



Guarantee

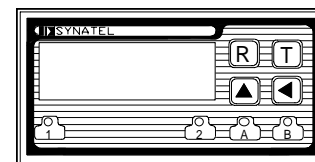
The equipment is covered by a 12 months guarantee from the date of shipment. Any faults arising due to faulty materials or workmanship, within the guarantee period, will be corrected free of charge providing the equipment is returned to us carriage paid.

Certificate of Conformity

The equipment covered by these instructions has been manufactured and tested in accordance with our quality assurance procedures and conforms fully with our published specification.

Health and Safety

Provided that the equipment covered by these instructions is installed and operated as directed, it presents no hazard and conforms fully to health and safety regulations.



THIS PRODUCT CONFORMS TO THE REQUIREMENTS FOR CE MARKING

When this product is incorporated into other machinery or apparatus, that apparatus must not then be put into service (in the E.C.) until it has been declared in conformity with the appropriate E.C. Directives.



PROGRAMMABLE COUNTER TYPE CUL1/CUL1R



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>-CUL1MAN

643-001E

OPERATING INSTRUCTIONS



ISSUE 2





SECTION 11 SPECIAL VERSIONS

A number of special functions are installed in the software and can be activated by SP number settings not covered in this manual. Synatel also offer a special programming facility if an application requires software not previously written.

To obtain further information, please contact our Technical Sales Department giving full details of your requirements.





SECTION 10 FACTORY SETTINGS

When supplied, the following settings will be installed:

SP01	= 000011	Fast up/down counter
SP02	= 001.000	Tachometer mode scaling factor 1:1
SP03	= 00000.5	Tachometer mode sampling period 0.5 seconds
SP04	= 00002.5	Tacho mode reset time 2.5 seconds
SP05	= 000000	No decimal point
SP06	= 001.000	Counter mode scaling factor of 1:1
SP07	= 08 - - 08	Counter mode relay pulse of 0.8 seconds
SP08	= 000000	Factory use only
SP09	= 000000	Factory use only
SP10	= 000000	Relay 1 programme setting not set
SP11	= 000000	Relay 2 programme setting not set
SP12	= 000000	Factory use only
SP13	= 000000	Factory use only
SP14	= 000000	Up counter resets to zero
SP15	= 000000	Keypad - all keys functional
SP16	= 000010	Slow speed NPN input
SP17	= 000000	Pulse doubling disabled
SP18	= 000000	Factory use only
SP19	= 000000	Display automatically resets on reaching batch

The settings above programmed the unit as an "up" counter with automatic display reset to zero at batch completion and a 0.8 second relay output pulse.

The unit can be altered to tacho mode displaying pulse per minute by changing SP01 to 000005.

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GENERAL

The CUL1 and CUL1R units are multifunction counter, timer, tacho and display units programmable by the user to fulfill a wide variety of indication, counting and control functions. Units can function as up, down or bidirectional counters, interval timers, fully scalable speed indicators, baking time indicators or ratio/slip indicators showing speed difference between two inputs.

The CUL1 has a single relay output and the CUL1R has two relay outputs. Depending upon the function selected, the relays can provide batch and pre batch outputs, under/over speed outputs or timer outputs. In count mode, outputs can be latched or pulsed.

Count inputs can be solid state (PNP or NPN) or contact inputs.

Units have a high brightness vacuum fluorescent display with selectable decimal point facility.

SECTION 1 INSTALLATION & CONNECTIONS

INSTALLATION

⚠ THESE UNITS HAVE NO USER SERVICEABLE PARTS AND CONTAIN POTENTIALLY LETHAL VOLTAGES. THEY MUST BE INSTALLED BY A QUALIFIED ELECTRICIAN IN ACCORDANCE WITH RELEVANT ELECTRICAL STANDARDS.

To ensure reliable and trouble free operation of the CUL1 and CUL1R the following guidelines should be strictly observed. Failure to do so may cause noise to be injected on to the input signal giving unreliable, operation.

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.

DON'T run the sensor cable, including the supply connections, with noisy cables

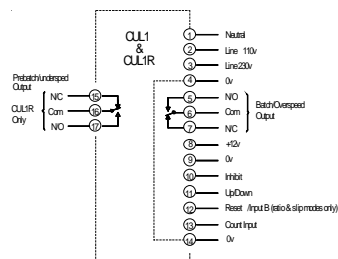
DON'T run noisy cables within 2" around the units

DON'T mount the units in close proximity to highly inductive loads

DO provide a clean supply to the units if possible

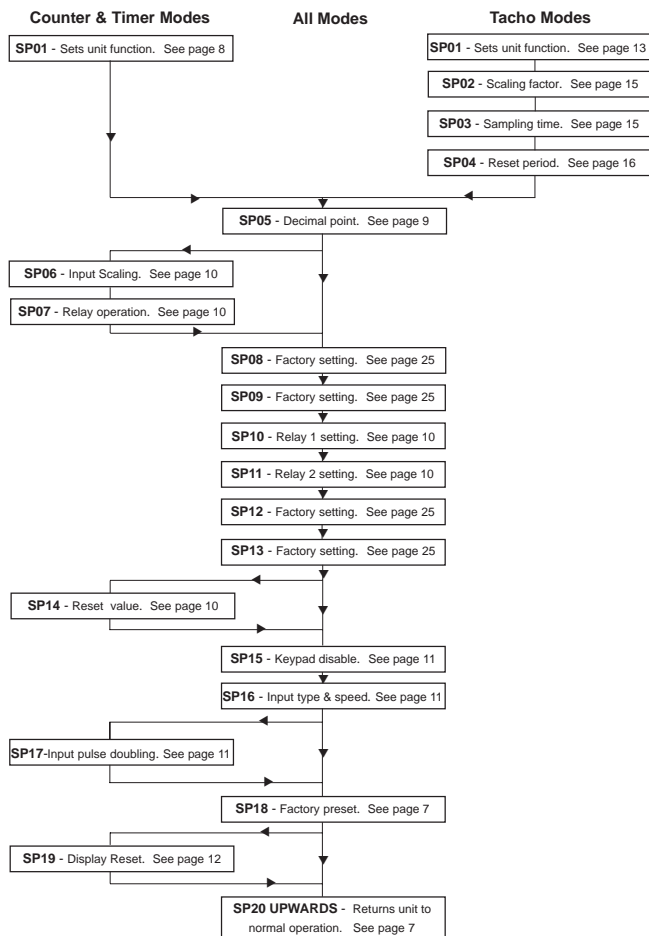
DO use multi screened cable to the sensor if rates of over 2000 PPM are to be measured. The screen should be connected to the ground terminal on the units with all other sensor connections including 0 V inside the screen

OVERALL CONNECTIONS



3

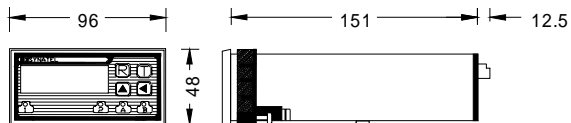
SECTION 9 FULL LISTING OF SP NUMBERS



24

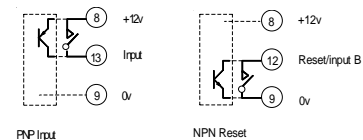
SECTION 8 OVERALL SPECIFICATION

Supply -	110/230V ac 50/60Hz +71/2% -15%
Consumption -	3VA max
Fusing -	Not provided, feed via a fused supply rated at 5A maximum
Sensor Supply -	12V 40mA max dc, smoothed unstabilised, max 5% ripple provided to feed sensors
Input -	NPN, PNP or contact input. Impedance 3.9K at 24V
Input Threshold -	On Level <15V approximately Off Level >8V approximately
Count Speed -	High Speed 1KHz max depending on function Low Speed 30Hz max
Memory Retention -	Unlimited memory retention in event of supply failure
Output -	1 set of voltage free changeover contacts rated at 3A 250V ac non inductive. CUL1 has additional set of voltage free changeover contacts rated @ 3A 250V ac non inductive. Relay function depends upon programme.
Reset -	Front panel push button or external volt free contact closure.
Inhibit -	Enables or disables front panel push buttons.
Display -	High brightness vacuum fluorescent display with 10mm high character.
Enclosure -	Din standard moulded, glass filled, nylon enclosure.
Connections -	In line plug in terminal block.
Dimensions -	



INPUT CONNECTIONS

The "count" input is used also for the tachometer input when used in tachometer mode and as the 'A' input when used in "ratio" and "slip" modes.



The count input can be configured for NPN or PNP. This is set in SP16.

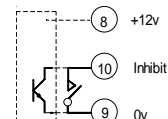
The up/down, reset and inhibit inputs are NPN only and cannot be changed

UP/DOWN INPUT

The up/down input can be used with counting modes to allow bi-directional counting. If the up/down input is connected to 0V, units programmed as an 'up' counters will count down.

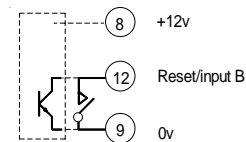
A two phase encoder can be fed to the count and up/down inputs to provide bi-directional counting. Note however that a count may be lost or gained each time the direction reverses.

In tachometer modes, the up/down input can freeze the display at its current setting.



RESET CONNECTION (EXTERNAL)

Push buttons, volt free relay contacts or NPN transistors can be used to reset the unit.



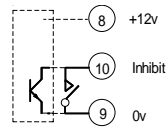
NPN Reset

NOTE

The reset input is also used for input B in ratio and slip modes

INHIBIT INPUT

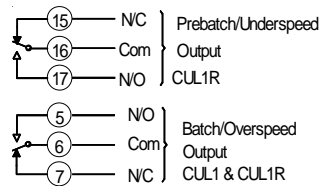
The "inhibit" input is used in conjunction with the keypad disable feature (SP15). When buttons are disabled in SP15, they can be enabled while the inhibit terminal is connected to 0V. This function operates in the NPN mode only.



OUTPUTS

Relay contacts are shown in the de-energised mode. Relays may be normally energised or de-energised depending on the function selected. (See below)

RELAY CONNECTIONS



The 'up' counter with memory is selected to retain count in event of power failure. Slow speed counting is selected to avoid contact bounce and the display will count on after batch completion to show the total amount dispensed including any overflow.

SETTINGS ARE AS FOLLOWS

- SPO1 = 11 - Up counter with power fail memory
- SP06 = 0.114 - Scaling factor (1 ÷ 8.75)
- SPO7 = 00-00 - Relay mode (latched until reset)
- SP16 = 000010 - Input type and filter (set to slow speed and NPN)
- SP19 = 000001 - Manual reset of display

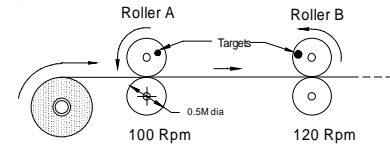
EXAMPLE NO 4 RATIO

The object in this case is to stretch a fabric between two pairs of rollers by 20%. NPN proximity sensors detect a single target on each pair of rollers and speed of each roller in metres/min must be available at the press of a button.

The ratio mode will be used (A/B) to display 1.2:1 and scaling will allow a read out in metres/min. Scaling will have no effect upon ratio reading.

Shafts are nominally running at 100RPM (A), 120 RPM (B)

Roller circumference = $0.5 \times \pi = 1.571$



SETTINGS ARE AS FOLLOWS

- SP01 = 3 - Ratio mode
- SP02 = 1.571 - Scaling
- SP03 = 0.5 sec - Sampling time
- SP04 = 2.5 sec - Reset time (default setting)
- SP05 = 0 - Decimal point (default setting)
- SP16 = 000000 - Input type (default setting)

The unit will display ratio (1.2) normally and by holding down ▲ button, it will display Speed A (100 RPM) or by holding down ▼, it will display Speed B (120 RPM).

As an alternative, the unit could show % slip (20%) by changing SP01 to 4. (Slip monitor mode)



The scaling factor is the number of pulses need at the detection point for the conveyor to travel the length of the oven.

$$\begin{aligned} \text{Pulley circumference} &= \pi d \\ &= 3.142 \times 25 \\ &= 78.55\text{cm or } 0.7855 \text{ metres} \end{aligned}$$

Number of revolutions to travel oven length

$$\begin{aligned} &= 5 \text{ metres} \div 0.7855 \\ &= 6.365 \text{ revolutions} \end{aligned}$$

Number of pulse from sensor

$$\begin{aligned} &= 6.65 \times 100 \text{ (100:1 ratio)} \\ &= 636.5 \end{aligned}$$

Note - calculation is unnecessary if the relationship between bake time and speed is known or determined experimentally. In this case, if it is known that a motor speed of 63.65 RPM = 10 mins baking, scaling factor is

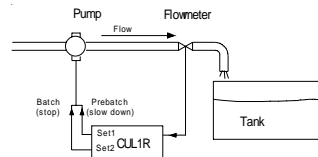
$$\text{Reading required} \times \text{PPM} = 10 \times 63.65 = 636.5$$

SETTINGS ARE THEREFORE

- SP01 = 1 - Oven time indicator
- SP02 = 00636.5 - Scaling factor
- SP03 = 0.5 - Sampling time (default setting)
- SP04 = 2.5 - Reset time (default setting)
- SP05 = 0 - Decimal point (SP01 = 1 automatically sets 2 decimal points to read minutes and seconds)
- SP16 = 0 - NPN input

EXAMPLE NO 3 CONTROL OF TANK FILLING WITH SLOW DOWN AND STOP

The object in this case is to fill a tank with a known quantity of water by monitoring flow with a flowmeter and switching off a pump at a set batch quantity. The flowmeter has a mechanical reed switch running at a maximum speed of 10 pulses/second and giving 8.75 pulse/litre.



SPO1	FUNCTION	SET 1 BUTTON	RELAY STATE	SET 2 BUTTON	RELAY STATE	COMMENTS
00001	Baking time indicator Mins:Secs	RELAYS DO NOT FUNCTION IN THIS MODE				
00101	Baking time indicator Mins:Decimals	RELAYS DO NOT FUNCTION IN THIS MODE				
00003	Ratiometer	Output when indicated reading exceeds setting	Energised when displayed reading is above setting	Output when indicated reading exceeds setting	Energised when displayed reading is above setting	Both relay functions are identical in this mode
00004	Slip Monitor	Output when indicated reading exceeds setting	Energised when displayed reading is above setting	Output when indicated reading exceeds setting	Energised when displayed reading is above setting	Both relay functions are identical in this mode
00005	Speed Indicator	Underspeed output	Energised above set speed	Overspeed output	Energised below set speed	Both relays de-energised under alarm conditions
00010	High speed up counter	Pre batch output	Relay energises at pre batch setting	Batch output	Relay energises at batch setting	
00011	Up counter with memory retention	Pre batch output	Relay energises at pre batch setting	Batch output	Relay energises at batch setting	
00013	Interval timer	Pre batch output	Relay energises at set time	Batch output	Relay energises at set time	
00014	"Down" Counter	Pre batch output	Relay energises at set value	Batch output	Relay energises at zero	
00015	Batch counter and input totaliser (T)	Pre-batch output	Relay energises at pre-batch setting	Batch output	Relay energises at batch setting	Pressing (T) totals button displays total number of input pulses (not total batches)



SECTION 2 GENERAL PROGRAMMING

PROGRAMMING OVERVIEW

If you have not programmed a CUL series unit before, you are strongly advised to practice using the first time user programming example shown on page 17, after first reading through this section, and section headed "Entering and Leaving Programme Mode".

The unit is programmed to fulfil specific requirements using a series of "SP" numbers from 1-20. Only a limited number of these functions are used for each particular variation.

The basic operating function counter/tacho/timer is selected using SP01. Each selection for SP01 activates different SP numbers from SP02 to SP20 and valid SP numbers are listed under each variation. It is important to check that each of the valid SP numbers is set correctly to suit the application.

Each SP number can be viewed or altered any number of times during programming and all settings are retained when the programme is exited. The programmer can therefore re-enter the programme at any time and view or change any settings.

The settings contained in invalid SP numbers are irrelevant and can be ignored.

There are separate sections for programming counters/timers and tachometers. It should be noted that the function of some SP numbers can vary depending on the selection in SP01. Ensure that the correct section is being followed, ie if a tachometer function is selected for SP01, follow "Programming Tachometers", if a counter/timer function is selected, follow "Programming Counter/Timers".

Certain settings referred to as "factory settings" are used for special functions not covered by this manual or are reserved for future software expansion. Altering these settings will generally have no effect, but for safety, they should be set to the default values shown on page .

ENTERING AND LEAVING PROGRAMMING MODE

The programming mode is entered by holding down any one of the four function keys (◀, ▲, Totals and Reset) and then applying power. The unit will display the software issue number for one second and then show SP01 with the '1' flashing.

A different SP number can be selected by using the ▲ arrow to increment the flashing digit from 0-9 and using the ← arrow to move to the next digit to the left. Having selected the SP number required, pressing the ▶ button will show the setting of the selected SP number with the right hand digit flashing. The value of the flashing digit can be scrolled from 0-9 using the ▲ button while the ← button can be used to move to the next digit to the left.

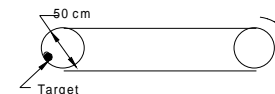
When the correct setting has been achieved, the programmer can return to the next SP number either by successive presses of the ▶ button or by pressing Totals once.

When programming has been completed, the user can revert to normal operation by entering an SP number greater than 20.

SECTION 7 PROGRAMMING EXAMPLES

PROGRAMMING EXAMPLE 1 CONVEYOR SPEED INDICATOR (CUL1R ONLY)

Requirement - A conveyor with a 0.5 metre diameter pulley is to display linear speed in metres/min to an accuracy of one decimal place. Overspeed alarm is required at 1000 RPM.



A target has been added to the shaft and a proximity sensor attached to give one pulse per revolution

$$\text{Pulley circumference} = \pi d = 3.142 \times 0.5 = 1.51 \text{ metres}$$

A scaling factor of 1.51 must be set to display metres.

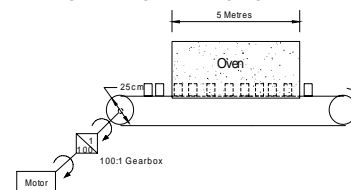
Settings therefore are:

- SP01 = 5 - Tacho mode
- SP02 = 1.51 - Scaling factor
- SP03 = 0.5 - Sampling time (default setting)
- SP04 = 2.5 - Reset period (default setting)
- SP05 = 1 - One place of decimals
- SP16 = 0 or 1 - NPN or PNP depending upon sensor type

After programming, adjust main batch setting to 1000.0

NOTE - in this mode, the relay is energised under normal conditions and de-energises when over speed.

PROGRAMMING EXAMPLE NO 2 BAKING TIME INDICATOR



Requirement is to display the baking or curing time of objects passing through an oven along a conveyor belt. The conveyor has a 25cm diameter pulley and the oven is 5 metres long. Baking times vary from 5 to 30 minutes and display is to show minutes and seconds. A single target has been attached to the motor shaft and is detected by an NPN output, proximity sensor.



SECTION 6 OPERATOR SETTINGS

Various settings can be carried out by the operator depending upon what the unit has been programmed to do. The following list explains how settings are operated or altered when allowed.

CUL1 & CUL1R

The main batch setting can be viewed by pressing the ◀ button. The setting will be displayed while the button is held down but the operation of the unit will be unaffected.

To alter the value, hold down the ◀ button and momentarily press the ▲ button. The display will show the current setting with the right hand digit flashing 00000. The setting can be altered to a new value by using the ▲ button to alter the setting of each digit and the ◀ button to select the next digit to the left.

Once the correct setting has been achieved the unit can be returned to normal operation either by successively pressing the ◀ button until the unit returns to normal operation or by pressing the "T" button.

Note that while adjusting the setting, normal operation is suspended.

CUL1R ONLY

The pre batch setting can be viewed by holding down the ▲ button and adjusted by holding down the button and then pressing the ◀ button. Alteration is then carried out as detailed for main batch setting.

RESET

In counter modes only, pressing the reset button resets the unit to zero on "up" counters, or batch quantity on "down" counters. In some special "up" counting applications, it may reset to a pre defined value as set in the programme (SP14).

TOTALS

In counter modes only, the total button displays the total number of batches produced. It can be reset by pressing the reset button while holding down the total button. In all other cases, the totals value will be retained.

The total button is not used in tacho modes.

SECTION 3 PROGRAMMING COUNTING AND TIMING MODES

PROGRAMMING - COUNTERS/TIMERS

This section details the range of functions which the units can perform in their counting and timing modes. In each, there are numerous different facilities including up or down counting, bi directional counting, full display scaling, a decimal point facility and options of NPN input, PNP input, and relay or contact input. The output relays can give a pulse output, a latched output or bi-stable output.

For "cut to length" type applications where the pre batch relay is required to operate a fixed count before the main batch, an auto calculation facility is included so that only the batch number needs to be set, the pre batch automatically adjusting to suit.

The basic operating function required is set in SP01 as detailed below and all related functions are set in various relevant SP numbers as detailed.

A "Total" button is provided which when pressed shows the total number of batches produced. This number can be reset by pressing the reset button while holding down the Total button. In all other cases, the total will be retained indefinitely.

Keyboard inhibit allows any of the front panel keys to be disabled preventing unauthorised use, unless the inhibit input terminal is connected to 0V by a link, push button or keyswitch.

Having selected the function required in SP01, carry on through all relevant SP numbers to ensure that all functions have been set to individual requirements.

0 0 0 0

- High speed "up" counter - 00010
- Up counter with power fail memory - 00011
- Interval timer - 00013
- Down counter - 00014
- Batch counter plus input totaliser - 00015

High Speed Counter (up counting only)

SP01 = 00010

Relevant SP numbers SP05, SP06, SP07, SP10, SP11, SP14, SP15, SP16, SP17, SP19

This mode provides the highest possible count speed (1KHZ). It is an up counter only and does not retain its count in event of an interruption of supply. It will always reset to zero. It will not count down, even if the up/down link is connected.



UP COUNTER WITH POWER FAIL MEMORY

SP01 = 00011

Relevant SP Numbers SP05, SP06, SP07, SP10, SP11, SP15, SP16, SP17, SP19

This mode allows the units to operate as up counters at a maximum speed of 100Hz with a facility to retain count in event of supply failure. Although intended primarily as an UP counter, they will count down if the up/down link terminals 10 and 12 are linked. Note however that they are not down counters and will only operate the output relays as they count up through the set values. These versions can operate in an auto slow down mode whereby the prebatch relay can operate a preset number before the main batch rather than at a specific number (see SP19)

Interval Timer with Dual Outputs

SP01 = 00013

Relevant SP Numbers SP05, SP06, SP07, SP10, SP11, SP14, SP15, SP16, SP19

In this mode, the units use their crystal derived internal clock to achieve highly accurate short or long time periods. The clock pulse can be scaled using the scaling function to give timing intervals from 0.05 seconds to 8 weeks. Typically, the scaling factor can give 1 second or 0.1 second pulses to give a meaningful display of lapsed time in seconds or tenths of seconds.

The timer can run continuously or can run only when an input contact is closed and the relays can latch or pulse.

This mode is used as a first time user programming example in section headed 'First Time User Programming Example'.

Down Counter

SP01 = 00014

Relevant SP Numbers SP05, SP06, SP07, SP10, SP11, SP15, SP16, SP19

This mode provides uni directional down counting for applications where a display of quantity remaining to count is required. The units reset to set batch value and counts down to zero. Pre batch operates at its set value before zero. Relay can latch until reset or give a variable length output pulse.

Batch Counter and Input Totaliser

SP01 = 00015

Relevant SP Numbers SP05, SP06, SP07, SP10, SP11, SP15, SP16, SP19

This mode provides batch counting (with pre batch output for slow down if required). Unit counts up to batch setting. Output can be latched or pulsed. Pressing (T) totals button display total number of input pulses received.

- 11) Press the ◀ button to show 01.000 and then the ▲ button 5 times to show 01.500.
- 12) Press the ◀ button to shown 01.500 and then successively press the ▲ button to show 00.500.
- 13) Press the ◀ button once to show 00.500 and again to show SP07.
- 14) Press the ◀ button to shown SP07 and again to show the value of SP07.
- 15) Use the ▲ button to set each digit and the ◀ button to move across the digits to achieve a setting of 20-00. Press the ◀ button once more to show SP08.
- 16) Press the ▲ button to show SP06.
- 17) Press the ◀ button to show SP06 and then the ▲ button to shown SP16.
- 18) Press the ◀ button to show value for SP16 usually 00000. Press the ▲ button to show 00001.
- 19) Press the ◀ button successively until the display reads SP17.
- 20) Press the ◀ button once and then the ▲ button once to show SP27.
- 21) Press the ◀ button to leave programming and return to normal operation. Unit should not be counting.

To Set A Time of 20 Seconds

- 22) Press and hold down the ◀ button, display will show the current time setting usually 0000.0.
- 23) While holding down the ◀ button, momentarily press the ▲ button, display will usually show 0000.0.
- 24) Use the ▲ button to set each digit to the required value and the ◀ to move left to each digit to set 0020.0.
- 25) Press T button to return to normal operation.

CUL1R users, please note that the additional relay can be used to give an output at any value less than 20.00. To set a value, press and hold down the ▲ button and momentarily press the ◀ button. Try entering a value of 0010.0 by using the ◀ and ▲ buttons and then press T.

The unit can now be returned to its original settings (see factory presets) or programmed to the function required.

WARNING - Ensure that SP16 is set correctly for PNP or NPN input. It will not function if incorrectly set.



SECTION 5 FIRST TIME USER PROGRAMMING EXAMPLE

This example is given purely to show in simple terms, the means by which the CUL1 and CUL1R can be set to their many different functions.

The units have an internal clock giving 20 pulses/second. The aim, in this example, is to set the unit to display time in seconds, resolving to 0.1 second (one decimal place), the unit running continuously and giving a pulsed main batch output of 2 seconds.

A 50 milli second clock is provided, giving 20 pulses/second. 10 per second are required (to give 0.1 second resolution). This is achieved by using the scaling factor to multiply the pulse rate by 0.5 ($10 \div 20$).

The settings to be programmed therefore are

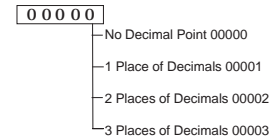
SP01 = 00013 Internal timer mode
 SP05 = 00001 One place of decimals
 SP06 = 00.500 Multiply by 0.5
 SP07 = 20--00 2.0 second pulse batch output and latched prebatch output
 SP16 = 00001 PNP input (NB - no input connection is needed for this example)

THE CUL1 AND CUL1R ARE SET AS FOLLOWS

- 1) Press and hold down the reset button. While holding down, apply supply and then release the button. The display will show a reference number for 1 second and then display SP01 with the '1' flashing.
- 2) Press the ◀ button again, display will show SP01 with the zero flashing.
- 3) Press the ◀ button again, display will show the current setting for SP01 with the right hand digit flashing.
- 4) Adjust the right hand digit if necessary using the ▲ button to scroll from 0-9. When the correct value is set, press the ◀ button to move to the next digit.
- 5) Set all values by using the ▲ button to scroll each digit and the ◀ button to move through the digits. When set, press the ◀ button successively. After reaching the left hand digit, one more press will cause the display to show SP02 with '2' flashing.
- 6) Press the ▲ button 3 times to show SP05.
- 7) Press the ◀ button once to show SP05 and again to show the value for SP05 usually 00000.
- 8) Press the ▲ button to show 00001.
- 9) Press the ◀ button successively to move the flashing digit to the left. On reaching the left hand digit press the ◀ arrow once more to show SP06.
- 10) Press the ◀ button to show SP06 and again to show setting for SP06 (normally 01.000).

SP05 - DECIMAL POINT

The display can show 1, 2 or 3 places of decimals. In counter modes, the decimal point is ignored by the unit and is only for the benefit of the operator. It does not affect the units operation in any way.



SP06 - SCALING FACTOR

Incoming pulses can be multiplied by any number from 0.0001 to 99.999 to give a wide range of input scaling values. This allows the unit to be set to take account of gear ratios, pulley diameters etc and give a display in mm, metres, litres etc. It is supplied set to 01.000 to count pulses in units of 1.

SP07 - RELAY OPERATION

Used to set the output mode for the relay/s. The relay/s can latch at batch completion or can give a pulse output for a preset time.

Each relay can be set to latch or pulse as required, independently of the other relay (CUL1R only).

The pulse output time is set in 0.1 second intervals from 0.1 - 9.9 seconds.
 NB. A setting of 50 = 5.0 seconds. A latched output is provided if either relay time is set to 00.

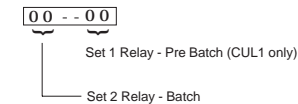


Diagram shows both relays set to latched

To set a pulse output of 1.5 seconds for the prebatch relay and 2.5 seconds for the batch relay, press 2515 and then press Set 1 (CUL1R only).

SP10 PREBATCH COUNT SETTING (CUL1R ONLY)

The prebatch count can be set during programming. This is important if the front panel buttons are to be permanently disabled to prevent operator adjustment. Normally however, the pre batch value would be set after programming.

SP11 BATCH COUNT SETTING

The batch count can be set during programming. This is important if the front panel buttons are to be permanently disabled to prevent operator adjustment. Normally however, the batch value would be set after programming.



SP14 RESET VALUE

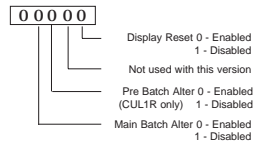
Counters normally reset to zero (or batch setting for "down" counters) when the internal or external reset is operated. The CUL series offers the opportunity of resetting to any value if required. The value is set on the display.

5 4 3 2 1

The unit with this setting would display 54321 when the reset was operated. For normal reset to zero, set 00000.

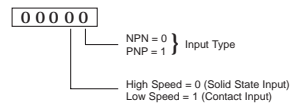
SP15 - KEYPAD DISABLE

Used to prevent alteration of specified functions by operators. If the digit is set to 1 the function is disabled unless the "inhibit" input is connected to 0v.



SP16 - INPUT TYPE AND INPUT FILTER

Sets the input type (NPN or PNP) and input filter speed



This feature applies only to count input and reset, all other inputs are NPN only. The unit will not function unless the NPN/PNP function is correctly set for the type of input to be used.

SP17 SINGLE OR DUAL EDGE CONTROL

The units normally count the leading edge of each pulse. They can count leading and trailing edges if required, which can increase accuracy providing the mark/space ratio is in the order of 50%.



11

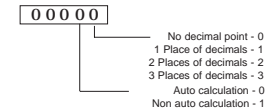
SP04 RESET PERIOD

Sets the time for the unit to reset to zero after cessation of input pulses. This setting MUST be longer than the slowest input pulse speed, eg at 10RPM, it must be longer than 6 seconds, it MUST also be set longer than SP03 otherwise the unit will display zero permanently. It can be set from 0.1-99 seconds.

SP05 DECIMAL POINT

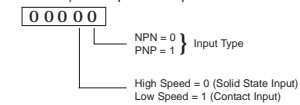
A decimal point can be inserted to give a display to 1, 2 or 3 decimal places. Inserting a decimal point automatically causes the unit to recalculate scaling factors to compensate (tacho modes only).

In some cases, it may be preferable that the decimal point is ignored by the CUL unit but is shown for user benefit only. This can be set as an option in the second digit.



SP16 INPUT TYPE AND FILTER

Sets the input type (NPN or PNP) and input filter speed



Note that only the "count" input is alterable. All other inputs (up/down input, reset and inhibit input are NPN only)

SP10 UNDERSPEED SETTING (CUL1R ONLY)

Sets the speed at which the underspeed output is given. This must be set during programming as keypad is automatically disabled (for relay function, see chart on page)

SP11 OVERSPEED SETTING

Sets the speed at which the overspeed output is given.

16





SP02 SCALE FACTOR

Sets the scale ratio or relationship between input pulse rate and display value.

Tacho Modes - The default value is 01:000 which displays pulses/min. If a display of 30 is required for an input speed of 60 pulses/min, the scaling should be set to 30/60 = 00.500. The maximum allowable setting is 099.999 and minimum setting 00.001.

The scale ratio does not need adjustment to allow for a decimal point (SP05) as the unit allows for it automatically. Automatic adjustment can be overridden if required.

Oven Timer Mode - The unit can be set to display minutes and seconds (SP01 = 00001) or minutes and decimals (SP01 = 00101). In either case, the unit automatically defaults to SP05 = 2, to give two decimal places. For minutes and seconds, two decimal places must be used. For minutes and decimals, 0, 1, 2 or 3 decimal places can be set using SP05.

In either mode, calculation of scaling factor is as follows:

Determine the display reading required for a corresponding input speed in pulses/minute to one decimal place.

eg if a display of 10 minutes 30 seconds is required for an input speed of 45 RPM, scaling factor is

$$10.5 \times 45.0 = 472.5$$

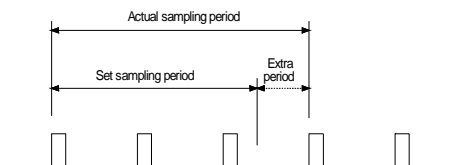
The maximum scaling factor which can be set is 99.999. If the calculated value is higher, the unit can only be used in the minutes and decimals mode (SP01 = 00101). In this mode, the calculated reading can be divided by 10 or 100 and the decimal point in SP05 altered to 1 place of decimals or no decimals respectively to display 1/10 minutes or minutes.

SP03 - SAMPLING TIME

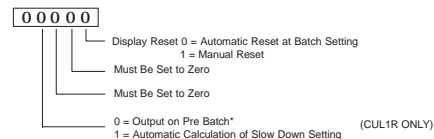
The units are intended as instantaneous tachos and normally sample time between two pulses to give highly accurate speed monitoring with a high speed update time, even on slow speed shafts.

They can be slowed down to minimise cyclic fluctuation in speed of shafts by extending the measurement period in SP03.

SP03 is normally set to 0.5 seconds but can be adjusted in SP03 from 0.1 to 99 seconds. Regardless of setting, the units maintain accuracy by monitoring from the first pulse leading edge to the pulse immediately following expiry of sampling time (see diagram below)



SP19 DISPLAY RESET AND AUTO CALCULATION OF PRE BATCH



Sets the function of the display upon reaching batch quantity and on the CUL1R only, the method of operation of the pre batch output.

The display can be set to automatically reset to zero at batch completion or to continue counting until internally or externally reset.

On the CUL1R, the Set 1 output can occur, either at a specific number or a set number before the main batch setting. The latter mode is referred to as Auto Calc slow down.

For example, if output on pre batch is selected and Set 1 is set to 25, an output will be given when the display reads 25, regardless of the setting of the Set 2 output. If Auto Calc slow down is selected, and Set 1 is set to 25, an output would be given 25 counts before the Set 2 setting. If Set 2 was set to 400, Set 1 relay would operate at 375 counts and Set 2 relay at 400 counts.

LEAVING PROGRAMMING

To exit programming and return to normal operation, specify an SP number greater than 20 (eg SP30) and press the ◀ button.



SECTION 4 PROGRAMMING - SPEED INDICATION MODES

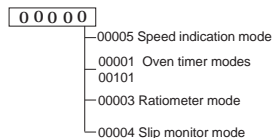
GENERAL INFORMATION

Speed indicators can provide a display of speed, flowrate, time interval or the ratio between two speeds.

The basic function required is selected in SP01 as shown below and all related functions are set in various relevant SP numbers as detailed.

Keyboard operation is inhibited during normal operation and alarm outputs must be set during programming using SP10 and SP11.

Having selected the function required in SP01, carry on through all relevant SP numbers to ensure that all functions have been set to individual requirements.



SPEED INDICATION MODE

SP01 = 000005

Relevant SP numbers SP02, SP03, SP04, SP05, SP10, SP11, SP16

In these modes, the unit can provide an instantaneous display of speed from a single input per revolution and can be scaled to give a display in engineering units eg mm/second, metres/min, litres/second etc. A decimal point can be inserted to resolve to 1, 2 or 3 decimal places. The sampling time can be adjusted to minimise the effect of cyclic fluctuation in speed.

Relay output can be used to give over or under speed alarms in addition to display of speed. For relay operating modes see chart on page .

Oven Timer Mode

SP01 = 00001 or SP01 = 00101

The display can be programmed in minutes and seconds or minutes and seconds or minutes and decimals with 1, 2 or 3 decimal places.

0 0 0 0 1 Sets minutes and seconds (SP05 must be set to 00000)

0 0 1 0 1 Sets minutes, or seconds and decimals depending upon scaling

Ideally suited for continuous baking ovens or sintering furnaces, this mode displays the length of time for which an item is travelling through an oven. The display, can be programmed in minutes and seconds or minutes and decimals with 1, 2 or 3 decimal places.

The unit can be scaled so that an input can be taken from any related shaft. The response time is virtually instantaneous but can be slowed to ignore the effect of cyclic speed variations if needed.

An example of this mode of operation is shown on page 20.

Ratiometer Mode

SP01 = 00003

Relevant SP numbers

In this mode, the unit will display the ratio between two shafts A and B by monitoring sensor pulse inputs from each shaft. The "A" input is fed to "count input" terminal number 11 and the "B" input to "reset" terminal 14.

The unit will normally display the ratio but the speed of "A" or "B" can be shown by pressing and holding down the ◀ and ▶ buttons respectively.

The display can be scaled using SP02 but both inputs will be scaled by the same amount and ratio will be unchanged. The indicated speed for each shaft however will alter by the scaling factor.

The relay output can be used to provide under or over ratio indication, but must be set during programming (SP10 and 11). Setting cannot be carried out during normal operation.

An example of this mode of operation is shown on page 22.

Slip Monitor Mode

SP01 = 00004

Relevant SP numbers

Similar to ratio mode (SP01 = 00003) A/B, this mode displays percentage difference $\frac{A-B}{A} \times 100$ generally known as "slip". The unit will normally display slip but the speed of "A" or "B" can be shown by pressing and holding down the ▶ and ◀ buttons respectively.

The A input is fed to "count" input terminal 11 and the B input to "reset" terminal 14.

The display can be scaled using SP02 but both inputs will be scaled by the same amount and ratio will be unchanged. The indicated speed for each shaft however will alter by the scaling factor.

The relay output can be used to provide under or over ratio indication, but must be set during programming. Setting cannot be carried out during normal operation.

An example of this mode of operation is shown on page 22.

