Document Title	Original Equipment Manufacture Technical Manual for electromechanical conveyor belt scales		
Applicable Company MASSive Group	**Document Number** MASS-MAN-001	**Revision** A	**Reference** ISO 9001:2015 ISO 14001:2015 ISO 45001:2018
Approval	**Designation**	**Signature**	**Date**
Responsible Department	Configuration Management		
Approved by	Gleed Dean		
Accepted by			

Installation, Maintennace and Operating manual for electromechanical conveyor beltscales

Date: 02-JUN-2026

Revision: 1.1

Approved by: Gleed Dean

Approver designation: COO

Contents

1. THEORY OF OPERATION

A conveyor belt scale has two components: the weigh-frame that transmits the mass of the product being conveyed to the load cells and the speed sensor that measures the speed at which the conveyor is moving. These two components are then computed by the scale electronics to give the total bulk material that has moved over the scale.
It is necessary for the weigh-frame to transfer the mass being carried by the conveyor belt to the load cells in a totally linear fashion. For obvious reasons if the mass is held up by the conveyor belt in any way during the weighing cycle then the scale weigh-frame cannot transfer the mass to the load cells in a linear and accurate way. This will mean that the scale will not measure the mass of the product being conveyed accurately.
In order to allow accurate weight transfer to the load cells, the scale weigh-frame must be accurately installed in relation to the conveyor itself. This installation process is of paramount importance to the accuracy, reliability and longevity of the scale. The installation process is covered in detail in Section 4 of this manual.
The speed input device is often overlooked when it comes to accurately setting up a scale or checking the calibration of a scale. The speed input device, although far less imposing than the weigh-frame, is as important as the weigh-frame when it comes to achieving accuracy on a conveyor belt scale. As can be seen in the calculation below, it is imperative that both speed and weight are accurately measured as they are both used in calculating the quantity of bulk material that passes over the belt.
The scale electronics computes the quantity of bulk material passing over the scale as follows:

$$Tt = \frac{M \times S}{Ct}$$

- M = Mass in Kilograms per meter / Pounds per feet
- S = Speed in Meters per second / Feet per second
- Ct = Calculation Time in milliseconds
- Tt = Total Weight added to totalizer

Below we can see a real world example of this

$$Tt(0.4kg) = \frac{M(100kg/m) \times S(\frac{2.0m}{S})}{Ct(20m/s)}$$

Every time the calculation is run the result (Tt) is added to an accumulator on the scale electronics display. This is commonly known as the totalizer function of the scale. The totalizer may also be transmitted by the scale electronics to a peripheral device such as a remote pulse counter, PLC, SCADA or DCS using a potential free contact pulse or any number of industrial communication protocols.

Note: The totalizer calculation shown above runs in both forward and reverse mode depending on whether or not M is negative or positive at the time.

In addition to a totalizer tonnage, the scale is often required to indicate and transmit the instantaneous flow-rate over the scale. This calculation is much the same as the totalizer

$$Tph = \frac{M \times S \times Cs}{Ct}$$

- M = Mass in Kilograms per meter / Pounds per feet
- S = Speed in Meters per second / Feet per second
- Ct = Constant in order to convert seconds to hours
- Cs = Constant in order to convert Kilograms to hours
- Tph = Material rate of flow in tons per hour

For example:
A belt is loaded at 100 Kilograms per running meter of length and is moving at 2.0 meters per second.

$$Tph(720Tph) = \frac{M(100kg/m) \times S(2m/s) \times Cs(3600)}{Ct(1000)}$$

Once the instantaneous flow-rate has been computed it is written to the scale electronics on the board display and may be transmitted by means of an analogue 4-20mA signal or even using one of the many industrial protocols to a peripheral device such as a SCADA, PLC or DCS.

As can be seen in the above calculations, the speed and weight measurements are equally important and must be accurate in order for the scale to give accurate weighing results. In order to “pass” accurately accounted for speeds and masses onto the scale electronics for computation purposes, the integrity of the weigh-frame and speed input device must be beyond question.

2. CORRECT APPLICATION OF TECHNOLOGY

A conveyor belt scale consists of five major components, namely: rollers, weigh-frame, load cells, speed input device and the electronics.

The **rollers** are the only components of the weigh-frame that come into contact with the conveyor belt itself. It goes without saying that the rollers must be aligned accurately with the belt in order to transfer the weight of the material conveyed accurately to the weigh-frame without exerting any other dynamic forces in the process.

The **weigh-frame** is the structure that supports the rollers and the weight of the belt and the product conveyed and ultimately transfers this mass to the load cells. Because of this, it is imperative that none of the aforementioned mass is “lost” due to the frame absorbing the load through deflection. Thus the scale frame is over-engineered to be rigid to a degree where deflection will be less than 1/1000. As it is the idler frame that holds the rollers in position, it is imperative that the frame allows the rollers to maintain an exact alignment with the belt. For this reason the scale frame and weigh class-idler sets must be precision made.

The **load cells** ultimately transfer the mass of the belt and product conveyed to the electronic controller. The calculations shown on the previous pages will enable you to envisage how important it is to have this done repeatedly and accurately. Once again the load cell mounting arrangement must be rigid and not absorb weight transfer through deflection of the scale frame or the stringer structure. The load cells themselves must have high resolution and must be capable of returning to the exact same position once they have been stressed and de-stressed. In order to this the load cells must only operate within their specified range, even during gross overloading of the conveyor.

The **speed input device**, as can be seen in the calculations on previous pages, is as crucial in determining accurate weights as the aforementioned components. The contact made with the belt must be consistent and without excessive wear and the device should deliver a high resolution accurate output to the scale electronics. The speed sensor must also be designed not to slip when the belt is wet.

The **electronics**, as can be seen in the calculations on previous pages, must have sufficient computing power in order to do the relevant computing in the shortest possible time. The more times per second that this calculation is performed the better the cut (sample) of actual product on the belt. This in turn will mean that at the higher the sampling rate of the scale the less the chance of "missing" a peak or trough of the product conveyed, hence higher accuracy. The electronics are not only responsible for computing, it must also display all relevant information to the operator and scale technician as well as transmit data to control devices such as a PLC, DCS or SCADA.

3. INSTALLATION PROCEDURE

1. POSITION SCALE FRAME AND IDLER SETS ON CONVEYOR STRINGERS
    1.1. check for obstruction over proposed installation area
    1.2. check securing points of scale and idler sets for obstructions

2. OBTAIN THE MEAN CENTRE LINE

3. INSTALL SCALE FRAME TO MEAN CENTRE LINE
    3.1. check scale frame assembly
    3.2. check on scale weigh class idler set installation
    3.3. install and level frame
    3.4. shim frame to correct height
    3.5. check scale frame installation

4. INSTALL THE +3 AND -3 IDLER SETS
    4.1. align +3 and -3 idler sets
    4.2. level +3 and -3 idler sets
    4.3. shim +3 and -3 idler sets
    4.4. check +3 and -3 idler sets

5. RUN INSTALLATION REFERENCE LINES

6. INSTALL +1 , +2, -1 AND -2 WEIGH CLASS IDLER SETS
   6.1. align +1 and +2 and -1 and -2 weigh class idler sets
   6.2. level +1 and +2 and -1 and -2 weigh class idler sets
   6.3. shim +1 and +2 and -1 and -2 weigh class idler sets
   6.4. check all weigh class idler sets installation

7. CHECK INSTALLATION INTEGRITY

8. CHECK BELT TRACKING AND ALIGNMENT

9. COMMISSIONING OF THE SCALE

4. FULL INSTALLATION OF ELECTROMECHANICAL CONVEYOR BELT SCALES

4.1. POSITION SCALE FRAME AND IDLER SETS ON CONVEYOR STRINGERS

4.1.1. CHECK FOR OBSTRUCTIONS

Place frame and idler sets in conveyor stringers where proposed installation is to take place. Check if there are any stringer components in the way of the scale frame, any components hindering the accurate installation and free movement of the scale frame must be removed. Obtain the permission of the resident engineer and remove the obstruction. Care must be taken not to affect the integrity of the conveyor structure in any way. If the integrity of the structure will be affected then the conveyor must be supported in another way before the obstruction is removed. Care must be taken to abide by corrosion protection and engineering standards when removing any obstructions linked to the conveyor structure. If any obstruction is found to be immovable then the scale installation must be shifted to the closest and next best location on the conveyor.

4.1.2. CHECK SECURING POINTS

Once the scale and idler sets are placed in position, check the points that require welding or drilling on the stringers. They must be free of obstruction and stringers must not be joined over scale area. Any joints within or in close proximity to the scale installation must be welded up to prevent movement. If drilled hole centers fall on the beam centres or other obstructions, the installation must be moved slightly if possible. If not possible, the mounting method or the scale itself must be modified to work around the obstruction.

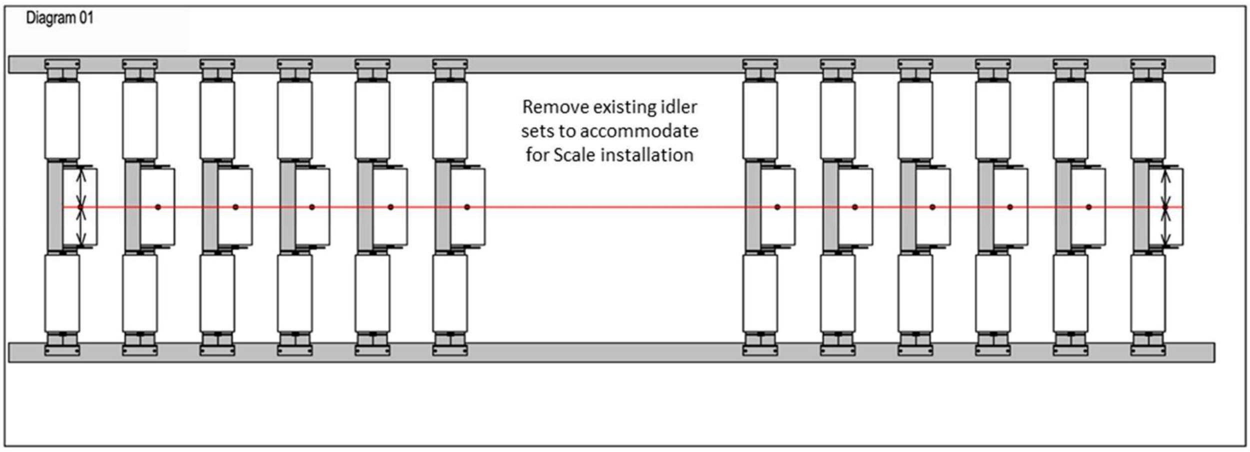
4.2. OBTAIN THE MEAN CENTRE LINE

Obtain a mean centre line as shown in Diagram 01. This is done by lightly pock marking the centre of the centre roll on each idler set at least six idler sets before either scale installation and six idler sets after the scale installation (excluding weigh class approach and retreat idler sets). A fish line is then run taking the mean average of all the pock marks as dead centre for the installation.

4.3. INSTALL SCALE FRAME TO MEAN CENTRE LINE

4.3.1. CHECK SCALE FRAME ASSEMBLY

Check that the scale frame has been correctly assembled and that the torsion rods and load cell assemblies are



correctly installed and tensioned.

CHECK ON SCALE WEIGH CLASS IDLER SETS FOR CORRECT INSTALLATION

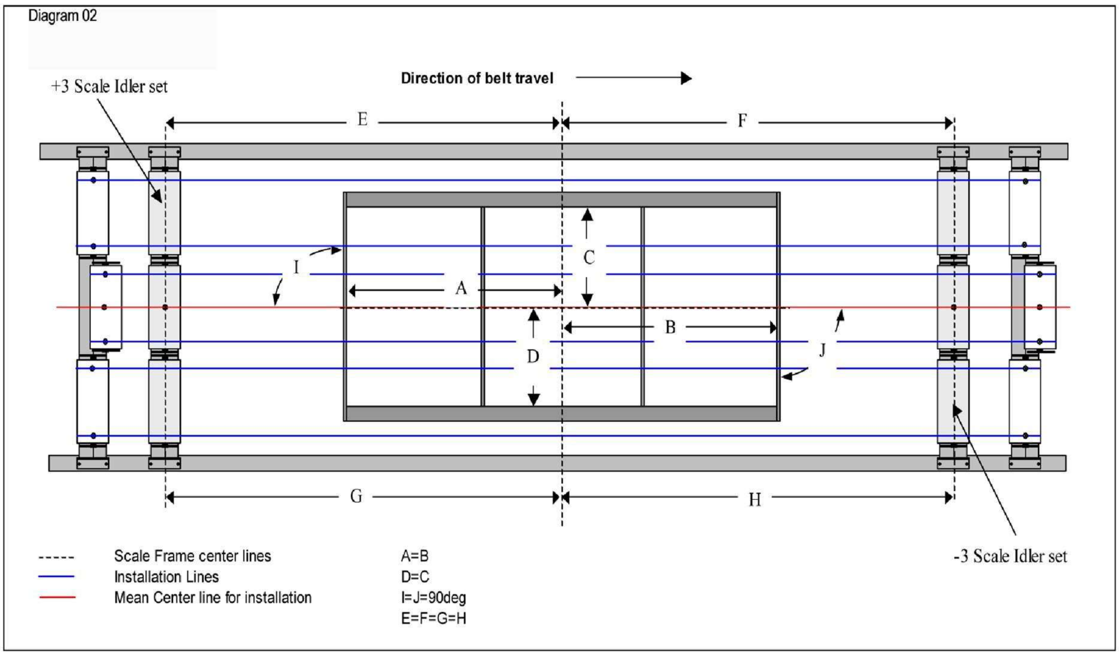
In most cases the scale itself will arrive on site with the on scale idler sets already installed, levelled, and aligned. The scale is set up in the factory to be exactly square. If the scale is not fully assembled for transportation or access reasons this must be done at the point of installation before the scale is placed in the conveyor.

On factory set up scales check the scale assembly before placing the scale in the conveyor. Look out for the following: Idler sets installed at design specified idler spacing, center roll level to scale frame in cross sectional direction. All securing bolts are tight and washers and nylock nuts are in place, the centre rolls are marked dead centre. The scale can now be positioned in the conveyor between the stringers and the alignment can take place. Make sure that the scale frame is level across the conveyor and dead centre to the mean centre line. The entire scale frame will then be square and level to the mean centre of the conveyor.

NB: DO NOT USE THE STRINGERS TO ALIGN THE SCALE THEY ARE NOT A RELIABLE REFERENCE POINT.

4.3.2. INSTALL AND LEVEL FRAME

The scale frame which is already in position on the stringer can now be aligned and installed exactly according to the installation reference line (mean centre line). Make sure that the scale frame is level and dead centre to the mean centre line. Refer to Diagram 02.



4.3.3. SHIM FRAME TO CORRECT HEIGHT

The scale frame can now be shimmed to the correct height using the mean centre installation reference line to obtain the exact height within 0.25 mm. The correct height is between 4 and 8 mm higher that the existing conveyor idler sets taken over at least eight idler sets before and after the scale weigh platform.

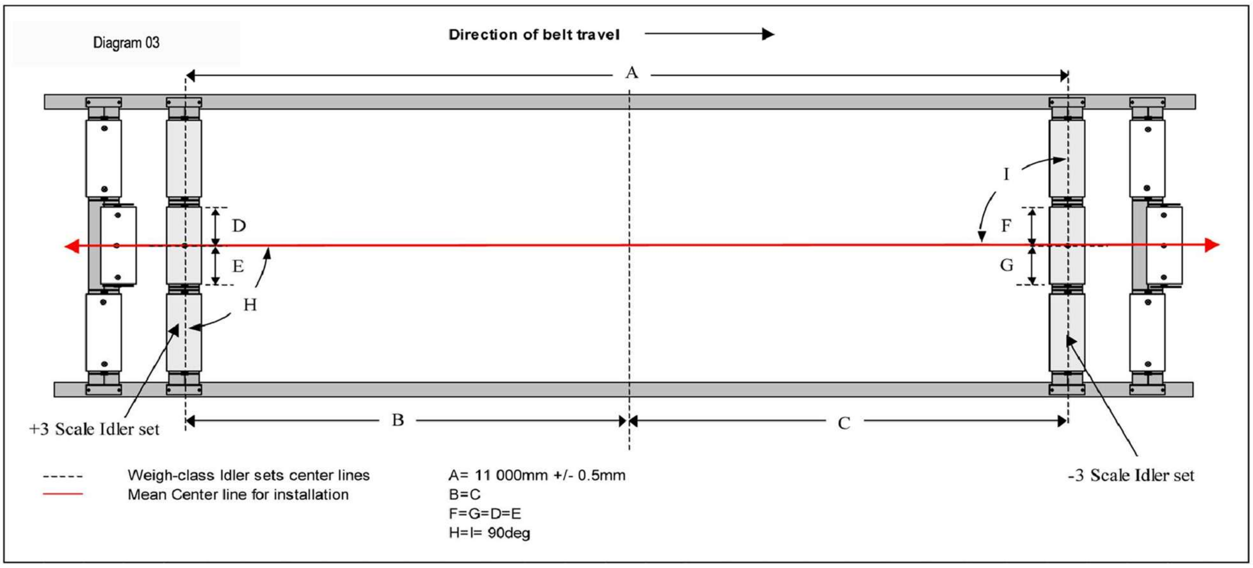
4.3.4. CHECK SCALE INSTALLATION

Make sure that the scale is installed exactly centre to the mean centre line, level across the stringers, level along the stringers, and 3mm (minimum & preferable) – 6mm (maximum) higher than the existing conveyor idlers according to the mean centre installation reference line. Check that the on scale torsion rods and load cell mounting arrangements are correctly installed and tensioned. If these are loose or if they work loose, the scale installation is affected and inaccuracies will occur. Check the scale frame for cross square in order to make sure that nothing has shifted.

4.4. INSTALL THE +3 AND -3 IDLER SETS

4.4.1. ALIGN +3 AND -3 IDLER SETS

The first approach and last retreat weigh class idler set must now be installed and aligned according to the mean centre line. Refer to Diagram 03. These idler sets must be exactly the same distance from the centre of the scale frame to within 0,25 mm. Leave the correct spacing for the +2, +1 and -2, -1 off scale weigh class idler sets. Spacing is as per design specification +/- 0,25 mm. The idler sets must be installed square to the mean centre line with the centre of their centre rolls being exactly on the mean centre line.



4.4.2. LEVEL +3 AND -3 IDLER SETS

Once the idler sets have been installed as above, they must be checked for being level across the conveyor. Place a spirit level on the centre roll and shim the idler set until it is level. Be careful on installations that are on an incline or decline. If the level is held slightly skew on the centre roll, the idler set will appear to be out of level. Make sure the level is held straight along the top of the centre roll. A line can be drawn on the centre roller using a square to assist with this.

4.4.3. SHIM +3 AND -3 IDLER SETS

Once the +3 and -3 weigh class approach and retreat idler sets have been levelled, they must be shimmed to be 4 to 8 mm higher than the existing conveyor idler sets using the already installed scale frame as a reference for height. Again, we work off a mean average as any of the existing conveyor idler sets may not be exactly the same height. The rule is however, that no existing roll within fifteen idler sets on either side of the scale installation may sit higher on the conveyor than any scale roll.

4.4.4. CHECK +3 AND -3 IDLER SETS

The +3 and -3 weigh class approach and retreat idler sets are now installed and can be used to run the installation reference lines. Do a final check on the +3 and -3 idler sets verifying that they are:
Square to the centre line
The correct distance from the centre of the scale
Equidistant from each other on both sides of the conveyor
Level across the conveyor using a good spirit level
Between 4 to 8 mm higher than any existing conveyor roll (using the scale height as a reference) within 15 idler sets on either side of the scale installation (or mean level).

4.5. RUN INSTALLATION REFERENCE LINES

Once point 4.4 above has been completed the +3 and – 3 idler sets can be used to run the scale installation reference lines. Using fish line at least 1mm thick, run six installation reference lines as per Diagram 02. Make sure that the lines are tensioned to almost breaking point so as to limit sagging between idler sets. Make sure that each line is placed the same distance from the sides of the rollers on both idler sets.

4.6. INSTALL +1 , +2 AND -1 , -2 OFF SCALE WEIGH CLASS IDLER SETS

4.6.1. ALIGN +1,+2 AND -1, -2 OFF SCALE WEIGH CLASS IDLER SETS

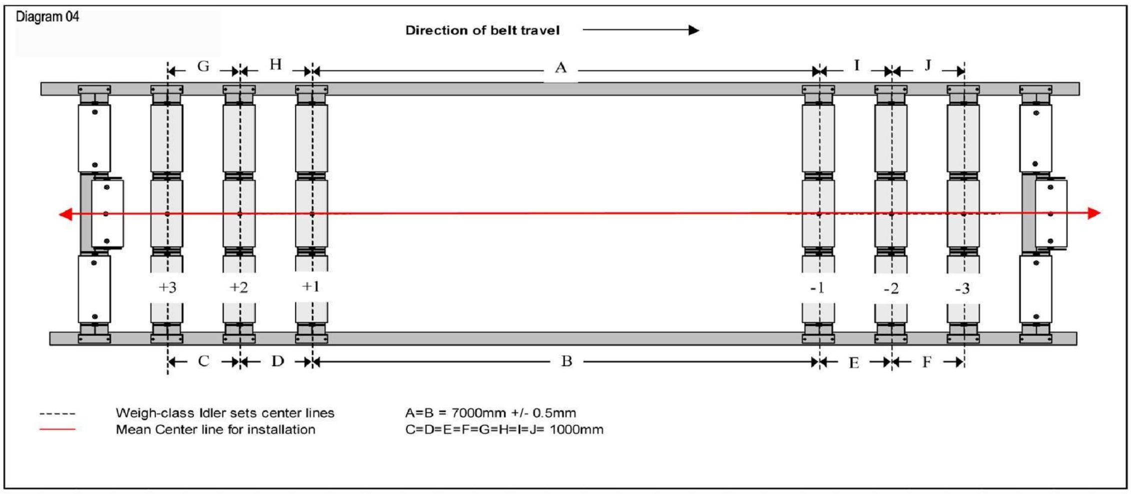
The second and third approach and first and second retreat weight class idler set must now be installed and aligned according to the mean centre line. See Diagram 04. These idler sets must be exactly 1000mm (±0.25 mm) from each other and the +3 approach and retreat idler set as well as the No. 1 and No. 4 (or 2 or 6 scale dependent) on scale weigh class idler sets. The idler sets must be installed square to the mean centre line with the centre of their centre rolls being exactly on the centre line.

4.6.2. LEVEL +1,+2 AND -1, -2 OFF SCALE WEIGH CLASS IDLER SETS

Once the idler sets have been installed as above, they must be checked for level across the conveyor. Place a spirit level on the centre roll and shim the idler set until it is level. Be careful on installations that are on an incline or decline. If the level is held slightly skew on the centre roll the idler set will appear to be out of level. Make sure the level is held straight along the top of the centre roll.

4.6.3. SHIM +1,+2 AND -1, -2 OFF SCALE WEIGH CLASS IDLER SETS

Once the off scale idler sets have been levelled, they must be shimmed to be the same height as the scale itself. Again, work off the installation reference lines.



4.6.4. CHECK ALL WEIGH CLASS IDLER SETS

The weigh class idler sets both off scale and on scale are now installed. The installation must be verified. Do a final check on the idler sets verifying that they are square to the mean centreline, Design specification from each other, level across the stringers and 4 to 8 mm higher than any existing conveyor roller for at least 15 idler sets on either side of the scale installation.

4.7. CHECK INSTALLATION INTEGRITY

Once the installation has been completed the entire installation must be re-checked as one loose bolt can cause the scale to perform badly or even get damaged. Leaving the installation reference lines in place check the installation from start to finish. Fill in the installation check sheet provided in order to start a history of the scale. Before checking the installation, check that the installation reference lines have not shifted and are still tensioned correctly. Check that all of the torsion rods are correctly tensioned. (You should be able to turn these with your hand. There should be some lateral movement in the cross sectional torsion rods above the scale frame.)

4.8. CHECK BELT TRACKING AND ALIGNMENT

Once the belt has been lowered, the belt must be run for at least 20 minutes before belt tracking can be accessed. The belt must be tracked as the correct installation of a scale can influence the belt tracking. If the tracking is out it must be adjusted without interfering with the scale installation area.

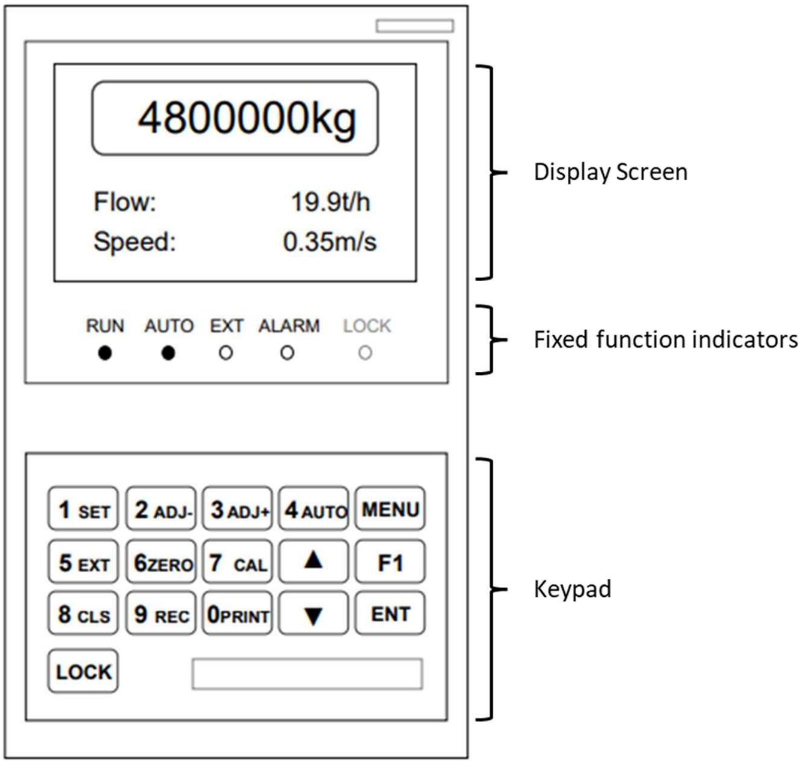
4.9. COMMISSIONING OF THE SCALE

The conveyor must be run for several days under normal loading in order for the scale installation to settle in before the scale is commissioned. Once the conveyor has been run under load any shift In the stringer structure (conveyor structure) will be able to be detected and corrected. In order to commission the scale the belt will have to be lifted over the scale installation area to a height of at least 1000mm. The scale installation is then checked using the same reference lines as used during the installation. If the scale installation has not shifted commissioning and calibration can proceed. If the installation has shifted the conveyor structure must be reinforced and the scale re-aligned before commissioning and calibration.

Leave the conveyor in its lifted position. The load cells are then connected to the electronics and the speed sensor fitted to the # 2 idler set on the scale itself. The scale is then calibrated using static test weights on the scale frame itself. NOTE: this is not final calibration as final calibration can only be done once the belt has been lowered and run for 20 min. The scale is then checked for balance using a single 20kg test weight placed on each of the four corners of the scale as close to the load cells as possible. When the weight is moved from one corner to the other the SM (scale mass) reading should be 20kg +/- 0.3kg. If this is not the case a minor adjustment of the load cell mounting rod underneath the scale frame can be made. Tighter will increase the SM indicated mass, looser will reduce it. Care must be taken not to adjust the scale out of alignment when making these adjustments.

Once the scale has been balanced the belt can be lowered and run empty for at least 20 min before final calibration can be done. See calibration manual.

5. Operation



5.1. EMCBS-100-E21 INTERFACE

Key Operations and Functions

Key Name	Description		Key Name	Description
MENU	Enter main menu Exit menu		LOCK	Keypad locking Keypad unlocking
ENT	Enter selected menu Save set parameter value		F1	Return to main display
▲	Shift cursor UP through menu Shift cursor LEFT through value		6 ZERO	Open dynamic zero function
▼	Shift cursor UP through menu Shift cursor LEFT through value		8 CLS	Open totalizer reset functionality
Numbers	Enters pressed value onto current cursor location		4 AUTO	Enable PID control Disable PID control

BASIC OPERATIONS

Unlocking / Locking Keypad

1. Press the Lock key (LOCK) to open the passcode entry screen
2. Enter in the Scales passcode, by using the numbered keys
3. Press the Enter key (ENT) to submit the passcode

Should the passcode have been successfully submitted, the main screen will be displayed. Should the passcode have been rejected, a “FAILED” screen will be displayed.

Changing Scale units

1. Press the Menu key (MENU) to open the Main Menu
2. Press the Enter key (ENT) to open the “F1 Settings” menu
3. Press the Enter key (ENT) to open the “Scale Basic” menu
4. Press the Down key (▼) until the “P107 Scale Unit” is highlighted by the cursor
5. Press the Enter key (ENT) to open the “P107 Scale Unit” parameter
6. Press the Down key (▼) until the required value is displayed
7. Press the Enter key (ENT) to save the displayed value to the parameter
8. Press the F1 (F1) to return to the main screen

Changing Display units

1. Press the Menu key (MENU) to open the Main Menu
2. Press the Enter key (ENT) to open the “F1 Settings” menu
3. Press the Enter key (ENT) to open the “Scale Basic” menu
4. Press the Down key (▼) until the “P100 Display Unit” is highlighted by the cursor
5. Press the Enter key (ENT) to open the “P100 Display Unit” parameter
6. Press the Down key (▼) until the required value is displayed
7. Press the Enter key (ENT) to save the displayed value to the parameter
8. Press the F1 (F1) to return to the main screen

Changing Belt Length

1. Press the Menu key (MENU) to open the Main Menu
2. Press the Enter key (ENT) to open the “F1 Settings” menu
3. Press the Enter key (ENT) to open the “Scale Basic” menu
4. Press the Down key (▼) until the “P102 Display Unit” is highlighted by the cursor
5. Press the Enter key (ENT) to open the “P102 Display Unit” parameter
6. Enter in the required belt length, using the numbered keys
7. Press the Enter key (ENT) to save the displayed value to the parameter
8. Press the F1 (F1) to return to the main screen

Performing a dynamic zero calibration

1. Press the Zero key (6ZERO) to open the Dynamic zero calibration screen
2. Enter in the required belt Rotations, using the numbered keys
3. Press the Enter key (ENT) to Initiate the dynamic zero calibration
4. Wait for the dynamic zero calibration to complete.
5. Press the Enter key (ENT) to save the calibration value to the “P104 Zero Value” parameter

Note that when the dynamic zero calibration is complete, the old Value, new Value and Error percent will be displayed, in the below manner

Old Value	:	XXXXX
New Value	:	YYYYY
E%	:	A

Note, Should the test need to be aborted / cancelled, the Menu button (MENU) can be pressed at any point.

Changing Span Coefficient

1. Press the Menu key (MENU) to open the Main Menu
2. Press the Enter key (ENT) to open the “F1 Settings” menu
3. Press the Enter key (ENT) to open the “Scale Basic” menu
4. Press the Down key (▼) until the “P105 Span Coeff” is highlighted by the cursor
5. Press the Enter key (ENT) to open the “P105 Span Coeff” parameter
6. Enter in the required Span Coefficient, using the numbered keys
7. Press the Enter key (ENT) to save the displayed value to the parameter
8. Press the F1 (F1) to return to the main screen

Changing SL Deadband

1. Press the Menu key (MENU) to open the Main Menu
2. Press the Enter key (ENT) to open the “F1 Settings” menu
3. Press the Enter key (ENT) to open the “Scale Basic” menu
4. Press the Down key (▼) until the “P106 SL Deadband” is highlighted by the cursor
5. Press the Enter key (ENT) to open the “P106 SL Deadband” parameter
6. Enter in the required SL Deadband, using the numbered keys
7. Press the Enter key (ENT) to save the displayed value to the parameter
8. Press the F1 (F1) to return to the main screen

6. Calibration

Calibration of your conveyor belt scale consists of two types of calibration namely, initial calibration and routine or maintenance calibration. Initial calibration is only performed after installation or major repairs or overhauling of the scale. Routine or maintenance calibration is performed after minor repairs or as part of a routine inspection in order to confirm the scales accuracy.

There are several methods of calibration that can be used in order to calibrate an electromechanical belt scale, below is an overview of the methods with a brief description of each, please contact us on www.mass.kg for further information.

TEST WEIGH SILO

This method relies on a test weigh silo that is on load cells the test weigh silo must be able to supply the scale with at least ten minutes of uninterrupted feed at, at least 100% of maximum federate. The feed should also be able to be set at 20%, 40%, 60%, 80% and 100% of maximum feed, this requires some sort of variable feeder in order to do this. The reason for this is to test the scale at more than one feed point, failing to do this makes the test completely unreliable.

Benefits

- High accuracy throughout the weighing range.

Drawbacks

- Completely reliant on the set-up, calibration and maintenance of the silo
- Huge initial expense in civils, and erection costs
- Requires space on site
- Expensive to maintain and calibrate system

BULK MATERIAL TEST

This is the industry standard when it comes to certifying the calibration of an electromechanical belt scale. If there is a certified weigh-bridge on site the product is simply weighed over the bridge and passed over the scale. A comparison is done and adjustments made. This process is done at least three times in order to confirm the test.

Benefits

- Highly accurate throughout the range
- Does not require additional costly equipment to be purchased
- Scale is tested against the site’s approved weighing device (weigh-bridge)

Drawbacks

- Nothing when compared to other methods.

DYNAMIC TEST CHAINS

This method, here a roller chain of exact weight is installed above the scale on an electrically operated drum. When calibration is required the chain is lowered onto a moving belt exerting an exact mass on the belt and the calibration is done.

Benefits

- Is very accurate and is used where high accuracy is required

Drawbacks

- Cost, this is fairly expensive although cheaper than a test weigh silo.
- The test is only done at one point in the range of the scale.
- Additional monthly costs as testing is required with static chains / weights to confirm linearity of scale.

STATIC TEST CHAINS

Where Chains of a known mass per meter are used to calibrate the scale with the belt standing.

Benefits

- Highly accurate as chains represent material loading better than weights
- Scale can be easily tested throughout the range by adding one chain at a time - Cost effective and does not interfere with production

Drawbacks

- Does not take the dynamics of a fully moving belt into account , needs to be verified with a bulk test.

STATIC TEST WEIGHTS

Where static mass pieces are used to calibrate the scale by means of placing them on the belt or scale frame.

Benefits

- Cost effective

Drawbacks

- Not very accurate as the mass pieces do not accurately represent product on the belt

BELT CUT MATERIAL TEST

Where a cut is taken of the material on the belt and compared to scale reading.

Benefits

- Cost effective

Drawbacks

- Time consuming
- Highly reliant on method and equipment used
- Not very accurate

ON BOARD TEST WEIGHT, RESISTOR CALIBRATION, THEORETICAL CALIBRATION

These methods are not recommended as there is no actual checking against a known value making them un-reliable.

RECOMMENDED CALIBRATION METHOD.

THE RECOMMENDED METHOD OF CALIBRATION IS MONTHLY STATIC TEST CHAINS THAT ARE VERIFIED WITH A BULK MATERIAL TEST INITIALLY AND THEREAFTER ONCE A YEAR.

6.1. INITIAL CALIBRATION

Initial calibration is done after the scale installation has been correctly performed and only after the conveyor belt has been run and checked for proper alignment to the carry rollers on the conveyor. Initial calibration consist of a mass and a speed calibration. The mass calibration is done on a static (stationary) belt, while the speed calibration is done on a moving belt.

6.2. SPEED CALIBRATION

Run the conveyor empty as this will give the highest speed output as the conveyor drive unit will not be under load. Measure the conveyor's speed using a distance wheel and stop watch or a digital tachometer. Either method is acceptable provided the accuracy of the equipment used can be verified. Leaving the conveyor running adjust the conveyor belt scale integrator to show the same speed as the speed which you have just measured. Different scale integrators have different methods of adjusting this, so you will have to utilize the Operation & Maintenance Manual for the type of scale integrator you have installed.

6.3. DYNAMIC ZERO CALIBRATION

With the conveyor belt running , ensure that there is no material flowing over the weigh area and that the belt tracking is in good order. Run the dynamic zero calibration function on the indicator for at least 3 revolutions of the total length of the conveyor belt. While the dynamic zero calibration is being performed the weigh area needs to be observed for any material that runs over the section, as any material present during the calibration will invalidate the calibration and will require repeating the calibration.

The dynamic zero calibration needs to be successfully performed twice in order to conclude this process.

6.4. STATIC SPAN CALIBRATION

Leaving the conveyor in exactly the same position as it was in when the static zero calibration was performed calculate the test-weight (Tw) mass required to do the static span calibration. The test-weight mass should be a least 70% of the scales maximum operational loading although the closer to 100% the better the confirmed accuracy will be.

With the implementation of Secondary and tertiary OEM Approved accuracy control measures such as Omniscience Science Digital's CTO Team, the required test weight (Tw)can be reduced to 50% of maximum operational loading.

The test-weight can be in the form of material (product) or static mass pieces which will be placed over the scale weigh-area* (Wa) during calibration. The test-weight mass must be able to be traced to an accurate and reliable source i.e. certified mass pieces or a certified check scale. The test-weight (Tw) value is calculated as such.

DESIGN THROUGHPUT t/hr = t/hr/60/60/m/sec

BELT SPEED m/ = Max kg/M = TW Value

The test-weight value above is 100% of the scale's maximum operation loading (Lm) if it is not practical for logistical purposes or if the scale is to be checked by means of a material bulk test after the initial calibration, then we can allow a test-weight (Tw) value of as low as 70% of the scales maximum operational loading (Lm).

Before commencing the static span calibration, check that the scale integrator is reading exactly zero loading, if not, you may have to perform the steps in point 4.3 above again or perform a Static Zero Calibration. If the scale is reading exactly zero, continue with the steps below.

The test-weight is taken and placed evenly over the scales weigh-area (Wa), in the case of static mass pieces it is preferable to place these between the idler sets and not directly above the carry rollers as this forms a more realistic loading of the belt, thus allowing belt tension to play a more realistic part in the calibration. Once the test-weight (Tw) has been evenly spaced over the weigh-area (Wa), adjust the scale integrator (indicated value "Ind") using the Operation & Maintenance Manual to read the same as the actual ("Act") or test-weight (Tw) mass.

Your scale has now been initially calibrated. A routine calibration or maintenance calibration must now be performed in order to confirm the scale's operational accuracy.

ROUTINE / MAINTENANCE CALIBRATION

The routine/maintenance calibration is performed after an initial calibration or minor repairs to the scale, Conveyor belt(to include changes in tension) or conveyor structure or for the purposes of verifying the scale's accuracy. A routine calibration consists of using the scales on board calibration functions to verify/check the scale's existing calibration and, if necessary, to make adjustments to the existing calibration. The routine calibration, like the initial calibration, covers both the speed and mass components of the scale on both the zero and span calibration points. Unlike the initial calibration, we do not adjust the scale without first evaluating the scale's existing calibration several times. The routine calibration consists of the following:

Reasons for a beltscale to require recalibration:

- Replacement of Idlers within the scale area,
- Changes in belt tension,
- Replacement of conveyor belt (Partially or completely),
- Changes in belt loading characteristics of more than 30%,
- Overloading events, where material load exceeded the design throughput by 100% or more,
- Impacts to either the scale or the supporting conveyor structure (such as walking on the belt or FEL hitting structure)

Routine Maintenance Procedure

Routine Maintenance start off with the checklist of the current condition the scale and its operational conditions, This checklist is visible on the OEM Calibration Certificate and is crucial to ensure that the beltscale is still within a good operating condition.

After completion of the inspections Speed calibrations (4.1 above), dynamic zero calibrations(4.2 Above) and span calibrations(4.4 Above) are all required in order to verify the accuracy of the scale.

7. MAINTENANCE

The maintenance schedules shown in this manual are for the first three months of operation of your conveyor belt scales. Due to the dynamics of the conveyor belt no two applications are the same and a plant specific maintenance schedule will have to be drawn up over time. The schedules attached are both necessary for the continued accuracy and the collection of data to compile a long term maintenance schedule.

Housekeeping

Daily cleaning of the scales is essential and must be carried out and monitored. Build up on the scale frame is added to the totalizer as if it was product on the conveyor. A record should be kept indicating how much spillage is cleaned off the scale every day. This will enable preventative measures to be taken regarding excessive spillage. 1 Kg of spillage on a scale installed on a belt running at 2 m/sec (meters per second) will accumulate in the region of 7,2 T/hr or 172 T/day of incorrect totalizer accumulation.

This problem is especially apparent in scales that are installed on conveyors within the lower flowrate range. 172 t/day on a belt that only conveys 50 t/hr is an error of + 14.33% which is a substantial error. For this reason it is essential to both record and clean the spillage on your scales at least once every day.

Zero calibration checks

Of all the calibration checks the zero calibration check is the most essential. Because of the way an electronic scale works a zero calibration check will indicate any “drift” in accuracy throughout the scales range.

For this reason it is essential that your scale be dynamically zero tested at least once a week for the first three months after installation. Thereafter the data collected during these weekly zero tests can be used to draw up a plant specific scale maintenance plan. Refer to the calibration section of this manual, page 24.

Span calibration checks

Span calibration checks must be performed at least once a month for the first three months of operation of a newly installed scale. Thereafter the data collected during these weekly zero tests can be used to draw up a plant specific scale maintenance plan.

Refer to the calibration section of this manual, page 24.

Loadcells

Load cells can be tested “in situ” by means of a linearity check. This check is only required on commissioning, during annual servicing or if a “drift” in accuracy has been detected during routine calibration checks.

Consult factory for technical support on this.

Electronics

The 920i electronics used on the Intelli-weigh scales do not require any routine maintenance other than maintaining a clean, dust-free environment for electronic cards. Failure of a card or a component will be shown on the units display indicating exactly what has failed. Cards can be easily replaced by removing two retaining screws and unplugging the faulty card and replacing it. This process only takes a few minutes and does not require recalibrating the scale.

Battery replacement

DO NOT DISCONNECT POWER WHEN DOING THIS.

The lithium backup battery that holds the scale set-points in memory needs to be replaced approximately every 5 years. When the low battery warning flashes on the 920i display remove the flat battery and replace it with a new one.

Communication and retransmission signals

The information displayed on the scale local display can be retransmitted to the plant control system or network. The Bus Networks and Ethernet comms do not require maintenance or calibration and simply transmits scale data in real number format to a PLL or SCADA/DCS.

The 4-20mA analogue retransmission and the totalizer pulse output do require routine inspections in order to see if they are working properly.

i. 4-20mA retransmission

The 4-20 mA card can be calibrated from the units setup menu and should be calibrated using a CALIBRATED digital multi-meter connected in series with the Cores going to the PLC, DCS or other remote device. Consult factory for procedure.

ii. Totalizer pulse output

This does not need calibration. Inspection consists of making sure the pulse width is set correctly according to the PLC input card scan time and making sure that the totalizer reading on the scale local display reads the same as the remote display over a set period of time. If there is a difference between the scale and the remote display the scan time on the PLC, DCS will either need to be adjusted or the pulse width of the digital output can be adjusted in the scale set-point menu.

See page 15 of this manual

Annual inspections

An annual inspection is required by Intelli-weigh field service technicians. This maintenance is critical to the continued accuracy, reliability and lifespan of the scale. The annual inspection must cover a physical measured inspection of the complete installation as indicated in the maintenance schedules of this manual.

Quarterly inspections

A routine maintenance inspection must be carried out every three months together with the quarterly span calibration checks. This quarterly inspection must cover a visual inspection according to the check sheet, which is available from our factory.

Wear items

MASS KG scales are designed to have a limited number of wear items. There are no bearings, knife edges, multi-stand cables etc. that need replacement. Only those wear items which are unavoidable have been used, these include:-

Rollers

The weigh class rollers fitted to the belt scales have a finite life span which is determined by the conditions under which they are made to operate. Rollers should be inspected visually every time a routine inspection is carried out on the scale. Things to look for are flat spots, bearing noise, vibration, and misalignment.

Note: No lubrication is required, all rollers have a "Sealed for life" bearing arrangement.

Load Cells

Load cells also have a finite life span, due to the continued bending of the cell body which is made of an alloy or steel metal fatigue will eventually occur. The rate at which it occurs depends on the duty cycle that the cell is exposed to. There is no recorded data on exactly how long a loadcell is expected to last. Load cells should be tested for linearity every time a span calibration check is performed. Recommended test intervals are once every three months.

Load Cell Mounting Arrangements

The rod end on the load cell mounting arrangement must be checked during annual inspections. If the rod end is not free moving, it must be replaced.

8. DECOMMISSIONING

The load cell on a conveyor belt scale are extremely sensitive to overload and impact loads, Here are also flexure plates and torsion rods that can easily be damaged.

Please contact the OEM to assist with any de-commissioning, removal or relocation of you belt scale to prevent, damage.

9. STORAGE INSTRUCTIONS

Storage of the equipment must me indoors in a cool, dry and dust free environment. Equipment must be stored in the original pallet and packaging it was shipped in by OEM factory

1. Equipment not stored as recommended by the OEM maty adverly affect the F&W under section 10 of the OEM Manual.
2. Rollers must be rotated 90 (Ninety Degrees) for every 20days of storage to protect the bearing.
3. Equipment must be inspected with photo report directly after
4. Above has been done

10. SAFETY INSTRUCTIONS

NOTE: Adhere to all site specific health, safety & environmental rules & protocols

Because the scale is installed within a conveyor the same safety procedures must be followed as are specified when working on a conveyor.

1. The conveyor must be locked out and a work permit taken before any work is done on the scale weighframe
2. or idler sets.
3. When dynamic calibration or inspections are done, a safe distance must be kept from the conveyor
4. at all Emes.
5. Communication with the control room must be established prior to work commencing.
6. Working alone on a conveyor should never be permitted. A colleague or assistant should always be
7. present in order to man the safety pull / trip wire and contact emergency services in case of accidental
8. contact with the moving conveyor.
9. Even if the trip / pull wire is activated the conveyor must be treated as live at all Emes.
10. Start up sirens can become faulty at any Eme and must not be relied upon to warn that the belt may
11. start.
12. The scale electronics is supplied by 110 / 220 V AC. Care must be taken when working inside the scale
13. electronics enclosure to prevent an electrical shock.
14. Again, it is imperative to work with a colleague or assistant who is trained to assist in case of accidental

15. electrical shocking.

NB: Consult site/plant supervisor and safety officer before commencing work.

10.1 Accuracy

Accuracy is guaranteed provided that:-

- The scale is installed in a stringer that meets the criteria for belt weighing as depicted by the American Scale Association.
- The scale is installed according to the procedures as shown in the Installation section of this manual.
- The routine maintenance procedures are followed as prescribed in the maintenance schedules shown in the Maintenance section, page 26 of this manual.
- Calibration data sheets are compiled and kept up to date as prescribed.
- Quarterly and annual inspections are performed by a properly qualified technician.