Serial Broken Filament Detector
BFD–SI-PC
User Information &
System Description

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Getting Started

When you receive the BFD-SI-PC unpack the unit and check all items are present and there is no physical damage. The package should contain the following items.

- 1 x BFD-SI unit
- 1 x Power Lead
- 1 x BFD sensor with fixing screws
- 1 x Serial data lead for connection to the p.c. communications port
- 1 x USB/RS232 Converter Kit
- 1 x CD Containing Data Recording Software, Test Program and Instruction Manuals
- 1 x Hardware Manual
- 1 x Software Manual

System Setup

Single Position Broken Filament Detector
Data Recording Software with Filament Distribution Graph

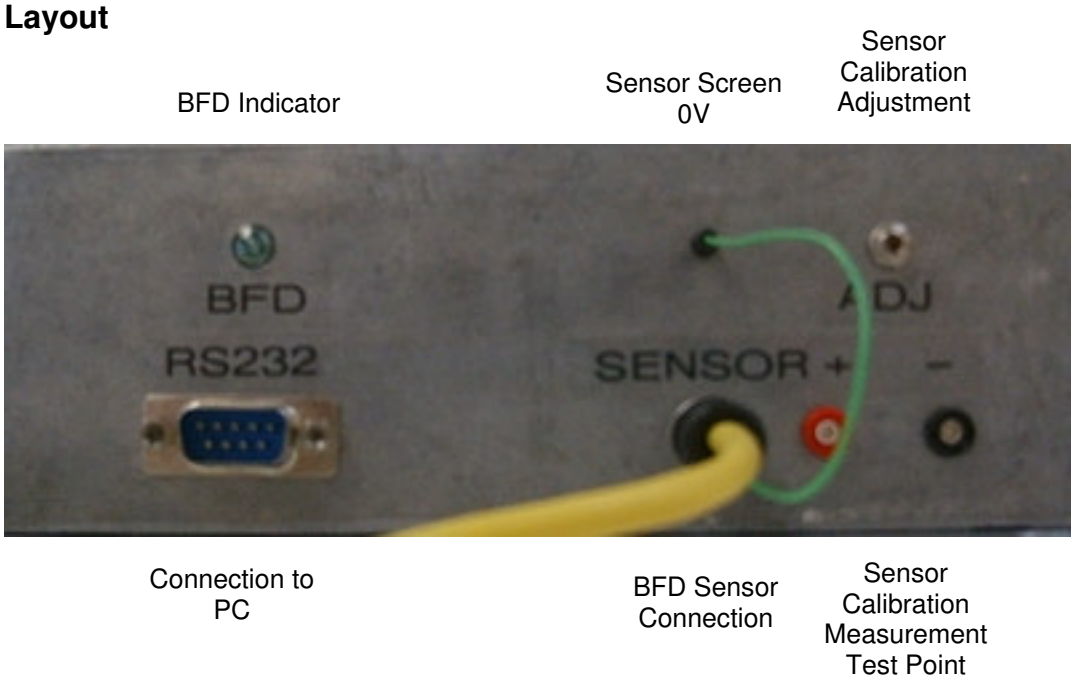
Power Requirements
Input Voltage • 85-264 VAC (120-370 VDC)
Input Frequency • 47-63 Hz

Connect the sensor to the unit, as shown below. For best immunity to electrical 'Noise' it is recommended the sensor is insulated from the machine body, f the sensor body is not insulated from the machine it is mounted on please do not connect the green sensor screen 0V. For advice on sensor mounting please see example section in this manual.

Connect the Data Lead to the RS232 D Type Plug, ensuring the end labeled BFD is connected to the BFD-SI Unit and the other end connected to the PC comm port. If the PC does not have a standard 9 Pin D Type port connector install the supplied USB/RS232 Converter on the PC and make connection to that.

Now install the Data Recording Software, please refer to software instruction manual for installation and operating instructions. After installing the software plug in the mains lead and turn on the BFD-SI Unit, and then open the data recording program.

Layout



The green led fitted to the unit performs two main functions.

1. Unit self test at power up. When unit is switched on the led will flash five times. When the five flashes have been performed the led will extinguish.

2. Filament detection Every time a filament passes through the sensor the led will flash, the LED will also flash when a CAL command is issued from the Test Program Utility, when the sensor passes the calibration test. The LED will not flash if the calibration test fails.

Serial Data Commands to the BFD – SI

The CD provided contains a Visual Basic test program to provide full control of the unit. There are three serial commands that can be transmitted to the BFD-SI unit. The commands from the p.c. are identified by a "P" in the data string and the returned information or telegrams from the BFD-SI are identified by an "M" in the string.

1) Reset Internal Filament Count Command

The p.c. sends the command: - chr$(2)(P0A/R/01)chr$(13)chr$(10)

The BFD-SI replies with :- chr$(2)(M0F/RES/03)chr$(13)chr$(10)

Once the returned string is received this confirms that reset has occurred.

2) Return the Filament Count Command

The p.c. sends the command :- chr$(2)(P0A/C/01)chr$(13)chr$(10)

The BFD-SI replies with :- chr$(2)(M10/XXXX/04)chr$(13)chr$(10)

Where XXXX is the filament count, max 9999 counts

3) Calibrate or Self Test Command

The p.c. sends the command :- chr$(2)(P0F/TST/03)chr$(13)chr$(10)

The BFD-SI replies with one of the following commands :-

a) If the sensor is not seriously contaminated and all circuits are functioning correctly.

chr$(2)(M12/CALOKY/06)chr$(13)chr$(10)

b) If the sensor is contaminated and is not able to function or has been disconnected or damaged or there is a fault within the electronics.

chr$(2)(M12/CALBAD/06)chr$(13)chr$(10)

Please Note

If there is an error the BFD-SI replies with: - chr$(2)(M0E/ERROR/05)chr$(13)chr$(10)

A full description of the operation and setup of the BFD-SI unit is given on the following pages of this manual.

The Broken Filament Signal

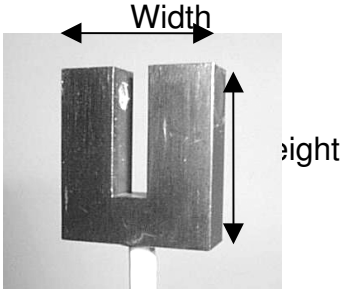
When a broken filament passes through the sensor head and breaks the infra red detecting beam, a signal is generated in the receiver. This signal is then sent to the BFD-SI unit and is amplified. The amplified signal is then sent to another amplifier. The signal is amplified once more and then sent to the output circuit. The second amplifier has a threshold voltage on its input; the reason for this is for noise immunity. It is known, from tests, that the smallest broken filament will generate a 100mV signal, at the output of the first amplifier so we can safely say that any signal below the threshold voltage, is not a broken filament.

The Calibration Function

The BFD-SI unit has a function that checks the performance of the sensor. This is done by electronically simulating a broken filament. When the calibration input is given to the unit, an output (a sensor must be plugged in) is generated if the sensor is working correctly. The simulation generates a signal in the head by dipping the infra red emitter current, by a pre-set value. This value was again determined by the tests during development. The dipping of the emitter current is exactly what happens when a broken filament passes through the sensor infra red beam. This signal is then processed through the amplifier and output circuits in the exact same way as if it were a filament.

BFD Sensor Head

Part Number: BFD-A-FCL-DH (Standard lead length 3 Metres. Standard Gap 6mm)
Description: Broken Filament Detector Sensor Head c/w Fixed Lead



BFD Sensor Head

Specifications:

Sensing Method:	Optical (InfraRed)
Cable:	Fixed 3 Metre 4 core fitted with M8 4 pole Connector to connect to BFD-SI Control Unit.
Dimensions:	Standard Sensor Width 27mm Depth 9.5mm Height 30mm
Material:	Aluminium

BFD Sensor Head Maintenance

The BFD sensor head will require cleaning from time to time due to contamination from spin finish etc. The BFD-SI unit will return the failed command to the p.c. when given the self-test command. The test points on the BFD units are useful points to monitor condition of the sensor head regarding contamination. When the sensor head becomes contaminated the BFD-SI unit automatic gain control circuit adjusts the sensor head beam current so that the sensor is working at its maximum sensitivity. To determine how contaminated the sensor heads are, monitor the test points using a voltmeter. A clean uncontaminated sensor head will give a voltage of 0.75v to 0.85 volts at its test point, if the head is contaminated then this voltage will be higher, due to the BFD-SI unit adjusting the sensor head beam current so that it is still functioning at maximum sensitivity. The more contaminated the sensor head is, the larger the voltage at the test point will be. The maximum voltage that the test point can reach is approximately 2.5V, if the test point is at this voltage then the unit will return the 'failed command' when the self-test command is given.
In order to reduce the voltage back to between 0.75 and 0.85 the head **MUST** be cleaned, in doing this the BFD-SI units automatic gain control circuit will adjust the sensor head so that it is still operating at maximum sensitivity.

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There is no need to adjust the test point voltage by altering the transmitter beam current adjustment potentiometer; this adjustment facility is only to be used when a new clean head is used to enable calibration of the head to the BFD-SI unit.

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Cleaning the BFD Sensor Head

The suggested method of cleaning the sensor head is to use compressed air. Using cleaning fluids will not ensure that the head is clean as some cleaning fluids can leave a residue. If after cleaning with compressed air the sensor test point voltage remains high ensure that the small hole on the receiver side of the sensor is not blocked. To clean the hole use a small piece of wire and insert it into the hole in order to remove the contamination.

BFD-SI Calibration Procedure

Required Equipment

Oscilloscope c/w Probe
Digital Volt Meter (DVM) Set to 2V Scale if not Auto-Ranging type
Terminal Screw Driver

Getting Ready

Connect the sensor head to be calibrated to the BFD-SI Unit. Connect 5V D.C to the power-input connector of the BFD-SI unit and connect to a PC using the Data Communications Lead.
Note: Allow one or two minutes for the sensor heads to adjust to their existing set points, after initial power-up.

Test Point Voltage Setting (Transmitter Beam Current)

Connect the +ve lead of the DVM to the red test point connector on the BFD-SI Unit and the -ve lead to the black test point connector. The Test Point voltage adjustment Preset is located next to the test point connectors on the BFD-SI Unit. Check the reading on the DVM, if it is reading between 0.75 and 0.85 Volts then no adjustment is required. If adjustment is required use a terminal screwdriver to alter the Preset. To reduce the voltage, turn the Preset anti-clockwise and clockwise to increase.

Note: If the sensor head being calibrated has been used previously ensure that it is clean. If unsure about how clean the sensor head is, turn the Preset fully anti-clockwise and check the voltage reading. If the minimum Test Point Voltage is 0.5V or more the sensor head is dirty and requires cleaning (cleaning details can be found in the manual) or it is faulty.

Note: If you are using a BFD-SI Unit that has been previously calibrated to a sensor head then the Calibration Pulse may not require any alteration. All that may be required is confirmation that the amplitude is 90mV ! 5%.

Calibration Pulse Amplitude Measuring and Setting

Refer to the image (Fig 1.1 on page 9) to locate the test point **(TPC1)** for the calibration amplitude measurement. Connect the ground termination of the oscilloscope probe to 0V. Connect the Probe to Pin 1 of the CA3240E operational amplifier and ensure that the oscilloscope is set as follows:

Voltage Setting: a.c.
Voltage Amplitude: 20mV per Division
Oscilloscope Trace at the top of the screen (looking for a negative going pulse)
Time: Slowest setting of the oscilloscope

With everything connect and set as detailed above send the calibration command from the p.c. the result seen on the oscilloscope trace should be a negative going pulse. The pulse width will be extremely narrow and will not be measurable with these settings of the oscilloscope, and does not need to be measured. The amplitude of the pulse should be 90mV ! 5%. Send the calibration command a number of times to verify the pulse amplitude.

If this amplitude is higher or lower than specified then it must be altered. The Preset that alters this amplitude is shown on the image (Fig 1.1 on page 8). By turning the Preset anti-clockwise the pulse amplitude will increase and clockwise adjustment will decrease the amplitude. When adjusting the amplitude, only a small amount of rotation of the Preset is required and before taking another reading from the oscilloscope, a few seconds should be allowed between adjustment and sending the calibration command. This is to allow the sensor head to settle back to its set point voltage.

Note: If an adjustment is done to the Calibration Pulse Height (amplitude) the Test Point Voltage MUST be re-checked and adjusted if required.

Preset Adjustment Location

Preset 1	Threshold Setting	Factory Set for 50mV(Electrical Noise Rejection Level)
Preset 2	Analogue Switch	Factory Set for 10uS (Does not require further adjustment)
Preset 3	Calibration Pulse	Factory Set for 90mV
Preset 4	BFD Output	Factory Set for 3mS or Fixed with no adjustment

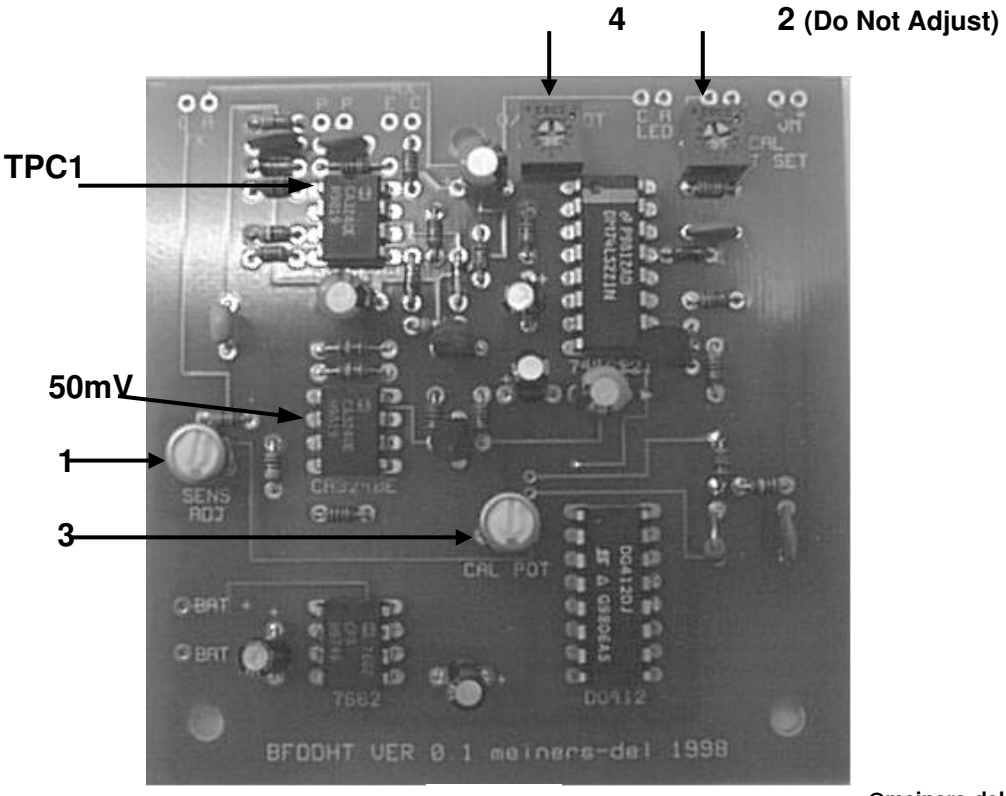
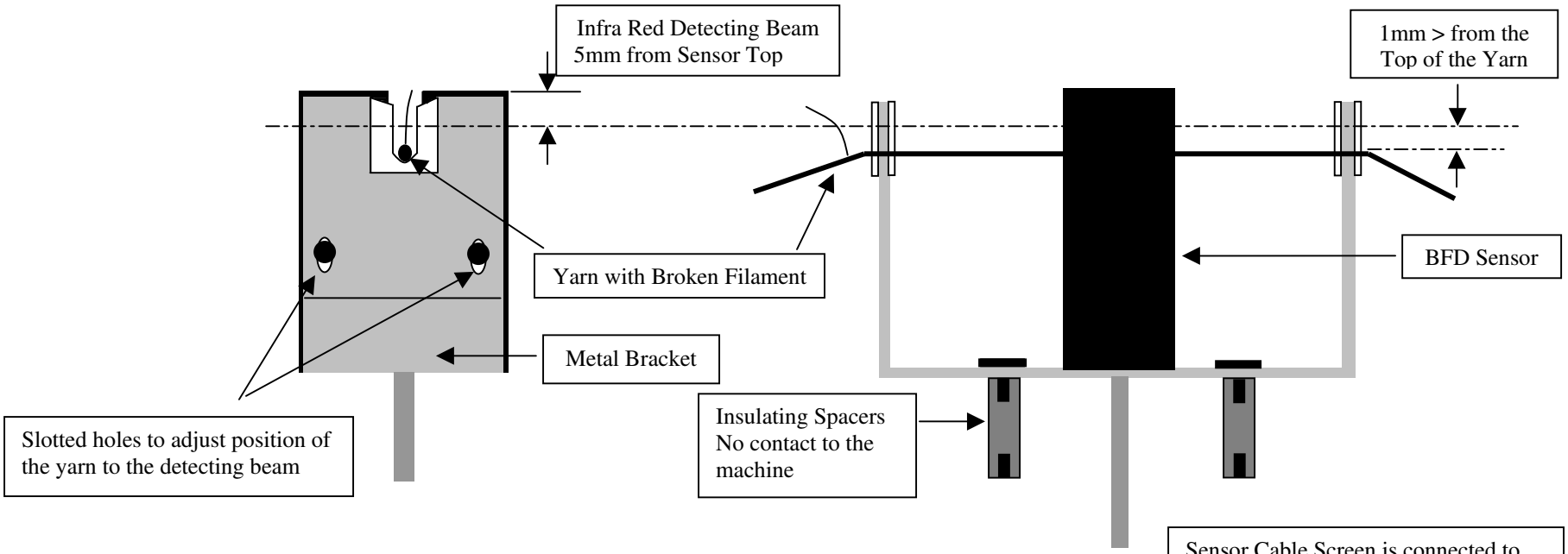


Fig 1.1

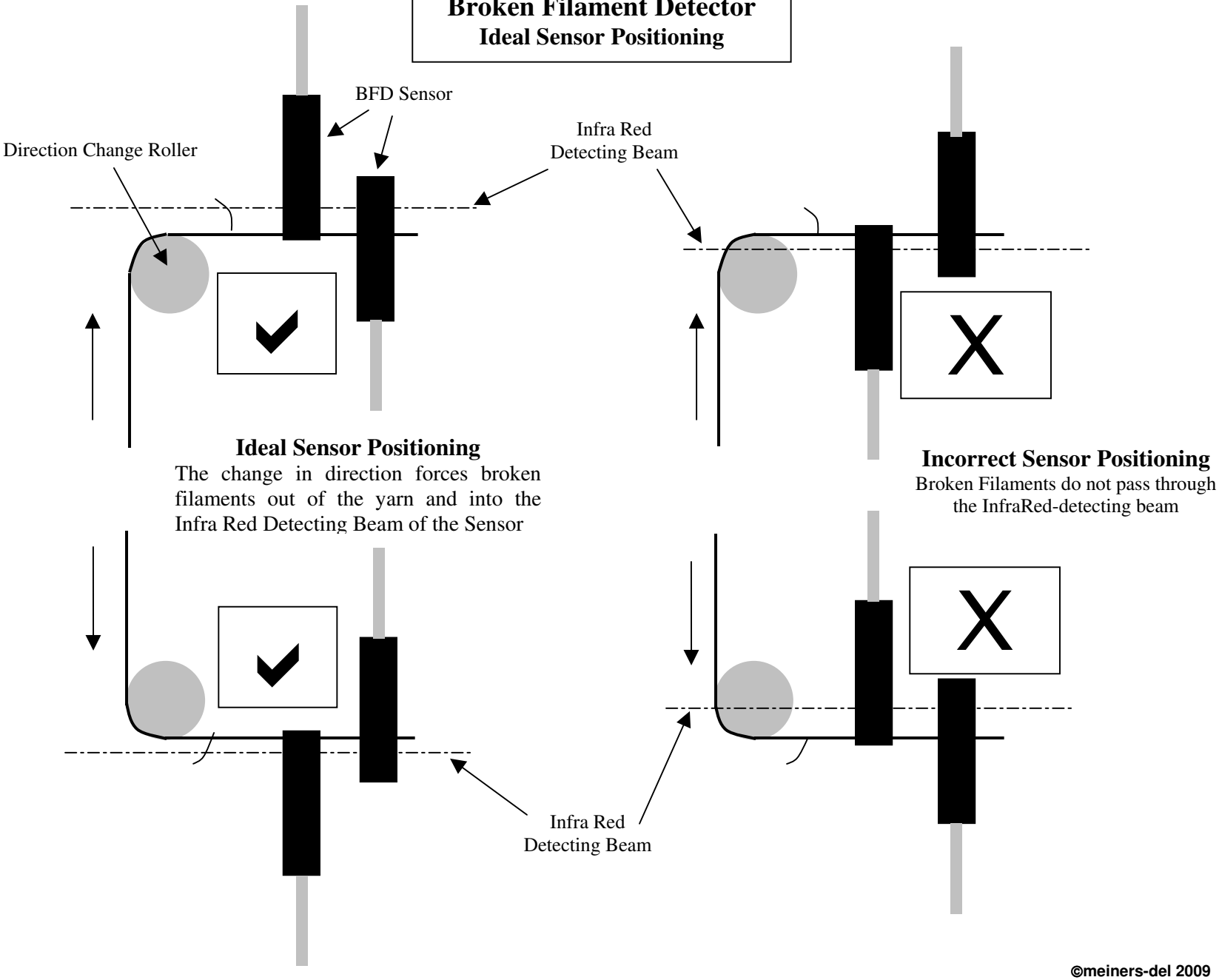
Broken Filament Detector

Example of mounting the Sensor on single bracket with yarn guides



Important Note:
The bigger the Yarn Denier the lower the yarn guide should be. This is to keep a suitable distance between the top of the yarn and the detecting beam of the Sensor.

Broken Filament Detector
Ideal Sensor Positioning



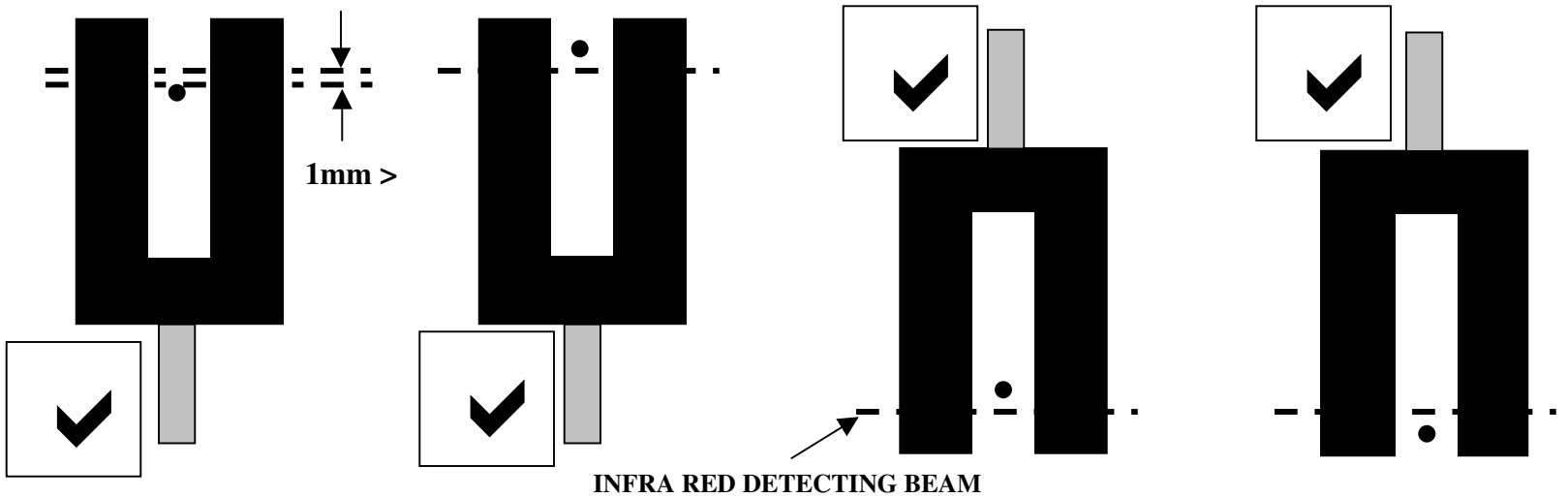
Ideal Sensor Positioning

The change in direction forces broken filaments out of the yarn and into the Infra Red Detecting Beam of the Sensor

Incorrect Sensor Positioning

Broken Filaments do not pass through the InfraRed-detecting beam

POSITION OF THE BFD SENSOR TO THE YARN TOP MUST NOT BE CLOSER THAN 1mm FROM THE INFRA RED DETECTING BEAM



POSITIONING THE YARN CLOSE, OR IN THE INFRA RED DETECTING BEAM WILL RESULT IN FALSE COUNTS.