

# West weigh

## Conveyor Belt Computer

### USER GUIDE V1.5

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## 0. Program Overview

The Conveyor Belt Computer program is designed :

- 1) to display the belt speed, rate and accumulated total
- 2) to setup the CBC unit for each application
- 3) to calibrate the sensors it uses
- 4) select display options
- 5) specify printer or computer communications

When the unit is switched on Run Mode is displayed. Press "#" to display the Main Menu, then use the Up and Down arrow keys or number keys to select one of the available option screens.

Pressing "ENT" ( Enter ) performs the selected function or displays the next menu. Pressing "#" returns to the last menu.

The "ENT" key is used to confirm a selection or calibration procedure and to store an entered number into the computer's memory. All values stored in the memory are retained even if the unit is switched off.

The main menu Help screen can be accessed by pressing the 'H' key. This screen shows the program version number and date.

When entering numbers to change a selected value, press the number keys or "ENT" to begin entry. The - sign will alternate between + and - values.

In Printer Setup it causes an immediate printout.

The decimal point is automatically displayed in the correct position.

To correct a wrong entry either press 0 until the wrong numbers move off the end of the displayed value, or press an arrow key or "#", then repeat the entry.

When the value is correct, confirm by pressing "ENT".

It is only then that the value is stored in the computer's memory. Pressing an arrow key or "#" before pressing "ENT" will return you to the original value.

## Passwords

Before changing values or calibrating the unit the program will require you to enter one or two password numbers, to prevent unauthorised operation.

Password 1 protects access to functions which can change the Rate or Total readings.

Password 2 gives further protection to Autotare %, Deadband %, and clearing of the Grand Total.

Once a password has been corectly entered, it remains entered until either Run Mode is selected or the unit is switched off.

After making password protected changes go back to Run Mode to prevent further unauthorised changes being made.

Both passwords may be changed in the Setup Screen, but the current password must be correctly entered in each case before any change is made. Select New Passwords, then press "1" to change password 1 or "2" to change password 2.

Setting a password to 0 will disable it.

Please make a (secure) note of any changes made to the passwords!

## Menu Structure

The menus are arranged as follows :

### Main Menu - **1 Run**

- 2 Setup
- 3 Calibration ----- > - 3.1 Speed Cal.
- 4 Display - 3.2 Weight Cal.
- 5 Printer ( optional ) - 3.3 Material Cal.
- 3.4 Current Loop

When the unit is switched on Run mode will be active.

Use the Arrow or number keys to highlight the required function then press "ENT" ( Enter ) to select it.

## Key Summary

| <u>Key</u> | <u>Name</u> | <u>Typical Functions</u>               |
|------------|-------------|--|
| 0 to 9     | 0 to 9      | enter number or select numbered option |
| "-"        | Minus       | select +/- values, printout now        |
| "ENT"      | Enter       | confirm or store value or calibration  |
| "#"        | Quit        | Return to last selection               |
| "H"        | Help        | Display Help screen                    |
| ^          | Up          | Move selection up or left              |
| v          | Down        | Move selection down or right           |

## 1.0 Run Conveyor Belt Computer

### Run Mode

This is the normal display of the CBC unit.

Displays measured values of Belt Speed ( m/S ), Rate ( tonnes/hr) Batch Number and either Grand Total or Batch Total ( tonnes ).

The Grand Total may be reset to zero, when it is displayed in Run mode, by pressing "0" and entering two correct passwords followed by "ENT".

The Batch Total is reset each time the unit prints out its results, ( See Printer Setup, section 4 ).

The Batch Total may be manually reset, when it is displayed in Run Mode, by pressing "0" and entering one password followed by "ENT" .

Press "2" to switch between Grand and Batch Totals.

Errors are displayed ( if any ) between the Rate and Total values.

Press 1 to clear the errors ( enter password first ).

Autotare is displayed ( if selected in the Setup screen and when the weight has been tared ) beneath the Belt Speed value.

A "D" is displayed after the total, if the rate is within the Deadband as set up in Display Setup. In this case the total is not accumulated.

A "T" may be displayed after the "D" when the unit is taring over the number of test belt-loops set up in the Speed Calibration menu, if Autotare is switched on in the Setup screen.

A "P" may be displayed after the "D" and "T" if the unit has been switched off since the Totals were reset to zero.

Press "3" to view the Power down Status. If a "P" is displayed the oldest time that the unit was switched off and the latest time it was switched on will be shown. Press "4" to view the Autotare Status as follows :

The Full Scale rate - rates above this value will give a Rate Error.

Deadband Rate - rates between +/- this value will not accumulate the total.

This is calculated from Deadband % and Full Scale Rate.

Autotare Limit Rate - When Autotare is on, (% value not 0)

the zero weight calibration will be adjusted when the rate is within the deadband. If the adjustment exceeds the Autotare Limit and Autotare Error will be given.

The Autotare Limit is calculated from Autotare % and Full Scale Rate.

The status "D", "T", "Autotare" and "Printing" are displayed as appropriate.

The Manual Offset rate is the amount that Autotare has added to the original manual calibration of the zero weight reading, expressed as a rate.

The Display Rate is the rate as normally displayed in Run Mode, that is after Autotare has adjusted it.

Press "5" to enter a new Batch Number.

The Batch Number counts up every time the Batch information is printed out ( the Batch Total is then cleared by the printout ). A new Batch Number may be entered, after password 1 has been entered. Batch number 9999 will be followed by number 0.

Press 6 or 7 to go to the Weight Calibration Screen, set up for Zero or Span calibration. Password 1 must be entered first. This allows easy recalibration of the weight signals. Pressing "#" will go back to the Run Mode screen.

Press 8 for the ( optional ) Shift Performance Report.

This is a display of the start and end times of the shift, the time that the rate was not inside the deadband % of Full Scale, the Total for the shift and the Average and maximum rates measured during the shift. Press 0 to start a new shift ( at the current time ). Press "-" to print the displayed report ( if the Printer option available ).

Password 1 is required to start a new shift.

Press "H" for the help screen.

Press any other key to return to the main menu.

#### Autotare

If Autotare is selected "on" in the Setup screen by entering a % value other than 0.0%, and provided

- i) the rate in tonnes/hour has remained within the Deadband % of the Rate Full Scale capacity for one belt revolution,
- ii) the belt is moving

then the zero weight calibration is set to the average weight over the next Cal. Duration number of belt revolutions.

( provided the rate remains within the Deadband % limit ).

"Autotare" is then displayed in the top right hand corner of the display and the weight reading is set to zero.

"D" and "T" are displayed after the total when the rate is within the "Deadband %" and when Taring has started, respectively.

This function is only enabled in the Run screen.

Cal. Duration may be entered in either the Speed or Weight calibration screens.

Rate Full Scale capacity may be entered in the Display Setup screen.

#### Autotare Limit

If the Autotare attempts to change the weight zero reading such that the Rate is changed by more than the Autotare % of Rate Full Scale ( compared to the original, manual zero setting ), an Autotare Error is given and the zero weight reading will not be changed.

### Clearing the Autotare

The Autotare offset may be cleared to zero by pressing "-" in the Weight Calibration screen when either Zero or Span Cal. are selected. The Autotare offset may be viewed in the Autotare Status display by pressing "4" in Run Mode.

### Relay Output - Relay 1

If the Relay Rate in the Setup Screen is not 0, the Relay 1 will output 50 mS pulses.

Each pulse represents the Relay Rate value in tonnes.

The relay will continue to pulse at a maximum rate of ten per second, until the total tonnes represented by the pulses sent out equals the Total value of tonnes accumulated.

If the Total is reset ( by pressing 0 ) the relay will also be reset and will send a pulse every time the Relay Rate value is accumulated in the Total.

### Errors

There are four errors which the CBC unit detects at any time, and displays when the Run screen is selected.

A fifth error, Autotare Limit is only detected in Run mode.

Any or all of them may be displayed - to clear the errors first the cause must be corrected, then press 1 and enter the required password and confirm by pressing Enter.

Switching the unit off and on again will not clear the errors nor will it reset the Total values to zero.

The program will continue to run normally even after an error condition has been detected, ( although the Total may be wrong).

The five errors are :

- |               |   |
|---------------|---|
| <b>LoadC</b>  | The Load Cell signal has caused an overrange value to be measured. This is probably a fault in the Load Cell or the wiring to it.<br>Technical Note : This is the ICL 7109 ADC overrange error.   |
| <b>Speed</b>  | The Speed calculated from the Pulse input is equal to or greater than 300.0 m/S . This is probably due to an incorrect speed calibration.   |
| <b>Weight</b> | The Weight calculated from the Load Cell input is equal to or greater than 3000.0 kg. This is probably due to an incorrect weight calibration.<br>Technical Note : The error may also be caused by the weight value being less than or equal to -3000.0 kg, although in normal operation this should never occur.   |
| <b>Rate</b>   | The Rate calculated from the Speed and Weight values is equal to or greater than the Scale Capacity value, entered in the Current Loop Calibration screen. The rate value is limited to 30000.0 tonnes per hour.<br>If another error is present ( e.g. <b>LoadC</b> ) the Rate error is most probably caused by that error giving a wrong value for the Rate calculation. If the Rate error is the only one, it is probably due to the Speed, Weight or Material calibration being incorrect. |

**Autotare Limit** If the Autotare function attempts to adjust the weight zero reading so that the Rate lies outside the Autotare % of Rate Full Scale. This indicates that the weight reading is no longer within Autotare % of its initial, manual calibration.

Note that the **LoadC** error is usually caused by a hardware (wiring) fault, but that **Speed, Weight,** and **Rate** errors are generally caused by incorrect calibration.

Technical Note : pressing 9995 in the Main Menu screen will display Speed and Weight input and calculated values.

#### Power Down Status

If the unit has been switched off ( for more than approximately 20 mS ), a "P" is displayed above the word "tonnes". Pressing "3" will display the power down status, and show the oldest time that the unit was switched off, since the Grand Total was cleared, and the most recent time the unit was switched on.

Pressing "0" to clear the Grand Total ( and entering the correct passwords ) will clear this message.

## 2. Setup Screen

### Display

|               |   |
|---------------|---|
| Autotare      | Turns the Autotare function on and off, and selects the Autotare % Limit of Rate Full Scale   |
| New Passwords | Allows the Password numbers to be changed<br><b>NB please note down the new passwords!</b>  |
| Weight Filter | Specifies the time over which Weight input is averaged.   |
| Pulse Filter  | Specifies the time over which Pulse input is averaged.  |
| Speed Input   | Selects one of three speed input options :<br><b>Ext</b> uses external speed sensor with a pulse rate of 0 - 1500 Hz.<br><b>+ Int</b> uses an internal 10 Hz pulse which is on if the Pulse input is held at a positive voltage or is left open circuit.<br><b>- Int</b> uses an internal 10 Hz pulse which is on if the Pulse input is held at zero voltage or is shorted to ground. |
| Mains Freq.   | Selects 50 or 60 Hz mains frequency filtering. This is to optimise the filter characteristics.  |
| Relay Rate    | Specifies the rate in either tonnes/hour or kilograms/Second which will cause Relay 1 to give one 50 mS pulse. The pulses will continue until the total has been sent out as to the relay.<br>Select the rate units in the Display Setup screen.  |



### 3. Calibration

There are four calibration screens, each one has the same general layout and method of operation. The top four lines ( beneath the title ) may be selected to enter calibration values manually, or to start and stop an automatic calibration.

The line second from bottom ( except in Material Calibration ), displays the progress of the calibration or an input value. This line varies for each screen.

The bottom line displays the value being calibrated, both before and after calibration. This allows confirmation that the calibrated value is correct.

#### Notes on Calibration

When calibrating Belt Speed using the internal ( 10 Hz ) signal, set the Pulse filter time ( in the Setup screen ) to the average time taken for the Belt to start up and slow down. In this mode the pulse input is used to switch the internal pulses on or off.

When calibrating the weight, the belt should be moving, and the calibration should be over a number of complete belt revolutions. This gives maximum the averaging of variations in the weight of the belt itself.

The weight, both zero and span will be calibrated using the Cal Duration as entered, and also the number of pulses per Belt Rev. It is therefore necessary to have calibrated or entered the number of Pulses per Belt Rev in screen 3.1 before using the automatically timed calibration in screen 3.2.

In general, calibration should be done in numeric order, and should be preceded by Setup.

i.e. 2 Setup, 3.1 Speed calibration, 3.2 Weight calibration,  
3.3 Material calibration, 3.4 Current Loop Output calibration.

Entering the following values noted down from a previous calibration will restore the CBC unit to the same state as if it had been calibrated :

- 3.1 Cal. Duration ( \*  
) Belt Length  
Pulses/Rev.
- 3.2 Span Weight ( \* )  
Zero Cal.  
Span Cal.
- 3.3 Weight Span  
W/Bridge Tot. ( \*  
) Percent Cal.
- 3.4 Scale Cap. Current  
Range ( \* )  
Cal. Output ( \* )

( \* ) Required for recalibration only.

#### 3.1 Speed Calibration

The CBC receives a speed signal either from an external source, or internally ( fixed at 10 Hz ), as selected in the Setup screen.

The speed signal must be calibrated to convert pulses per second ( e.g. from a sensor giving 50 pulses per rotation of a conveyor belt drum ) into belt speed in metres per second.

To do this the number of pulses for one belt revolution and the length of the belt in metres must be entered.

The belt length must be measured and entered manually.

The pulses per belt revolution may be entered manually ( if known) or calibrated as follows :

- 1) Enter the number of belt revolutions for the calibration duration. ( e.g. Cal. Duration 4 Revs. )  
This number is the same as in 3.2 Weight Calibration.
- 2) Enter the length of the conveyor belt.  
( e.g. Belt Length 100.000 metres )
- 3) Using a mark at one point on the conveyor belt, press Start/Stop as the mark passes to start the calibration.
- 4) Wait until the mark has passed by four more times ( four belt revolutions ) and press Start/Stop again to stop the calibration.
- 5) Press Enter is to confirm that the calibration procedure was carried out correctly.

The total number of pulses received is then divided by the selected number of belt revolutions and automatically put into the Pulses/Rev value.

While calibrating, the total number of pulses received by the CBC unit are displayed ( either externally or internally generated).

The calibration procedure applies equally to external or internal speed inputs, as selected in the Setup screen.

If the **+ Int** or **- Int** options are selected in the Setup screen, the Pulse input should be wired or switched to the turn the signal on.

### 3.2 Weight Calibration

The CBC receives a weight signal from one to three Load Cells.

The Load Cell weight signal must be calibrated to convert counts ( a number representing Load Cell output ) into kilograms.

To do this the counts from the Load Cell must be measured, or entered manually ( if known ), for both a Zero weight and a known Span weight, as follows :

***Please ensure that the belt is stopped and is clear of material before proceeding***

- 1) Enter the number of belt revolutions for the calibration duration. ( e.g. Cal. Duration 4 Revs. )  
This number is the same as in 3.1 Speed Calibration.
- 2) Select Zero Cal. and press Enter.  
To enter a known value manually, press any number key without pressing Enter first.
- 3) Ensure that there is no weight on the Load Cell weighing assembly and press enter to calibrate the Zero weight. The primary password may be asked.

At this point of the calibration the screen will show 'calibrating'. It is important to wait approximately 10 seconds so that an average zero value can be taken by the integrator. Once 10 seconds has passed press enter to confirm the calibration. The Zero is now calibrated.

- 4) Enter the value of the calibration Span weight which will be attached to the Load Cell assembly ( say 50.0 kg ).
- 5) Select Span Cal. and press Enter.  
To enter a known value manually, press any number key without pressing Enter first.
- 6) Ensure that the calibration weight ( e.g. 50.0 kg ) is placed on the belt directly above the Load Cell weighing assembly and press enter to calibrate the Span weight.

The notes following item 3 will then apply, except that the difference between the counts measured for Zero weight and Span weight will be put into the Span Cal value.

### 3.3 Material Calibration

The CBC unit takes the Belt Speed and Weight measurements and calculates the Rate at which weight is passing the Load Cell. It also accumulates ( Integrates ) the weight passed by into the Grand Total and Batch Total weight values.

Because of variations in the conveyor belt, and uncertainties due to vibration and wear, the Total as calculated directly from the Speed and Weight and Weigh Span values may not agree precisely with the weight actually transferred, as measured by a weighbridge, for example.

To eliminate such variations, the Material calibration screen allows the Rate and Total values to be adjusted between 80% and 120% of the values calculated from the Speed and Weight signals, as follows :

- 1) Enter the Weigh Span value. This is the length of conveyor belt over which the Load Cell weighing assembly actually measures weight.  
This value is used by the program to calculate Rate and Total values currently being measured, but will not affect previously accumulated Totals.
- 2) Select Start/Stop and press Enter. This starts a temporary Total value accumulating ( independent of the main two in the Run screen ).  
This Total is always reset on starting the Material calibration.
- 3) When a known weight of material has passed by on the conveyor belt ( and been loaded onto a weighbridge, for example ), press Enter again to stop the calibration,
- 4) Enter the weighbridge value into W/Bridge Tot. If the weighbridge value is within 80 to 120 percent of the calculated value you may press enter to confirm the Material calibration. If the values are outside this range the program will assume an error has been made and will display " Values out of Range! " and not change the values.

The Percent Cal value may also be entered manually, if the required correction is known, press Enter to confirm the new calibration.

The Material Calibration only affects the Rate currently being measured, and does not change any previously accumulated totals.

### **3.4 Current Loop Calibration**

The CBC unit has an optional Current Loop / Voltage Output board which allows the Rate value to be displayed on an external meter, or recorded by a data logger.

The Current Loop Output board is calibrated by means of three "pots" located on the Current Loop Output board.

The Current Loop Calibration screen allows various currents to be sent out so that the "pots" may be adjusted to give the correct current and voltage, as follows :

- 1) Enter the Scale Capacity value. This is the number of tonnes per hour ( TPH ) or kilogrammes/Second ( kg/S ) which will give a current of 20.00mA. The maximum current is 20.47 mA or 2.35% above the Scale Capacity value. This value is not necessarily the same as the Rate Full Scale set up in the Display screen.
- 2) Enter 0.00 mA into the Cal. Output value. This is the current which will be sent out when Calibration mode is switched on.
- 3) Select Calibration and press enter to turn Calibration mode on.  
The display of Weight rate is turned off and the Current Output is set equal to the Cal Output value, 0.00 mA.
- 4) Rotate the zero voltage "pot" RV2 fully clockwise.
- 5) Enter 20.00 mA into the Cal. Output value. This current will now be sent to the meter.
- 6) Connect a voltmeter to the 0 - 10 Volt output and adjust the Volt Span "pot" RV1 until 10.00 Volts are displayed.

- 7) Connect a current meter to the Current Loop output and adjust the Current Span "pot" RV3 to give 20.00 mA .
- 8) Enter 4.00 mA into the Cal. Output value. Adjust RV3 to give 4.00 mA current.
- 9) Enter 20.00 mA into the Cal. Output value. Adjust RV2 to give 20.00 mA current.
- 10) Repeat steps 8 and 9 until both values are correct.

The calibration may be checked by entering several different Cal Output values and measuring the current.

- 11) Select Calibration and press Enter to turn Calibration mode off. The Weight Rate should now be displayed together with the current corresponding to it.
- 12) The current Range may be selected as either 0 - 20 mA or 4 - 20 mA. For 0 - 10 Volt select the 0 - 20 mA range.  
The 0 - 10 Volt output will give 10.00 Volts corresponding to a Current Loop output of 20.00 mA . In 4-20mA mode the voltage output will be 2.0 - 10.0 Volts.  
The 0 - 20 mA range will output 0.00 mA for a zero Weight Rate, the 4 - 20 mA range will output 4.00 mA. Either range will output 20.00 mA for a Weight Rate equal to the Scale Capacity. This does not affect any of the other calibrations.

#### 4. Display Setup

The Rate Full Scale capacity is used to calculate the Deadband from Deadband %, the Autotare Limit error from Autotare %, and to give a Rate Error if the rate exceeds it. Go to Run mode and press "4" to view Autotare Status which gives a summary of these values.

The number of decimal places of the Total, Speed and Rate displays may be adjusted by pressing Enter, or the number of places required.

Values between 0 and 3 will set the format to :

|   |       |
|---|-------|
| 0 | 1000  |
| 1 | 100.0 |
| 2 | 10.00 |
| 3 | 1.000 |

for Total and Rate, and

|   |        |
|---|--------|
| 0 | 1000.0 |
| 1 | 100.00 |
| 2 | 10.000 |
| 3 | 1.0000 |

for Speed.

The value of these items is unchanged, i.e a Grand Total which reads 12.34 tonnes will read 12.3 tonnes if the decimal place number is changed.

The units of the Rate display may be selected as either tonnes/hour ( t/hr) or kilograms/Second ( kg/S ).

The display of the Rate value in Run mode may be averaged by setting the Rate Filter option. The time set in seconds is the time over which the Rate will be averaged.

The Deadband option, if switched "On" by entering a value other than 0.0%, stops the Total being updated if the Rate is below the entered % of the Rate Full Scale capacity.

The "Negative Rates" option, if switched "on", allows negative Rate values to decrease the Total values. It is switched on or off by pressing the "-" key when the Deadband line is selected. A "-" sign appears at the end of the Deadband line if the "Negative Rates" option is on, and negative rates will be subtracted from the Total.

## 5. Printer Setup

A printer may be connected to the serial port to log the Total value accumulated at preset time intervals. Whenever a printout occurs ( through Interval timer, External Switch or by pressing "-" ) the Batch Total is reset to zero.

Baud Rate : The serial baud rate may be set from 150 to 38,400 baud. The format is : 8 bit, no parity, 1 stop bit.

The Serial mode option selects one of three modes :

- i) ----- no handshaking
- ii) DTR h/s DTR signal from printer ( positive voltage to enable printing) connected to P6 pin 6.
- iii) XON h/s Xon/Xoff handshaking.

Press "3" with Serial Mode highlighted to select either RS232 or RS485. The correct IC's must be installed for each option - see Appendix D.

The Print mode option selects one of three serial modes :

- i) Computer : for connection to a computer. The computer controls the sending of data ( see Appendix C ).
- ii) Printer : prints Date, Time, Grand Total, Batch Total and Rate at the specified time and intervals.
- iii) Print+C : prints Date, Time, Total and Rate followed by five calibration values at the specified time and intervals.

If Computer mode is selected the other print options will not operate. See Appendix C for details.

Pressing 3 with Print mode highlighted will switch between "Wide" or "Normal" . "Wide" enables EPSON compatible printers to print the Totals in wide characters. "Normal" is for non-EPSON compatible printers or if this feature is not required.

Ext. Switch selects Pulse 2 input as a switch used to initiate printout the current measured values.

Press "3" with Ext. Switch highlighted to enter the Printer Header name. ( See the end of this section ).

### Interval Printout

The Interval time is the time between printouts in (days)\_hours:minutes , where the (days) are only displayed if the value is not zero (i.e. not today ).

Set the Interval to 00:00 to turn Interval printing off.

The Next Printout time is the time when the next printout will occur. It is displayed as days\_hours:minutes, where the (days) are only displayed if the value is not zero ( i.e. not today ). If you enter a time before the actual time, the value set will be the actual time.

This time will be updated automatically each printout, and will show the time of the next printout.

For example, if the actual time is 09:34, and you would like printouts every 2 hours starting at 11 o'clock, set the Interval to 2:00 and the start time to 11:00. The printout will occur at 11:00, 13:00, 15:00 ... 23:00 and 01:00, 03:00, 05:00 ..., every two hours, the following day, etc.

Note that when the time of the Next printout is on the next day, a "1" will precede the Next Printout time to indicate "tomorrow".

e.g. Next Printout 1 01:00 after the printout at 23:00 .

Similarly the Interval may include a number of days.

To enter a number of days in either the Interval or Next Printout times, enter the number of days first, then the time. The CBC program will move the number of days into the correct position after Enter is pressed.



## Printer Header

Pressing "3" with Ext. Switch highlighted enters the Printer Header screen. This is a text comment which is printed at the start of each printout, and may contain the company name, bin number etc.

Some instructions are displayed, and two lines of thirty characters each of text.

The characters are numbered from 0 to 59, the currently selected character and its value are displayed above the text.

Pressing the Up and Down arrow keys selects the last or next character. Enter a number and press enter to change the value of this character. The number should be the ASCII value of the required character. ( A = 65, B = 66 etc.)

Character 0 and its value are displayed on first entering this screen, it performs a special function, and is the number of characters that the printer header will print. This must be a value between 1 and 59 for any printer header to be printed.

All the other characters ( 1 to 59 ) may be any value between 0 and 255, and thus may be control characters for the printer, to specify larger fonts, underline, linefeeds etc.

Pressing "H" switches the automatic form feed off and on and the end of each printout. The top right hand corner shows "+FF" if the form feed is enabled, "-FF" if not.

Pressing "-" prints immediately, so that you can check the header.

Press "#" to Quit back to Printer Setup.

### Real Time Clock and Calendar

The CBC unit has a digital clock and calendar which may be set to the current date and time as follows :

- 1) Press enter with the Clock highlighted.
- 2) Press the up and down arrow keys to select the value to be changed.
- 3) Enter the new value and press Enter to confirm the new value.
- 4) Use the up and down arrow keys to select the other values and enter as appropriate.

Press an arrow key, Quit or Help to leave the value unchanged.

Press '#' to leave the clock select menu.

Note that changing the Clock may affect the Next Printout display, so it may be necessary to enter the Next Printout time again.

## 6. Specifications

Power Supply : Switchable 210 - 280 Volts AC or 90 to 150 Volts AC, ( 50 or 60 Hz ).

Operating Temperature : 0 to 50 Celsius, non-condensing.  
Optional internal heater.

Cabinet : Sealed to IP65

Display : 30 character x 8 line backlit LCD.  
4.24 x 4.24 mm or 8.48 x 8.48 mm numeric characters supported in software.

Keyboard : 16 key ruggedised keypad, sealed to IP67,  
mounted inside cabinet.

Speed input : 0.01 % timing accuracy, resolution 1 pulse.  
Maximum pulse rate 1.5kHz.

Pulse input : 50mS response time.

Weight input : 0.1 % accuracy, resolution 7.326 uVolt .  
Maximum input voltage +/- 30mV nominal  
Selectable 50/60 Hz digital filtering.

Calculations : 16 , 32 and 48 bit internal operations, performed every 200mS ( 5 Hz scanning rate on inputs ).

Maximum Belt Speed = 99.999 m/S  
Maximum Weight = 3000.0 kg  
Maximum Rate = 180,000.0 tonnes/hour  
Maximum Total = 999,999.99 tonnes

Calibration : Menu driven software, all values stored in non-volatile RAM. Easy re-calibration and manual entry of previous calibration values.

Current Loop Output board : ( optional )

0 - 10 V voltage output : 0.1 % accuracy, resolution 2.44 mV.

0 - 20 mA current output : 0.2 % accuracy, resolution 4.88 uA.

## APPENDIX A Internal Calculations

The Rate value in g/S is calculated as follows :

$$\text{Rate} = ( \text{Weight} * \text{Speed} / \text{Weigh-span} ) * \text{Percent-cal}/100$$

The units are :

|             |            |
|-------------|------------|
| Rate        | 1.0 g/S    |
| Weight      | 0.1 kg     |
| Speed       | 0.0001 m/S |
| Weigh-span  | 0.01 m     |
| Percent-cal | no units   |

A factor of 3.6 = 3600/1000 is used to convert kg/S to tonnes/hour .

The Total value is calculated as follows :

$$\text{Total} = \text{SUM}[ \text{Rate} ] / 5 \text{ accumulated at } 5 \text{ Hz.}$$

The Rate value is added to the Total 5 times every second.

In 1 Second, five Rate values are accumulated, hence the division by 5.

## APPENDIX B Minimum and Maximum Values

|  | Minimum  | Maximum    | Units                        |
|--|----------|------------|------------------------------|
| Belt Speed   | 0        | 99.999     | m/S                          |
| Rate   | -180,000 | 180,000    | tonnes/hour = 50,000 kg/S    |
| Total  | -1       | 999,999    | tonnes ( 0 decimal places )  |
|  | -0.001   | 99,999.999 | tonnes ( 3 decimal places )  |
| Autotare   |          | 0          | 25.0 % Full Scale Rate       |
| Passwords 1,2  | 0        | 9999       |                              |
| Weight Filter  | 0.2      | 25.4       | Seconds ( in 0.2 increments) |
| Speed Filter   | 0.2      | 25.4       | Seconds ( in 0.2 increments) |
| Relay Rate   | 0        | 99.999     | tonnes/pulse                 |
| Cal. Duration  | 1        | 100        | Belt Revolutions             |
| Belt Length  | 1        | 99,999.99  | metres                       |
| Pulses/Rev   | 1        | 9,999,999  | pulses                       |
| Speed  | 0        | 99.999     | m/S                          |
| Cal. Duration  | 1        | 100        | Belt Revolutions             |
| Span Weight  | 0        | 3000.0     | kg                           |
| Zero Cal.  | -30000   | 30000      | counts                       |
| Span Cal.  | -30000   | 30000      | counts                       |
| Weight   | -3000.0  | 3000.0     | kg                           |
| Weigh Span   | 0        | 300.00     | metres                       |
| W/bridge Total   | 0        | 9999.999   | tonnes                       |
| Percent Cal.   | 80.0     | 120.0      | %                            |
| Scale Capacity   | 1        | 180,000    | tonnes/hour = 50,000 kg/S    |
| Current Output   | 0        | 20.47      | mA                           |
| Rate FullScale   | 0.001    | 180,000    | tonnes/hour = 50,000 kg/S    |
| Deadband   | 0.1      | 10.0       | % Full Scale Rate            |
| Rate display in units of tonnes/hour or kg/Second, averaged over |          |            |                              |
| Rate Filter  | 0.2      | 25.4       | Seconds ( in 0.2 increments) |
| Rate and Total display with 0, 1, 2 or 3 decimal places.         |          |            |                              |
| Speed display with 1, 2 3 or 4 decimal places.                   |          |            |                              |

## APPENDIX C Serial Output

Three output modes may be selected in the Printer Setup screen:

- i) **Computer** - A serial protocol to allow data from the CBC unit to be sent to a remote computer or logging device.

The Load Cell Integrator will respond to a ctrlA character ( decimal 01 ) sent to its RS232 port by returning the following 20 byte string of data values :

| <u>Number</u> | <u>Data</u>                        |                  |
|---------------|------------------------------------|------------------|
| 0             | Weight 1 hi                        | 0.1 kg           |
| 1             | Weight 0 lo                        |                  |
| 2             | Speed 3 hi                         | 0.0001 m/S       |
| 3             | Speed 2                            |                  |
| 4             | Speed 1                            |                  |
| 5             | Speed 0 lo                         |                  |
| 6             | Rate 3 hi                          | 0.001 kg/S       |
| 7             | Rate 2                             |                  |
| 8             | Rate 1                             |                  |
| 9             | Rate 0 lo                          |                  |
| 10            | Total 3 hi                         | 0.001 tonnes     |
| 11            | Total 2                            |                  |
| 12            | Total 1                            |                  |
| 13            | Total 0 lo                         |                  |
| 14            | ILO 1 hi                           | 0.01 mA          |
| 15            | ILO 0 lo                           |                  |
| 16            | Pulsing 1 hi                       | 0 = belt stopped |
| 17            | Pulsing 0 lo                       |                  |
| 18            | Checksum of previous 16 characters |                  |
| 19            | CRC of previous 17 characters.     |                  |

The Load Cell Integrator will respond to a ctrlB character ( decimal 02 ) sent to its RS232 port by returning a 256 byte string of all calibration values stored in RAM followed by a checksum byte and CRC byte.

All values sent high byte(s) first.

Any other character returns an ACK character ( decimal 06 ).

- ii) **Printer** - prints Date, Time, Total and Rate in ASCII directly to a printer.
- iii) **Print+C** - prints Date, Time, Total and Rate in ASCII directly to a printer, followed by selected calibration values.

## **APPENDIX D External Plug Connections**

### **P1 - Mains Power Input ( 3 pin terminal)**

110VAC or 240VAC switchable.

Pin 1 Live ( left pin viewed facing terminal block )

Pin 2 Earth ( middle pin )

Pin 3 Neutral ( right pin viewed facing terminal block )

### **P2 - Load Cell Input ( 8 way terminal plug )**

1 to 4 300 ohm Load Cells, 10V drive.

Pin 1 +5V separate power ( optional - add link 2 )

Pin 2 +5V power

Pin 3 + input

Pin 4 - input

Pin 5 -5V power

Pin 6 -5V separate power ( optional - add link 1 )

Pin 7 not used ( may be connected to cable screen )

Pin 8 Earth ( cable screen )

### **P3 - Pulse/Speed Sensor Input ( 4 way terminal plug )**

Low level < 1.67V, high > 3.33V, hysteresis 1.33V, 0 to 1.5 kHz.

Pin 1 0V

Pin 2 input

Pin 3 +12V ( nominal ) power

Pin 4 Earth

### **P4 – Print Demand Input. ( 2 way terminal plug ) Volt free**

Pin 1 0v

Pin 2 +5v

By closing these contacts (via normally open switch) a “print” function is initiated.

### **P5 - ILO Board Outputs ( 6 way terminal plug )**

Isolated 0/4-20mA current and 0-10V voltage Rate signal.

Pin 1 Earth

Pin 2 Not used

Pin 3 0V

Pin 4 0-10V output

Pin 5 Current loop negative ( NB -12V to pin 3 )

Pin 6 Current loop positive

### **P6 - Relay Output 1 ( 6 way terminal plug )**

DPCO "Dry" contacts, 240VAC 5A, 50mS ( nominal ) pulses.

Pin 1 Common A

Pin 2 Normally open A

Pin 3 Normally closed A

Pin 4 Common B

Pin 5 Normally open B

Pin 6 Normally closed B

**P7 – DC input (2 way terminal plug)**

Pin 1 Live  
Pin 2 Neutral

**J5 - Serial Port ( 6 way terminal plug ) RS232**

RS232 connections to printer 25 way "D" male

|       |            |   |
|-------|------------|---|
| Pin 1 | 0v         | to Pin 7 on printer 25 way "D" male plug  |
| Pin 3 | TXD output | RXD to Pin 3 on printer 25 "D" male plug. |



## **APPENDIX E Program Test Mode**

Program Test Mode is included to facilitate testing of the sensors and initial setup of the CBC unit.

Pressing "999" in the Main Menu screen ( press "#" from Run Mode screen ) displays these options. Select an option by pressing the appropriate key :

- "1"      Sets password 1 to 1234 and password 2 to 2345.  
          The Master password must be entered first.
- "2"      Sets default setup values ( not calibration values ).  
          Any setup options will be over-written with the standard default values. This is used when the unit is first assembled to set up sensible values.  
          Also sets password 1 to 1234 and password 2 to 2345.  
          The Master password must be entered first.
- "3"      displays and optionally clears a RAM checksum error. If an extra tone is heard when the unit is switched on, a RAM error has been detected, and probably corrected. Units which are operated in electrically very noisy conditions may give this warning. Press enter to clear the error.
- "5"      displays the Hardware Test screen. The "raw" data from the sensors is displayed, to assist in fault diagnosis.
- "7"      switches to Remote Link mode. This is a program debugging mode, for use with the chip Forth Cross Target Compiler. Switch the unit off to exit.
- "8"      gives the User Options menu. The User Option password must be entered for this. The Printer screen and Shift Performance Report screens may be enabled in this screen.

### **Special Passwords**

"1" and "2" require the Master Password to be entered. This is a number only to be disclosed to authorised service personnel.

The Master Password for CBC V1.5 09 September '15 is,

Password : **3142**

## **APPENDIX F RAM Protection scheme**

Because the CBC unit is operated in electrically noisy environments, special software protects the calibration data held in non-volatile RAM. A backup copy of the data is made, and the main and backup RAM data is checked when the unit is switched on, or is reset by electrical noise ( a rare event ).

If both RAM areas are correct, no action is taken, if one of the areas contains an error, the good area is used to correct the error. If both areas have errors it is assumed that the unit is being switched on for the first time, and the printer interval, baud-rate, serial port mode and LCD contrast are reset, to allow easy setting up of the unit.

Three types of warning tone are given after the initial "scale" is sounded, when the unit is switched on, if there are errors :

- 1) single beep - means an error occurred and has previously been corrected. Go to the Program Test mode ( see Appendix E ) and press "9993" to see the number of times an error has been corrected, and press enter to clear them. This is to highlight an electrically noisy environment which is causing the RAM data to be corrupted, so that action may be taken.
- 2) double beep - an error is being corrected. Next time the unit is switched on it will give a single beep - follow the procedure in 1) above to clear the warning beep.
- 3) multiple beeps - RAM totally corrupted, and has been reset. This should only happen when the unit is first built, or if the RAM chip is unplugged. Follow the procedure in 1) above to clear the warning beep.

When the CBC unit is switched off a short high-pitched beep is sounded. This indicates that the unit has stopped its operation in an orderly manner so as not to corrupt RAM data.

### **Ground ( Earth ) Loops**

If the CBC has repeated RAM errors, it may be caused by an incorrect ground ( Earth ) circuit. Link LKE1 on the CBC Power Supply Board ( next to the mains input screening box ) may need to be fitted. Check the AC voltage across LKE1 ( with the link not fitted ). If it is greater than a few volts it will probably be best to fit the link. Fitting the link connects the mains Earth ( ground ) to the CBC's 0 Volt power supply connection. Whether to fit the link may only be determined experimentally, because it depends on whether the same connection is made somewhere else in the system.

There should be only one connection between Earth and the CBC's 0 Volt line - if an external module, e.g. Load Cell makes this connection, the link should be left out.

If there is no connection, the voltage between Earth and CBC 0 Volt line will "float" and there could be several hundred volts between them. In this situation the link should be fitted, to avoid possible electrical noise problems.

More than one connection can lead to "ground loop" problems.