds

SP - 05 = Decimal Point = _____ 0 for a display of 12345
1 for a display of 1234.5
2 for a display of 123.45
3 for a display of 12.345

SP - 10 = Overspeed hi = _____ 000000 (disabled) to 999999
SP - 11 = Overspeed lo = _____ less than SP-10 or 0 if disabled

SP - 16 = Sensor Type = X X X X X

^ ^	0 npn
^ ↑	1 pnp/reluctance
^	0 hi speed
↑	1 lo speed

PROGRAMMING - EXAMPLES

Application Tachometer
Sensor Type Inductive 3 - wire NPN
Detecting Stud on a shaft
Maximum Input Rate 5000 pulse per min
Display Required 5000
Overspeed Display Off
Indicate 0 below 20ppm
Min. Update Time 0.5 seconds

Program Sequence
SP-01 00000
SP-02 01.000
SP-03 0000.5
SP-04 0003.0
SP-05 00000
SP-10 000000
SP-16 00000

Step 1 - Calculate the Scale Ratio for **SP-02**
No modifications are required to the display value because it has no decimal point

Hence:-

DISPLAY = 5000
RATE = 5000

& Therefore

SCALE RATIO = DISPLAY / RATE
= 5000/5000
= 1

& adjust to 5 digits with decimal point
SP-02 = 01.000

Step 2 - Convert reset time from ppm to seconds for **SP-04**

RESET TIME = 60 / RATE
= 60/20
= 3 seconds

& adjust to 5 digits with decimal point
SP-04 = 0003.0

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

Application Tachometer
Sensor Type Reed Switch Flowmeter
Detecting Magnetic Impeller 1 rev = 1 litre
Maximum Input Rate 25 pulse per min
Display Required 25.0 (litres/min) ie 1 place of decimal
Overspeed Display 20 ppm
Indicate 0 below 2 ppm
Min. Update Time 5 seconds

Program Sequence
SP-01 00000
SP-02 01.000
SP-03 0005.0
SP-04 0030.0
SP-05 00001
SP-10 00020.0
SP-11 00019.8
SP-16 00010

Step 1 - Calculate the Scale Ratio for **SP-02**
Modify the display value by removing the decimal point
Hence:-

DISPLAY = 25.0
RATE = 25

& therefore

SCALE RATIO = DISPLAY/RATE
= 25.0/25
= 1

& adjust to five digits with decimal point
SP-02 = 01.000

Step 2 - Convert the Reset time from ppm to seconds for **SP-04**

RESET TIME = 60 / RATE
= 60 / 2
= 30

& adjust to 5 digits with decimal point added
SP-04 = 0030.0

Step 3 - Determine position to force decimal point for **SP-05**
required display 25.0 so decimal point is 1 from right hand end

& hence
SP-05 = 00001

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 lo speed to eliminate the contact bounce.
Hence **SP-16** = 00010

Application Tachometer
Sensor Type Optomax Reflex PE, Opto output
Detecting 2 Holes per rev in disc on conveyor drive
Maximum Input Rate 523.4 pulse per min
Display Required 200 (ft/min)
Overspeed Display 180 (ft/min)
Indicate 0 below 10 (ft/min)
Min. Update Time 1 second

Program Sequence
SP-01 00000
SP-02 00.382
SP-03 0001.0
SP-04 0002.3
SP-05 00000
SP-10 000180
SP-11 000178
SP-16 00000

Step 1 - Calculate the Scale Ratio for **SP-02**
Hence:-

DISPLAY = 200
RATE = 523.4

& therefore

SCALE RATIO = DISPLAY/RATE
= 200/523.4
= 0.3821

& adjust to five digits with decimal point rounding if required to 3rd place of decimal
SP-02 = 00.382

Step 2 - Convert Reset time from display units to seconds
Note that is different method for obtaining the reset time since it has been stated in display units in this instance ft/min so we have to work backwards to obtain the time
Input RATE required to produce display of 10.0

RATE = RESET VALUE/SCALE RATIO
= 10.0/0.382
= 26.12

RESET TIME = 60 / RATE
= 60/26.12 = 2.29
= 2.3

Hence **SP-04** = 0002.3

Comments
Since the input is an opto-isolator you could select either an npn or pnp. We would suggest,however, that the npn is used due to it's lower impedance. In this instance the isolator emitter and collector should be connected to 0 V and IN1 respectively. The filter must be set to hi speed.
Hence **SP-16** = 00000

Application Oven Timer in Minutes and Seconds
Sensor Type PNP Inductive Sensor on Conveyor Drive Maximum
nput 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
SP-01 00001
SP-02 0152.4
SP-03 0015.0
SP-04 0060.0
SP-05 00002
SP-10 000000
SP-11 000000
SP-16 00011

Step 1 - Calculate the Scale Ratio for SP-02
Convert the DISPLAY time to 1/10 's of minute
DISPLAY= 25.0 + 25/60= 25.0 + 0.4167= 25.4

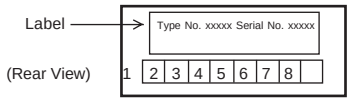
Hence
SCALE RATIO = DISPLAY X RATE
= 25.4 X 6
SP-02 = 152.4

Step 2 - Convert the Reset time from ppm to seconds for SP-04

RESET time = 60/RATE = 60/1
= 60
SP-04 = 60.0

Comments
As the input on this is very slow the lo 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



TACH1V5 Connections

1 - Neutral	5 - 0v
2 - 110v	6 - +12v
3 - 240v	7 - Reset
4 - Earth	8 - Count

NPN Input. SP16=XX00 S1=1