Conveyor Belt Tear Detector
BSD 6000

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Overview

Principle of Operation

The Scan Belt Tear Detector system detects a longitudinal conveyor belt rip by monitoring the edges of the conveyor belt via two striker arms that are in constant contact with the belt edges. In the event of a conveyor rip, a conveyor belt tends to either collapse or 'push out' along the length of the rip due to the troughing angle and inclination of the idler rollers. This results in a change of the of the conveyor belt width which is detected by the Belt Tear Controller. In addition, the linear alignment of the striker rollers could also provide belt training information.

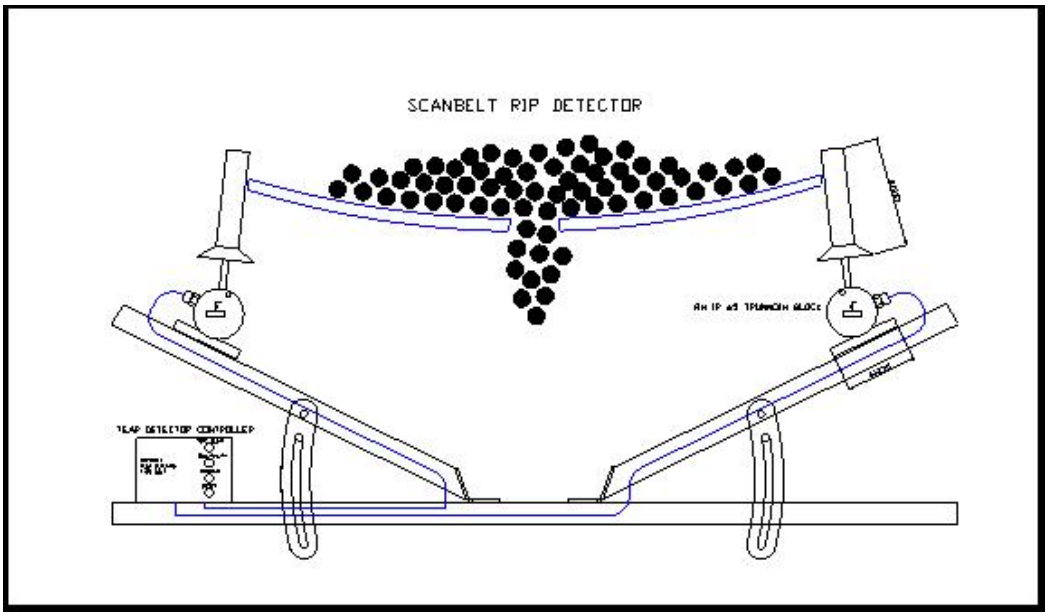
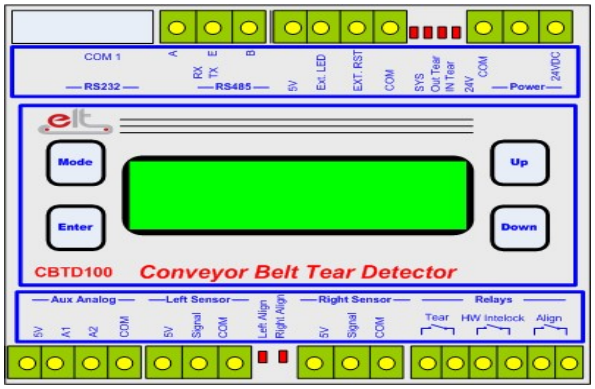


Figure 1 Belt Tear Detector Principle of operation

Features and Benefits

- Active Conveyor Belt Tear Detection
- Configurable Trip Delay
- Configurable Belt Tear Sensitivity
- Capable of operating in harsh environments
- Robust stainless steel construction



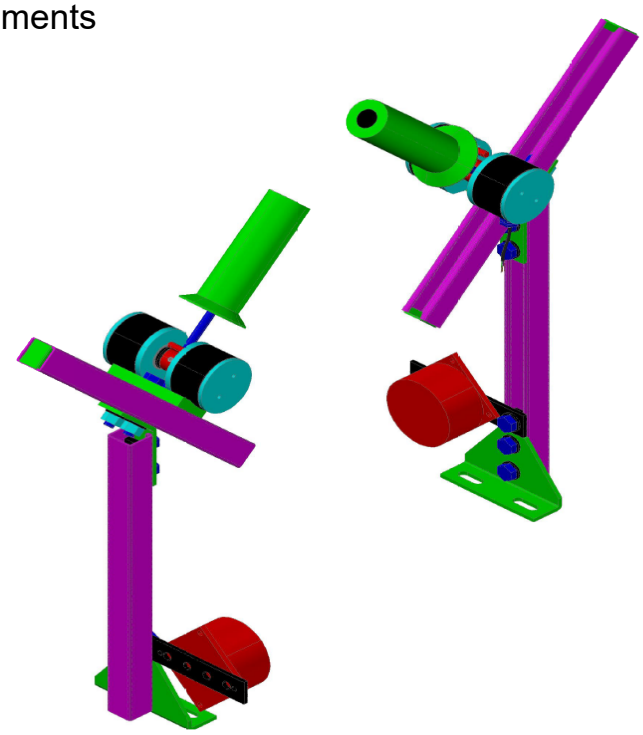


Figure 1. Conveyor Belt Tear Detector and Striker Roller Assembly

Hardware Specifications

- **Electrical**

Description	Specification
Power	
Supply Voltage	18-27 V DC
Supply Current	300mA
Mechanical	
Form Factor	Din Rail Mountable
Dimensions	105mm x 125mm x 60mm
Environmental	
Operating Temperature	0-60 Degrees Celsius
User Interface	
Keypad	4 Button Tactile Keypad
LED Indicators	System 24V Input Supply Inward Tear Outward Tear Left Alignment Right Alignment Modbus RTU Port Transmit Modbus RTU Port Receive External Fault LED
LCD	2 X16 Line Character
I/O	
Inputs	Left Roller Sensor
	Right Roller Sensor
	Auxiliary Analog Port
Outputs	Alignment Fault voltage Free Relay Contact Tear Fault Voltage free Relay Contact Hardwire Interlock Fault Voltage Free Contact

Application Ports	
Modbus RTU RS232 Port	Baud Rate: 9600 bps, 1 Stop Bit, 1 Start Bit, 8 Data Bits No Parity Bits
Modbus RTU RS485 Port	Baud Rate: 9600 bps, 1 Stop Bit, 1 Start Bit, 8 Data Bits No Parity Bits
Switching Devices	

Table 1 Hardware Specifications

- Mechanical

Description	Specification
Frame	Hot Steel Dip Galvanized
Trunion Block	Stainless Steel
Shafts	Stainless Steel
Bearings	Pre lubricated and sealed
Seals	Nitle
Rollers	**Polyurethane**
Bolts And Nuts	**Electro Galvanized**
Enclosures	**ABS/Poly Carbonate IP65 UV Inhibited**

Functional Specifications

Conveyor Belt Tear Detection

The CBTD100 monitors the *relative offset* of the conveyor belt from a pre-set position, configured *after* a conveyor belt has been correctly trained.

A reduction or expansion in the conveyor belt width as result of an *inward or outward* longitudinal tear will result in the detection of either an OUTWARD Tear or INWARD Tear fault if the resultant relative offset from the preset position is less than or greater than the configured sensitivity. Figure 1a illustrates the installation position after the belt has been trained. Distances D1 and D2 are the preset positions. Distances D1 and D2 should be equal if the conveyor belt together with the CBTD100 are correctly installed.
Figure 1b illustrates an inward tear while 1b illustrates an outward tear.

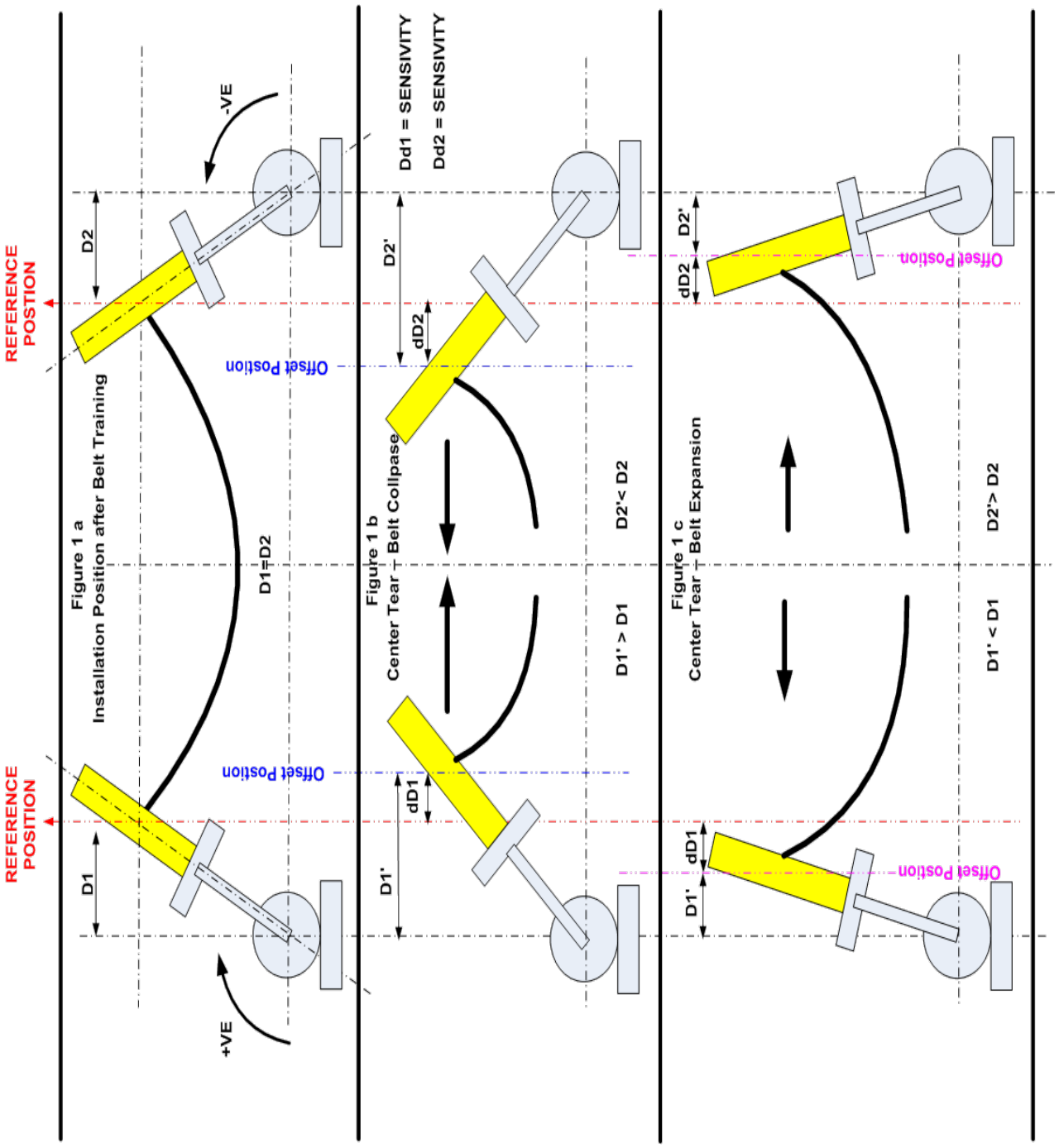

REFERENCE POSTION
D2
-VE
Offset Position
Figure 1 a
Installation Position after Belt Training
D1=D2
REFERENCE POSITION
D1
Offset Position
+VE
Dd1 = SENSIVITY
Dd2 = SENSIVITY
D2'
dD2
Offset Position
Figure 1 b
Center Tear - Belt Collpase
D2'< D2
D1' > D1
dD1
D1'
D2'
dD2
Offset Position
Figure 1 c
Center Tear - Belt Expansion
D2'> D2
D1' < D1
dD1
D1'
Offset Position

Figure 1 Illustration of Inward and outward tear situations
Referring to figure 1b, distance D1' > D1 by a distance of dD1 and while D2' < D2 by distance of dD2.

Distances dD1 = dD2, the *Belt Tear Sensitivity*, is configurable. As rule of thumb, the *Belt Sensitivity* should approximately 5% of the conveyor belt width. For a 1200mm wide belt, this translates to 60mm. A belt tear resulting in an offset of greater than 60mm (dD1=dD2=60mm) on both the rollers will result in belt tear fault.

Note that the conveyor belt is installed such that the center of the rollers line up with the edge of the conveyor belt. This alignment results in a 1 degree rotation for every 3.5mm lateral movement of the conveyor belt.

A 5% change in width of a 1200mm wide conveyor belt will result in a rotational angle of

Rotational Angle =1200 x 10/100 / 3.5mm= 15.5 Degrees

In the event of a fault, the instrument deactivates the Hardwire Interlock Relay and activates the relevant relay i.e. either the Tear Fault or Align Fault Relay.

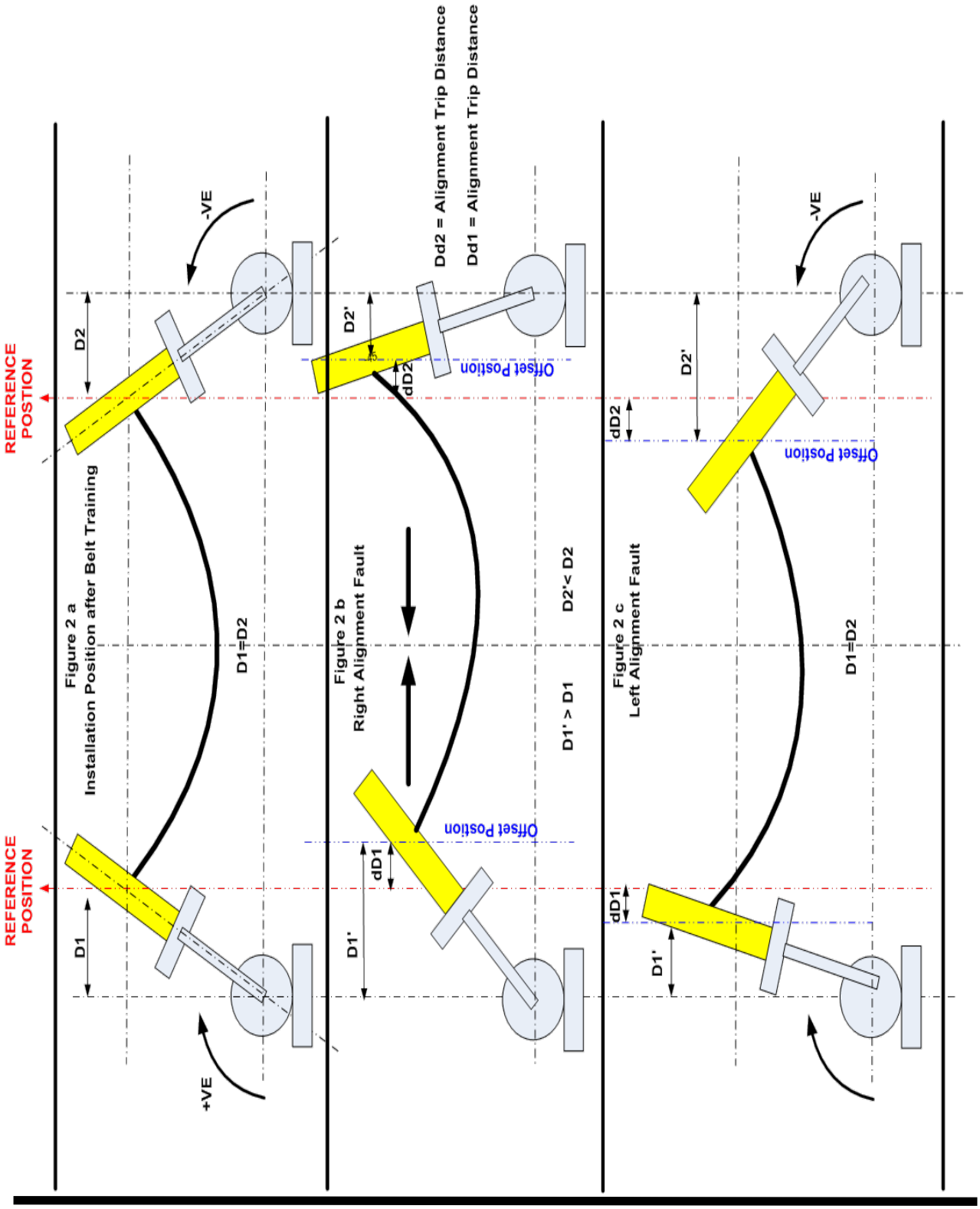
The fault is latched until a reset is pressed. This provides the operator and maintenance personnel with sufficient information to repair the problem.

Conveyor Alignment Detection

The CBTD100 monitors the *relative offset* of the conveyor belt from a pre-set position, configured *after* a conveyor belt has been correctly trained.

The instrument detects an alignment fault when both the roller arms relative offset positions exceed the pre-configured alignment trip position. The figure 2a illustrates the condition. Referring to figure 2b, a right alignment condition is detected when both the left and right roller offset positions dD1 and dD2 exceed the pre-configured *alignment trip setting.* The instrument allows the conveyor belt to 'drift' within the alignment trip setting. As mentioned above, a 3.5mm lateral movement results in a 1 degree rotational roller arm movement.

Figure 2 Left and Right Alignment Illustration


REFERENCE POSTION
REFERENCE POSITION
D2
D1
-VE
+VE
Figure 2 a
Installation Position after Belt Training
D1=D2
Figure 2 b
Right Alignment Fault
D2'
dD2
Offset Position
Dd2 = Alignment Trip Distance
Dd1 = Alignment Trip Distance
D2'< D2
D1' > D1
dD1
D1'
Figure 2 c
Left Alignment Fault

Wiring Diagram

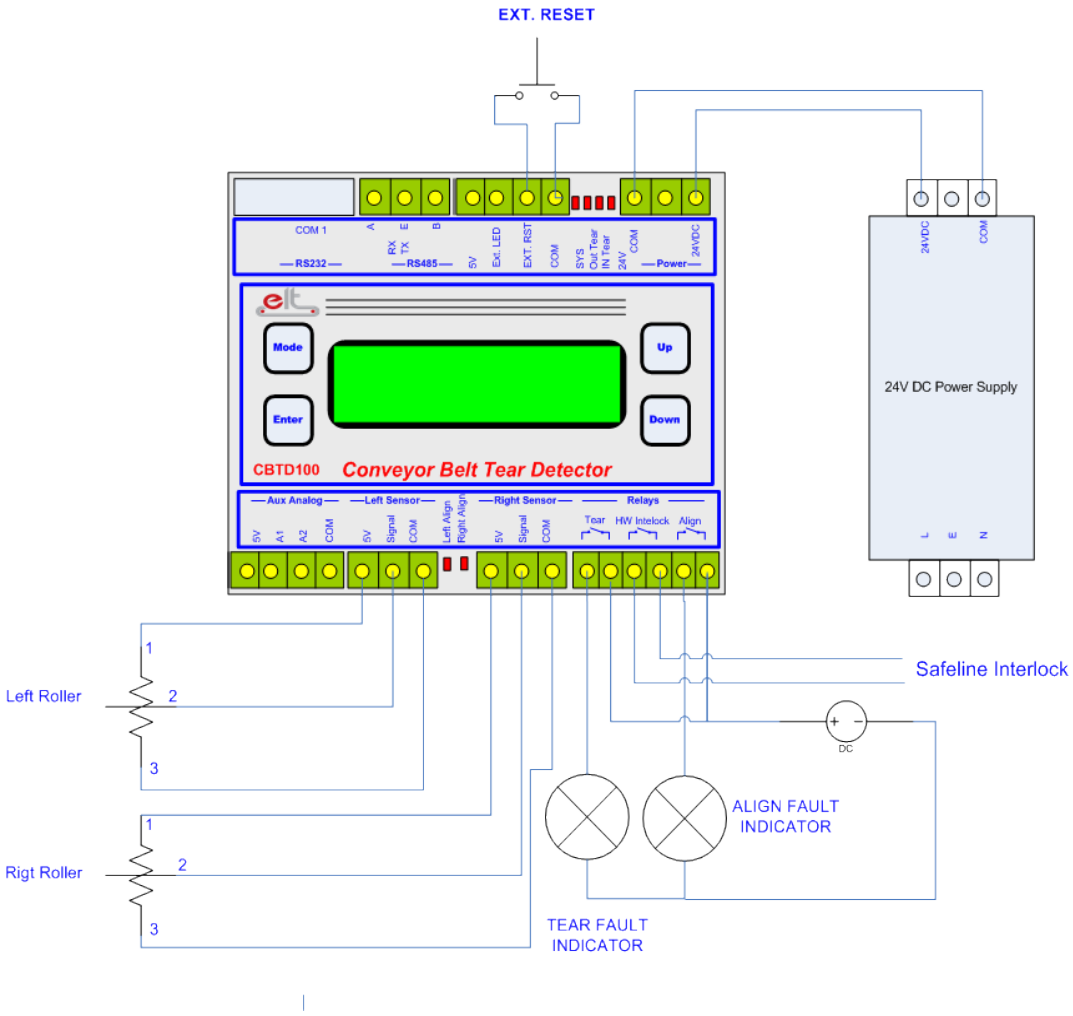


Figure 3. Typical connection diagram

Device Configuration

The following parameters allow the CBTD100 to be configured for a wide variety of applications.

Parameter No	Parameter	Description	Range
1	Belt Tear Trip Delay	Time delay before a trip condition	1-99 sec
2	Belt Tear Sensitivity	Sensitivity of the belt width change. This setting is a percentage of belt width. (50mm)	0-100mm
3	Align Warn Distance	Alignment Warning Distance in mm. This is relative to the installed position	1-100mm
4	Align Trip Distance	Alignment Trip Distance in mm. This is maximum drift allowed before a trip condition (100mm)	1-100mm
5	Align Trip Delay	Time delay before a trip condition. (10 sec)	1-100s

Table 2. Configurable Parameters

User Interface

The CBTD100 operates in either Running mode or Configuration Mode

Running Mode

In running mode, the LCD displays the following information

Relative Offset: This is relative offset of each striker roller relative to the reference position. The unit of measurement is mm.

Belt Status: This is the status of the conveyor belt. This can be OK, Align Fault, and Belt Tear Fault.

When a fault occurs, the instrument flashes the fault with a ‘Reset Clears Fault Message”

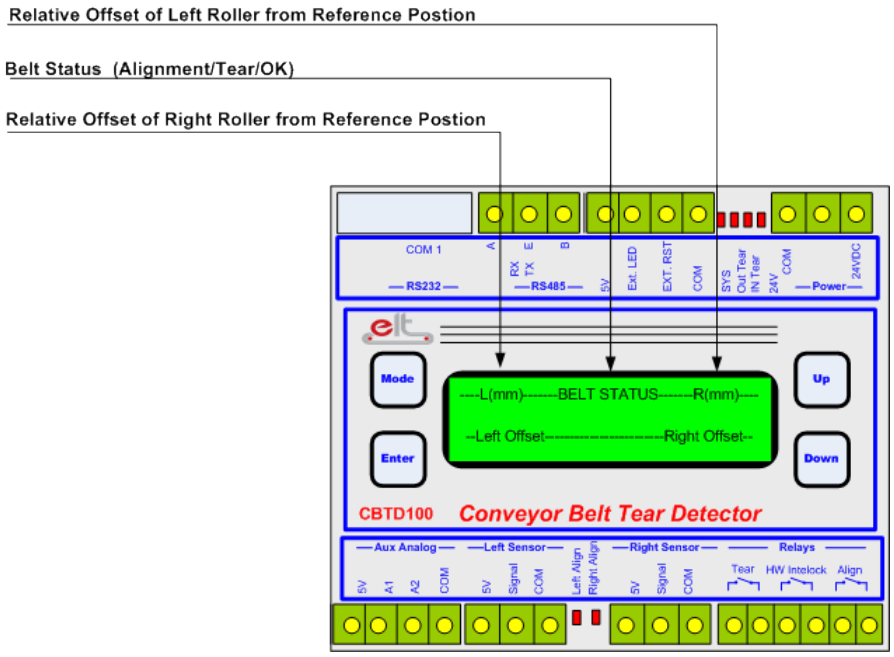


Figure 5. User Interface during Run Mod

Configuration Mode

Keypad Button definition

Multi Function Key. From Running Mode, a key press of more than 2 seconds allows access to the configuration mode.

In Configuration Mode, the key serves as a cancel button, returning the user to the previous menu. From the Main Menu, the user is returned to running mode

Allows user to modify parameter.

Allows user to modify parameter

Allows a modified parameter setting to be stored.

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Contact Information

Electrotron cc
3A Slegtkamp Street
Middelburg
1050
Tel: 0132462655
Fax: 0866896603
Email: sales@elt-za.co.za
Web : www.elt-za.co.za