INSTALLATION & OPERATING

INSTRUCTIONS

SYNASPEED DIGITAL DISPLAY UNIT

(B:HSSYNSMAN(3A))

CONTENTS

INTRODUCTION

The Synaspeed is a 6 Digit Microprocessor Speed Indicator/Counter, housed in a DIN standard 96 x 48mm panel mounting enclosure.

Incorporating a sophisticated custom made microprocessor the unit can be programmed by the user to fulfil a wide variety of different speed indication, timer indication and counter functions. Scaling facilities are incorporated to allow the units to take account of gear ratios, belt diameters and display speeds in engineering units e.g. metres/min., feet/min. etc. A decimal point may be set to any point on the display if required. An input pulse divider is incorporated.

A high clarity fluorescent display enables the reading to be easily seen under virtually all lighting conditions.

Synaspeed operates on 110/240V supplies and provides a 24V DC sensor supply to energise proximity sensors, photocells etc.

INSTALLATION

The Synaspeed should be connected as shown in fig. 2. Supply should be from a source fused at 5A maximum.

The circuitry is inherently highly resistant to external electrical interference. However for reliable operation the following precautions should be observed:-

1. Mount the unit as far away from heavy electrical switchgear as possible.

2. Separate the unit connection cables from other high voltage or high current cables.

3. Use screened cable for interconnecting the input device and Synaspeed unit if cable run exceeds 5 metres or if cables are run near high voltage cables.

TECHNICAL SPECIFICATION

Supply Voltage Required:	110/240V AC at 3VA max.
Fusing:	Internal fusing not provided. A supply fused at 5A max. should be used.
Detector Supply:	24V DC at 40 milliamps max. Smoothed unstabilised.
Enclosure Dimensions:	48 x 96 x 100mm deep.
Panel Cutout	42 x 90mm.
Display Height	10 millimetres.
Max. Input Rate	15,000 rpm.
Connections	Via 7 way plug-in terminal block at rear.
Accuracy	0.05% at 20 degrees C.

INSTANTANEOUS SPEED INDICATION - PRINCIPLE OF OPERATION

Instantaneous speed measurement is the best method for most applications. A single pulse per revolution is generally sufficient and therefore a suitable input can be obtained from a proximity sensor detecting a metal protrusion on a rotating shaft or linear reciprocating shaft. This can be achieved by using an existing protrusion such as a shaft key or flange bolt. Alternatively a suitable metal target can be added.

The unit operates by using an internal clock to measure the time taken for one revolution of the shaft. This is proportional to minutes per revolution and the unit calculates from this the speed in rpm. The rpm figure can be scaled to enable the display to read directly in engineering units e.g. metres/min., feet/min. etc. The scaling facility can also be used to take account of gear box ratios, pulley diameters etc.

The divider facility (Page 9) can be used to minimise display "jumping" caused by cyclic fluctuations in input speed and must be used at input speeds over 1500 pulses/min.

The decimal point facility (Page 9) can be used to give any desired display resolution.

AVERAGING SPEED INDICATOR

Generally only used for shaft speeds in excess of 1000 rpm, the unit in this mode generates a quartz crystal controlled time base and displays the number of pulses received in the programmed time period.

The most common application is the use of a 60 tooth wheel generating 60 pulses per revolution and using a time base of 1 second to display revolutions per min.

The input Divider and Display Decimal point facilities may be used as required. Turn to Page 11 for programming details.

INTERVAL TIME/BAKING TIME INDICATOR - PRINCIPLE OF OPERATION

Many applications exist where an indication of inverse speed is required.

Typically, heat treatment processes.

The time for which a product is heat treated is inversely proportional to speed. Therefore increasing the speed reduces the time displayed. The Synaspeed may be programmed to display the treatment time in hours, minutes or seconds using this function.

The unit display is updated every second input pulse to give a virtually instantaneous readout in most cases.

The Divider and Decimal Point facilities may be used if required.

Refer to Page 10 for programming information.

TOTALISING COUNTER - PRINCIPLE OF OPERATION

The Synaspeed may be programmed as a simple totalising counter. It may be used in conjunction with proximity sensors, photocells or mechanical contact inputs etc., and will provide a 6 digit totalising counter with facilities for external reset.

The internal Lithium cell will store the recorded count for up to 10 years in the event of supply failure.

Input pulses can be multiplied or divided and the decimal point facility may be used if required. Turn to Page 10 for programming information.

PROGRAMMING AN INSTANTANEOUS SPEED INDICATOR

In this mode the Synaspeed operates as an instantaneous response speed monitor. The unit will update its display every second input pulse. Therefore on a shaft rotating at 60 rpm, the display will be updated every 2 seconds.

Synaspeed incorporates facilities which allow it to take account of gear box ratios, pulley diameters etc., and give a display directly in engineering units such as metres/min., feet/min. etc. A decimal point is also incorporated, programmable to any position.

The attached information details how to set up the unit to suit specific requirements. If however the user is unfamilier with the programming system, we strongly advise that a straight forward rpm display should be set up first to become familier with the setting method. To do this follow the procedure below from step 1 to 17 ignoring step 3.

With practice, it takes only a few minutes to set the unit up and does ensure that the instructions are fully understood.

The unit may be bench programmed and then disconnected and installed on a machine if desired.

The unit is supplied programmed as a 1:1 tacho as part of our final test procedure and may be installed without reprogramming for this function.

STANDARD RPM INDICATOR

The unit is programmed in a series of 11 steps using two pushbuttons located on the side of the case (see fig. 'X'). The buttons may be pressed using either the two plastic tools provided or two small screwdrivers.

Reprogramming may be carried out as often as necessary by following the procedure below. This allows the unit to be used for numerous different applications.

Note that if the 'C' button is accidentally pressed causing the setting to go beyond the desired point, successive pressing will cause the unit to scroll back to the correct point.

If the 'F' button is accidentally pressed causing a wrong setting, the correct setting procedure must be repeated from step 1 below:-

1. Cancel existing programme by holding down buttons 'F' and 'C' (with tools provided or with two screwdrivers) and then applying power at the same time. The display should read 11111 (ignore any decimal points which may appear during programming sequence). If it reads LLLLL, press the 'C' button once to show 11111.

2. Press 'F' button once, display should read 1.00. Press 'C' button until display reads 1.03. (For Baking Time Indicators, set 1.04). If you accidentally go past the setting, successive pressing of the button will scroll the display back to the correct value. Press 'F' button once, display should read set 1.

3. If a straightforward rpm tacho is being set and:-

   (i) A divide facility is not required (Step 33).

   (ii) Maximum input is below 1500 pulses per min. (Step 33).

   (iii) A decimal point is <u>NOT</u> required (Step 31)

   Proceed to Step 4.

   Otherwise move to Step 18.

4. Press 'F' button once, display will read SET 2.

5. Press 'F' button once, display will read 2.05.

6. Press 'C' button once, display will read 2.06.

7. Press 'F' button once, display will read 3.00.

8. Press 'F' button once, display will read 4.01.

9. Press 'F' button once, display will read 5.07.

10. Press 'F' button once, display will read 6.01.

11. Press 'F' button once, display will read 7.01.

12. Press 'F' button once, display will read 8.07.

13. Press 'F' button once, display will read 9.00.

14. Press 'F' button once, display will read 10.07.

15. Press 'F' button once, display will read 11.04.

16. Press 'C' button until display reads 11.00.

17. Press 'F' button once. Unit is now calibrated.

Display will stay at 11.00 until input pulses are received. To prove that unit is functioning, wire a pushbutton from "input" to "0V" on the terminal block and press a few times.

18. CALIBRATION OF SYNASPEED FOR SPECIAL INSTANTANEOUS SPEED INDICATION APPLICATIONS (REFER TO PAGE 10 FOR BAKING TIME INDICATOR APPLICATIONS)

This section details the method of programming the unit to give a reading other than direct rpm plus incorporation of decimal point and divider values. If you are unfamilier with Synaspeed/PUC programming methods, you are strongly advised to set your unit firstly as an rpm indicator to familiarise yourself with the setting method. (See Page 5)

Otherwise proceed as follows:-

Calculate the units 'K' factor as follows:-

Determine the figure which you wish to display and the corresponding input frequency in pulses per minute. Ignore any decimal points on the display only for this calculation. The display decimal point is for the user only, the Synaspeed does not take account of it. Therefore if you intend to programme the unit to display 0-60 metres per min. to an accuracy of one decimal place, (0-60.0 metres/min) the display reading required must be set as 600.

19. Example: Display is to read 0-125.0 metres/min. for input frequency of 0-82.7 PPM. The display value is 1250 and input frequency, 82.7. Divide facility is not used in this example.

Calculate 'K' factor using formula below - note that a calculator having more than 8 digits may be needed. This may be avoided by dividing 5242860 by frequency and then multiplying by display reading.

$$K = \frac{5242860 \times \text{DISPLAY REQUIRED} \times \text{DIVIDER VALUE}}{\text{FREQUENCY (PULSES/MIN)}}$$

Using Above Example

$$K = \frac{5242860 \times 1250 \times 1}{82.7}$$

$$= 79245163.23$$

20. Round figures after decimal point up or down to nearest whole number.

= 79245163

Convert into 10 digit reference

= 0079245163

21. Divide into two separate 5 digit numbers calling least significant digits 'SET 1' and most significant digits 'SET 2'.

e.g. SET 1 = 45163

SET 2 = 00792

22. Press the 'C' button once, display will read 42860 and R.H.digit will be flashing. Use the 'C' button to increment the zero to the required setting. If you accidentally pass the setting, successive pressing of the button will scroll the display back to original number.

23. Press 'F' button once, the 10s digit (6) will flash. Use 'C' button to adjust if necessary.

24. Press 'F' button once, the 100s digit (8) will flash. Proceed as above until all 5 digits are correctly set and L.H.digit is flashing.

25. Press 'F' button once, display will read SET 2.

26. Press 'C' button once, display will read 00052. Proceed as in (23) to set each digit to the correct value and leaving the L.H. digit flashing.

27. Press 'F' button once, display should read 2-05.

28. Press 'C' button once, display should read 2-06.

29. Press 'F' button once, display should read 3-00.

30. If you do not require to display a decimal point, and do not require a divider, return to Step 8 to complete programming, otherwise proceed to Step 31.

31. DECIMAL POINT

Use 'C' button to set position of the decimal point. The value set indicates the number of digits to the LEFT of the decimal point, for example a setting of 3.04 will give a reading of xxxx.xx. If no decimal point is required, leave at 3.00. Note that the decimal point is not recognised by the unit; it is for the user only.

Press 'F' button, display should read 4.01.

32. If a divider value is not required, return to Step 10, Page 7 to complete programming, otherwise proceed to 33.

33. DIVIDER

Incoming input pulses can be divided by any whole number from 1-99. The unit sets a divider value of .1. and this gives the fastest update time.

Setting the divider value - Used either for speeds above 1500 rpm or where cyclic fluctuations in machine speed cause an erratic display.

The divider can be set to any number between 1 and 99. Note that the 'K' factor (Step 19) must be altered to accommodate the factor selected. Note also that the unit response time will be increased by the selected divider factor.

For speeds above 1500 rpm, a divider value of 10 or greater should be used.

Failure to do so will result in the display blanking out. To prevent an erratic display, the correct divider value can be found by trial and error.

34. Press 'F' button once, display should read 5.07.

35. Press 'F' button once, display should read 6.01.

36. Press 'C' button successively until display reads the desired divider value.

37. Press 'F' button once, display should read 7.01.

38. Complete programming from Step 12.

39. PROGRAMMING THE SYNASPEED AS A BAKING TIME INDICATOR

For Baking Time Indication, the unit is programmed in a similar way to the method used for special speed indication applications detailed on Page 5, with the following alterations:-

a) STEP 2 - Set display to read 1.04 not 1.03.

b) STEP 18 Page 7 - Formulae used to calculate 'K' factor is as follows:-

$$\frac{5224090 \times \text{Divider Value}}{\text{Required Display} \times \text{Input Speed (Pulses/Min.)}}$$

'K' factor should ideally be greater than 500. It can be increased by use of a divider but note that the unit response time is increased by the same factor.

PROGRAMMING THE SYNASPEED AS A TOTALISING COUNTER

The Synaspeed may be programmed as a totalising counter to count and display incoming pulses. The normal high speed input is used for solid state signals from proximity sensors, photocells etc., and the low speed input is used for contact inputs from relays, micro switches etc.

Programming is similar to that detailed for the tacho - (see Page 5) except that in Step 2, Page 6 the display should be set to read 1.00.

The decimal point facility Step 31 (Page 9) and divider facility Step 33 (Page 9) may be used as required.

PROGRAMMING AN AVERAGE SPEED INDICATOR

If you are not familier with the programming method used in the Synaspeed, you are strongly recommended to set the unit as a simple instantaneous speed indicator as detailed on Pages 5, 6 and 7. Otherwise follow the procedure detailed below:-

1. Cancel existing programme by holding down buttons 'F' and 'C' (with tools provided or with two screwdrivers) and then applying power at the same time. The display should read 11111 (ignore any decimal points which may appear during programming sequence). If it reads LLLLL, press the 'C' button once to show 11111.

2. Press 'F' button once, display should read 1.00. Press 'C' button until display reads 1.02. If you accidentally go past the setting, successive pressing of the button will scroll the display back to the correct value. Press 'F' button once, display should read set 1.

3. Press 'F' button once, display should read 2.05.

   Press 'C' button once, display should read 2.06.

   Press 'F' button once, display should read 3.00.

4. If a decimal point is required go to Step 31, otherwise proceed to Step 5.

5. Press 'F' button once, display should read 4.01.

6. Press 'F' button once, display should read 5.07.

7. Press 'F' button once, display should read 6.01.

8. Press 'F' button once, display should read 7.01.

9. Press 'C' button successively to set the time base period in seconds from 1-99. If the desired setting is accidentally passed, successive pressing of 'C' passed 99 will return the display to 7.01.

10. Press 'F' button once, display will read 8.07.

11. Press 'F' button once, display will read 9.00.

12. Press 'F' button once, display will read 10.07

13. Press 'F' button once, display will read 11.04.

14. Press 'C' button until display reads 11.00

15. Press 'F' button once, display will read 0.

The unit is now calibrated and ready for use.

16. DECIMAL POINT

Use 'C' button to set position of the decimal point. The value set indicates the number of digits to the LEFT of the decimal point, for example a setting of 3.04 will give a reading of xxxx.xx. If no decimal point is required, leave at 3.00. Note that the decimal point is not recognised by the unit; it is for the user only.

Press 'F' button, display should read 4.01.

Return to Step 6 (Page 6) and complete programming.

EXAMPLES

CONVEYOR SPEED INDICATOR (1)

The Synaspeed is to be calibrated such that an input pulse rate of 17.67 pulses per minute gives a required display of 35.6 metres per minute.

Ignore the display decimal point position in the calculations as this is simply added onto the display after calibrating i.e. required display is 356.

The divider will be set to 1.

Following the steps as previously outlined:-

(a) Using speed indicator equation then

$$\text{Scale Factor} = \frac{5242860 \times 356 \times 1}{17.67} = 105628645.16$$

(b) Round the scale factor

Scale Factor = 105628645

(c) Convert to a 10 digit number

Scale Factor = 0105628645

(d) Split down the middle

Scale Factor = 01056 28645

(e) Allocate the values to SEt 1 and SEt 2 stores

SEt 1 = 28645 and SEt 2 = 01056

CONVEYOR SPEED INDICATOR (2)

Conveyor is driven by a chain drive with a reduction ratio of 3.56:1 onto a 0.5m diameter roller. Indicated speed required is 0-60 metres/min. to one decimal place accuracy. To prevent display jumping due to speed variations caused by a slack chain, a divide by 8 facility is selected.

Roller circumference is 0.5 XTT = 1.57 metres.

1 metre of belt travel = $\frac{3.56}{1.57}$ Revolutions of input shaft

= 2.2675

at 60m/min., shaft speed = 60 x 2.2675
= 136.05 rpm

'K' Factor = $\frac{5242860 \times 600 \times 8}{136.05}$

= 184974112.4

Convert to 10 digit and round down

= 0184974112

SET 1 = 74112

SET 2 = 01894

The unit may be programmed as detailed on Page 6 noting that SET 1 and SET 2 are programmed as detailed in Step 20.

Decimal point is set as detailed in Step 31 and Divider is set as detailed in Step 33.

BAKING TIME INDICATOR

The Synaspeed is to be used as a timer indicator. At an input pulse rate of 60 pulses per minute, the required display is 20 minutes. Also on timer indicators it is advisable to enter a divider to ensure a stable display.

The input divider value is usually best obtained by trial and error when used for this purpose, so use a value of 4 to start with. For accuracy, the scale value calculated in step (a) should always be greater than 500 if possible. This is done by increasing the divider value.

FAULT DIAGNOSIS

Synaspeed contains no user serviceable components and must be returned to us for serivce. Units covered by the guarantee detailed below will be repaired free ofcharge. Other units will be repaired and charged on a time plus materials basis.

The following series of checks will help to ensure that external faults are eliminated before the unit is returned. DANGER: These checks must be carried out by qualified Technicians accustomed to handling mains operated equipment.

SYMPTOM	PROBLEM	
Display blank (Unlit)	(a)	No mains supply to unit. Check supply voltage.
	(b)	Interference protection circuit has operated. Switch off supply for 10 seconds and switch on again. If unit works, there may be interference on input lines. Check installation instructions or refer to Synatel.
	(c)	Check 24V DC supply on Pins 4 & 5. If not present, unit is faulty.
Display reads zero and will not count	(d)	Check function of input device by connecting a meter across input terminals and switching input device on and off. Voltage should vary between 0 and 24V. It must drop below 10V and rise above 20V for satisfactory operation. If the input stays at 24V, check input device. The Synaspeed requires an NPN input. You may have a PNP input. This situation may be cured by connecting a 2200 ohm resistor between input and 0V Terminals 7 or 8 and 4. This will place an additional load of 10mA on the sensor.

Display shows 10% of correct value	(e)	The display decimal point has been used in calculating the calibration factor. Recalculate and reprogramme ignoring the decimal point e.g. to read 156.0 RPM use 1560 in calculation.
Display erratic	(f)	Fluctuations in machine speed are being registered, re-programme using a suitable input divider value.
Display fail to indicate correctly at high speed	(g)	A divider value of 10 must be used at speeds above 1000 RPM when using an instantaneous speed indicator. Re-programme remembering to allow for divider value in calibration factor.

GUARANTEE

The equipment is guaranteed for one year from date of despatch against problems arising from faulty design, materials or workmanship.

Units suffering from faults arising solely from the above will be repaired/replaced at our discretion free of charge providing they are returned to us carriage paid.

Issue 1 (July, 1988)

(B:SYNSMAN(3A))

FIG 1

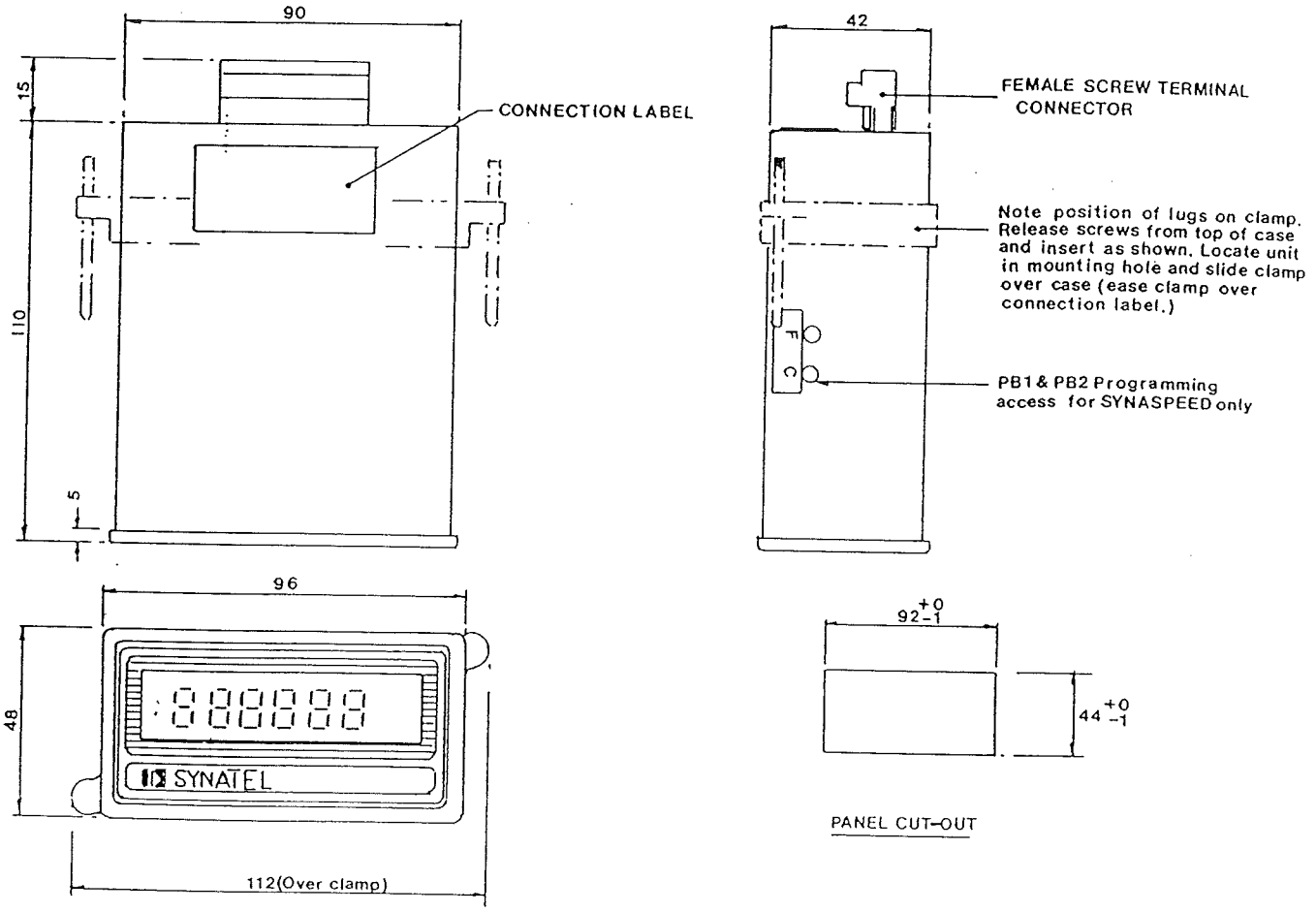

FIG 2a

STANDARD CONNECTIONS

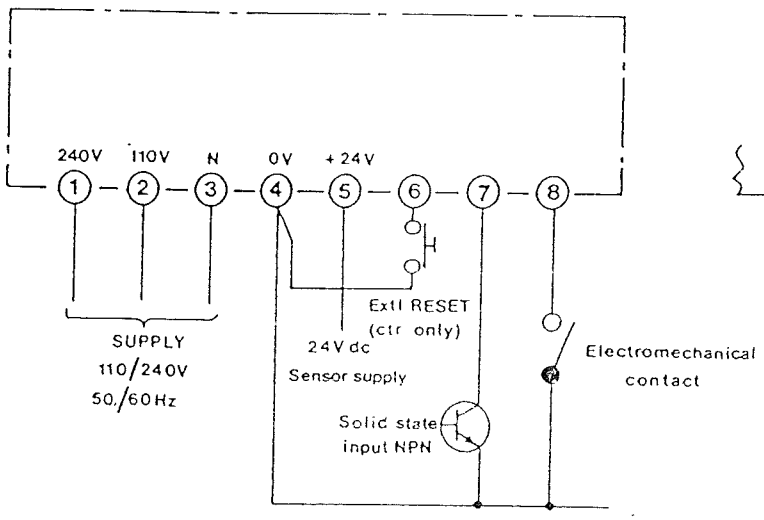

FIG 2b

SENSOR INPUT CONNECTIONS