

LINATEX®
Rubber Products

Wear Indicator Operations Manual

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Solutions



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1. INTRODUCTION

The Linatex® Wear Indicator system provides a complete solution to many of the traditional issues surrounding the maintenance of hose in highly abrasive environments. It provides 24 hour-a-day monitoring and peace of mind.

By installing the Linatex® Wear Indicator System you will avoid the need for physical inspections and costly emergency maintenance downtime. Unexpected hose failures that can cause environmental spills, and health and safety incidents, will be substantially reduced.

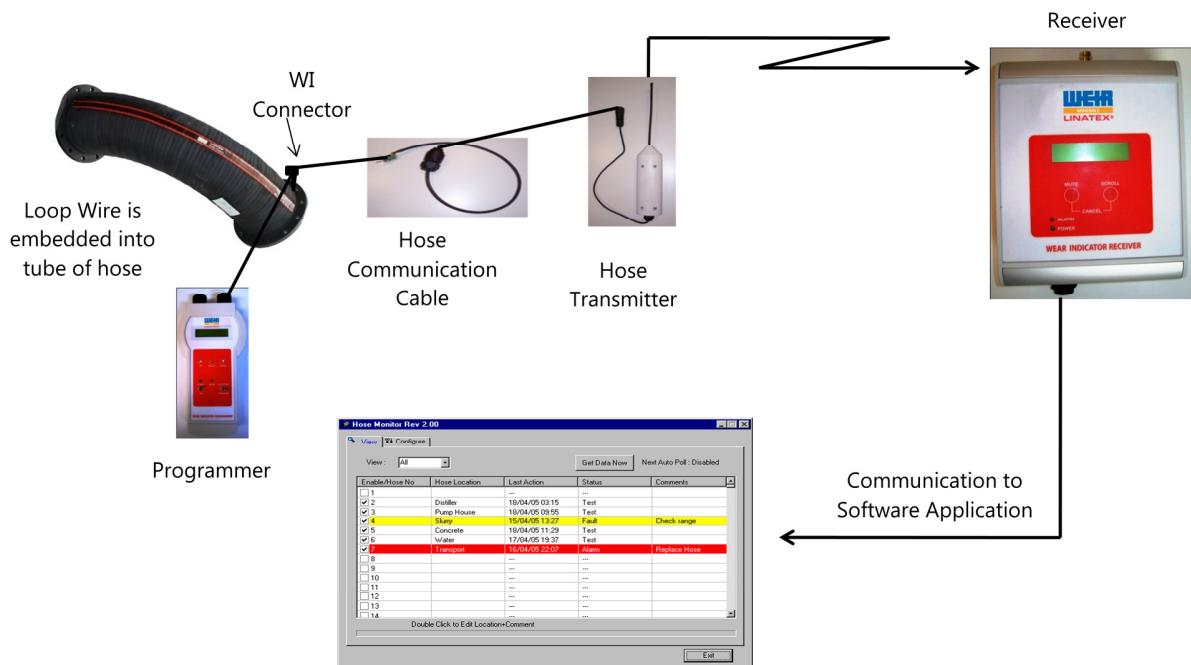
The Wear Indicator System is used to monitor the wear in industrial hoses and report when the wear exceeds a certain point in the hose wall. Unlike other wear indicator systems which only check for a break in the wire (continuity) to detect a go/no go hose failure point, the Linatex® Wear Indicator System senses a change in resistance as measured by ohms – this precision measurement provide for more accurate results. Therefore, the system can be used with conductive or non-conductive slurries.

A Hose Transmitter can be "paired" with each hose and report the hose condition daily. This data can be transmitted distances over 2 miles depending upon site conditions. Data collected by the receiver is transferred to a PC via a communication link to the Linatex® Wear Indicator System software program. This program displays identity, location and wear status of hoses, including alarms.

The Linatex® Wear Indicator System is a revolutionary early warning system for hose handling highly abrasive materials.

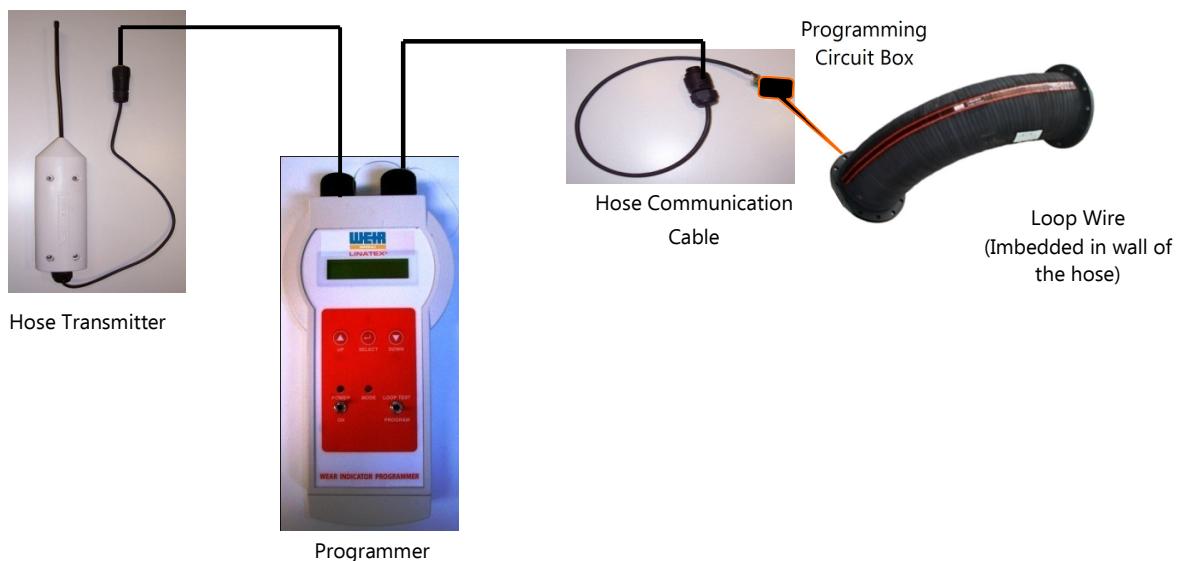
Warning: Any changes or modifications not expressly approved by Linatex® could void the user's authority to operate this equipment

2. PRODUCT-AT-GLANCE – LINATEX® WEAR INDICATOR SYSTEM



- Receive hose with Wear Indicator System installed
- Install Wear Indicator Software
- Program Hose ID
- Set Transmitter Address (1-998) and match with Hose ID
- Send Test Signal to Receiver
- Receiver communicates with software

3. PROGRAMMER



The Programmer has several functions including:

- Reads the Hose Transmitter address, check ID match and measure battery voltage
- Sets the Hose Transmitter address (001 to 998)
- Match the Hose Transmitter to the Hose ID
- Check the hose loop wire and Hose Termination
- Perform a test transmission
- Make the Hose Transmitter send a message every 1 minute

For all new hose installations, you will need to use a Programmer to:

- Test the condition of the hose's wear indicator circuit [\(7.3\)](#)
- Test the status of the Hose Transmitter [\(7.4\)](#)
- Set the address of the Hose Transmitter [\(7.5\)](#)
- Match the hose ID to the Hose Transmitter [\(7.6\)](#)
- Send one or more test signals from the Hose Transmitter to the receiver [\(7.7 and 7.8\)](#)

For the full operations guidelines for the Wear Indicator Software Application, refer to [Appendix A – Installing a Wear Indicator System with Transmitter](#)

4. HOSE TRANSMITTER

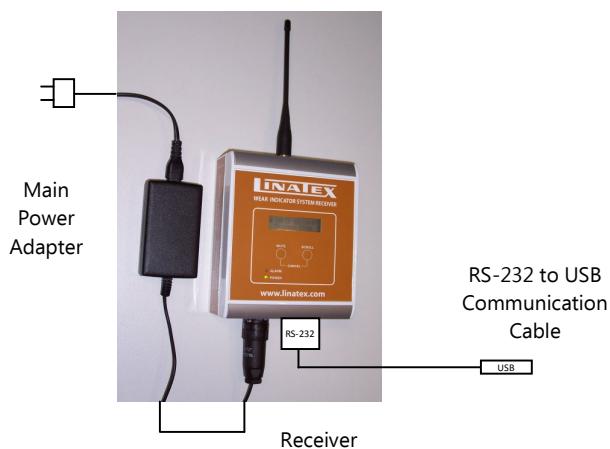


The Hose Transmitter is designed to monitor the state of a loop wire embedded into the wall of a hose. The Hose Transmitter will send a message daily, reporting the status of the loop wire. If the loop wire is compromised, it will transmit an alarm message.

The Hose Transmitter is used to identify location of a hose, therefore it is given the location number. Since the Hose Transmitter is "paired" with the Hose ID that is programmed into the hose, it will not operate unless connected to that particular hose.

Frequency of Operation:	900 MHz						
Battery test performed:	50mS after Hose Transmitter is powered up (battery under load)						
Voltage thresholds:	<table border="0"> <tr> <td>Battery OK</td><td>BattV \geq 5.3V</td></tr> <tr> <td>Battery Low</td><td>4.7V \leq BattV $<$ 5.3V</td></tr> <tr> <td>Battery Flat</td><td>BattV $<$ 4.7V</td></tr> </table>	Battery OK	BattV \geq 5.3V	Battery Low	4.7V \leq BattV $<$ 5.3V	Battery Flat	BattV $<$ 4.7V
Battery OK	BattV \geq 5.3V						
Battery Low	4.7V \leq BattV $<$ 5.3V						
Battery Flat	BattV $<$ 4.7V						
Operation:	<p>Normally asleep (current consumption is 2.1uA)</p> <p>Wakes up every 2.1 seconds for 840uS to measure loop wire (awake current consumption is 1.8mA)</p>						
Transmission Format:	<p>2400 baud, 8 bits, no parity, 1 stop bit</p> <p>Each transmission consists of 5 consecutive identical messages</p> <p>Each message is 9 bytes (36mS) separated by a 30mS gap</p> <p>Total transmission of 330mS</p>						
First Transmission:	24 seconds after power up						
Normal Transmission:	Once every 24 hours with 2 minute randomization						
Alarm Condition:	3 consecutive loop wire alarms detected over 5 seconds causes an alarm. The alarm condition will be transmitted 6 times daily, once every 10 minutes with 16 second randomization.						
Loop Wire:	<p>Will detect a loop wire series resistance $>$ 250 ohms as an alarm</p> <p>Will also detect a loop wire parallel resistance $<$ 680K, so it can be used to detect conductive slurries in the hoses</p> <p>Hose ID, Loop Wires and Hose Termination are all embedded in the hose wall.</p>						
Loop Wire ID:	Made up of a unique 48 bit ID and an 8 bit CRC						
Address Range:	001 to 999						
Default Address:	999 (factory programmed)						
Communication Mode:	Times out after 30 minutes						
Test Transmission:	Either a single test transmission OR once every minute for 30 minutes (Initiated by the Programmer)						
Battery Life:	Approximately 2 Years						
Power On:	Power is applied to the Hose Transmitter, when it is plugged into the hose.						

5. RECEIVER



The Receiver acquires radio frequency (RF) messages from up to 999 Hose Transmitters and stores each hose status in memory. This information is available for transfer when the Receiver is accessed via the communication link by the Wear Indicator software program.

LCD:	16 character x 2 line
Hose Data Displayed:	Hose Number (001 to 999) Time + Date Battery (Empty < 4.7V) (Low >= 4.7V and < 5.3V) (Full >= 5.3V)
	Hose state "Nrm" – Normal (daily message) "Alm" – Alarm (loop broken) "Tst" – Test (initiated by programmer) "Cfg" – Configuration Error (ID doesn't match)
Communication:	2400 baud, 8 bits, no parity, 1 stop bit.
Alarm LED:	Indicates a hose alarm is present
Relay:	Operates when a hose alarm is present
Sounder:	Beeps when a hose alarm is present, stops beeping when "Mute" button is pressed.
Buttons :	"Mute" – display present time and stops the sounder beeping "Scroll" – display present state of each hose "Clear" – "Mute" and "Scroll" pressed together, clears all data in memory

FCC – Federal Communication Commission:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter (identify the device by certification number, or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

6. WEAR INDICATOR SOFTWARE APPLICATION

The Wear Indicator Software Application is provided as an installable program on a CD. This software program allows users to monitor hoses remotely when using the Hose Transmitter.

Users will be able to view hose data, assign locations and Hose IDs, and add special text for each hose being monitored. The software also lets the user set the time interval the Wear Indicator application automatically polls the Receiver.

For the full operations guidelines for the Wear Indicator Software Application, refer to [Appendix B – Wear Indicator Software Application/Operation](#)

7.0 APPENDIX A - INSTALLING A WEAR INDICATOR SYSTEM WITH TRANSMITTER

7.1 WHAT YOU NEED

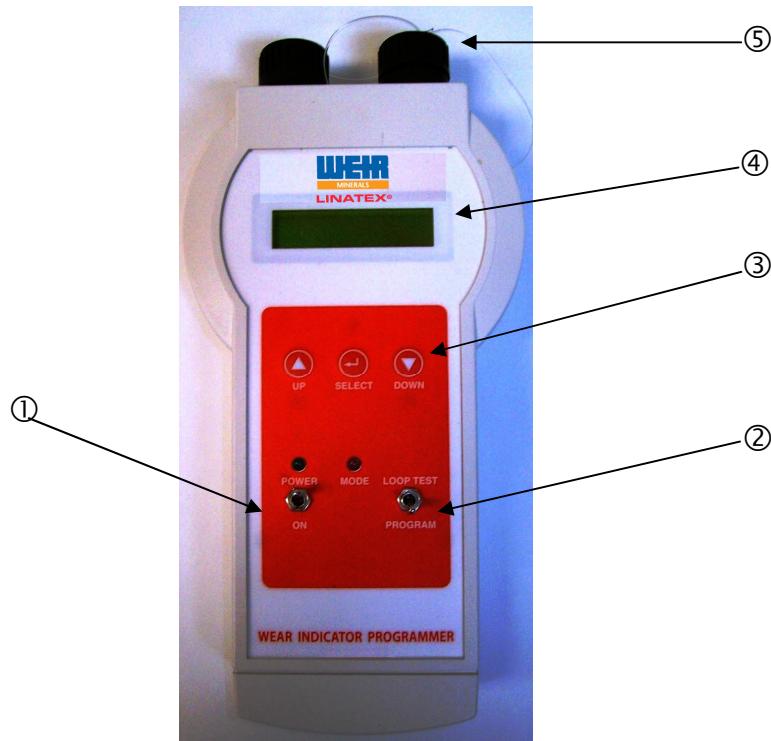
- A transmitter
- A wear indicator programmer
- At least one extension cable (2 or 5 meters)
- An operating wear indicator receiver within range of the transmitter's signal
- One unused, unique address available on the receiver

7.2 BEFORE CONNECTING A TRANSMITTER TO A HOSE

Before connecting a transmitter to a wear indicator hose, you will need to use a programmer to:

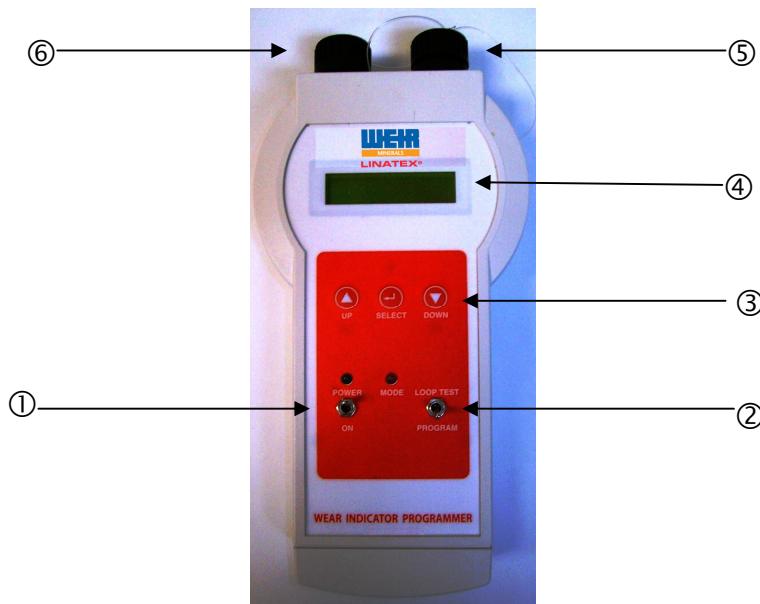
- Test the condition of the hose's wear indicator circuit [\(7.3\)](#)
- Test the status of the transmitter [\(7.4\)](#)
- Set the address of the transmitter [\(7.5\)](#)
- Match the hose security ID to the transmitter [\(7.6\)](#)
- Send one or more test signals from the transmitter to the receiver [\(7.7 and 7.8\)](#)

7.3 TESTING THE CONDITION OF THE HOSE'S WEAR INDICATOR CIRCUIT



1. **Set the power switch ① on the programmer to the ON position (switch pointing down).** The green power LED light above the switch should on. If it does not, the programmer battery may need to be pushed in to its holder or replaced before proceeding further.
2. **Set switch ② to the LOOP TEST position (switch pointing up).**
3. **Wait until the display ④ shows **Plug in HoseLoop**** 
4. If the programmer is not already connected to the hose, **plug the connector at one end of the extension cable in to socket ⑤ at the top right of the programmer.** Plug the cable's other connector in to the socket on the wear indicator hose.
5. **Press SELECT button ③ and wait for display ④ to show one of the following responses:**
 - **Loop Wire: OK** – which means the hose circuit is satisfactory
 - **Loop Wire: Alarm** – which means the hose circuit has a fault, such as an open circuit or a short circuit due to a worn hose lining 
6. If desired, step 5 may be repeated one or more times.
7. Proceed to 7.4.

7.4 TESTING THE STATUS OF THE TRANSMITTER

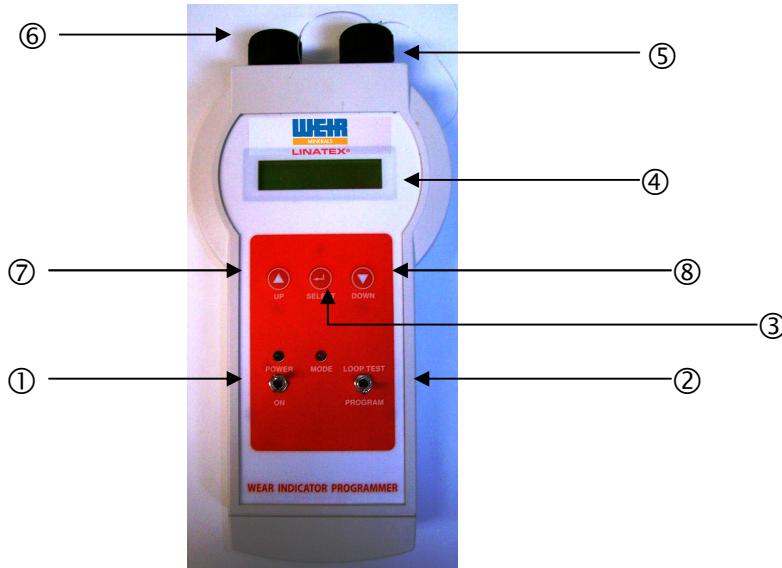


1. **Power switch ① in the ON position, set switch ② to the PROGRAM position** (switch pointing down).
2. **Wait until the display ④ shows **Plug in T'mitter**:** 
3. If the transmitter is not already connected to the programmer, **plug the connector on the end of transmitter's cable in to socket ⑥ at the top left of the programmer.**
4. Press the **SELECT button ③** and wait for **display ④ to show **Tx:123 6.6V ID:✓**** 
Where:
 - **Tx:123** Shows the transmitter's current programmed address from 001 to 999 (Tx:123 is example of hose 123 location)
 - **6.6V** Shows the DC battery voltage, typically about 6.5 to 6.7 V for a new transmitter
 - **ID:✓** The transmitter is matched to the hose identification (**ID:x** shows it is not matched).

NOTE: If the following message is displayed instead, turn the power switch off and then on and repeat steps 2 to 4. 

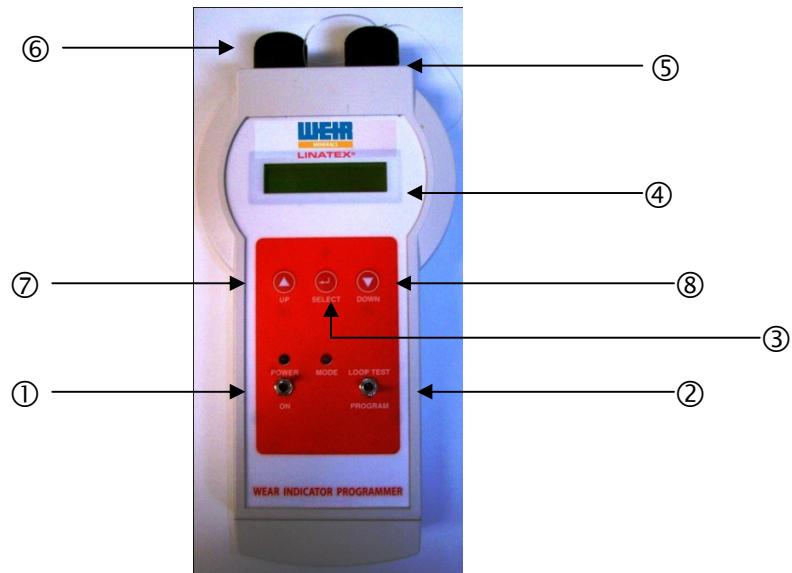
5. If desired, the **SELECT button ③** may be pressed again to repeat step 4 one or more times.
6. Proceed to [7.5.](#)

7.5 CHANGING THE TRANSMITTER'S ADDRESS



1. **Power switch ① in the ON position, switch ② in the PROGRAM position, and the transmitter cable connected ⑥, use the UP ⑦ or DOWN ⑧ buttons to scroll the second line of display, item ④ to show 2. New Addr ↗↓**
2. **Press the SELECT button ③ and wait for the second line of display ④ to show 2. New Addr: 123 with the first digit (1) flashing:**
3. To set the transmitter address number, **use the UP ⑦ or DOWN ⑧ buttons** to increase or decrease the flashing first digit to the desired number (0 to 9).
4. Press the **SELECT button ③** to make this number the first digit of the new address.
5. **Use the UP ⑦ or DOWN ⑧ buttons** to increase or decrease the now flashing second digit (2) to the desired number (0 to 9).
6. Press the **SELECT button ③** to make this number the second digit of the new address.
7. **Use the UP ⑦ or DOWN ⑧ buttons** to increase or decrease the now flashing third digit (3) to the desired number (0 to 9).
8. **Press the SELECT ③ button** to complete the new address, and return the second line of the display to 2. New Addr ↗↓.
9. Proceed to 7.6.

7.6 MATCHING THE TRANSMITTER TO THE HOSE ID



1. Power switch ① in the ON position, switch ② in the PROGRAM position, and the transmitter cable connected ⑥, use the UP ⑦ or DOWN ⑧ buttons to scroll the second line of display to show **3. Match ID ↕↑↓**

Tx:123 6.5V ID:x
3. Match ID ↕↑↓

2. Press the **SELECT** button ③ and wait for the **first line of display** ④ to **briefly** show

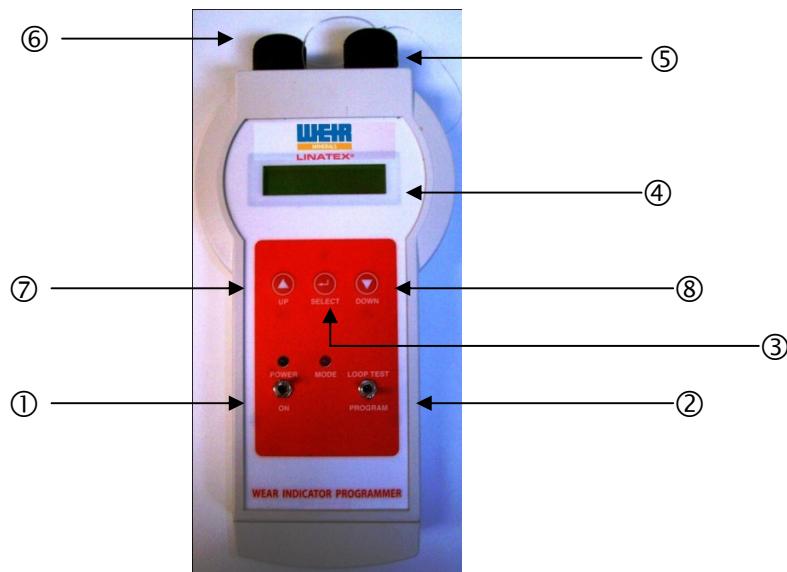
ID Match Done
3. Match ID ↕↑↓

before returning to show **Tx:123 6.5V ID:✓** **Tx:123 6.5V ID:x**
3. Match ID ↕↑↓

ID:x changes to **ID:✓** This signals that the transmitter is matched to the hose identification (ID)

3. Proceed to 7.7 or 7.8.

7.7 SENDING A SINGLE TEST TRANSMISSION TO THE RECEIVER

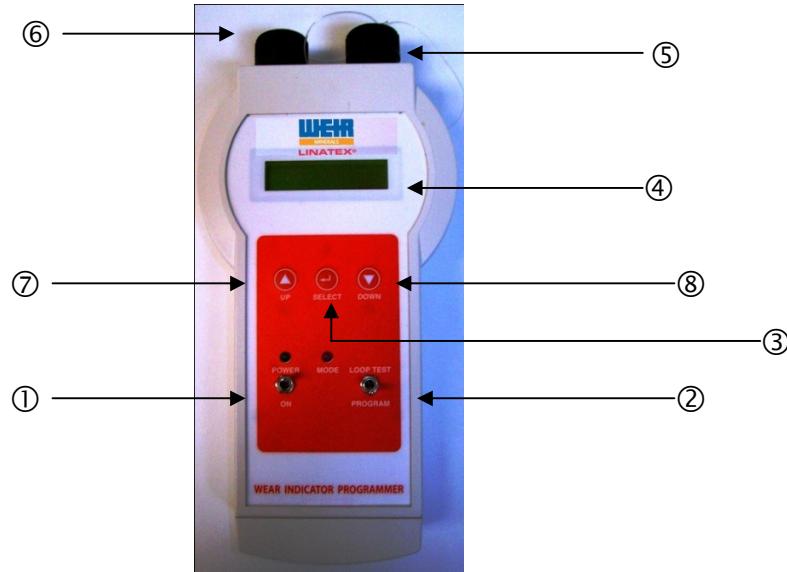


1. **Power switch ① in the ON position, switch ② in the PROGRAM position, and the transmitter cable connected ⑥, use the UP ⑦ or DOWN ⑧ buttons to scroll the second line of display to show **4. Test Tx ↴↑↓****

TX123 6.7V ID:✓
4. Test Tx ↴↑↓
2. Press the **SELECT button ③ and first line of display ④ to briefly show Test Tx Sent** before returning to show **Tx:123 6.7V ID:✓** (or similar).

Test Tx Sent
4. Test Tx ↴↑↓
3. If desired, repeat step 2 one or more times.

7.8 SENDING AN AUTOMATIC REPEATED TEST TRANSMISSION TO THE RECEIVER



1. **Power switch ① in the ON position, switch ② in the PROGRAM position, and the transmitter cable connected ⑥, use the UP ⑦ or DOWN ⑧ buttons to scroll the second line of display to show 5. Tx 1 Min ↕↑↓.**
2. Press the **SELECT button ③** and **first line of display ④** to **briefly** show **1 Min Test Sent** before returning to show **Tx:123 6.5V ID:✓** (or similar). If the transmitter is then left in this mode, it will continue sending a test transmission every minute for the next half hour.
3. If desired, press the **SELECT button ③** to repeat 4.
4. To stop the test transmissions, either select another programmer mode or turn the **power switch ① to the off position** (switch pointing down).

7.9 CHECKING THE TRANSMITTER'S TEST TRANSMISSION AT THE RECEIVER



1. When a test transmission is sent from the transmitter using the programmer (1.7 or 1.8), an operating receiver within range of the transmitter's signal will show the test transmission on the second line of its display ① as **Tst 001/001 T999:**

A photograph of a digital display showing the text 'Tst 001/001 T999'. The text is in a green font on a black background. The 'Tst' part is in a larger font, followed by '001/001' and 'T999' in a smaller font.

where

Tst shows it is a test transmission
001 is the transmission number
/001 is the total number of transmissions stored in the receiver
T999 shows the address of the transmitter that sent the test transmission (999 in this example)

8.1 HARDWARE REQUIREMENTS

The Wear Indicator Application is provided as an installable program on a CD. It is recommended that the software be installed on a Pentium PC running Windows '95, '98, 2000, ME, Vista or XP.

8.2 HARDWARE CONNECTION

The standard connection is an RS-232 / USB cable. A DB-9 port is located at the bottom of the Receiver. Cable is connected to a spare USB communication port on selected PC.

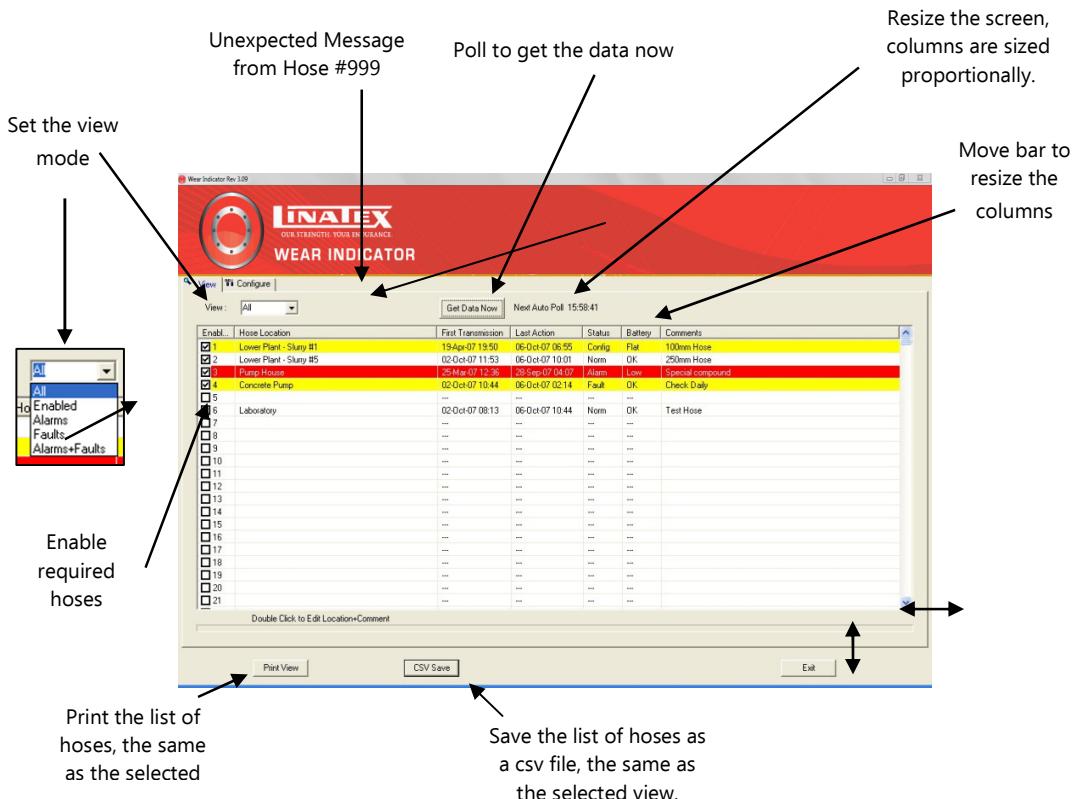
An optional Bluetooth Wireless connection option is available.

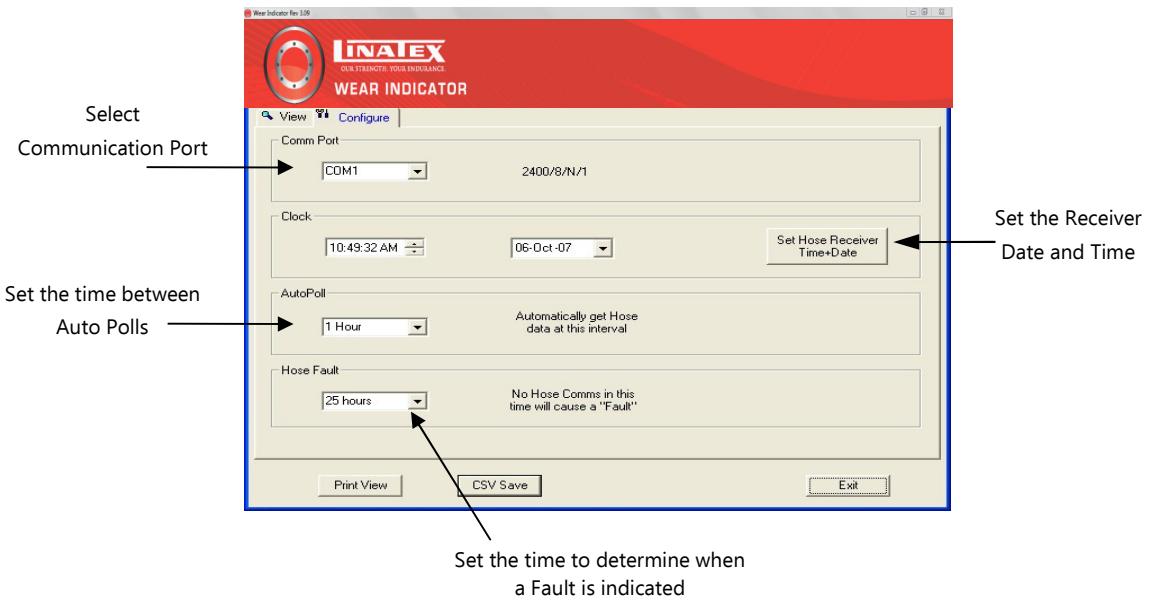
8.3 SOFTWARE INSTALLATION INSTRUCTIONS

- Insert the Wear Indicator Application disk in the CD drive
- The Install program should auto start. Follow the on screen instructions.

The application will be installed in c:\ProgramFiles\WearIndicator

8.4 SCREEN ARRANGEMENT





8.5 OPERATION

8.5.1 Selecting the Communication Port

From the drop list, select the communication port that you have connected to the Receiver.

8.5.2 Setting the Date and Time

Select the current date and time in the "clock" window, and press the "Set Receiver Time+Date" button.

8.5.3 Auto Polling

Sets the time interval the Wear Indicator application automatically polls the Receiver. This is the same as pressing the "Get Data Now" button.

8.5.4 Hose Fault Time

If there is no response from an enabled Hose (either a test signal or an alarm) in a predefined time then the Hose is deemed to be "Faulty". If a signal comes in from that hose at a later time, then the faulty status is cleared. Hoses transmit a test signal daily – however, there may occasionally be a clash in signal and it won't get through. Therefore the operator can choose to determine a hose is faulty if no signal is received after 1 day, 2 days, 3 days etc. The application checks for faults once every minute.

8.5.5 Retrieving Hose Data

Press the "Get Data Now" button and the stored data in the Receiver will be retrieved and displayed.

At this point you will have a copy of the data in the Receiver and a copy of the data in the Wear Indicator list.

You will be prompted "Do you want to clear all alarms from the Receiver?" If you answer "YES" then all messages saved in the Receiver communications alarm area will be erased.

If you answer "NO", the communications alarm area will remain unchanged.

8.5.6 View

The Hose data displayed can be changed to display All hoses, Enabled Hoses, Faulty Hoses, Alarmed Hoses or Alarm+Faulty Hoses. Alarms are displayed in Red, Faults are displayed in Yellow, and Test signals are displayed on a white background.

8.5.7 Enabling a Hose

Simply click on the check box to enable or disable a Hose from being monitored for fault. Note that any Hose Test or Alarm is displayed, whether it is enabled or not.

8.5.8 Changing Description and Comments

Simply double click on the hose line to edit the description and or comments.

8.5.9 Deleting Status

The status that appears in the Wear Indicator application list can be selectively deleted. (This is required if a Hose goes into alarm, and the status needs to be cleared.) Simply select a single Hose by clicking on it – or select random hoses by pressing the "Ctrl" button while clicking on several hoses – or select a range of hoses by clicking on the first hose, then press the "Shift" button and then click on the last hose. After the required hoses are selected, press the "Del" key. If the "deleted" hose is disabled, then the date/time and the status will be cleared. If the "deleted" hose is enabled then the status will be cleared, but the present date/time is saved. This prevents a fault appearing until the Fault time has expired.

8.6 FILE FORMAT

The data in the Wear Indicator application list is saved in two files named "HoseDescription.csv" and "HoseStatus.csv" which are in CSV format (Comma Separated Variables) – files are located in c:\ProgramFiles\WearIndicator.

If the files are to be manipulated and then further used by the Wear Indicator Application, it is recommended that a program such as "Notepad" is used.

If however the data is to be used for reporting purposes, Excel can open the files directly. Note : If manipulating the data using Excel, and the data needs to be saved, it is recommended to save the file with a different name using "File-Save As".

8.7 PRINT VIEW BUTTON

First select the "View" as All, Enabled, Alarms, Faults, Alarms+Faults and then pressing the "Print View" button will print the data in the presently selected View format.

8.8 DATA COLUMN WIDTH

The data column widths can be sized by clicking on the header separator and dragging the column to the required width. If the screen is resized, the columns are automatically resized proportionally to the selected widths. If the application is stopped and restarted, the column widths are reset to the pre-selected widths.

8.9 CSV SAVE BUTTON

First select the "View" as All, Enabled, Alarms, Faults, Alarms+Faults and then pressing the "CSV Save" button will save the data in the presently selected View format, to a CSV format file.

8.10 WEAR CSV FILE

At midnight every day a single line is added to the csv file "Wear.csv" which lists the time of the hose transmission and the hose status. This file builds up a history of each hose.

Date	1	2	3	4	5.....	999
25-Mar-07	17:50 O	22:07 O	12:36 A	--:--	--:--	--:--
26-Mar-07	17:49 O	22:06 O	--:--	--:--	--:--	--:--
27-Mar-07	17:51 O	22:08 O	--:--	--:--	--:--	--:--
28-Mar-07	17:53 O	22:07 F	--:--	--:--	--:--	--:--

This file lists all 999 hoses horizontally, whether they are presently enabled or not.

The data in this csv file may need to be extracted using a custom application, as Excel will only read a maximum of 255 columns! (It may be viewed by opening it in Notepad)

8.11 SPECIAL ADDRESS – HOSE #999

Hose address #999 is reserved as the default address programmed into Hose Transmitters when they are shipped from the factory. If a message is received from a Hose with this address, it means the hose has not been programmed. In this special case, a flashing message will appear between the "View" selection and the "Get Data Now" button. This Hose Transmitter should be sought out and reprogrammed with an address in the range 001-998. (Simply delete the status of Hose #999 to remove the flashing message)

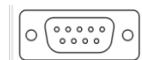
8.12 HOSE STATUS

The Hose status may be:

Normal		(white)
Alarm	(broken loop wire)	(red)
Fault	(no communication)	(yellow)
Config	(ID doesn't match)	(yellow)
Test	(initiated manually)	(white)

9.0 GLOSSARY

Alarm	An “alarm” is when the hose wire is broken. An alarm takes priority and cannot be overwritten with a good or test signal.
Fault	A “fault” is when a hose doesn’t send a signal. A fault can be cleared when a good or test signal is received.
Hose ID	Unique identification given by to hose with Wear Indicator system installed. Number is assigned to Hose Transmitter and paired to Hose. Addresses should be selected after user verifies open ID locations on Wear Indicator software program.
Hose Transmitter	<p>The Hose Transmitter is designed to monitor the state of a loop wire embedded into the wall of a hose.</p> <ul style="list-style-type: none">• The Hose Transmitter will send a message daily, reporting the status of the loop wire.• If the loop wire is compromised, it will transmit an alarm message.• Each Hose Transmitter is “paired” with the Hose ID that is programmed into the hose, and will not operate unless connected to that particular hose
Programmer	<p>The Programmer has several functions including:</p> <ul style="list-style-type: none">• Reads the Hose Transmitter address, check ID match and measure battery voltage• Sets the Hose Transmitter address (001 to 998)• Match the Hose Transmitter to the Hose ID• Check the hose loop wire and Hose Termination• Perform a test transmission• Make the Hose Transmitter send a message every 1 minute
Receiver	The Receiver acquires radio frequency (RF) messages from up to 999 Hose Transmitters and stores each hose status in memory. This information is available for transfer when the Receiver is accessed via the communication link by the Wear Indicator software program.
RS-232	Recommended Standard 232; serial communication requiring a port for connecting to peripheral devices. A DB-9 port is used on Receiver.



10.0 TROUBLESHOOTING / HELPFUL HINTS

TRANSMITTER ADDRESS Review the Wear Indicator Software program **first** to identify available address locations. The Hose Transmitter is used to identify the location of a hose, therefore it is given the location number. Since the Hose Transmitter is "paired" with the Hose ID that is programmed into the hose, it will not operate unless connected to that particular hose.

FAULT Note that the hoses only send a signal once a day – and the signals are sent at a random time interval – and it is a one way transmission – so it is possible for 2 hoses to send a transmission at exactly the same time, which means the signal won't get through, because of the clash. If the PC program is set to flag an alarm if a signal hasn't been received in 25 hours, it may appear that the hose is faulty, but the signals may have clashed – so it may be better to set the fault time to 47 hours (no "good" or "test" signal in 2 days)

"Faults" should be monitored, and if they persist for days, then action should be taken (such as checking the Hose Transmitter at the location of the fault) **Faults will automatically clear** when the problem is fixed.

ALARM When an "alarm" occurs it means there is a real problem, and human intervention is required – the hose wire is broken, and the Hose Transmitter has reported the problem. So if the hose wire is broken, it means the hose is worn and should be investigated and replaced. Once the investigation of the hose is done, the **alarm must be manually cleared** from the system – so that monitoring of that location can continue.

11.0 INFORMATION TO THE USER (FCC PART 15.105)

NOTE: ---CLASS A DEVICES

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

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Notice: The information in this document is subject to change without notice. Changes, technical inaccuracies, and typographical errors will be corrected in subsequent editions. Graphics are for reference only.