Safeline Tablex / Tablex-Pharmx

Power Supply Module

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OPERATING AND
INSTRUCTION MANUAL
MODEL: TABLEX - PHARMX

Supplied by:

SAFELINE LTD
MONTFORD ST, SALFORD, ENGLAND
Tel: 44 (0)161 848 8636
Fax: 44 (0)161 888 2292

This detector must only be used for the express purposes as advertised by Safeline and as referred to in this and other Safeline approved literature.

Aims of this manual.

This manual is intended to help those customers who need to:

1) Install the detector
2) Commission the detector subsequent to replacement or installation.
3) Operate the detector on a day to day basis.
4) Change some of the product dependent and installation dependent parameters.
5) Communicate with the detector using serial communications.
6) Arrange a maintenance schedule using the printer option.

This manual is NOT intended as either-

1) A Service Manual, (although some fundamental diagnosis is included in this manual).
2) A Workshop Manual - No detailed technical analysis, either mechanical, electrical or electronic is contained in this manual.
3) Commercial information - for example sales literature or publicity information.

Safeline technical publications are designed to be backwardly compatible with all previous versions of detectors in the family. This means that the later issues of manuals will be fully compatible with older equipment, however the older equipment may not have all of the features of later manuals.

NOTE.

An upgrade service is available from Safeline, at a fee, that will upgrade older detectors to the latest specification, where possible. Please contact your supplier's technical departments for information on this service. Remember to have your serial number ready when making the call.

Published in England

Amendments

Safeline have a policy of updating manuals to include new features, correct erratum, or incorporate customers requests. The Amendment Record below is provided for the express purpose of the customer, or supplier, to record any amendments that may have been included in this document.

For further information or to order copies of this document contact Safeline Ltd. at the address shown on the title page of this document, quoting the reference number given on the title page.

If the document was purchased directly from Safeline, or the supplier is unavailable at the supplier address given, then contact Safeline directly via the address given on the title page of this document.

If the owner of the manual has any comments or suggestions as to the form, content or presentation of this manual then they should write their suggestions and send them to the Technical Department at the Safeline address given on the title page.

Amendment Record

If you receive an update for this manual then:

1. Attach the update sheet(s) to the rear of the manual.

2. In the row whose 'Amendment' number matches that of the received amendment:-

   a) Print your name in the 'Incorporated By' box.

   b) Print the 'Date' box with the date you updated the manual.

AMENDMENT	INCORPORATED BY	DATE
1. Issue 1	Safeline	May 2000
2. Issue 2	Safeline	Sept 2000
3. Issue 3	Safeline	November 2000
4. Issue 4	Safeline	July 2002
5. Issue 5	Safeline	December 2002
6. Issue 6	Safeline	March 2003
7. Issue 7	Safeline	April 2003
8. Issue 8	Safeline	July 2003
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Warnings and Cautions


WARNING

THE ABOVE CAPTION IDENTIFIES AN OPERATING PROCEDURE OR PRACTICE THAT COULD RESULT IN PERSONAL INJURY OR DEATH.


CAUTION

THE ABOVE CAPTION IDENTIFIES AN OPERATING PROCEDURE OR PRACTICE THAT COULD RESULT IN DAMAGE, OR DESTRUCTION, OF THE DETECTOR, THE PROCESS OR ITS SURROUNDINGS.

THE ABOVE CAPTION IS USED TO DRAW THE READERS ATTENTION TO A NOTE OF EXTRA IMPORTANCE.


CAUTION

THIS MANUAL IS REGARDED AS AN INTEGRAL PART OF THE DETECTOR.
THIS MANUAL MUST ALWAYS BE KEPT WITH THE DETECTOR FOR THE WHOLE OF ITS OPERATING LIFE.


WARNING

WHEN THIS CAPTION IS SHOWN ON THE EQUIPMENT IT IS USED TO INDICATE THE POSSIBILITY OF ELECTRIC SHOCK.


CAUTION

WHEN THIS CAPTION IS SHOWN ON THE EQUIPMENT IT IS USED TO INDICATE THAT THE MANUAL MUST BE CONSULTED BEFORE PROCEEDING.

Safety Instructions

Most companies have a code of practice for their employees which is designed to ensure their safety in the working environment. When new equipment is introduced it is important that operators, maintenance engineers and supervisors are aware of the potential hazards.

The following guidelines must be followed by any person concerned with the operation, installation or handling of the detector to ensure correct operation and to avoid any damage to the detector or to the person concerned.


WARNING

The equipment should only be used in accordance with the instructions given herein. Failure to comply with these instructions may lead to the protection provided by the equipment becoming impaired.
Safeline will not be liable for incidental or consequential damage if the equipment is not installed in accordance with the instructions given.


WARNING

On no account should any of the electrical panels of your detector be opened by anyone other than a qualified electrical engineer. Voltages in excess of 30 volts rms or 50 volts DC. can, in certain circumstances be lethal. When working on electrical or electronic equipment always follow current health and safety practices and observe all other applicable regulations.


CAUTION

For correct operation and to prevent any damage to the detector follow the instructions given in this document under the heading 'Installation'.


CAUTION

In accordance with EN 61010-1:1993 this equipment has been designed to be safe at least under the following conditions:

Indoor use.

Altitude up to 2000m.

Storage temperature: -10 °C to +50 °C (15 °F to 120 °F)
Operating temperature: -10 °C to +40 °C (15 °F to 110 °F)

Maximum relative humidity 93% for temperatures up to 40°C.

For connection to TN (EN60950:1992) power distribution systems only, for connections to other power distribution systems please contact your supplier.

Mains supply voltage fluctuations not to exceed +10%/-15% of the nominal voltage.

Transient overvoltages according to INSTALLATION CATEGORY III.

Pollution degree 2 in accordance with IEC 664.

Detector Precautions


CAUTION

During installation and operation of the detector the following points must be considered. Failure to do so may result in difficulties of operation, degradation in the performance or damage occurring to your detector.

1. **Electric Arc Welding**

   Electric Arc Welding must not be carried out on the detector system.
   If Electric Arc Welding must be carried out on any attached systems, disconnect and remove the detector head and detector power supply box prior to welding.

2. **Power Source**

   It is recommended that the power source should be taken from a source which supplies only low power equipment.
   It is recommended that the detector should not be connected to power sources which are supplying varying current loads, e.g. Inverters, variable-speed drives etc.
   It is recommended that the power source for the detector should be connected via an independent spur.
   The power source for the detector should be fitted with an isolation switch and the appropriate circuit breaker and/or fuse.

3. **Electromagnetic Interference**

   It is recommended that the detector should not be installed in close proximity to any devices which may emit electromagnetic interference e.g. Radio transmitters.
   Ensure all Inverters and variable-speed drives in the proximity of the detector are installed in full accordance with their manufacturers instructions.
   Where possible avoid placing any cables from Inverters, variable-speed drives etc. in close proximity to the detector or the detector cables.
   In particular take care to avoid placing the detector in the proximity of any equipment that generates electromagnetic interference in the same frequency range as the detector.

4. **Avoiding aperture damage**

At all times ensure that the product does not come in contact with, or impact onto the detector aperture or aperture lining.

5. **Handling and lifting**

When transporting and handling the detector damage may result if the lifting equipment (e.g. sling, cable assembly or by hand) passes through the aperture of the detector.
Never pass any lifting or supporting equipment through the detector aperture.
Always observe best practices for handling heavy items when lifting or moving the detector.

6. **Detector support structures**

Avoid supporting the detector on vibrating structures and/or machines subject to mechanical shock.
No part of the supporting structure should rely on the detector for structural integrity.
No part of the supporting structure should be attached to the detector other than through the detector mounting blocks supplied.

7. **Orientation of contaminants**

Metal detector sensitivity is expressed as the diameter of the smallest spherical object which can be detected. (i.e. diameter of a ball).
Sensitivity to non-spherical objects of the same material (e.g. wire fragments) will vary according to the orientation of the object as it passes through the detector aperture. If the diameter of the object is less than the stated spherical sensitivity the object may not be detected.

8. **Product packaging materials**

To achieve the optimum detector performance in applications where the product being inspected is packaged - ensure that the packaging materials used are free from metal contamination.

9. **Continuous maintenance and testing**

It is recommended that at regular intervals testing with an appropriate test sample is performed to ensure the detector and any attached reject mechanism is functioning correctly.
It is recommended that inspection and cleaning of the detector system should be carried out at regular intervals.

Contents

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LIST OF ILLUSTRATIONS

LIST OF ABBREVIATIONS

A	Ampere
AC	Alternating current
AH	Aperture height
CRC	Cyclic redundancy check
D.C.	Direct current
Fe	Ferrous
ft	foot
Hz	Hertz
k	Kilo (10^3)
kHz	KiloHertz
kV	Kilovolt
kΩ	KiloOhm
LCD	Liquid crystal display
LED, led	Light emitting diode
m	metre
mA	milliampere
MFZ	Metal free zone
MHz	MegaHertz
min	minute
mm	millimetre
ms	millisecond
non-Fe	Non-ferrous
NPN	Negative-positive-negative (type of transistor)
PNP	Positive-negative-positive (type of transistor)
PSC	Product signal cancellation
PVR	Performance validation routines
QA	Quality assurance
RMS	Root Mean Square
V	Volt
VA	Volt amps
W	Watt
^{0}C	Degree Celsius
^{0}F	Degree Fahrenheit

PRINCIPLES OF OPERATION FOR THE METAL DETECTOR

Safeline detectors utilise a low power, high frequency, magnetic field coil system which has the ability to sense minute disturbances created by metal particles. A metal particle passing through the aperture of the detector will create changes in the magnetic field inside the detector.

The changes in the magnetic field will generate electrical signals in the coil system which can be characterised by the parameters Phase and Amplitude.

The amplitude/size of the signal is related to the size of the metal particle passing through the field, the larger the metal particle the greater the amplitude of the signal.

Different types of metal generate signals, which differ in phase angle. The term phase angle is a comparative term and is a measurement of phase relationship relative to some reference

Vibration Signals

Great care is taken in the design and manufacture of the Safeline detectors to minimise the effect of vibration on the performance of the detectors. However mechanical disturbances do create vibration signals from the coil system.

Vibration signals can be represented in the same way as signals generated by metal particles i.e. a signal with amplitude and phase.

The vibration signal is used as a reference when comparing the phase angle of signals from the coil system. For example, if we say stainless steel has a particular value of phase angle, the phase angle is the angle relative to vibration. Reasons for selecting vibration as the reference phase will become apparent.

Product Effect

Metal detectors are used to inspect all types of products e.g. food pharmaceuticals, plastics, chemicals and many others.

Some products exhibit a ‘product effect’ i.e. the product itself generates a signal in the same way as a metal particle. This results from the bulk conductivity of the product at high frequency.

For most products, usually dry products, the product effect is negligible. Wet or moist products, e.g. meat, sauces, soups etc. generate a large product effect signal which will influence the effective operating sensitivity of the detector.

Product effect signals can be represented diagramatically as a signal with amplitude and phase in the same manner as the signals from metallic particles.

Phase Control

The Safeline metal detector contains a phase control circuit which discriminates between the wanted signals from metal particles and the unwanted signals from vibration and product effect, i.e. it maximises the detectors response to metal particles whilst minimising the effects of the unwanted signals.

Probably the simplest way of reducing the vibration or product effect signals would be to adjust the sensitivity control. However, the sensitivity control would reduce the sensitivity to all signals, metallic signals, vibration and product signals alike.

What is required is a more selective adjustment that will discriminate between different signals. The phase control does this, it selectively reduces the signals from vibration and product effect with minimal effect on the metallic signals.

A comparison can be made with a domestic Hi-Fi system. The volume control of the Hi-Fi increases or decreases the amplitude of all signals just like the metal detector sensitivity control. The bass control of the Hi-Fi selectively controls the low frequency notes only. This is similar to the phase control circuit, however the phase control circuit in a Safeline metal detector is very much more selective.

Signals from the detector coil system can be represented as shown in Fig 1

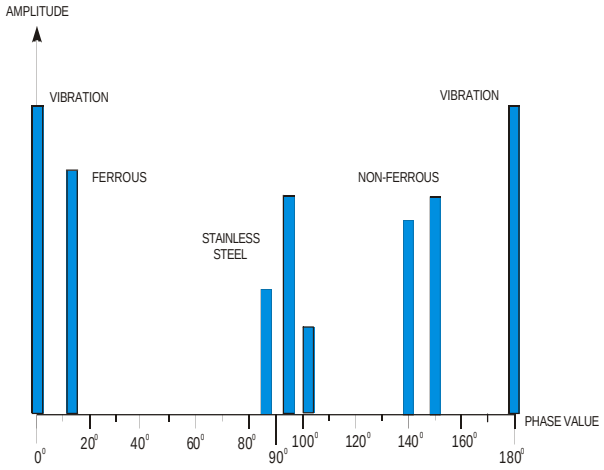


Fig 1 Phase/Amplitude

The characteristic of the phase control circuit is as shown in Fig 2. This shows the position of the phase control aligned to minimise the unwanted vibration signal. All signals which break through the phase control characteristic (the shaded area) will trigger the detector. From this it can be seen that the amplitude of the unwanted vibration signal would have to be increased to trigger the detector.

It can be seen from Fig 2 that the phase control characteristic masks off some of the ferrous signal and has a minimal effect on the Non Ferrous/Stainless Steel signals

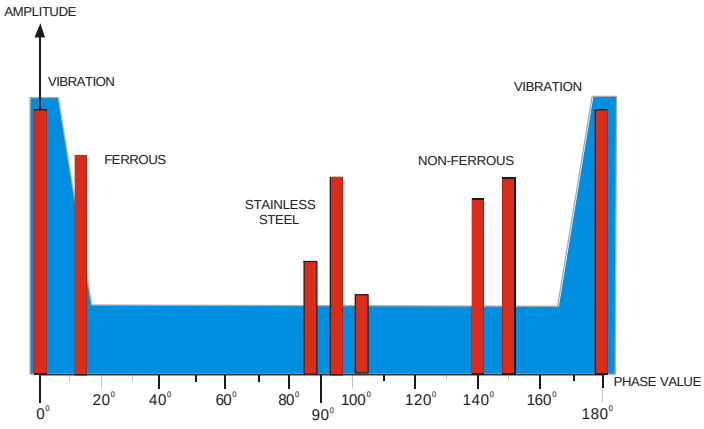


Fig 2 Effects of Phase control

The phase control is used to minimise unwanted product effect signals. Fig 3 shows a typical example. It can be seen from Fig 3 that the phase control characteristic masks off some of the Stainless Steel signals and has a minimal effect on the Ferrous signal. The detectors phase setting may be adjusted to align the phase control over any unwanted product effect signal.

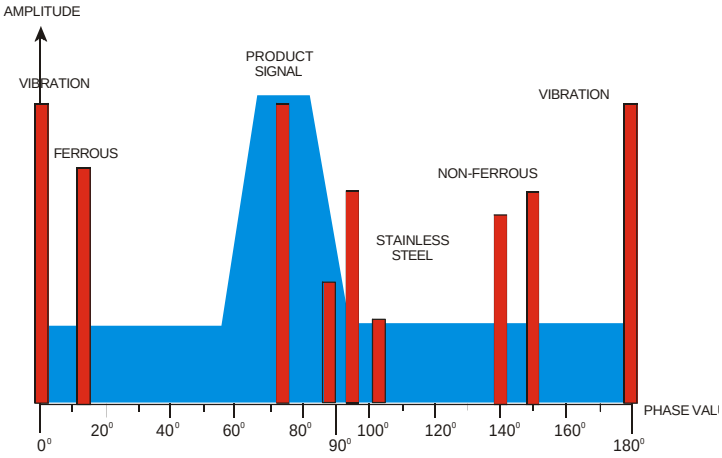


Fig 3 Effects of unwanted signals

In general if operating the detector with any product which exhibits a product effect the Non Ferrous/Stainless Steel sensitivity will decrease.

Features of your Metal Detector

Product Numbers

When installed on a product line there may be many different types of product passing through the metal detector at different times.

To get the maximum performance from your metal detector these different products may require different settings for sensitivity and the phase control. For this purpose Safeline metal detectors can store settings for up to 21 products. These settings may then be recalled by the operator, as required, by selecting a specific 'product number' for each product name in the detector.

Timer Groups

Experience has shown that although there may be a need for up to 21 product settings for the sensitivity and phase control, the type of reject mechanism used by the 21 products falls into one of a few groups. Safeline metal detectors allow the engineer to set up a reject mechanism/timer type once and associate this with a timer group.

Individual product numbers can then be assigned to one of these timer groups.

This means that the reject timers do not have to be set 21 times - just once for each group.

In general, only one timer type and setting will be required for most applications.

Timer Types

A wide range of timer types and settings are available to the engineer,only one is used on this system

Timer **tm1** is a simple reject timer without any delay time.

Automatic Setup

This is a feature that allows phase control and sensitivity, and frequency of operation (multi-frequency option only) of the metal detector to be set up automatically.

Inverse Detection

This feature is used in applications where the absence of a metal contaminant, rather than the presence of one, needs to be detected.

A gated timer must be used with this feature.

QUALITY ASSURANCE SUPPORT (OPTION)

(Performance Validation Routines -PVR

Two modes of detector operation, (QA Inspector mode and QA Operator mode) help the user comply with ISO 9000 and BS5750, by ensuring that the metal detector system is tested and operating to the user's specified quality assurance standards of performance.

Information may be transferred directly from the metal detector to paper by using a printer. Refer to Appendix C for sample printouts.

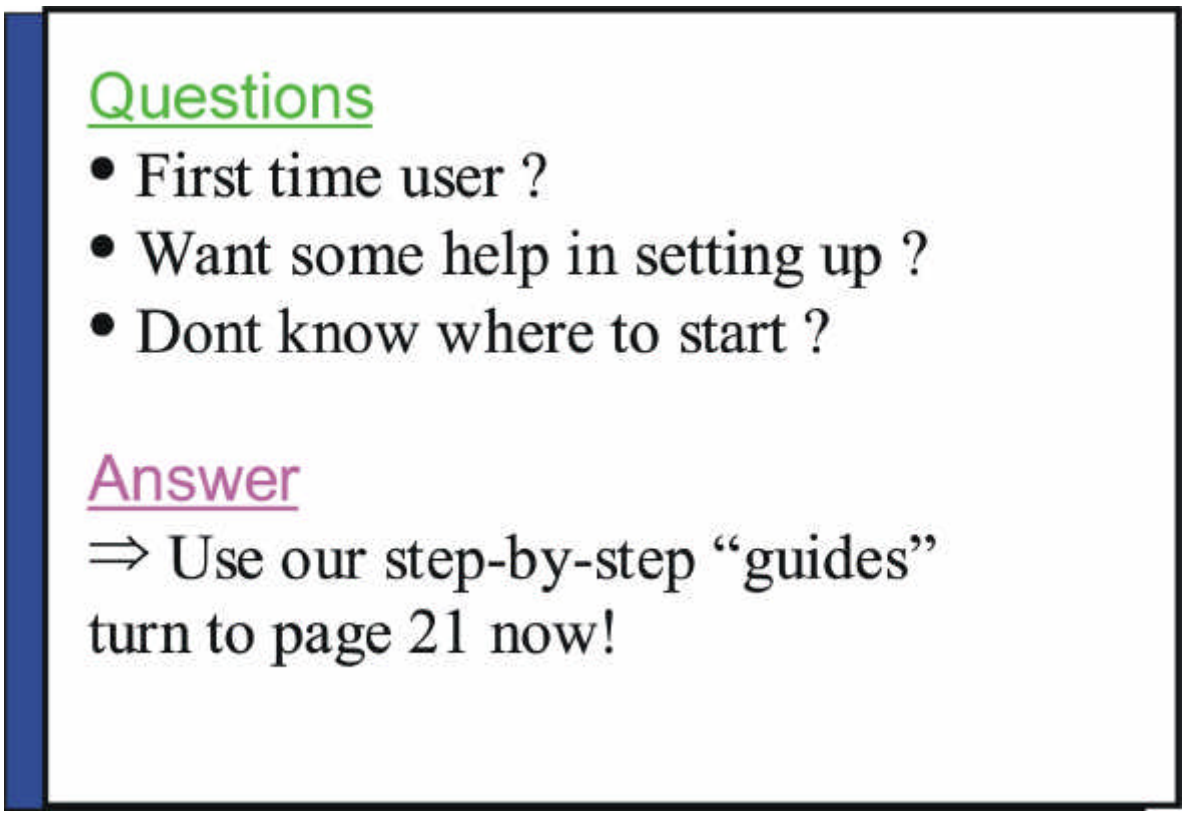
Timed requests for a check of the metal detector can be set.

Logging of rejects and logging of changes in the detectors settings can be set and these can be printed out on a timed basis e.g. for companies operating 8 hour shifts - once every 8 hours.

Serial Communications

The metal detector has a serial communication port.

The link is a two wire serial connection to allow information to be transferred to and from the metal detector. Refer to Appendix D for more information



TECHNICAL SPECIFICATION

Technology

High frequency low power electromagnetic coil system - monitored and controlled by a microprocessor system.

Frequency of Operation of Coil

Crystal controlled in the range 10 kHz to 1 MHz.

Multifrequency (optional) and single frequency units are available.

Product throughput speed

Selectable.

Fast

0.05 to 7.5 m / min / mm of aperture height
(4 to 600 ft / min / inch of aperture height)

Higher and lower speeds are available on request.

Power Input

Voltage	85-132V, 50/60Hz 160-264V, 50/60Hz

Note
Voltage selector switch shown on page 86

Power	100 VA *
Frequency	50 to 60 Hz.

For connection to TN (EN60950:1992) power distribution systems only. For connections to other power distribution systems please contact your supplier.

* Assumes no loads on the switched power outputs.

Internal Battery

Discharge time	typical 6 months from power off at temperature of 20^{O}C
Battery life	typical 5 years
Nominal voltage	3.6 Volts D.C.

Temperature Range

Operating	-10 °C to +40 °C (14 °F to 110 °F)
Storage	-10 °C to +50 °C (14 °F to 120 °F)

Humidity Range

Maximum relative humidity 93% for temperatures up to 40^{O}C.

Warm Up Time

Zero seconds at an ambient temperature of 20 °C

Environmental Protection

Stainless steel version IP65, NEMA 4X

For more hostile environments a protective cover is available for the control panel.

To achieve the specified protection the module and power unit cover must be torqued down to 5 Nm (45 in.lbs), or 4.5 Nm (40 in.lbs) for the module if the environmental protection cover is used.

Sound Output

Less than 62 dBA at a distance of 1 m (without printer).

Switched Power Output

Switched by detector ON/OFF switch.

Switched live and neutral, non-switched earth. Not internally fused.

Maximum current	1 A

Reject Relay

Volt free changeover contacts that operate on the detection of metal.

Maximum power	500 W
Maximum current	3 A (non-inductive)
Maximum voltage	250 Volts A.C., or 30 Volts D.C. (non-inductive)

System Fault Relay (Optional)

Volt-free changeover contacts that operate when the Reject Confirmation Unit signals a reject fault.

Contact rating see **Reject Relay**.

Detect Signal

Operates on the detection of metal.

Output type	NPN open collector
Maximum voltage	35 Volts D.C.
Maximum current	100 mA

Fault/Detector Active Output

Output that operates if a fault occurs in the metal detector or the detector is inactive.

Output type	NPN open collector
Maximum voltage	35 Volts D.C.
Maximum current	100 mA

Q.A. Due/Overdue Output

Output that operates when a performance test becomes due or when a performance test becomes overdue.

Output type	NPN open collector
Maximum voltage	35 Volts D.C.
Maximum current	100 mA

Reject Confirmation Sensor Requirements

Operating voltage	15 Volts D.C.
Operating current	30 mA maximum
Output type	NPN open collector

RS232 Serial Communications

Two communication ports COM1 and COM2 are available from within the power unit enclosure.

Voltage levels as per RS232 standard, typically ± 9 volts.

Baud rate :	9600
Data bits :	1
Start bits :	1
Stop bits :	1
Parity bits :	1
Parity type	Odd

COM1 - 2 or 4 wire control for use with printer (Hardware handshaking is only possible with 4 wire control).

COM2 - 2 wire control for communications with metal detector.

Spherical Sensitivity

Dependent on aperture size, and frequency of operation, all sensitivity information is expressed in diameters of spherical samples.

Non spherical objects such as wires will exhibit an orientation effect, ie. they can be more easily detected in certain axis. If the diameter of the wire is less than the spherical sensitivity setting the sample may not be detected in all orientations.

Sensitivity Ratios

Dependent on frequency of coil system e.g. at 800 kHz
Non Ferrous x 1.0 Fe diameter

Stainless Steel x 1.4 Fe diameter

Sensitivity Gradient

Less than two diameters.
This is the difference in sensitivity measured at the centre of the aperture and the sensitivity at any other point in the aperture not closer than 10 mm to the surface.

Timer Ranges

Timer type **tm1**

Type: Simple reject timer.
Reject time has a range of 50 ms to 60 s.

Construction of Materials

Contact Parts

Product Desription	Material of Construction
Product Throughput Chute	Veralite 200 PETG (Complies to FDA 21 CFR 177.1315)
Reject Mechanism	316L Stainless Steel (EN 1.4404)
Reject Housing	316L Stainless Steel (EN 1.4404)

Non Contact Parts

Product Desription	Material of Construction
Reject Cover	Acrylic
Head	304 Stainless Steel (EN 1.4301)
Aperture Lining	PVC (Darvic)
Frame	304 Stainless Steel (EN 1.4301)
Control Module/Power Supply	304 Stainless Steel (EN 1.4301)

Construction of the Detector Installation

The design and construction of the metal detector support framework will influence the performance of the detector.

Follow the guidelines below to obtain the best performance.

- Mount the detector to its support framework using the four plastic insulation sets supplied with the detector.
- Avoid passing metal conduit or electrical cables through the metal free zone or near the aperture of the metal detector.
- See Appendix E for the theory behind the construction of the metal framework.

A typical installation is shown in Figure 4.

Positioning the Detector Head

Better sensitivity will be achieved if vibration from other machines is isolated from the detector.

- Avoid supporting the detector head on or near vibrating structures and/or machines subject to mechanical shock.
- Position the detector head to allow easy access to the control panel.
- Position the detector to allow removal of the control unit for servicing.

Electrical Connections

WARNING

If the detector is supplied as part of a system, read all the system literature before commencing electrical installation

In order to reduce the possibility of problems with electrical interference, do NOT run any metal detector cable next to other cables carrying switched or heavy loads.

Electrical connections to the power unit are as shown in Figure 5

Power connections to the power filter (where fitted) are shown in Figure 6.

Arrangement of the gland assemblies for connecting the power cable to the power supply unit are shown in Figure 7.

Note. When installed correctly, the detector head should be electrically insulated/isolated from the support structure and connected to earth/ground only through its own electrical connections.

These instructions are for connection to TN (EN60950:1992) power distribution systems only. For connections to other power distribution systems please contact your supplier.

Type & Aperture Size	Through Put Size	OL	OW	IH	OH
TABLEX 76x22	71x18	536	793	536-1106	236-806
TABLEX 76x38	71x34	536	793	536-1106	236-806
TABLEX 95x38	90x34	536	793	536-1106	236-806

The dimensions shown are for European standards, for American standards the dimensions Increase from 236-606 to 736-1106 but needs manual adjustment.

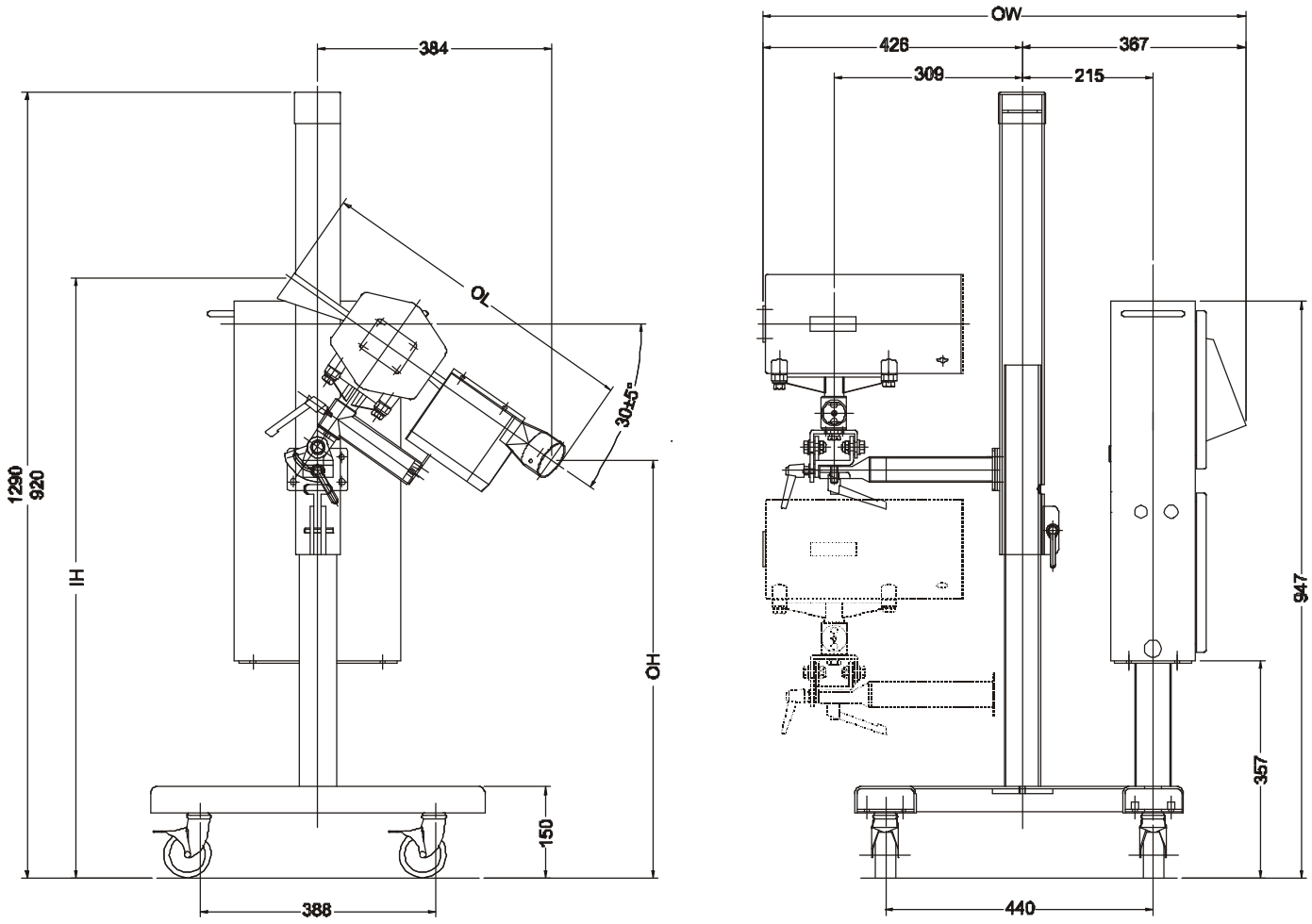


Fig 4 Typical Pharmaceutical Detector

ELECTRICAL INSTALLATION

WARNING

Ensure all power has been disconnected from the detector before attempting to work on any electrical components of the detector.

CAUTION

The following procedure should only be carried out by qualified Safeline personnel or qualified Safeline agents.

I

General

When installing the detector do NOT position the power cable adjacent to other cables carrying switched or heavy loads (this will reduce the possibility of electrical interference affecting detector operation).

Location and Layout of the Detector Terminals

Access to the detector terminals is gained by removing the power supply box lid, as detailed in the next section.

Once the power supply box lid has been removed, the terminals can accessed.

The layout of the terminals is shown in Figure 8

Removing the Power Supply Box Lid

1) To remove the power supply box lid, remove the four screws.

2) Raise the power supply box lid.

3) Lift the power supply box lid completely away from the power supply box.

To refit the power supply box lid ensure that the seal around the box lid is in place and undamaged then carry out the above procedure in reverse order.

Wiring and circuit breaker details

Details of the power connection to the detector power filter (where fitted) and the position and rating of the recommended circuit breaker are shown in Figure 9.

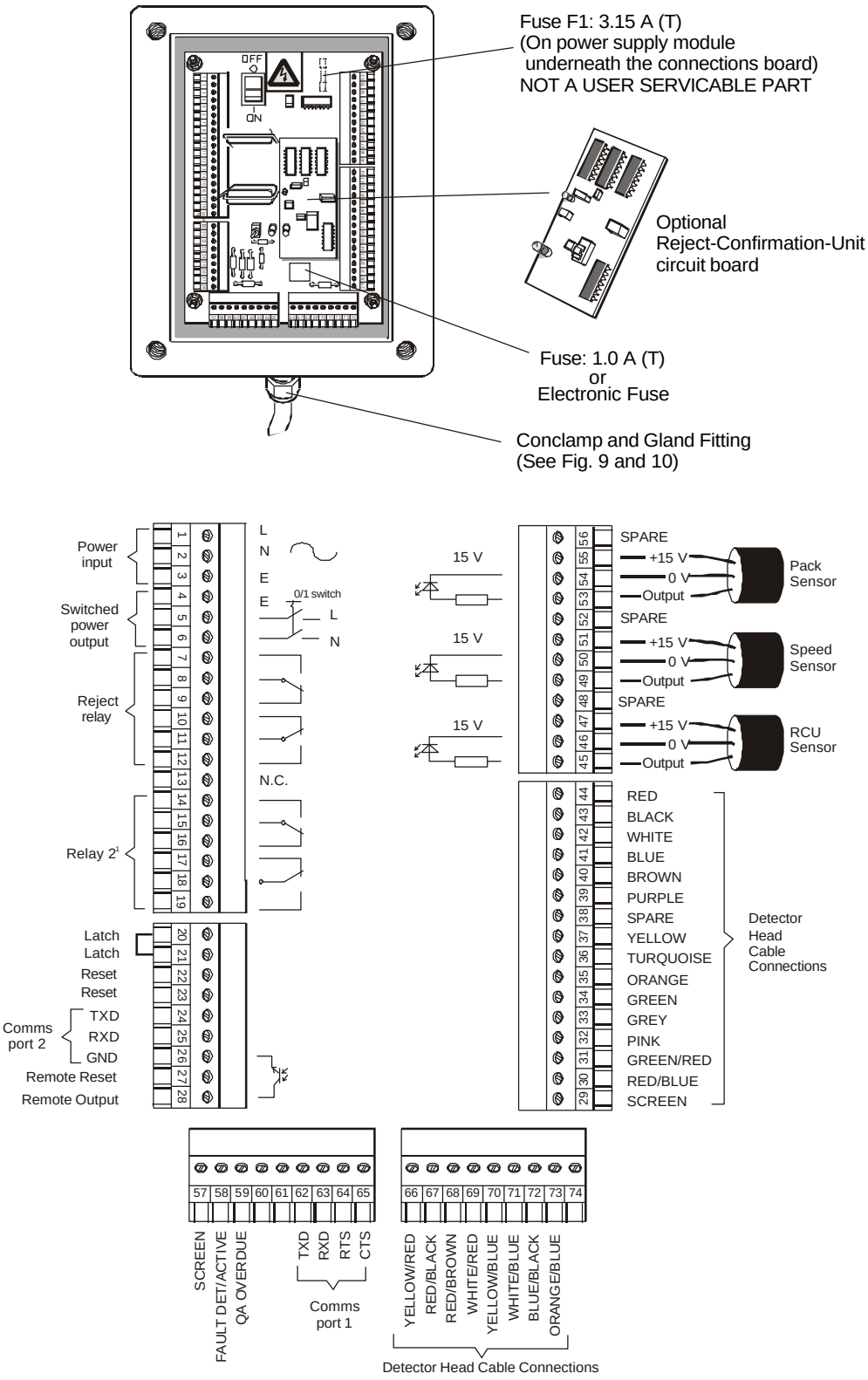
Arrangement of the gland assemblies for connecting the power cable to the power supply unit are shown in Figure 10.

Questions

- First time user ?
- Want some help in setting up ?
- Dont know where to start ?

Answer

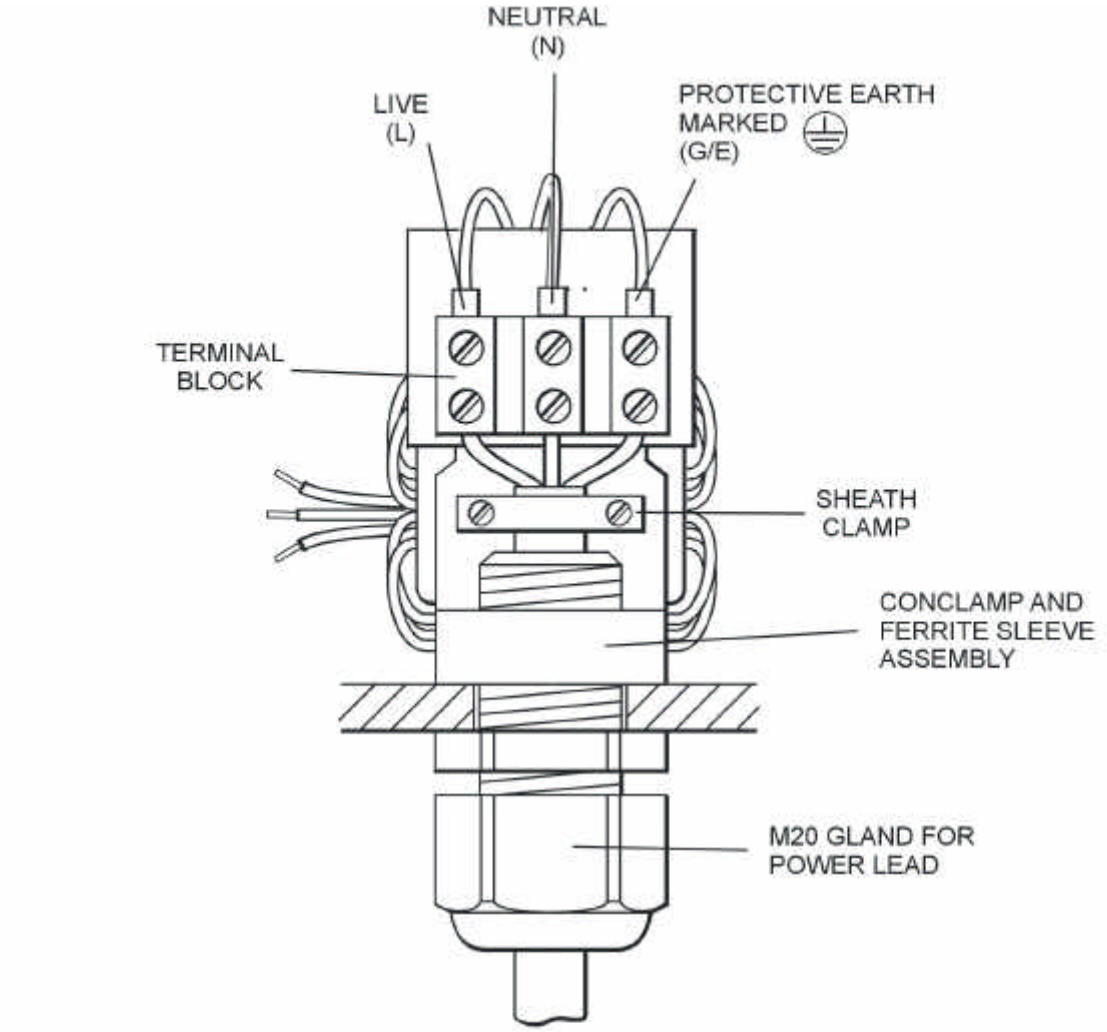
⇒ Use our step-by-step “guides”
turn to page 21 now!



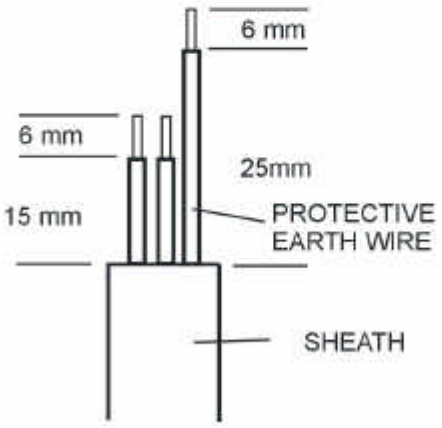
NOTES

1) LINK 2 MUST BE FITTED IF THE MODULE HARDWARE IS LESS THAN VERSION 62 (INTRODUCED 25/10/93) AND DOES NOT INCLUDE REJECT CONFIRMATION.
2) METAL DETECTION RELAY CONTACTS - RL1. THE RELAY CONTACTS CHANGE FROM THE STATE SHOWN WHEN METAL IS DETECTED
3) SYSTEM FAULT RELAY CONTACTS - RL2.(OPTIONAL). THE RELAY CONTACTS CHANGE FROM THE STATE SHOWN IF THE REJECT CONFIRMATION UNIT SIGNALS A REJECT FAULT OR THE METAL DETECTOR SIGNALS A HEAD OR MODULE

Fig 5 Layout of Components and Terminals



CONCLAMP TERMINAL ASSEMBLY



RATINGS

1) **RECOMMENDED MAINS LEAD**

AREA 0.75^2 mm

CONSTRUCTION 24 x 0.2 mm

CURRENT RATING 6 AMP.

COLOURS BROWN-LIVE, BLUE-NEUTRAL, GREEN/YELLOW-EARTH.

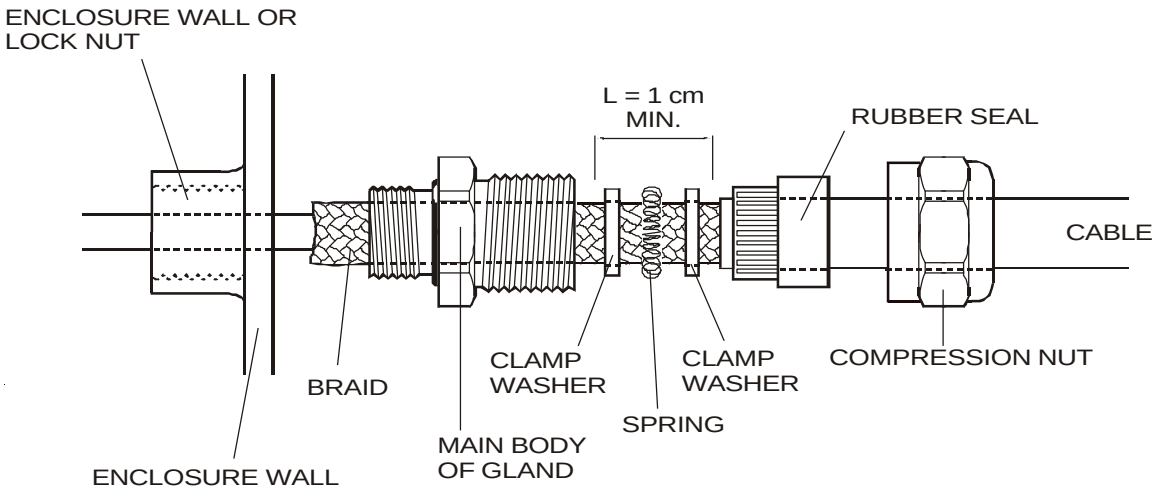
2) **a) RECOMMENDED CIRCUIT BREAKER DOUBLE POLE, CURRENT RATING 3 AMP OR 4 AMP, TYPE C CIRCUIT BREAKER TO BE MOUNTED CLOSE TO EQUIPMENT.**

OR

b) RECOMMENDED FUSE RATING CURRENT RATING 4 AMP OR 5 AMP ANTI-SURGE (T).

POWER LEAD PREPARATION

Fig 6 Power Connections to the Detector



EMC FEEDTHROUGH TYPE CABLE GLAND ASSEMBLY

Fig 7 Cable Gland Assemblies for Power Supply Unit

INTRODUCTION

The Control Panel

The metal detector control panel (see Figure 8) is the interface by which the user may observe and control the metal detector's performance. All of the metal detector's operating characteristics may be programmed through the control panel.

A Liquid Crystal Display (LCD) shows the information contained in the metal detector's, computer. With this display and by using the touch keys the metal detector's performance is controlled.

With the help of the 2-colour bargraph display, the user may observe the signals generated by metal contaminants or products passing through the metal detector.

When the signal from the detector is large enough to illuminate one or more red LEDs on the 2-colour bargraph display, a detect indicator in the centre of the control panel will illuminate.

The detect indicator will remain illuminated until the signal from the LED bargraph is equal to or less than 10 green LEDs.

The detect indicator will also illuminate if any faults occur with the detector

Changing the metal detection characteristics can only be achieved by gaining access to the metal detector's computer. Access is restricted by the use of a security code. Different security codes enable different modes of operation. In this way the control of particular parameters may be restricted to certain personnel or user groups.

Remember to record all settings in the Settings Sheets at the rear of the manual.

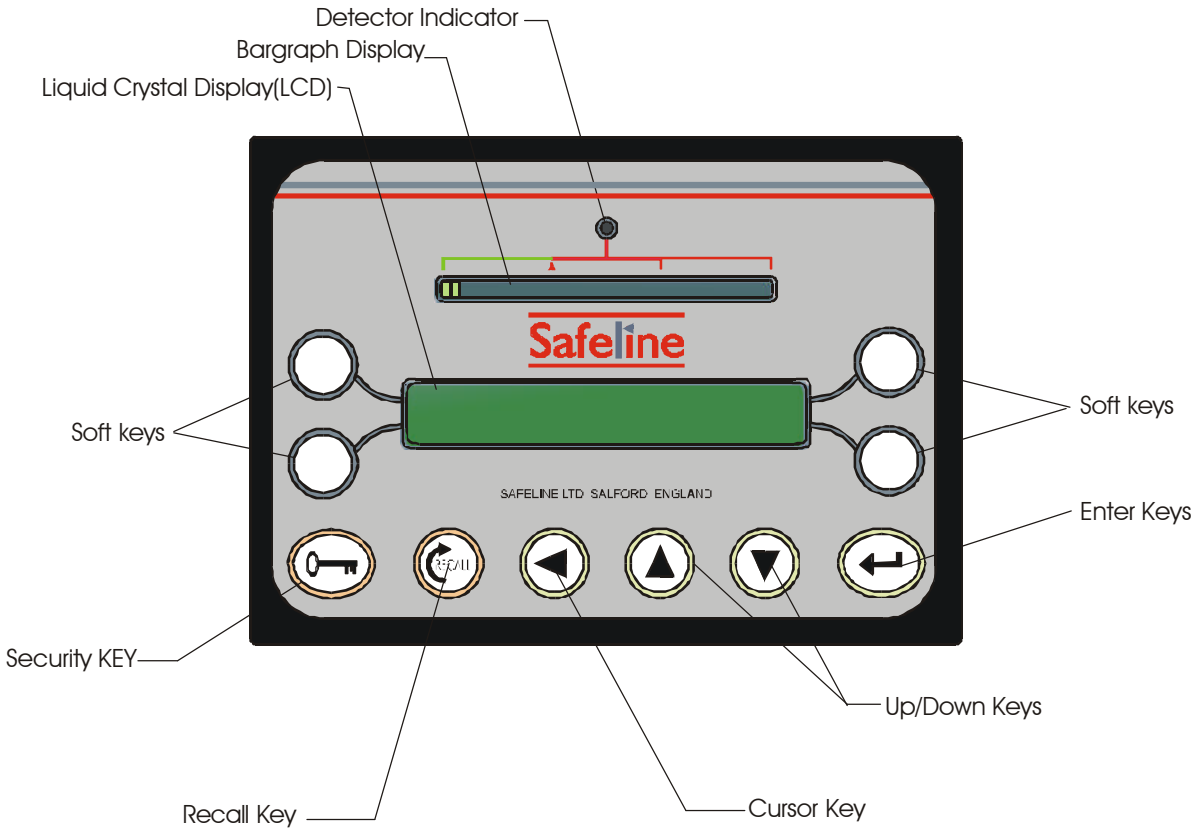


Fig 8 Control Panel

The Page Display System

There is a requirement to display more than the LCD can display at any one time.

To expand the display capabilities a page display menu system is used. This can be compared to the pages of a book. When there is more than one page of information to be displayed the word ETC will appear on the display. Pressing the appropriate soft key adjacent to ETC will cause the display to move to the next page or scroll forward. To turn back to the previous page or scroll backwards press the Recall key. Using this technique many pages of information can be stored in the computers memory and displayed as required.

On the LCD a small ▶ pointer may appear adjacent to the soft key. This indicates that a particular parameter can be changed.

If the parameter to be changed is a number and the appropriate soft key is pressed the pointer will now point inwards towards the number to be adjusted and a cursor bar appears under the digit to be changed. (Refer to Changing Numeric Values for further information).

If the parameter to be changed is not a number but requires the user to make a choice, i.e. ON or OFF, YES or NO the current selection will be indicated by a flashing marker on the display.

The Touch Keys Explained

Soft Keys

The function of the four soft keys is controlled by the computer software and will change dependent upon where you are in the program.

Cursor Move Key

This key is used to control the movement of the cursor bar when changing the setting of a numeric value

A small cursor bar will appear under the active digit on the LCD display when a parameter is available for adjustment

Example 1 2 3 4

One press of the cursor move key will move the cursor bar one step to the left,
Example 1 2 3 4.

Combined use of this key and the Up/Down keys will enable adjustment of all the digits.

NOTE:-
This key will only operate when the cursor bar is visible on the LCD display**.**

Up/Down keys

Use of these keys will increase or decrease the value of a particular digit.

NOTE:-
These keys will only operate when the cursor bar is

visible on the LCD display**.**

Security key

When pressed in Running mode it will bring up the 'ENTER SECURITY CODE display and is the first step to gain access into other modes.
If pressed whilst in any of the other modes it will exit the current mode and return to the Running mode display.

Enter key
Used to enter data into the computer memory. For example when changing the sensitivity on the display it is necessary to press the ENTER key to store the new value in the computer memory.

Recall key

Use this key to scroll backwards to the previous display page in the menu.

NOTE:-
The ETC soft key is used to scroll forward

Entering security codes

To prevent unauthorised access to the detector all settings have to be performed from a different operating mode than the default Running Mode.

To change to another operating mode the user must enter a four digit security code.

The instructions below detail how to enter a security code.

1) Press the Security key.

2) Use the Up and Down keys to alter the digit the cursor is underneath.

3) When the correct value is showing on the digit press the Enter key.

4) The cursor will move one position to the right and the entered digit will be replaced by an asterix character, *.

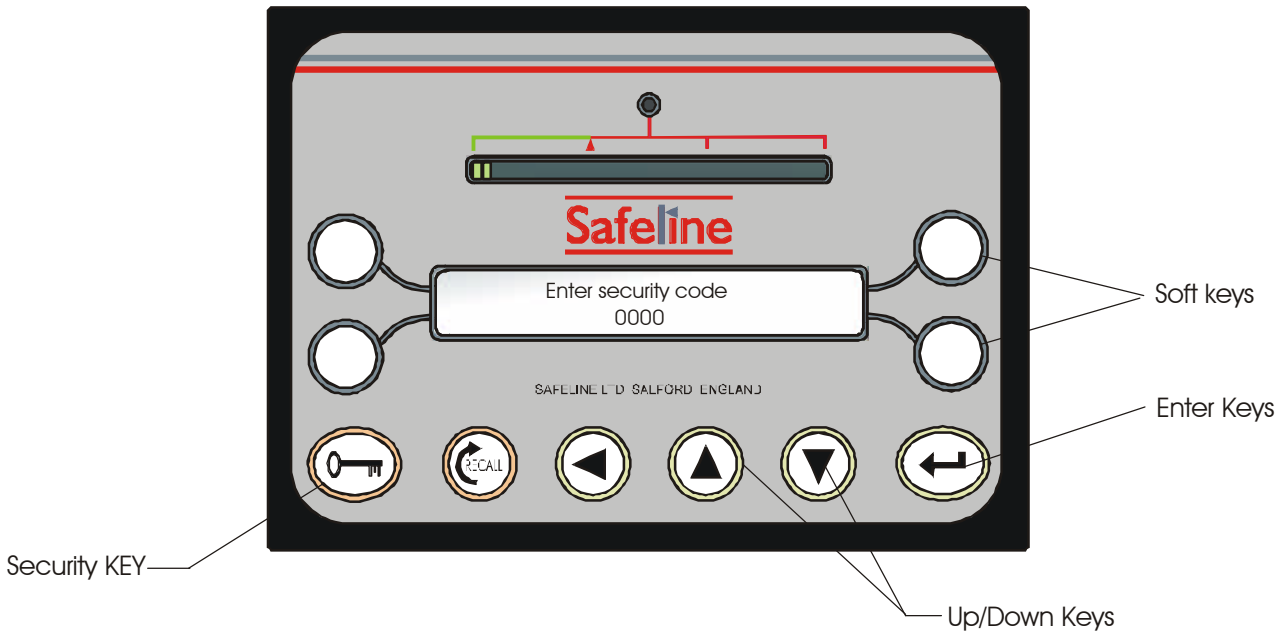
5) Repeat steps 2) to 4) for all four digits.

6) When the final digit is entered the detector will either;
   a) Go to the first display of the operating mode whose security code was successfully entered

      or

   b) Return to the Running Mode display if an incorrect security code was entered.

Note.
Default values for the security codes can be found in the Introduction part of the Security Setup section, later in the manual, and at the start of the relevant section of this manual.



Changing Numeric Values

Various settings in the program are stored as numbers, eg product number, sensitivity, etc.

Numeric values can only be adjusted if a ▶ pointer is visible on the LCD display adjacent to the parameter to be adjusted and pointing toward the adjacent soft key.

The display opposite shows two adjustable numeric parameters, on the right of the display.

If a ▶ pointer is not visible the value of that parameter cannot be changed in the current mode.

Note:
If the adjustable parameter is on the left side of the display it will be indicated by a ◀ pointer, which will change to a ▶ pointer when selected.

To change the numeric value of a particular setting use the following procedure.

1) Enter security code, and press the ETC softkey until the correct page is shown.

2) Press the soft key adjacent to the parameter 2 to be adjusted. The ◀ pointer will now point inwards towards the parameter and a cursor bar will appear under the first digit of the number.

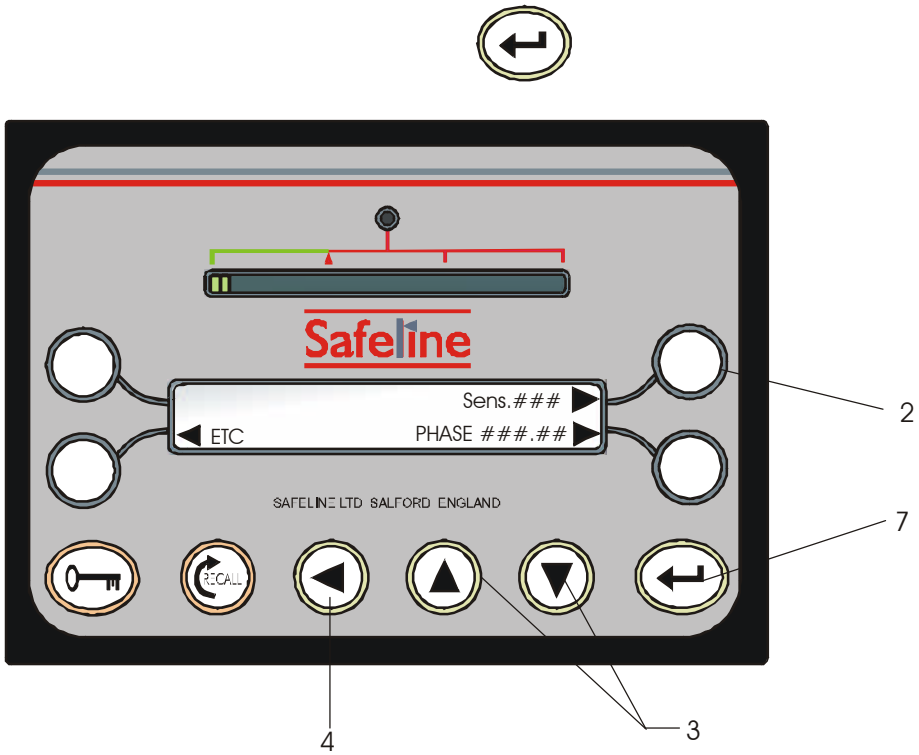
3) Press the Up/Down keys 3 and adjust the digit to the required value.

4) Press the cursor move key 4 to move the cursor bar to the next digit.

5) Repeat step 3).

6) Repeat steps 3) and 4) for each digit to set the required value.

7) Press the
key to store the new value in memory.



INTRODUCTION TO THE GUIDES

The following guides are intended to help users setting up a detector for the first time.

The guides are written as a sequence of step-by-step references to instructions in other sections of this manual.

The guides highlight settings which have to be adjusted for most applications before correct operation of the detector may begin.

Before attempting to use the ‘guides' the operator should read the following sections of this manual :

1) Principles Of Operation, page 1
2) Features, page 3
3) The Control Panel, page 14
4) The Page Display System, page 15
5) Entering Security Codes, page 16
6) Changing Numeric Values, page 17

Don’t worry if you didn’t understand everything in the sections above. The guides make things easy !

Please remember to record all settings in the Settings Sheets at the rear of the manual.

There are four guides:

a) **Universal Settings Guide**.
This guide lists the settings which control various operating characteristics of the detector. These settings may be altered to suit the particular requirements of the application. The word “Universal” is used as these settings affect all product numbers.

b) **Product Number Settings Guide**.
The detector has the ability to store settings for 21 different product numbers. Each product number contains a group of settings which are set to optimise the detector performance for a particular product. This guide takes the user through the setting up of this group of settings for particular product types.

c) **Performance Validation Guide**.
The detector supports many features that can be used to validate the performance of the detector. This guide takes the user through the required settings for performance validation (quality assurance) operation.

Introduction To The ‘How to...’ Boxes

Alongside the guides you will find a few boxes with titles that begin with the words **‘How to...’**.

These boxes detail in a step-by-step fashion how to perform certain simple routines with your detector;

e.g. ‘How to Print’,
‘How to Carry out a Performance Test’.
etc.

Item(s) referred to in some guides may be options not available on your detector - if so ignore the item(s).

Universal Settings Guide

Introduction

The following settings affect the detector operation independent of the current product number. This guide should be the first guide used.


NOTE

All of the items below may be set whilst product number 0 is selected as the current product number.


NOTE

All of the following items may be set from the Engineer Mode of operation.

1) ‘**Language’** on page 42.

Set the appropriate language for the displays.

2) **‘Set Date And Time’** on page 43.

Set today’s date.

3) **‘Set Date And Time’** on page 43.

Set the current time.

4) **‘Reject Inhibit’** on page 41.

If you want to prevent the reject device activating whilst setting up the detector.

5) **Vibration Setup’** on page 40.

Set up the speed of the product - either manually or automatically.

6) **‘Reject Timers’** and subsequent timer sections on pages 69 and 70.

Set up the detector to the vibration characteristics of your system.

7) **‘Security Setup’** on page 53.

If you intend using a pack sensor or those features that require a pack sensor.

8) ‘Detection Buzzer ‘ on page 41

Set up the required timer groups to the appropriate timer types and settings.

9) **‘Reject Confirmation’** on page 42.

Set up the security codes for entry into the various operating modes of the detector.

10) **‘Boost Mode’** on page 42.

Set whether you want the internal buzzer to sound at detection.


NOTE

In the majority of cases there will be no need to adjust the following items. The following items are shown here for completeness.

If you are using the reject checking facilities of the detector.

At or near to full sensitivity a further 20% sensitivity improvement may be possible.

Product Number Settings Guide

Introduction

This guide should be performed for each product type that will be monitored by the detector. The majority of products which have no product effect will operate on a single product number. This guide sets all product-dependant settings of the detector.


NOTE

The '**Universal Settings Guide'** should be used before this guide.


NOTE

All of the following items may be set from the Engineer Mode of operation.

1) **'Product Number and Automatic Setup'** on page 46.

Select the required product number to set up next.

2) **'Select and Update Timer'** on page 42.

Select the timer group for the product number.

3) **'Inverse Detection'** on page 38 (NOT USED ON PHARMX)

If the product number is an inverse detect application then select Inverse Detect.

4) **'Automatic setup'** on page 45

Use the automatic facility of the detector to set the phase and sensitivity.

5) Go back to step 1) above for the next product to be set up.

If required then select the Product Signal Cancellation feature.

6) **'Product Number and Automatic Setup'** on page 36

If required then select the Automatic Tracking feature.

7) **'Reject Inhibit'** on page 40.

Finally change the product number to the product number that is to be used next.

*If this feature was enabled during **the 'Universal Settings Guide'** then disable it after completing this guide.*

Performance Validation Guide

Introduction

This guide will lead you through setting up the performance validation features of the detector.


NOTE

The '**Universal Settings Guide'** should be used before this guide.


NOTE

The '**Product Number Settings Guide'** should be used before this guide.


NOTE

All of the following items may be set from the QA Inspector Mode of operation.

1) **'Test Samples'** on page 59.

Set up the test ball sizes that the operator will be prompted to pass through the aperture when performing validation tests.

2) **'Test interval'** on page 61.

Set up the test interval so the detector will prompt the operator to perform Performance Validation Tests at regular intervals.

3) **'Overdue Period'** on page 61.

Set up the amount of time to allow after prompting for a test before the test is considered overdue.

4) **'Change QA Operator Code'** on page 62.

Set up the security codes (maximum of 9 separate codes) for the operators who will be performing the Performance Validation Tests.

How to... 'Carry out a Performance Validation Test'

Step 1) Enter one of the QA Operators security codes.	**'Entering security codes'** on page 16.
Step 2) Select the material of the test sample.	**'Select Test Material'** on page 63.
Step 3) Pass the test sample with the product through the detector aperture.	**'Select Test result'** on page 64.
Step 4) Go back to Step 2) if testing more samples, else press the PROG/EXIT key.	

You have now set up the minimum requirements of a performance validation system. The following items will set up additional Performance Validation featiures.

5) **'Alarm if DUE or OVERDUE'** on pages 62.

Select the operation of the output from the detector that gives remote warning of a Performance Test becoming DUE or OVERDUE.

6) **'Printer Fitted'** on page 58.

Select whether a printer is to be used.

7) **'Printer Fixed or Portable'** on page 58.

Select whether a printer will be permanently connected.

8) **'Line Identification'** on page 58.

Enter a 4 digit identifier that will appear on all printouts, (useful where more than one detector is being operated).

9) **'Shift report options'** on page 59.

Select what should appear on shift printouts.

10) **'Shift report start'** on page 60.

Set the starting time for the automatic shift printouts.

11) **'Shift report Interval'** on page 60.

Set the time between the automatic shift printouts.

How to... 'Print from the keypanel'

Step 1)
Enter the QA Inspector security code. — **'Entering security codes'** on page 16.

Step 2)
Select the QA Inspector Print Menu. — **'QA Inspector Print Menu'** on page 64.

Step 3)
Select the type of printout required - either 'Print All Settings' or 'Print The Shift Report'. — **'QA Inspector Print Menu'** on page 65.

Step 4)
Press the PROG/EXIT key.

MANUALLY SETTING THE DETECTOR FOR A PRODUCT

General

At this stage the metal detector should have been installed and the user should be familiar with the principles of operation, basic operation of the control panel, and have worked through the universal settings guide as described in previous sections.

The Safeline detector has the ability to store settings for 21 different product numbers.

Sensitivity, phase, frequency, and power drive when set correctly will optimise the detection sensitivity.
The timer type will optimise reject operation, for different pack lengths or product speed.
Inverse detection will allow the action of the reject timer to be reversed, allowing product with no metal contamination to be rejected whilst metal contaminated product is accepted.

Product signal cancellation may give improved performance for a minority of products which present consistent product effect characteristics.

The phase control can play a dominant role in optimising the detectors performance for particular products. For many products, those which do not exhibit a product effect, the optimum setting of the detector will be with phase set at around 0°. With those products that exhibit a product effect, improved detection sensitivity can be achieved by aligning the phase control to minimise the product signal.

When making adjustments to the detector for a particular product the user should ensure that product is passed through the detector aperture in its usual manner to create a worst case product effect condition.

Notes on Passing Product Through the Detector


NOTE

The product should be continually moving, the detector will not operate with standing/stationary product in the aperture.

To ensure that the detector is set up correctly and will operate satisfactorily during normal production, we recommend that the product used for set up is passed through the detector in the worst case position and orientation which would occur during normal production.

The worst case product effect condition is when the greatest disturbance of the coil system/largest product signal is experienced. This occurs when the coil system condition changes from no product to maximum product.

If the product is a continuous length/strip, the worst case product effect is given from the leading edge/face of the product. Product fully spanning the detector head gives a much reduced signal.

With individual or boxed/cartoned product the worst case product effect condition occurs as the product enters and leaves the detector. If the product is rectangular the product effect signal will generally be more severe if the product enters the detector aperture long edge leading, as opposed to short edge leading. The gaps between the products will create the worst case product effect condition. If successive products are touching a reduced product signal will result.

For the majority of product types the worst case condition occurs the closer the product is to the faces of the detector aperture.

The technique of setting up to the worst case product effect condition will ensure that no false product rejections occur during normal running conditions.

Manual Setup for Non Product Effect Applications

Many products exhibit little or no product effect signal when passed through the detector, these products are often referred to as non product effect or dry products. Typical dry product are paper, plastics, flour, rice, noodles, etc.


NOTE

At higher detector head operating frequencies products previously considered as dry products may start to exhibit product effects. If this is the situation use of the phase control may give better results, refer to 'Manual Setup For Product Effect Applications' below.

Manual setup may be used to optimise the detector sensitivity, phase,and power drive settings for non product effect applications.

When manual adjustment has been carried out to optimise the detector performance, the final adjustment normally required is simply a matter of setting the sensitivity control to give the required detection standard.

Product number 00 has its phase setting fixed for non product effect applications and may be used to simplify the manual setup.

All product number settings are factory-set for non product effect applications and therefore steps 4), 5), and 6), will not be required on previously unused product numbers.

1) Enter Supervisor/Engineer access code, page 16.

2) Select the lowest available product number (01 to 20), page 37.

3) Set the Sens to 199, page 37.

4) Set the 'Phase' to 0° (default setting), page 37.

5) Set the 'Power drive' to HIGH (default setting), page 38.

6) Ensure the product is flowing through the detector in its normal manner. If a product signal is observable on bargraph display ensure the product is flowing through the detector creating worst case product effect conditions, refer to 'Notes On Passing A Product Through The Detector' earlier.

8) If a product signal is observable on bargraph display adjust the sensitivity control, Sens (page 37),so that the peak signal from the product gives 3 to 4 bars on the bargraph display(s). Refer to note 1) below.

9) Test the sensitivity of the detector by passing metal samples through the aperture of the detector (preferably positioned on or placed in the product).

10) If required adjust the Sensitivity (page 37) to achieve the required spherical performance standard.

11) If there are other product types to be inspected repeat this procedure from step 2).

12) Press 'PROG/EXIT' to return to the running mode.

Note

1) For applications where the peak product signal indicates between 6 and 19 bars on the bargragh displays the product may be classified as either a non product effect or a product effect type. In order to determine which setup condition will give the best sensitivity it will be necessary to carry out both types of setup (i.e. Manual Setup for Non Product Effect Applications and Manual Setup for Product Effect Applications). A comparison should be made between the two sets of results and the most favourable settings selected.

Manual Setup for Product Effect Applications

Wet/moist product, i.e. meat, cheese, fish, soups, sauces, etc. generate product signals when passed through the detector. At high sensitivity settings the signal will normally be clearly visible on the bargraph display.

Manual setup may be used to optimise the detector phase, sensitivity,and power drive settings for product effect applications.

The objectives of the following procedure is to establish the setting of phase which will align the phase control circuit with the product signal. The correct setting will give minimum signal from the product on the bargraph display.

There will be one value of phase which will give the minimum signal, this is known as the "null point" setting. Changing the phase setting up or down in value from this setting will increase the amplitude of the signal.

It is much easier to find the correct phase setting by starting at a low sensitivity setting then repeating the process in stages at increasing sensitivities.

When using the phase control to minimise product signals the detector may become more susceptible to vibration. The final setting of the sensitivity may be limited by vibration effects rather than product effect.

1) Ensure product is flowing through the detector creating worst case product effect conditions, refer to 'Notes On Passing A Product Through The Detector' earlier.

2) Enter Supervisor/Engineer access code, page 16.

3) Select lowest available product number (01 to 20), page 37

4) Set the 'Power drive' to HIGH (default setting), page 38.

5) Adjust the sensitivity so that the peak signal from the product gives 3 to 4 bars on the LED bargraph display. If the signal is very large, such that the sensitivity control falls below a setting of 100 refer to note (1).

6) Press the ‘Enter’ key to store the new setting in memory.

7) Set phase to 000.00°.

8) Adjust sensitivity so that the peak signal from the product gives just less than full scale indication on the LED bargraph display.

9) To find the null point, change the phase setting to 10° and observe if the amplitude of product signal indicated on the bargraph display reduces. Repeat the process increasing the phase setting in steps of 10°, i.e. 20°, 30°, 40°, 50°, 60°, etc. until the null point is located.

   For example if as the phase setting is increased there is clear reduction in signal from 80° to 90°, and then from 90° to 100° the signal starts to increase again, this indicates that the null point is between 80° and 100°.

10) Now reduce the phase setting in steps of 2° i.e. 98°, 96°, 94°, 92°, etc. the product signal indicated on the bargraph display should now reduce in amplitude. Decrease the phase setting in steps of 2° until the product effect signal is reduced to a minimum and then starts to increase again.

    For example if as the phase setting is reduced there is clear reduction in signal from 94° to 92°, and then from 92° to 90° the signal starts to increase again, this indicates that the null point is between 94° and 90°.

11) At this stage the product effect signal indicated on the bargraph display should be quite small. To obtain a more precise phase setting increase the sensitivity setting to give a larger signal indication on the bargraph display.

12) Now increase the phase setting in steps of 0.5° i.e. 90.5°, 91°, 91.5°, 92°, etc. until the product effect signal is reduced to a minimum and then just starts to increase again. Using the 0.1° digit adjust the phase setting up and down until minimum signal i.e. the null point is found.

13) Although not always necessary a more precise null point will be found by now using the 0.01° in a similar manner to the 0.1° digit as described in 11). Using the 0.01° digit adjust the phase setting up and down until minimum signal i.e. the null point is found.

    The phase control circuit is now aligned to the product signal, next adjust the sensitivity so that the product signal gives a maximum signal of 3 to 4 green bars on bargraph display. If the sensitivity setting is less than 100 refer to note 1).

14) Check the susceptibility of the detector to vibration, if unacceptable (i.e. system vibration is showing on the bargraph) reduce the sensitivity until acceptable.

15) Press the ‘Enter’ key to store the new settings in memory.

16) Test the sensitivity of the detector by passing metal samples through the aperture of the detector (preferably positioned on or placed in the product) and note the results.

17) If there are other product types to be inspected repeat this procedure from step 2).

18) Press ‘PROG/EXIT’ to return to the running mode.

Notes

1) As a guide...If during manual setup the sensitivity is adjusted below 100, then improved spherical performance may be achieved by switching to LOW and repeating the manual setup procedure, omitting step 4).

   Under these conditions, to ensure that the best sensitivity is achieved, it is recommended that the manual setup procedure is carried out for both settings of (i.e. HIGH and LOW). A comparison should then be made between the two sets of results and the most favourable settings selected.

   If during manual setup sensitivity is adjusted below 100 and is already switched to LOW, then switch ‘Power drive’ to LOW and repeat the manual setup procedure, omitting step 4) and step 5).

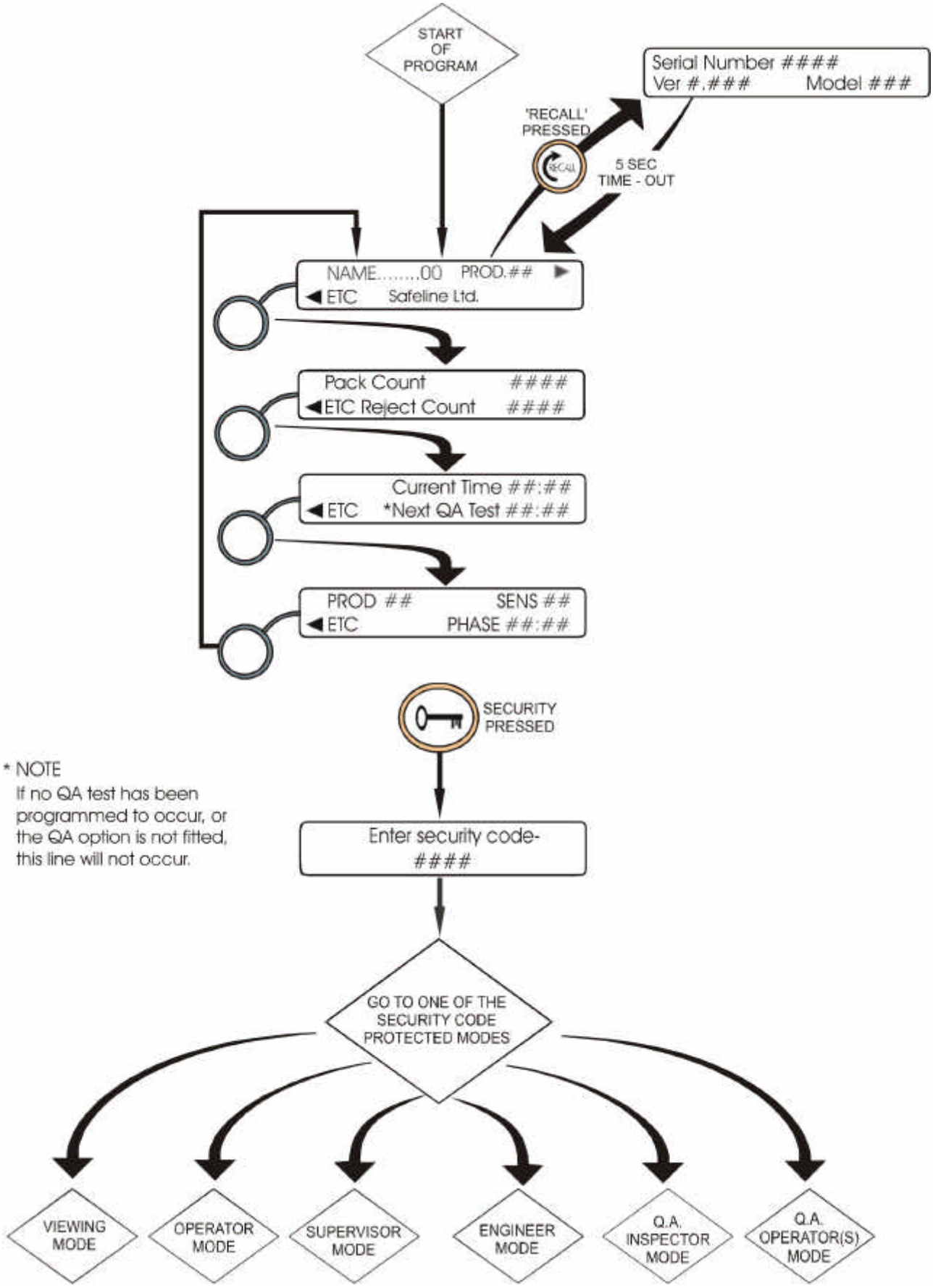


Fig 9 Running Mode Flow Chart

RUNNING MODE

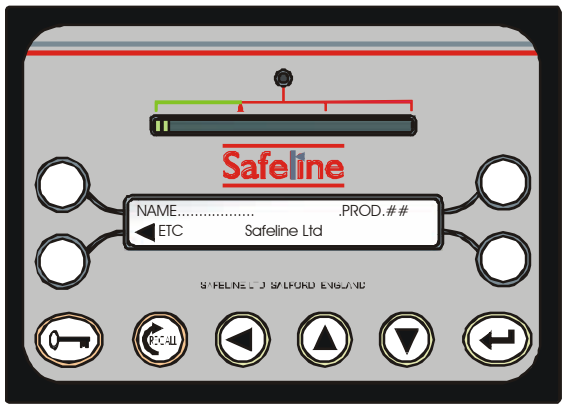
Remember to record all settings on the Settings Sheets at the rear of the manual.

Introduction

Please refer to Figure 12 for the complete sequence of displays in the Running Mode.
The Running Mode is the default mode of operation and the detector is automatically started in this mode after power on.

The display opposite is the first display of the Running Mode, and is the display that the detector returns to when any of the other operating modes are exited.

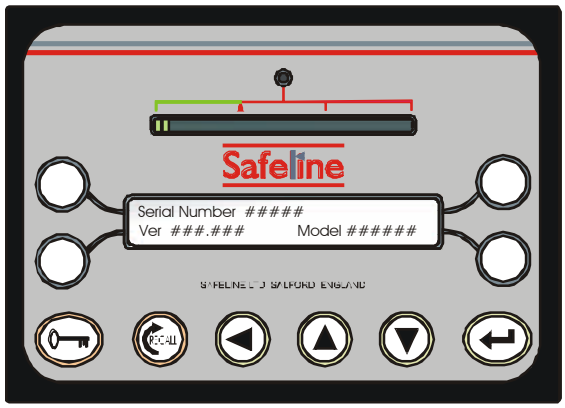
Press the Recall key to observe the following display.



Serial Number, Version and Model

IMPORTANT

The display opposite contains vital information that will always be requested when contacting Safeline. Make sure you have the above information to hand before telephoning.



Serial Number - The serial number of your metal detector.

Model # # # # # # - The right-most number indicates the stagger frequency of your module. The next four numbers indicate the frequencies of operation your detector supports. The left-most number indicates the memory size fitted to your detector.

Ver ###.## - The software version of your metal detector.

After a period of 5 seconds the display will return to the display shown above. Pressing the soft key adjacent to ETC will change the display to the following.

Pack Count

This feature is not typically used for Tablex unit application.

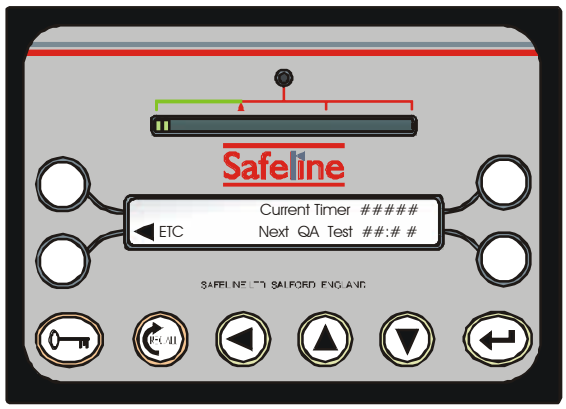
Time

This display shows the current time and the time of the next QA test.

Refer to the Engineer Mode section for information on setting the current time.

Refer to the QA inspector section for information on setting the Next QA Test time.

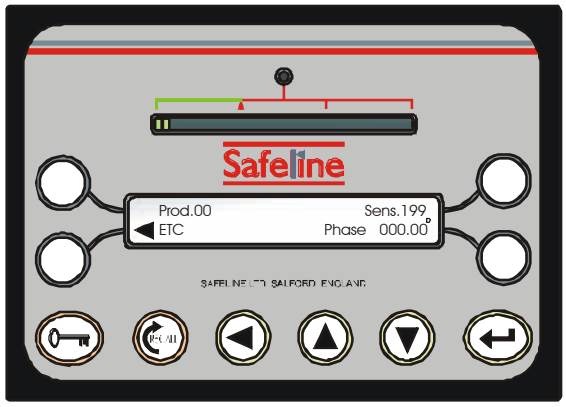
NOTE
If no QA test is programmed, or the QA option is not fitted, then 'Next QA test ##:##' will not appear.

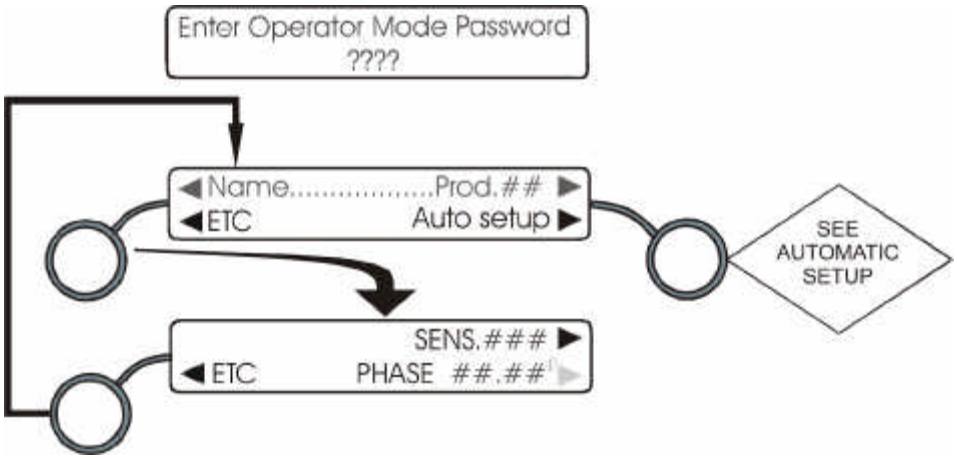


PROD.##
This display shows the current product.

SENS.###
This display shows the current sensitivity.

PHASE.###.##
This display shows the current phase.





NOTE

Auto.Setup feature and adjustment of sens and phase are only available if operator access is set to Full

Fig 10 Operator Mode Flow Chart

OPERATOR MODE
(Default security code = 0001)

Introduction

Please refer to Figure 10 for the complete sequence of displays in the Operator mode.

The Operator mode is intended for personnel who require to operate the detector in a very limited way but who are prohibited from altering any settings vital to the detector operation.

The following items can be set when in the Operator mode.

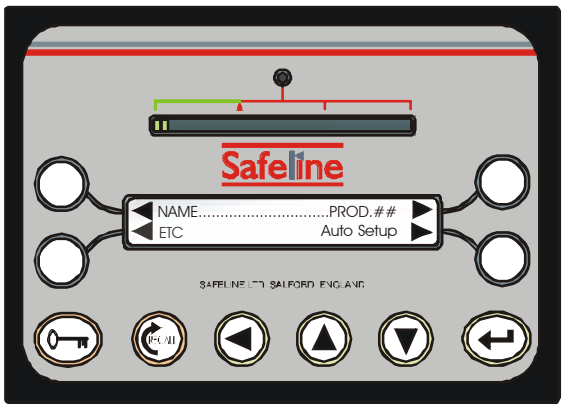
Remember to record all settings on the Settings Sheets at the rear of the manual.

Product Number, Auto Setup and Name

AUTO SETUP

CAUTION

Use of the Auto setup facility may alter settings previously set in other modes.
Press the soft key adjacent to Auto Setup to proceed to the Auto Setup sub-routine. Refer to the Auto Setup section for more information.



PROD ##
Press the soft key adjacent to PROD to select the product number the detector is to use or that you wish to set up. Use the cursor key and up and down keys to select a number between 00 and 20. Press the ENTER key when the correct Product Number is displayed.

NAME
Press the soft key adjacent to NAME to select the product by name. Press the ENTER key when the correct product name is showing.

NOTE
Auto.Setup feature is only available with operator access set to Full.

Sensitivity and Phase

SENS
Press the soft key adjacent to SENS to change the Sensitivity value. Use the cursor key and up and down keys to select a value between 000 to 199. Press the ENTER key when the correct sensitivity is showing.

Note. At a sensitivity setting of 000 the metal detector will still be able to detect very large pieces of metal.

PHASE
Press the soft key adjacent to PHASE to change the phase value.
Use the cursor key and up and down keys to select a value between 0.00^0 and 180.00^0.
Press the ENTER key when the correct phase is showing.

NOTE
This display is only available if operator access is set to Full

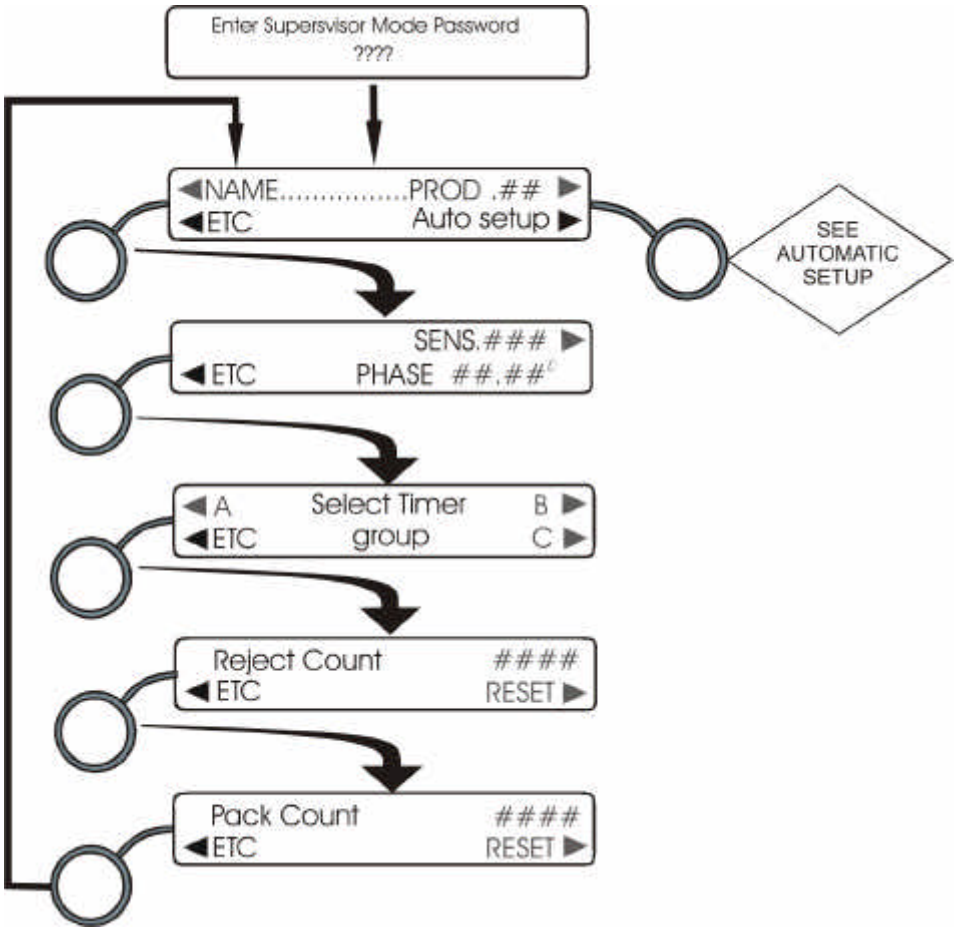


Fig 11 Supervisor Mode Flow Chart

SUPERVISOR MODE
(Default security code = 0002)

Please refer to Figure 11 for the complete sequence of displays in the Supervisor mode.

The Supervisor mode is intended for personnel who require to operate the detector in a very limited way but who are prohibited from altering any settings vital to the detector operation.

The following items can be set when in the Supervisors mode.

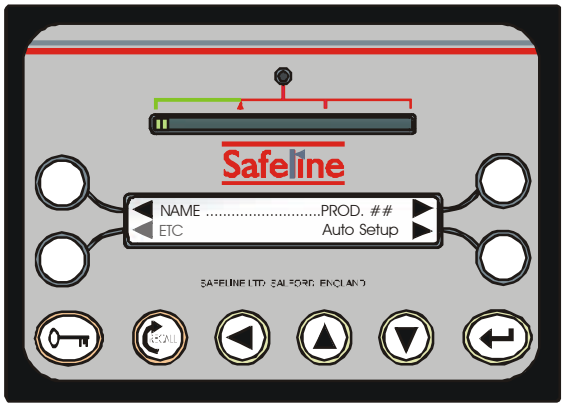
Remember to record all settings on the Settings Sheets at the rear of the manual.

Product Number, Auto Setup and Name
AUTO SETUP

CAUTION

Use of the Auto setup facility may alter settings previously set in other modes.

Press the soft key adjacent to Auto Setup to proceed to the Auto Setup sub-routine. Refer to the Auto Setup section for more information.

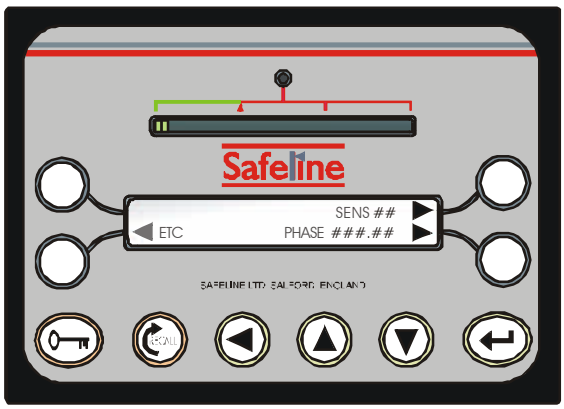


PROD ##
Press the soft key adjacent to PROD to select the product number the detector is to use or that you wish to set up. Use the cursor key and up and down keys to select a number between 00 and 20. Press the ENTER key when the correct Product Number is displayed.

NAME
Press the soft key adjacent to NAME to select the product by name. Press the ENTER key when the correct product name is showing.

Sensitivity and Phase

SENS
Press the soft key adjacent to SENS to change the Sensitivity value. Use the cursor key and up and down keys to select a value between 000 to 199. Press the ENTER key when the correct sensitivity is showing.



Note. At a sensitivity setting of 000 the metal detector will still be able to detect very large pieces of metal.

PHASE
Press the soft key adjacent to PHASE to change the phase value.
Use the cursor key and up and down keys to select a value between 0.00^0 and 180.00^0.
Press the ENTER key when the correct phase is showing.

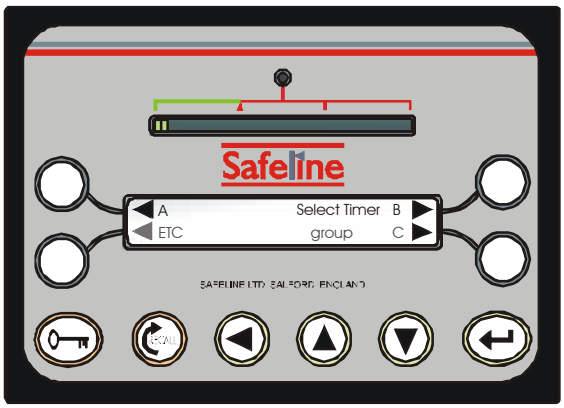
Select Timer Group

Ensure you have read the 'Introduction to timers' in the features section of the manual, see page 3.

This display is used to select which timer group the current product number should use, (either timer group A, timer group B or timer group C).

The currently selected timer group for the current product number is indicated by a flashing cursor over the group letter.

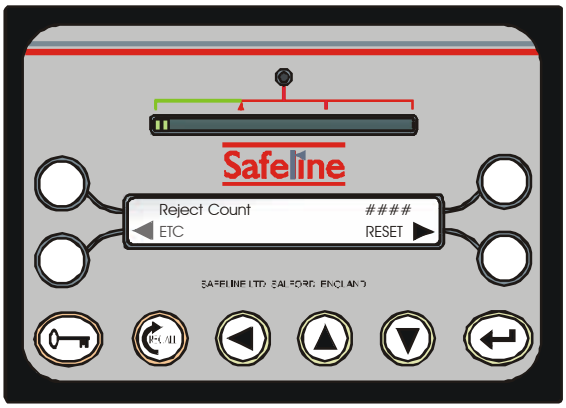
Press the soft key adjacent to the required group letter. The flashing cursor will appear over the selected group letter. When the cursor is indicating the intended group letter press the soft key adjacent to ETC to move to the next display.



Reject Count

This display shows the number of reject relay operations. It does not show the number of detections or the number of rejects.

RESET - Press the soft key adjacent to RESET to zero the Reject Count value.



Pack Count

This feature is typically not used for the Tablex Unit.

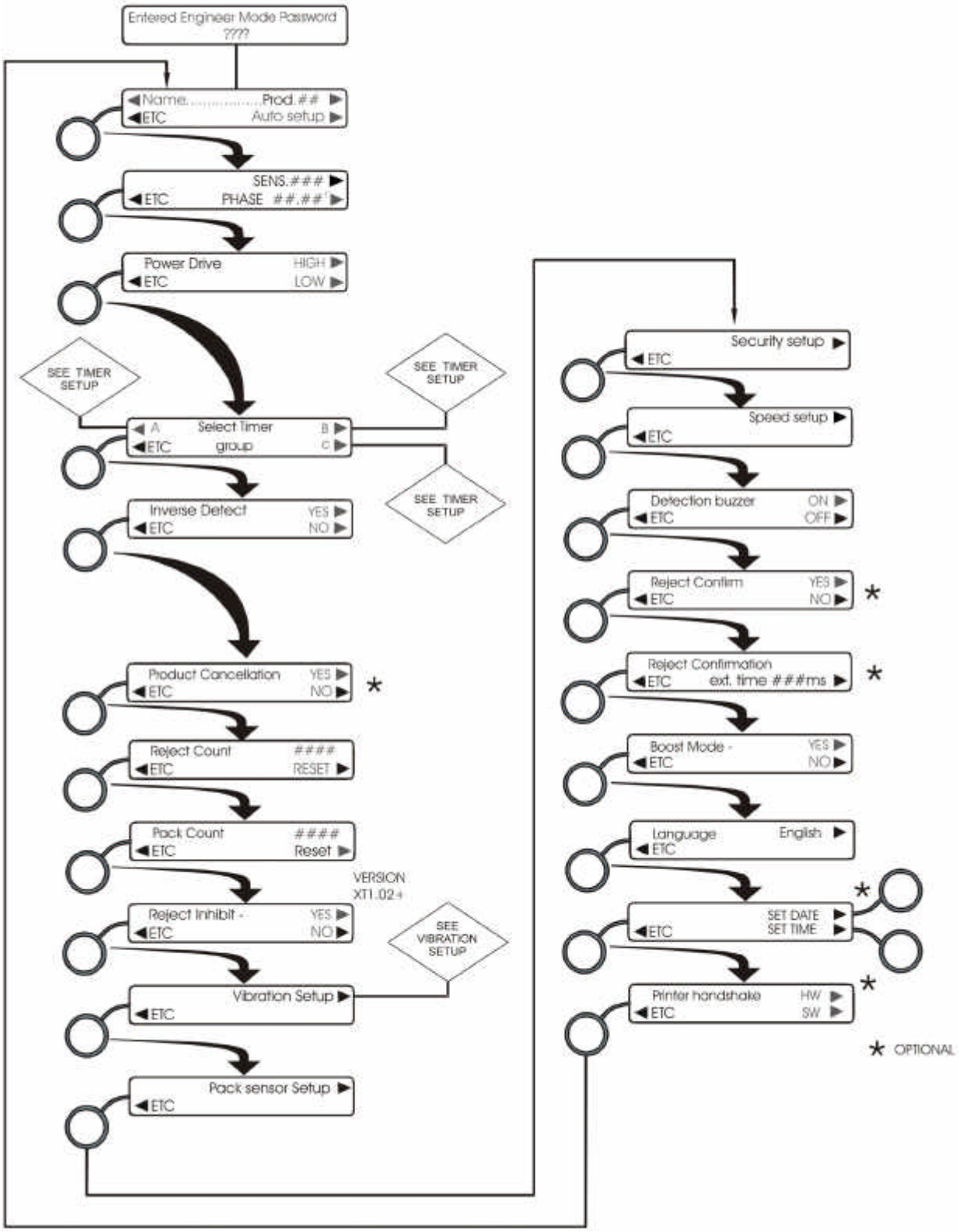


Fig 12 Engineer Mode Flow Chart

ENGINEER MODE
(Default security code = 0003)

Introduction

The Engineer's mode gives access to all variables and is used when first installing the metal detector or when making changes to setup characteristics.

Various operating characteristics of the detector are programmable and may be altered or configured to suit the particular requirements of the application.

The configuration process should be performed by the engineer when first installing the detector. The following items can be set when in the engineer's mode.

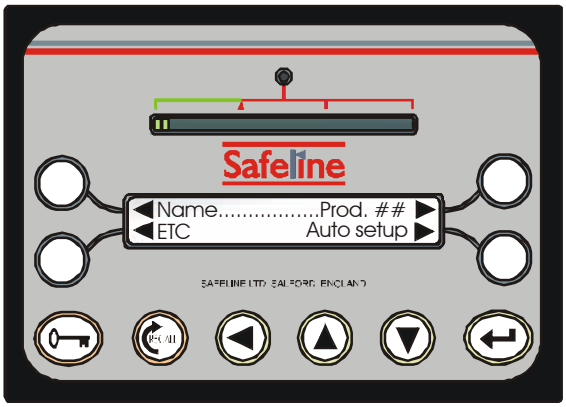
Remember to record all settings on the Settings Sheets at the rear of the manual.

Product Number, Auto Setup and Name

AUTO SETUP

CAUTION

ENTER key when the correct name has been entered. **Use of the Auto setup facility may alter settings previously set in other modes.**



Press the soft key adjacent to Auto Setup to proceed to the Auto Setup sub-routine. Refer to the Auto Setup section for more information.
select a number between 00 and 20. Press the ENTER key when the correct Product Number is displayed.

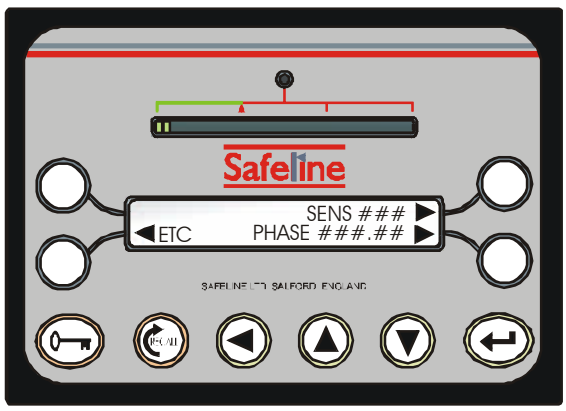
Note
Auto setup is display between product number 1 through 20.

PROD ##
Press the soft key adjacent to PROD to select the product number to which the new settings will apply. Use the cursor key and up and down keys to

NAME
Press the soft key adjacent to NAME to edit the name or the current product number. Press the ENTER key when the correct Product Number is displayed.

Sensitivity and Phase

SENS
Press the soft key adjacent to SENS to change the Sensitivity value. Use the cursor key and up and down keys to select a value between 000 to 199. Press the ENTER key when the correct sensitivity is showing
.
Note. At a sensitivity setting of 000 the metal detector will still be able to detect very large pieces of metal.



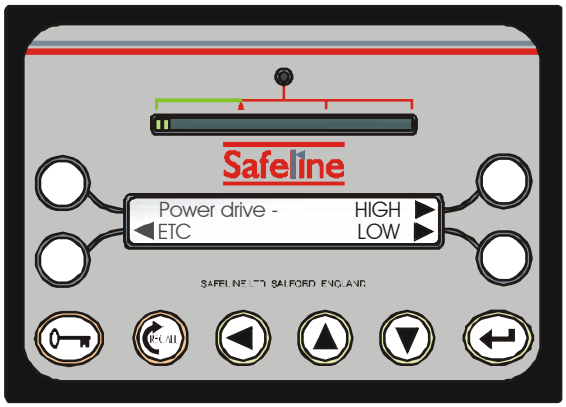
PHASE
Press the soft key adjacent to PHASE to change the phase value. Use the cursor key and up and down keys to select a value between 0.00^0 and 180.00^0.Press the ENTER key when the correct phase is displayed.

Power Drive

This feature allows the level of high frequency power being fed into the coil system to be changed, and is selectable for each product number.

For a small number of applications, such as inverse detect, or where the product being inspected has a large product effect signal, it may be necessary to select the LOW power drive setting to reduce the sensitivity of the Detector.

If for a particular product this setting is changed it will be necessary to readjust the Phase and Sensitivity, this may be done automatically or manually.



HIGH Press the soft key next to HIGH to select the normal level of power drive
For the majority of applications the HIGH power drive setting will be used.
LOW
Press the soft key next to LOW to select the reduced value of power drive.

Select and Update Timer

CAUTION

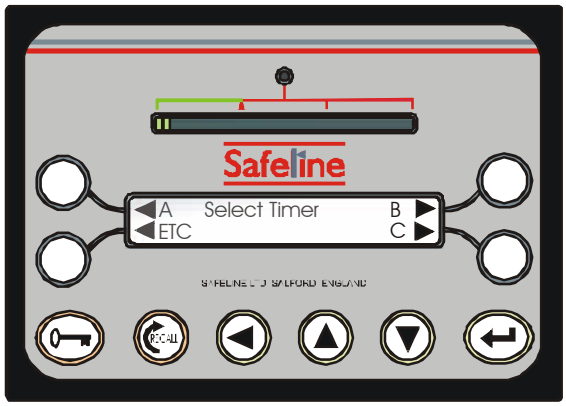
Ensure you have read the sections on timers in the Features section of the manual (see page 3).

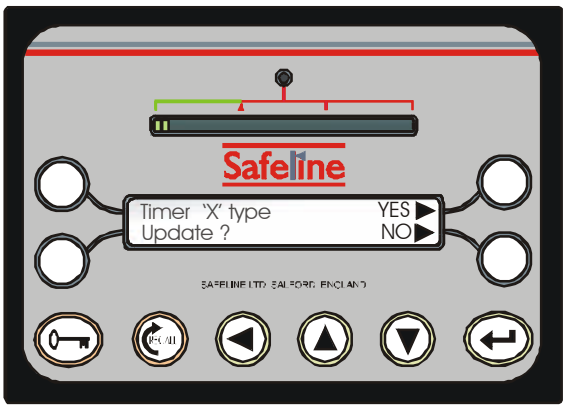
This display is used to either:

1) Select which timer group the current product number should use.

or

2) Select which timer group the current product number should use AND adjust the timer group settings such as timer type, delay time etc. The currently selected timer group will be indicated by a flashing cursor appearing over the
3) group letter. Press the soft key adjacent to the group letter required. As soon as one of the three soft keys for the different groups is pressed the display opposite will appear.





If you are only intending to select the group to which the current product number will apply (number 1. above) then press the soft key adjacent to NO.

If you require to adjust the settings for the selected timer group then press the soft key adjacent to YES and refer immediately to the REJECT TIMERS section later in the manual.

Inverse Detection

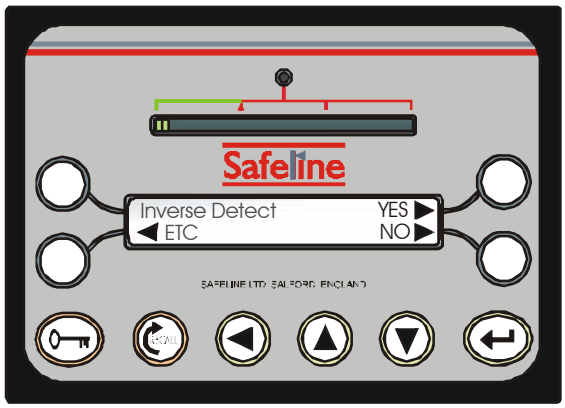
This feature allows the action of the reject timer to be reversed, such that the product containing no metal contamination is rejected whilst metal contaminated product is accepted.

The feature is often used to verify that a product contains a metallic premium or free gift.

YES - YES to enable inverse detection for the current product number and reverse the action of the reject timer.

NO - Select NO to keep the reject timer in normal mode.

Note:
This feature can only be selected when using a gated timer. Typically not used for Tablex Systems.



Reject Count

This display shows the number of reject relay Operations. It does not show the number of Detections or the number of rejects

RESET –Press the soft key adjacent to RESET To zero the Reject Count value

Pack Count

This feature is not typically used for Tablex unit application.

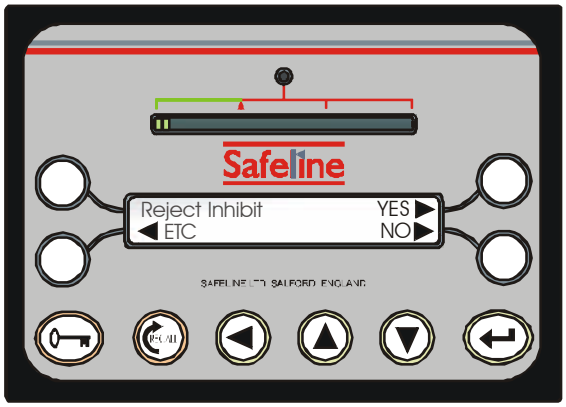
Reject inhibit (Version XT1.02 or Higher)

WARNING

DO NOT USE THIS FACILITY TO INHIBIT THE REJECT DEVICE DURING MAINTENANCE WORK. ALWAYS REMOVE THE POWER SUPPLY TO THE REJECT DEVICE BEFORE MAINTENANCE WORK IS STARTED.

YES - Select YES to override the operation of the reject device during setting up operations.

NO - Select NO for normal use



Vibration setup

Press the soft key adjacent to Vibration setup to enter the Vibration Setup menu.

Refer to the Vibration Setup section for more information.

Pack sensor setup

This feature is not typically used for Tablex unit application.

Security Setup

Press the soft key adjacent to Security Setup to enter the Security setup menu.

Refer to the Security Setup section for more information.

Speed sensor setup

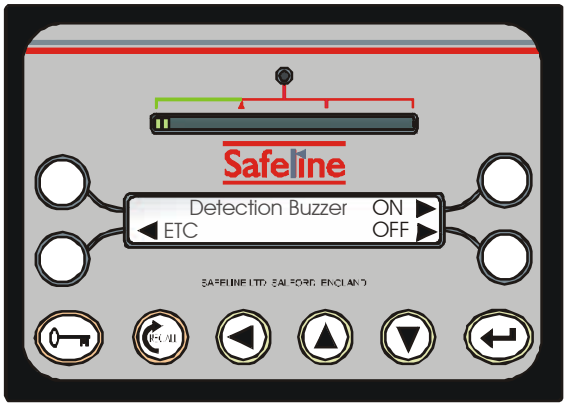
This feature is not typically used for Tablex unit application.

Detection Buzzer

ON - Select ON so that the buzzer will sound when metal is detected.

OFF - Select OFF to prevent the buzzer sounding when metal is detected.

Note:
The buzzer will always sound if a key is pressed or a fault occurs irrespective of the setting here.



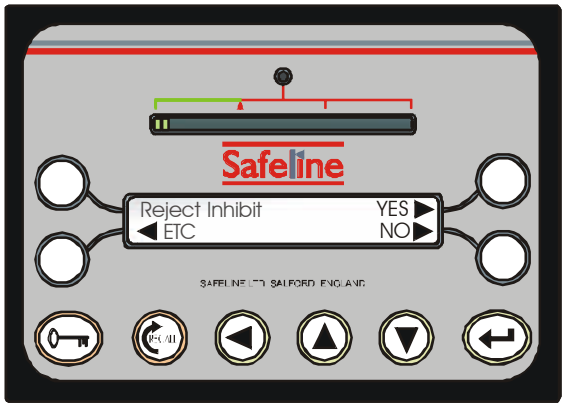
Reject inhibit

WARNING

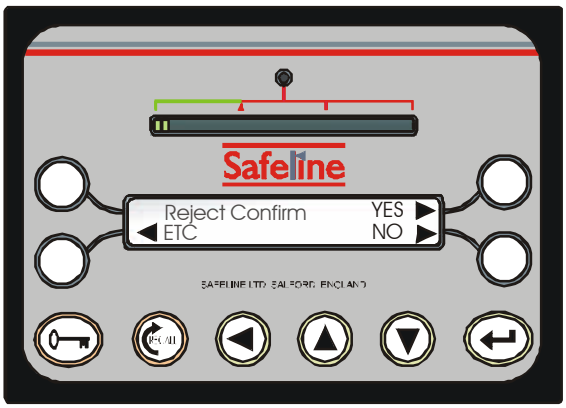
DO NOT USE THIS FACILITY TO INHIBIT THE REJECT DEVICE DURING MAINTENANCE WORK. ALWAYS REMOVE THE POWER SUPPLY TO THE REJECT DEVICE BEFORE MAINTENANCE WORK IS STARTED.

YES - Select YES to override the operation of the reject device during setting up operations.

NO - Select NO for normal use



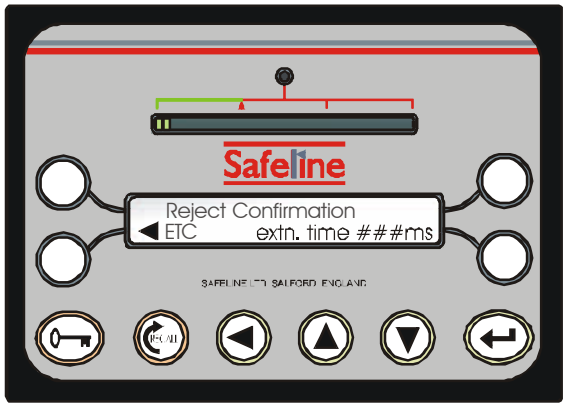
Reject Confirmation (Option)



The optional Reject Conformation Unit (RCU) confirms that the reject mechanism has operated at the correct **time**

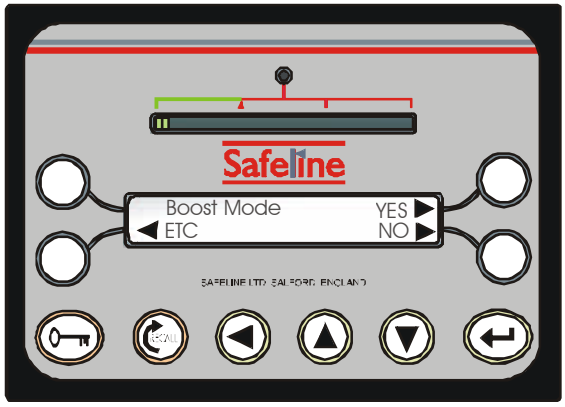
YES - Select YES if you require Reject Confirmation
NO - Select NO if the Reject Confirmation is not required

EXTN. TIME - This is the time taken for the external sensor to detect that a contaminated package has been rejected



Note. This display will only appear if YES is selected on the display above. For timer types tm3 and tm3G the extn. time is not used and window time is used

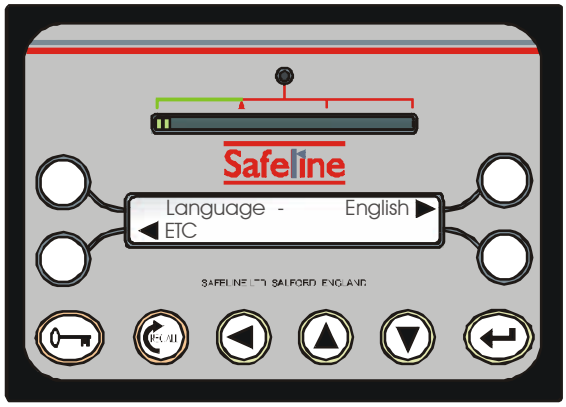
Boost Mode



YES - Select YES to improve the sensitivity by 20% at a sensitivity of 199.

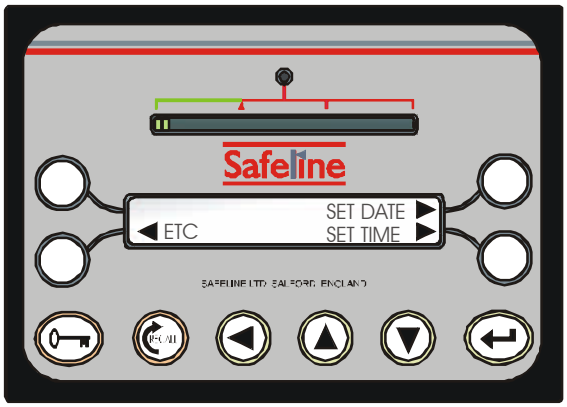
NO - Select NO for normal sensitivity at 199.

Language



LANGUAGE – Use the soft key to scroll through The languages(including English). The languages Available are:
English
French
Italian
Spanish
German
Dutch
Danish
Swedish
Japanese
Polish

Set Date and Time (Option)

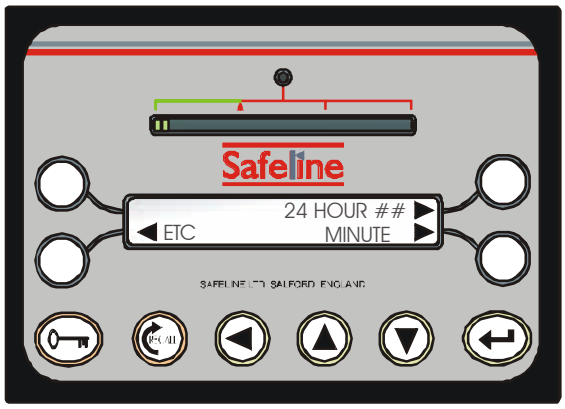


SET DATE - Press the soft key adjacent to SET DATE to proceed to the SET DATE display

SET TIME - Press the soft key adjacent to SET TIME to proceed to the SET TIME display.

YEAR - Press the soft key adjacent to YEAR to adjust the year value. Use the cursor key and up and down keys to select the correct year. Press the ENTER key when the correct year is set.

MONTH - Press the soft key adjacent to MONTH to adjust the month value. Use the cursor key and up and down keys to select the correct month. Press the ENTER key when the correct month is set.

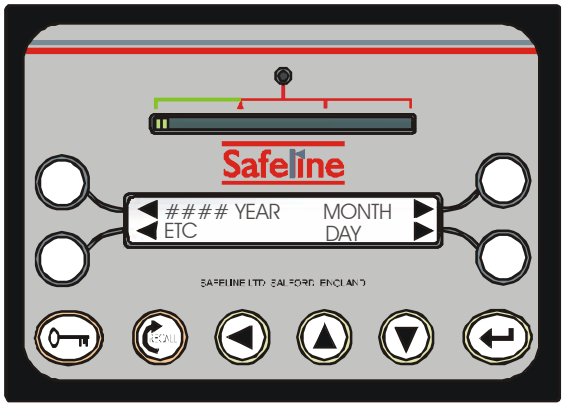


DAY - Press the soft key adjacent to DAY to adjust the day value. Use the cursor key and up and down keys to select the correct day. Press the ENTER key when the correct day is set.

24 HOUR - Press the soft key adjacent to 24 HOUR to adjust the hour value of the current time. Use the cursor key and up and down keys to select the correct hour. Press the ENTER key when the correct hour is set.

The clock uses the 24 hour format.

MINUTE - Press the soft key adjacent to MINUTE to adjust the minute value of the current time. Use the cursor key and up and down keys to select the correct minute value. Press the ENTER key when the correct minute is set.



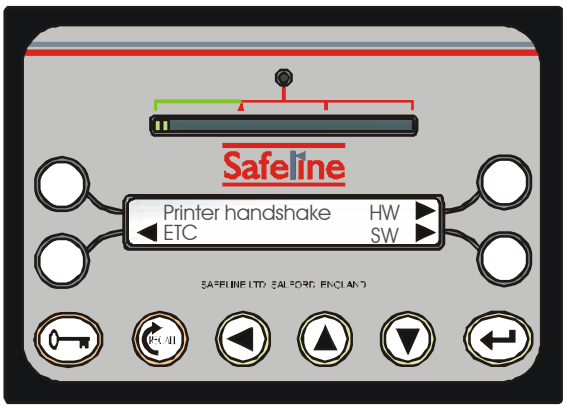
Printer Handshake (Option)

This display controls the handshaking mode that the electronic module uses with a dedicated printer.

HW - Press the soft key adjacent to HW if a hardware handshake is required. This is the default setting.

SW - Press the soft key adjacent to SW if a software handshake is required. If this option is selected the detector uses X-ON X-OFF flow control.

Refer to Appendix B for more information



AUTOMATIC SETUP

Introduction

The automatic setup feature may be used to automatically set the following;

- Sensitivity
- Phase (see Note below)

The automatic setup feature is designed to make setting up your metal detector as easy as possible by requesting the operator to pass the product through the aperture at specific times and NOT requiring the operator to adjust any of the controls.

Before using the automatic setup feature ensure that

a) If a pack sensor is fitted that the pack sensor has been set up correctly.

b) That the speed of the product has been set-up correctly.

c) The sensitivity limit has been set correctly.

d) If the application is an 'Inverse detect' application that the 'Inverse detect' feature has been enabled before starting automatic setup.

The automatic setup feature can NOT be used to set up for products on a continuously running product line.

The automatic setup feature will correctly set up for products that exhibit or do not exhibit a product effect.

Normally the operator will have to pass the product through the aperture about four times (see the section below entitled “Notes on passing product through the detector” At worst the operator will be requested to pass the product through the aperture ten times.

If a pack sensor is to be used with the detector, set up the pack sensor details before starting automatic setup - for certain products the use of the pack sensor will speed up the operation of automatic setup.

The automatic setup supports ‘Inverse detect’ applications. If required select the ‘Inverse detect’ feature ON for the current product number prior to starting automatic setup.

Note

1) Automatic setup will attempt to setup the detector in the currently selected Operating Frequency setting. However there are two conditions where automatic setup will change the currently selected 'Operating Frequency’ setting, these are;

In a minority of cases following automatic setup it may be necessary to manually trim the phase and/or sensitivity to optimise performance. Refer to the earlier Sensitivity and Phase display for details on how to do this.

Remember to record all settings on the Settings Sheets at the rear of the manual.

NOTES ON PASSING PRODUCT THROUGH THE DETECTOR

NOTE

The product should be continually moving, the detector will not operate with standing/stationary product in the aperture.

To ensure that the detector is set up correctly and will operate satisfactorily during normal production, we recommend that the product used for automatic set up is passed through the detector in the worst case position and orientation which would occur during normal production.

The worst case product effect condition is when the greatest disturbance of the coil system/largest product signal is experienced. This occurs when the coil system condition changes from no product to maximum product.
With individual or boxed/cartoned product the worst case product effect condition occurs as the product enters and leaves the detector. If the product is rectangular the product effect signal will generally be more severe if the product enters the detector aperture long edge leading, as opposed to short edge leading. The gaps between the products will create the worst case product effect condition. If successive products are touching a reduced product signal will result.

For the majority of product types the worst case condition occurs the closer the product is to the faces of the detector aperture.

The technique of setting up to the worst case product effect condition will ensure that no false product rejections occur during normal running conditions.

Carrying Out Automatic Setup

The operator is not required to take any action for most of the displays other than to pass the product when instructed.

(1) Ensure **no** product is passing through the detector.

(2) Select a sample product.

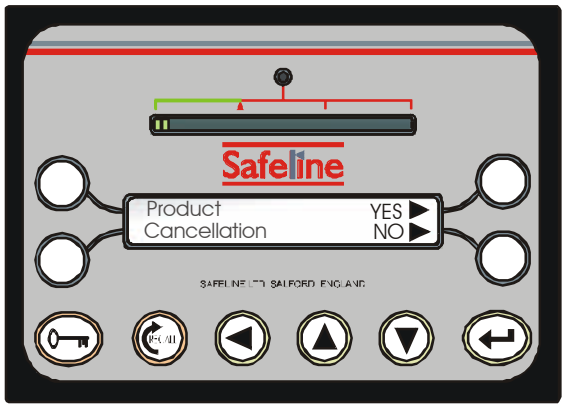
(3) Select auto-setup and follow the displayed instructions. Most of the displays will require no operator interaction. The exceptions to this rule are shown below

---

When this display is showing, pass the product through the aperture in its normal manner to create a worst case product effect signal, for more details refer to 'Notes On Passing Product Through The Detector' earlier.

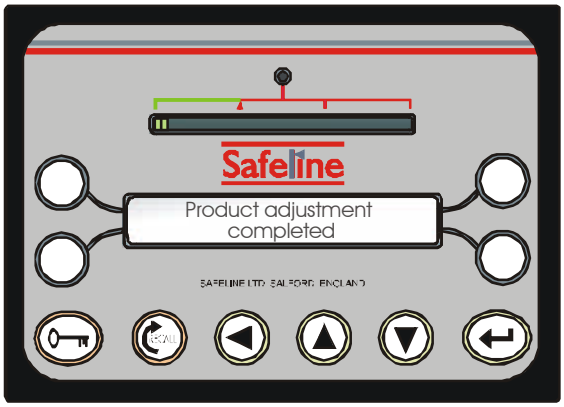
If the detector does not detect any product being passed within a thirty second period, the unit will revert back to the display from which automatic setup was started.

If product signal cancellation is required for the current product number select YES, else select NO



This display appears when automatic setup has finished. The display will be seen for a few seconds, and then will revert back to the display from which automatic setup was started.

Passing the product through the aperture should now give 2 to 4 segments on the bar graph display



NOTE

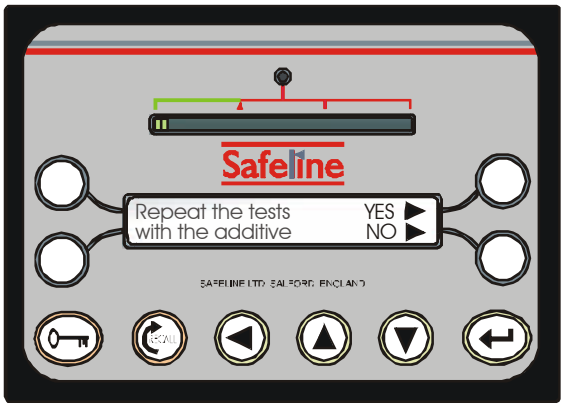
In a minority of applications it may be necessary to manually trim the phase and/or sensitivity to optimise performance. If this is required refer to the 'How to Manually Trim The Phase And/Or Sensitivity' later in this section.

Test the sensitivity of the detector by passing metal samples through the aperture of the detector (preferably on or in the product).

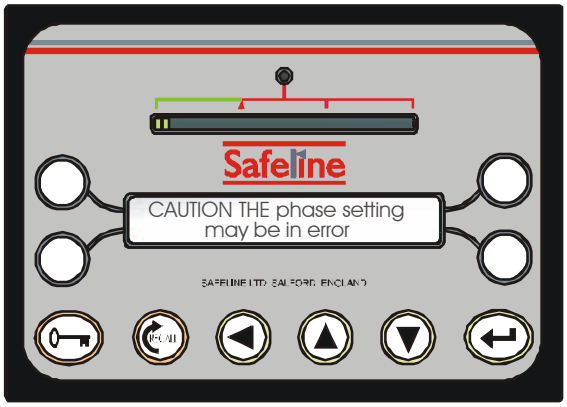
If required manually adjust Sensitivity (page 51) to achieve the required spherical performance standard

Note the sensitivity level for the bargraph may be limited by the vibration characteristics of the system. If this is the case then ensure that manually increasing the sensitivity does not cause the detector to trigger from system vibration.

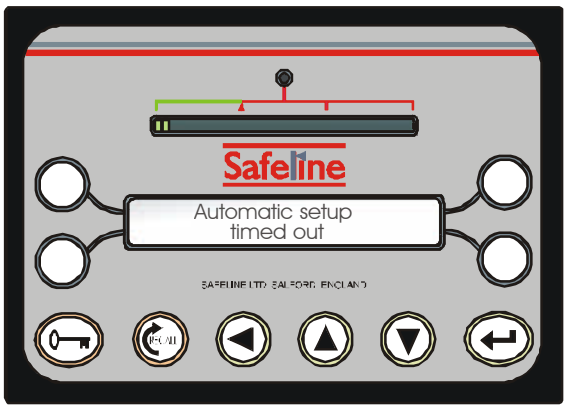
This display occurs if automatic setup is being performed on a product number with the inverse detect feature enabled.
Selecting YES allows the calibration of the product and additive combination to be performed again. This allows different orientations of the additive to be tested - the automatic setup will always choose the best setting out of all of the orientations tried.
When there are no more orientations to be tried Select NO.



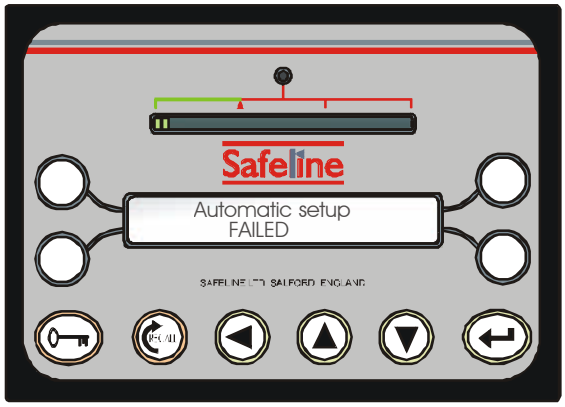
This display will occur if the electrical signal produced by the product passing through the aperture was insufficient to guarantee the accuracy of the setting of the phase control



This display will occur if no product was passed through the detector when requested.



This display may occur for one of the following reasons.



1) The detector is sensing a signal when there should be no product passing through the aperture.

Repeat the automatic setup and ensure that no product is passed through the detector when instructed, and that no product or metal is close to the aperture and influencing the detector.

2) The automatic setup has requested the user to 'Pass product through aperture ....' and no product has been sensed within the required period.

Repeat the automatic setup and ensure that the product is passed through the aperture when requested.

3) The automatic setup has not been able to setup correctly due to the size of the product signal. *Switch 'Power drive' to LOW (page 38) and repeat the automatic setup.*

How to Manually Trim The Phase and/or Sensitivity

The objective of the following procedure is to ensure the setting of phase and sensitivity are optimised following automatic setup.

The correct setting of the phase will be one value which will give minimum signal from the product on the bargraph display, this is known as the "null point" setting. Changing the phase setting up or down in value from this setting will increase the amplitude of the signal.

The correct setting of the sensitivity will be a value which gives a peak signal from the product of 3 to 4 bars on the LED bargraph display.

1) Pass the product through the aperture in its normal manner to create a worst case product effect signal, for more details refer to 'Notes On Passing Product Through The Detector'.

If required adjust the sensitivity so that the peak signal from the product gives 3 to 4 bars

2) on the LED bargraph display. Press the 'Enter' key to store the new setting in memory.

3) Adjust the sensitivity so that the peak signal from the product gives a reading on the LED bargraph display of approximately half full scale (i.e. 10 green bars), refer to note 1).

4) To verify/optimise the "null point" set by the automatic setup, increase the phase setting in steps of 1° and at each step observe if the amplitude of product signal indicated on the bargraph display reduces. If an increase in product signal is observed, then decrease the phase setting in steps of 1° and at each step observe if the amplitude of product signal indicated on the bargraph display reduces.

   For example if the automatic setup value is 90°, and as the phase setting is increased there is a clear reduction in signal as we change from 90° to 91°, and then from 91° to 92° the signal starts to increase again, this indicates that the "null point" is between 90° and 92°.

5) Now reduce the phase setting in steps of 0.2° i.e. 91.8°, 91.6°, 91.4°, 91.2°, etc. until the product effect signal is reduced to a minimum and then just starts to increase again.

For example, if as the setting is reduced there is clear reduction in signal from 90.8° to 90.6°, and then from 90.6° to 90.4° the signal starts to increase again, this indicates that the "null point" is between 90.8° and 90.4°. Using the 0.1° digit adjust the phase setting up and down until minimum signal i.e. the "null point" is found.

6) Although not always necessary a more precise "null point" will be found by now using the 0.01° in a similar manner to the 0.1° digit as described in 5).

The phase control circuit is now aligned to the product signal, next adjust the sensitivity so that the product signal gives a maximum signal of 3 to 4 green bars on bargraph display, refer to Note.

7) Check the susceptibility of the detector to vibration, if unacceptable (i.e. system vibration is showing on the bargraph) reduce the sensitivity until acceptable.

8) Press the 'Enter' key to store the new settings in memory.

Note

When using the phase control to minimise product signals the detector may become more susceptible to vibration. The final setting of the sensitivity may be limited by vibration effects rather than product effect.

VIBRATION SETUP

Introduction

This menu is used to set-up the detector for optimum performance with any vibration present in the system.

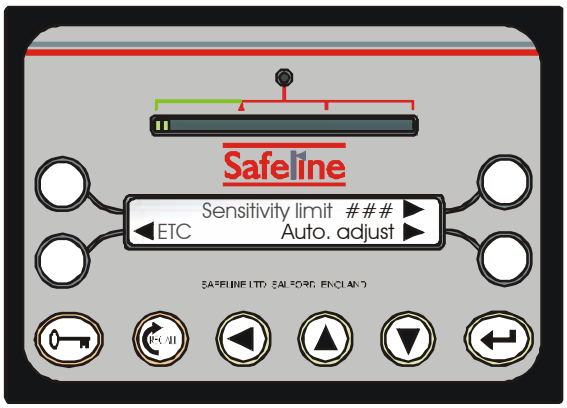
NOTE
When adjusting the sensitivity limit ensure that all mechanical and electronic equipment that may be a source of vibration is operating (including reject devices etc.).

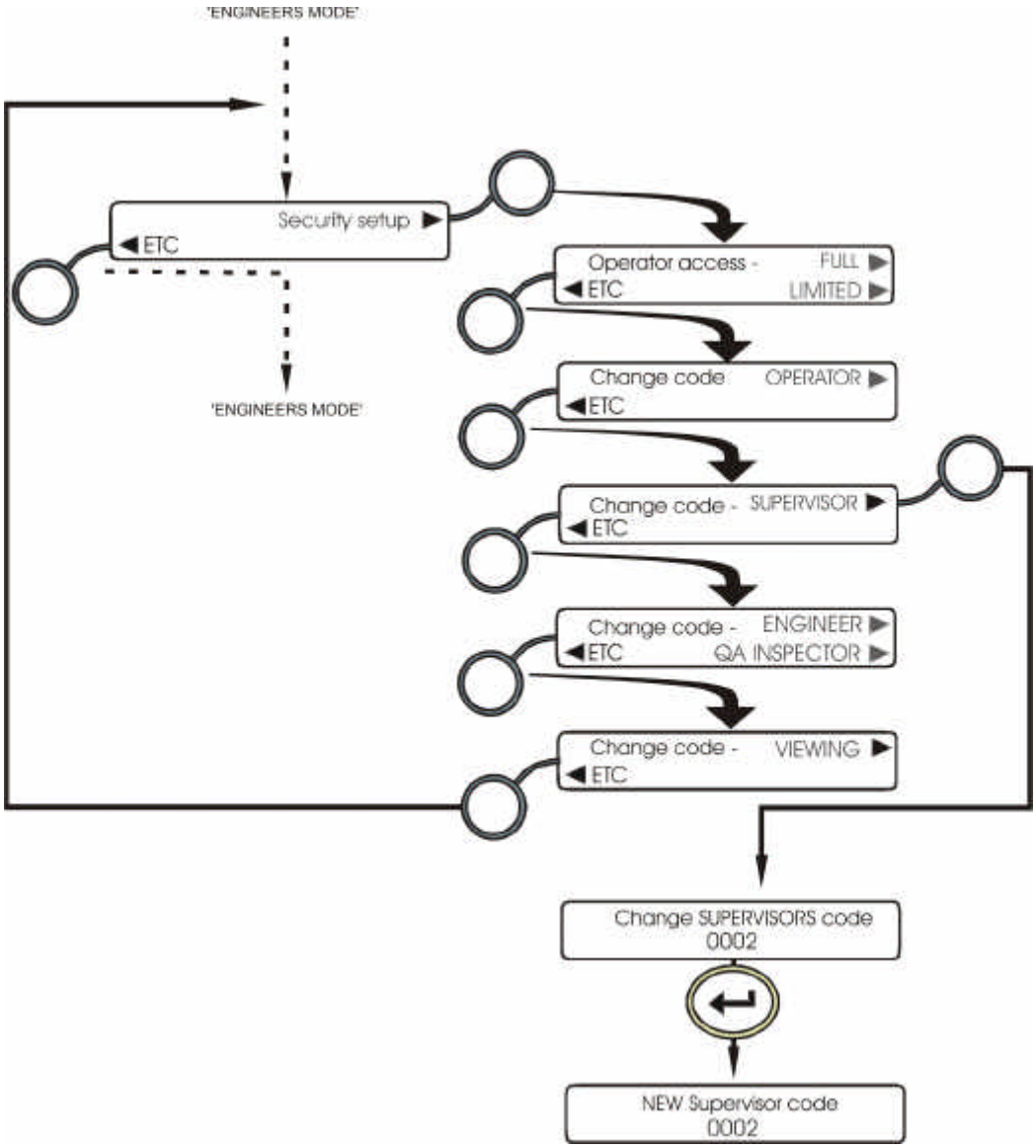
Sensitivity limit

This display is used to manually or automatically set-up the maximum sensitivity that will be set by the automatic setup feature of the detector. The maximum sensitivity must be reduced in situations where the detector is subject to high vibration.

Press the soft key adjacent to sensitivity limit to manually set the sensitivity limit. Press the ENTER key when finished.

Press the soft key adjacent to Auto. Adjust to automatically set the sensitivity limit.





NOTE
This flow chart shows the sequence when changing the Supervisor security code. The sequence is the same for the Operator, Engineer, QA Inspector and Viewing security codes.

Fig 13 Security Setup Flow Chart

SECURITY SETUP

Introduction

At Safeline metal detectors are shipped from the factory with the following security codes pre-programmed.

Code 0001 = Operator mode

Code 0002 = Supervisor mode

Code 0003 = Engineer mode

Code 0004 = QA Inspector mode

Code 0005 = Viewing mode

The Security Setup sub-routine allows the changing of the security codes for up to four of the operating modes (i.e. Supervisor, Engineer, QA Inspector and Viewing). The Security Setup sub-routine can only be accessed from the Engineer Mode.

CAUTION

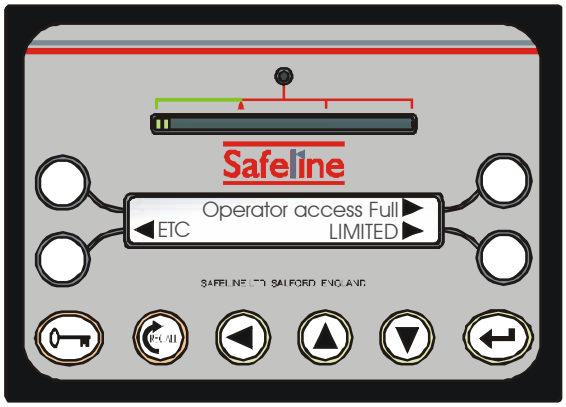
Take care to memorise your new security Codes.

Operator access

This display enables the detector to operate such that by entering the OPERATOR security code it is possible to change the sensitivity and phase of a product as well as just changing the product number.

LIMITED Press the soft key next to LIMITED to prevent any person with an OPERATOR security code from being able to alter phase and sensitivity.

FULL Press the soft key next to FULL to allow any person with an OPERATOR security code to adjust phase and sensitivity.



Changing security codes

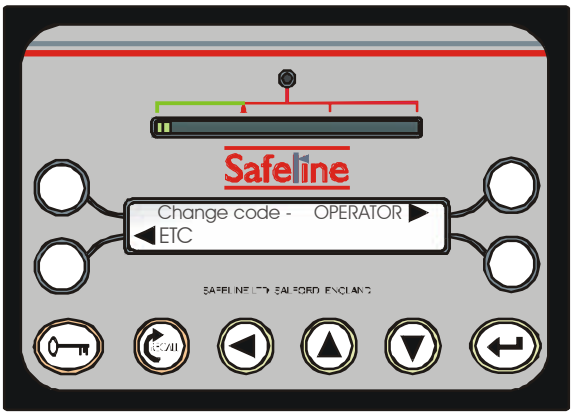
1) Press the ETC key to step through the following four displays,

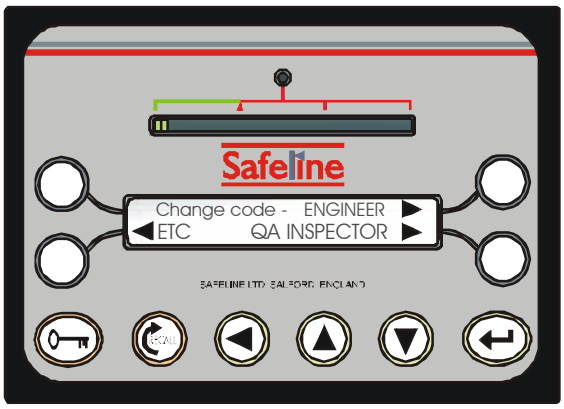
2) Press the soft key adjacent to the required security code (i.e. OPERATOR, SUPERVISOR, ENGINEER, QA INSPECTOR or VIEWING

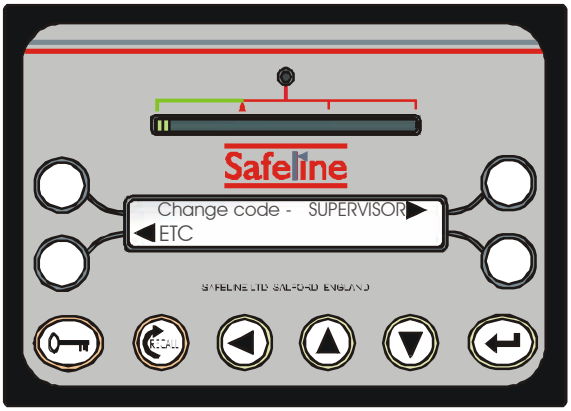
3) If the soft key adjacent to SUPERVISOR is pressed the display opposite will appear.

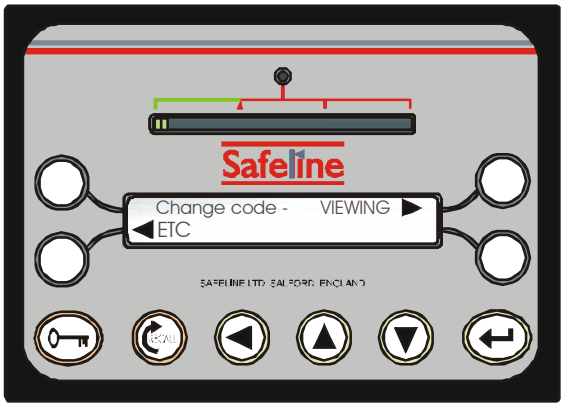
4) The cursor appears under the first digit. Use the up and down keys to change the number and then press the ENTER key. A * replaces the number and the cursor moves to the next digit.

5) Repeat Step 4) for the remaining three digits

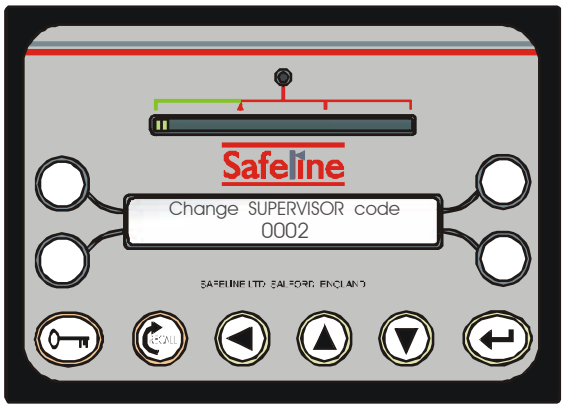








Changing security codes cont…..



6) When the last digit has been set press the ENTER key and the display opposite appears.

7) Press the ENTER key if the number is correct, and return to the Engineer Mode.

8) If the number is not correct press the RECALL key and carry out Steps 1) to 7) again.

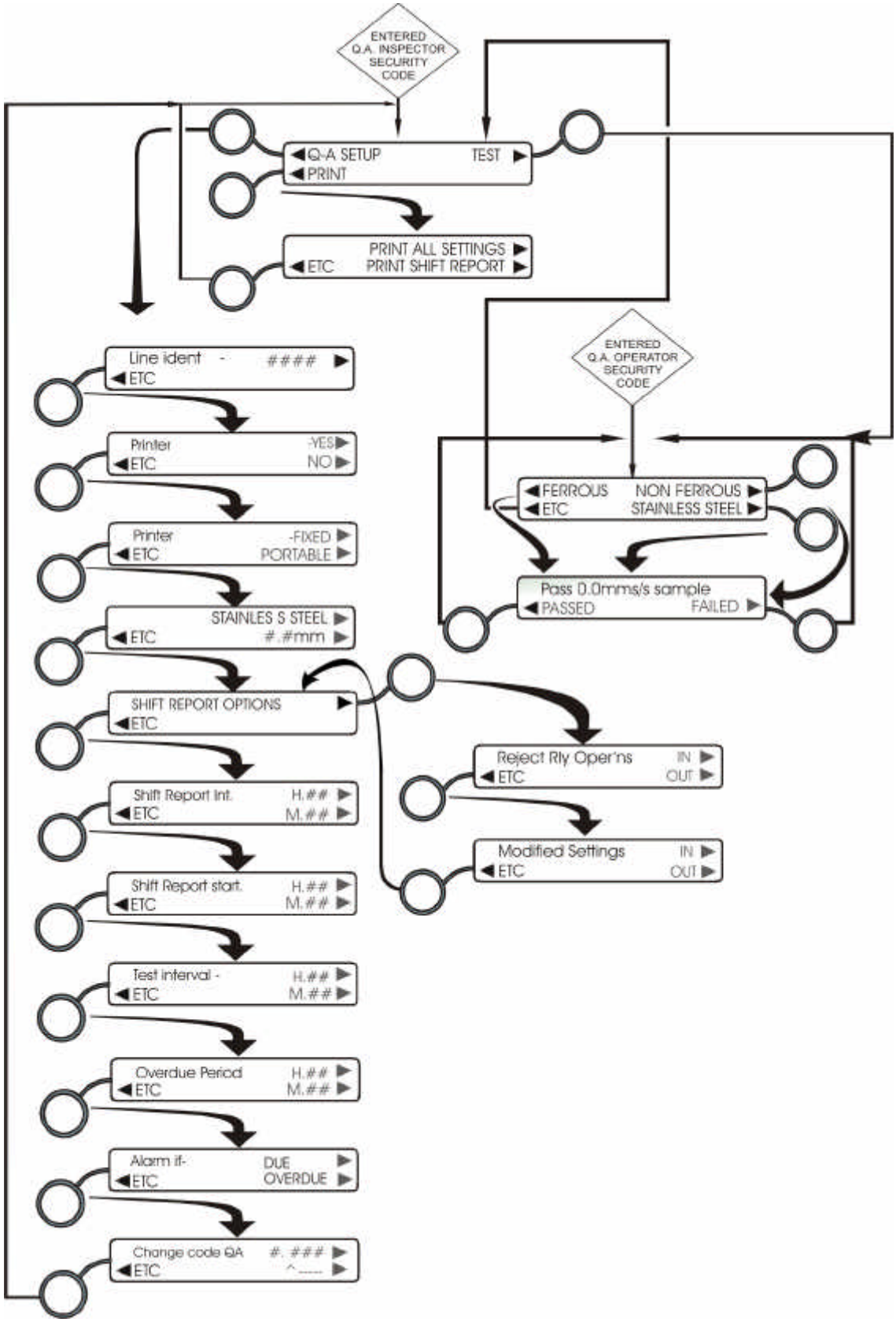


Fig 14 Qa Inspector and Operator Flow Chart

QA INSPECTOR MODE (OPTION)

(Default security code = 0004)

Introduction

The performance validation routine (PVR) helps the users comply with ISO 9000 and BS5750 by The printer also records general information relating to the detector performance, it will date and time stamp events such as rejections and changes made to the detector settings. The printer is a very useful management tool for recording events that affect detector performance.

Refer to Appendix C for illustrations of typical printouts ensuring that the detector system is tested and operating to the users specified quality assurance (QA) standards of performance.

The quality standards of many user companies require the detector and its reject system to be manually tested at specified intervals by authorised QA personnel to validate compliance.

QA personnel may programme the detector to indicate when testing is required and to give an alarm if testing is not carried out at the appropriate time. Individual QA personnel may be allocated a personnel security code which would be used to ensure that the individual responsible for testing does so at the specified time.

Remember to record all settings on the Settings Sheets at the rear of the manual.

Printer

Although effective as a feature in its own right the PVR is most effective when used in conjunction with a printer; the printer will provide a date and time stamped hard copy print out showing when the detector was tested and by whom.

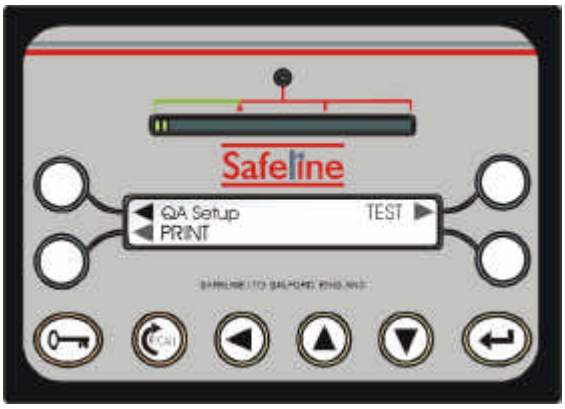
The hard copy print out can be used to demonstrate authorised personnel's compliance with company standards and hence the user companies compliance with the agreed quality standard. This may prove invaluable to companies wishing to demonstrate compliance with the ISO 9000, BS5750, the UK Food Act, and for users supplying the major retail organisations with strict detector standards.

The printer also records general information relating to the detector performance, it will date and time stamp events such as rejections and changes made to the detector settings. The printer is a very useful management tool for recording events that affect detector performance.

Refer to Appendix C for illustrations of typical printouts.

Configuring the Performance Validation Routine

On entering the QA Inspector's mode press the soft key adjacent to QA SETUP

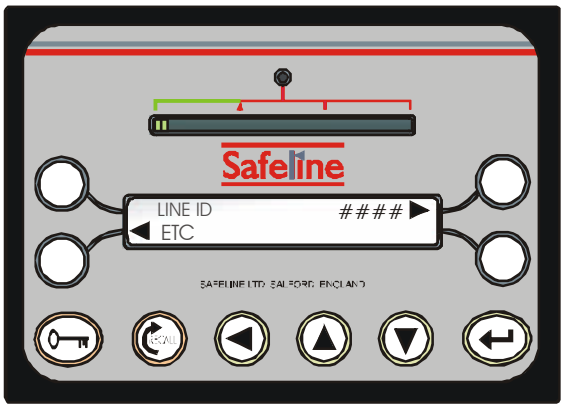


Line Identification

This is a number that is printed near the beginning of all printouts.

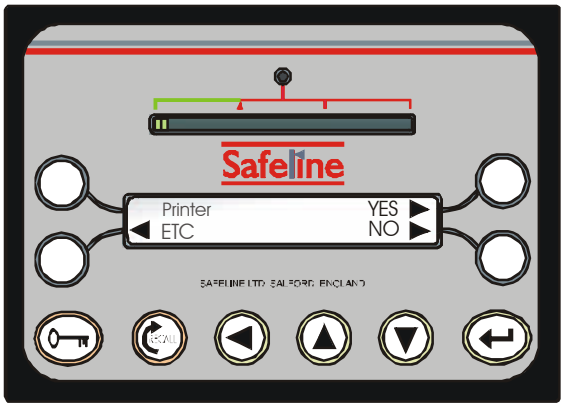
LINE ID - Use the cursor key and up and down keys to set the line identification number.

For example the left hand two digits could be the line number and the right hand two digits could be the metal detector number.
Press ENTER when the required line identification is showing.



YES - Select YES if a printer is installed

NO - Select NO if there is no printer installed.

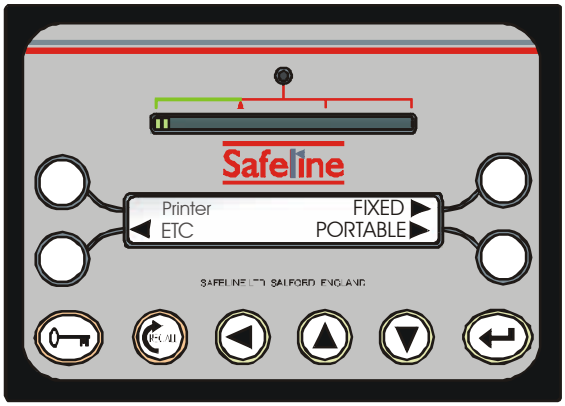


Printer Fixed/Portable

Portable printers will not give a "data collection unit not ready" message if a QA test is performed without a printer attached. Fixed printers will always give the message if a printer is not connected.

FIXED - Press the soft key adjacent to FIXED if the printer is permanently connected.

PORTABLE - Press the soft key adjacent to PORTABLE if the printer is not permanently connected.



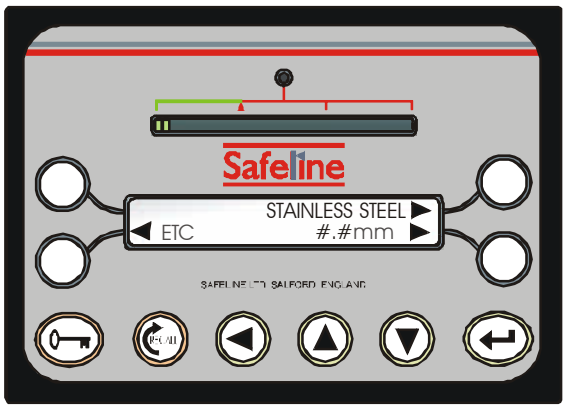
Test Samples

Press the soft key adjacent to the material type to select either a Ferrous, Non-Ferrous or Stainless Steel sample.

Press the soft key adjacent to the mm and use the cursor key and up and down keys to set the required sample size.

Press ENTER when the correct size is showing.

Different sizes can be set for all three materials.



Shift Report Options

Line Identification

Press the soft key adjacent to SHIFT REPORT OPTIONS to allow setting of the parameters that will be recorded on the timed and manual printouts.

At the Reject Relay Operations display press a soft key adjacent to IN or OUT.

IN - Select IN to include the date and time of all reject relay operations which have occurred, since the last shift report, in the print out of the current shift report.

OUT - Select OUT to prevent the print out of the data and time of all reject relay operations between shift printouts.

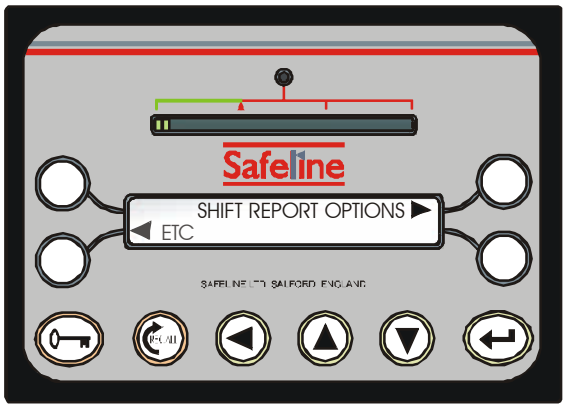
At the Modified Settings display press a soft key adjacent to IN or OUT

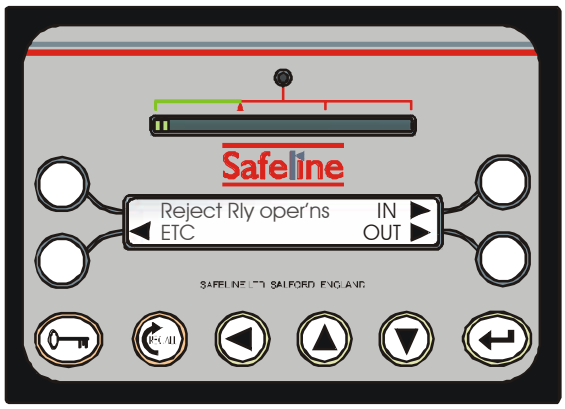
IN - Select IN to include certain settings which have been changed since the last shift report, in the current shift report. The shift report will include the settings new value and the date and time that it was changed.

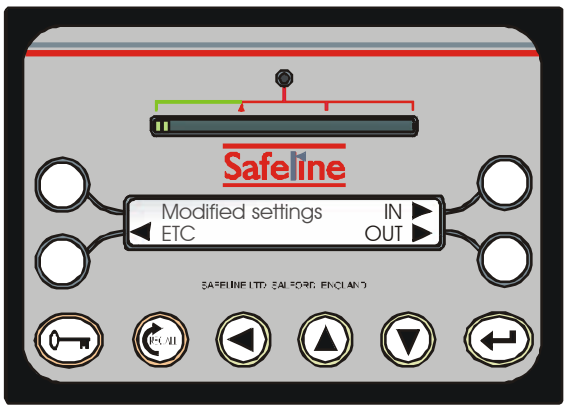
The settings which are recorded are :

- Product Number
- Sensitivity
- Phase
- Timer Type
- Pack and Reject count resets
- Reject Inhibit
- Tracking
- Power drive
- Detector Speed
- Boost

OUT - Select OUT to prevent the recording and print out of any changes to the settings between shift printouts.

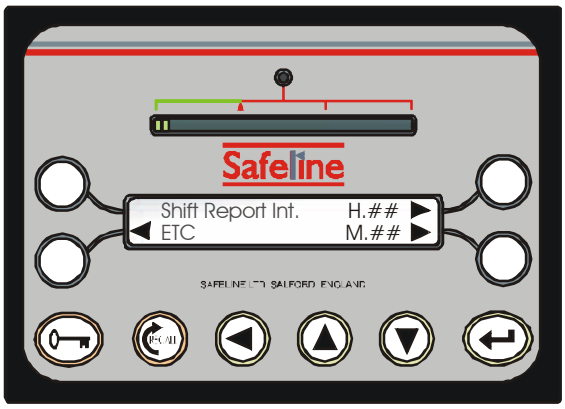






Shift Report Interval

The shift report can be automatically printed on a timed basis. This display allows the QA inspector to adjust the interval between printouts to a maximum interval of 24 hours 0 minutes.



H - Press the soft key adjacent to H to adjust the hours value. The maximum number of hours is 24. Use the up and down keys to change the value . Press the ENTER key when the correct number of hours is shown.

M - Press the soft key adjacent to M to adjust the minutes value between 0 and 59.

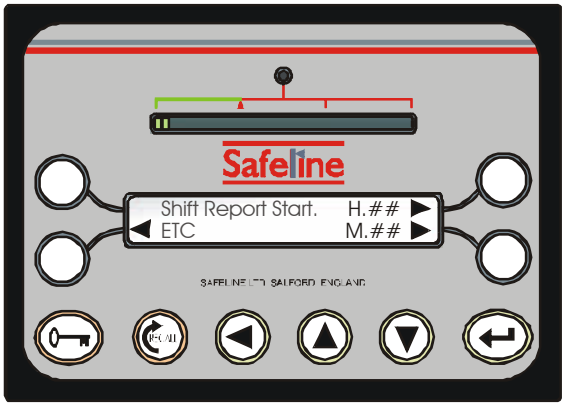
Use the up and down keys to change the value.

Press the ENTER key when the correct number of minutes is shown.

NOTE :
Setting the Shift Report Interval time to 0:00 will disable the shift report facility.

Shift Report Start Time

This display allows the QA inspector to specify a start time for the automatic printing of shift reports.



H - Press the soft key adjacent to H to adjust the hours value between 0 and 23.

Use the up and down keys to change the value.

Press the ENTER key when the correct number of hours is shown.

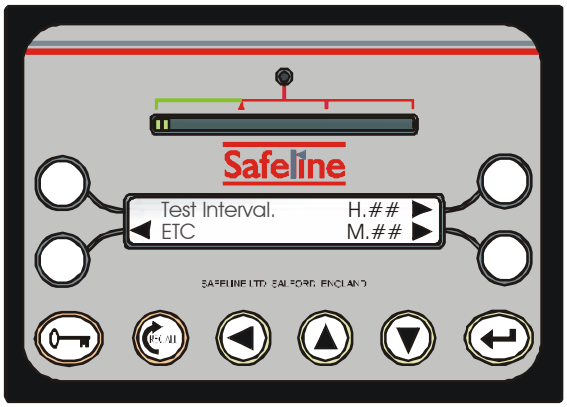
M - Press the soft key adjacent to M to adjust the minutes value between 0 and 59.

Use the up and down keys to change the value.

Press the ENTER key when the correct number of minutes is shown.

Test Interval

This display allows the QA inspector to set the time period between which the detector requests the QA personnel to carry out a performance check.



At the time interval specified the message, 'REQUEST FOR PERFORMANCE CHECK' appears on the display.

The test interval time is restarted once a performance check has been completed.

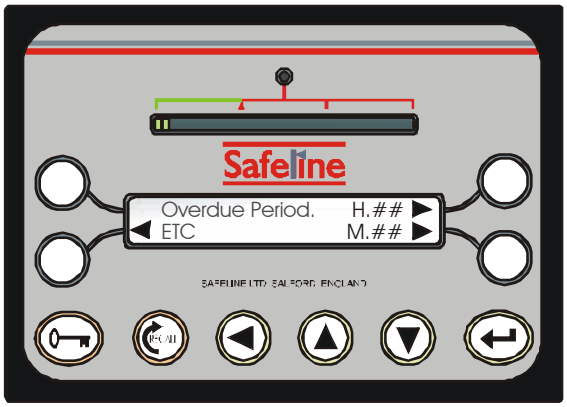
H - Press the soft key adjacent to H to adjust the hours value. The maximum number of hours is 8. Use the up and down keys to change the value . Press the ENTER key when the correct number of hours is shown.

M - Press the soft key adjacent to M to adjust the minutes value between 0 and 59.
Use the up and down keys to change the value.
Press the ENTER key when the correct number of minutes is shown.

NOTE :
Setting the time to 0:00 will disable requests for timed performance checks.

Overdue Period

This display allows the QA inspector to adjust the time period allowed, following a performance check request, before the test becomes overdue.



Once the test becomes overdue the 'REQUEST FOR PERFORMANCE CHECK' message is replaced with 'OVERDUE FOR PERFORMANCE CHECK'. At the same time the bar graph display and buzzer are sequenced on and off to attract the operator's attention.

H - Press the soft key adjacent to H to adjust the hours value. The maximum number of hours is restricted to half of the test interval time
Use the up and down keys to change the value.
Press the ENTER key when the correct number of hours is shown.

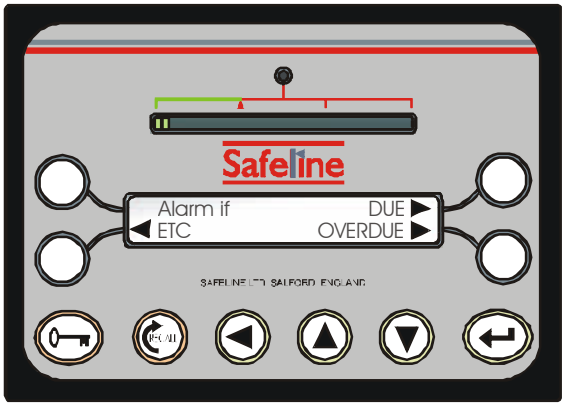
M - Press the soft key adjacent to M to adjust the minutes value between 0 and 59.
Use the up and down keys to change the value.
Press the ENTER key when the correct number of minutes is shown.

Alarm If Overdue

An alarm output is available if a Performance Check becomes either due or overdue.

DUE - Press the soft key adjacent to DUE if an alarm is required when a Performance Check is due.

OVERDUE - Press the soft key adjacent to OVERDUE if an alarm is required when a Performance Check is overdue.



Change QA Operator Code

This display allows the setting of up to nine QA operator security codes.

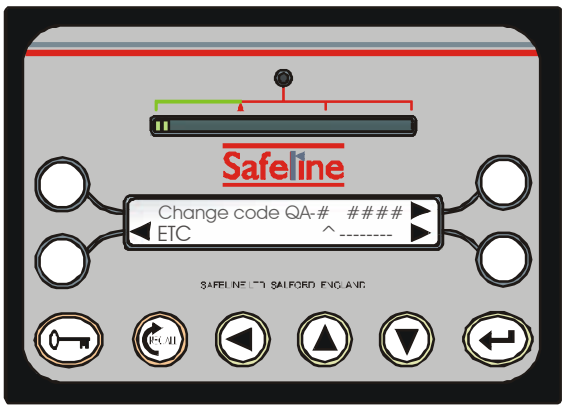
Press the soft key adjacent to the dotted line to select a QA operator number (1 to 9).

Press the soft key adjacent to #### and change the code number using the cursor key and up and down keys.

Press the ENTER key to store the new code in memory.

Repeat the operation for as many QA Operator's as required.

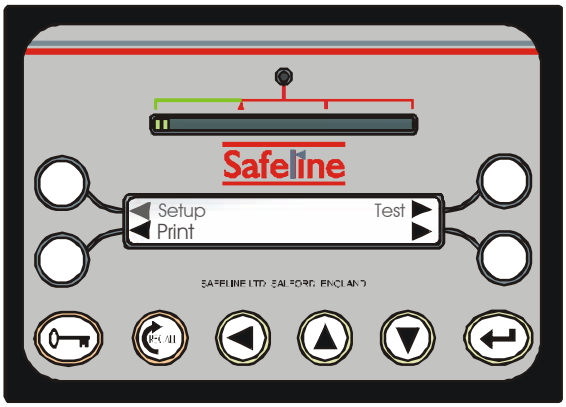
Press the ETC key to return to the first display of the QA Inspector Mode.



QA Inspector Print Menu

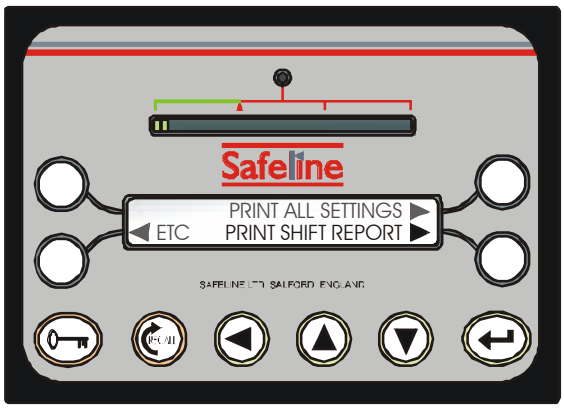
From the QA Inspector Mode press the soft key adjacent to PRINT to access the print-on-demand facilities.

For sample printouts see Appendix C.



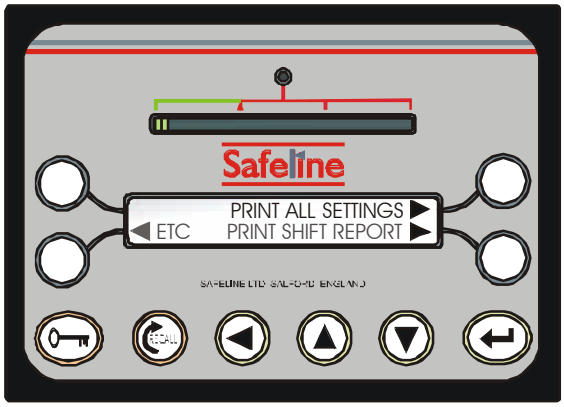
PRINT ALL SETTINGS

Press the soft key adjacent to PRINT ALL SETTINGS to obtain a printout of the current values of all the Engineer Mode and QA Inspector Mode settings.



PRINT SHIFT REPORT

Press the soft key adjacent to PRINT SHIFT REPORT to obtain a printout of the stored entries from the start of the current shift.



Notes.

1) The content of the shift-report printout will depend on which of the following two options were selected by the QA Inspector.
   (See the Shift Report Options section earlier).

   a) Any reject relay operations during the shift,

   and

   b) Any settings that have been modified during the shift

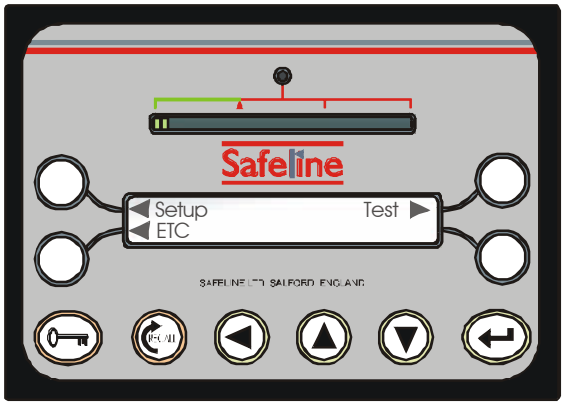
2) After printing the shift-report the detector will clear all the current shift information and start collecting information for the next shift.

QA Inspector Test Menu

From the QA Inspector Mode press the soft key adjacent to TEST to access the QA Operator Mode, (performance checking).

(See the QA Operator Mode section for details of this operating mode).

Note. The performance check printout occurs as soon as a performance check is completed by either the QA Inspector or one of the QA Operators.



QA OPERATOR MODE

Introduction

This mode is for carrying out a performance check of the detector, and thus provide immediate validation of the detector's integrity.

The QA Inspector has the facility to set a timer in the detector that will cause a 'REQUEST FOR PERFORMANCE CHECK' message to appear at pre-set intervals.

A QA Operator or the QA Inspector may perform these tests to validate the detector at any time however note that the test interval timer will be restarted from 00:00 minutes as soon as a test has been performed.
The time that the next test will be requested is displayed in the Running Mode. Please see the Time section of the Running Mode for details.

A printout is automatically printed immediately a performance check is carried out, providing the printer option has been selected by the QA Inspector.

A sample of the performance check printouts is provided in appendix C.

QA Operator Security Codes

All detectors are shipped from the factory with the following security codes for QA Operators modes;

Code 1000 = QA Operator 1 Mode
Code 2000 = QA Operator 2 Mode |
etc
Code 9000 = QA Operator 9 Mode

Carrying Out a Performance Check

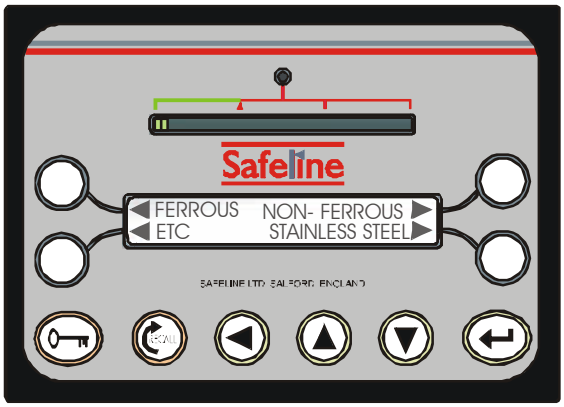
Notes on the Test Sample

Always pass the test sample through the detector aperture with the product.
If the detector is inspecting individual products prepare a sample pack(s) with the sample(s) to be tested placed at the centre rear of the pack(s).

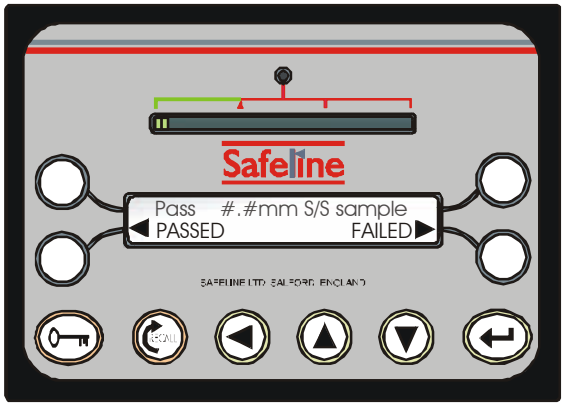
Select Test Material

Notes on the Test Sample

1) Press a soft key that is adjacent to the material of your test sample.



Select Test Results



1) The display shown opposite appears.

2)

a) If inspecting individual products place the pack on the conveyor and allow it to pass through the detector aperture without skewing or slipping.

b) If inspecting continuous or loose product place the test sample on into the product flow, and allow it to pass through the detector aperture.

3) Check that the test sample has been detected by monitoring the detect led on the detector front panel.

4) Where applicable check that the reject device operates to reject the test sample.

5) Press the soft key that is adjacent to the test result, e.g. PASSED or FAILED.

6) The display shown previously will re-appear.

7) If there are more test samples to be checked then repeat steps 1 to 4 for each sample.

Worst case testing

Follow the guidelines below to ensure that the detector is tested to its worst case limits.

1) Check

2) Check

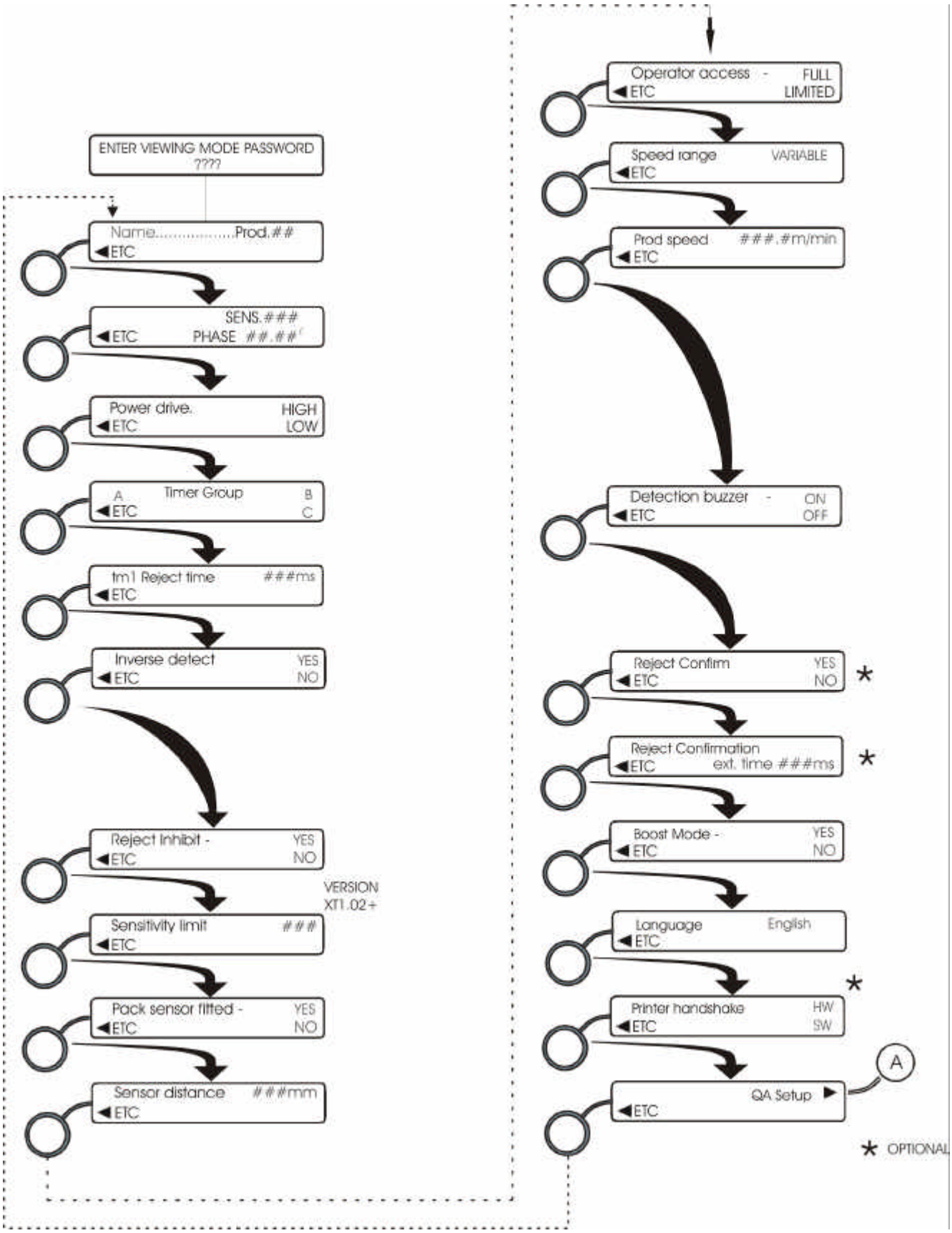


Fig 15 (a) View Mode Flow Chart

VIEWING MODE

(Default security code = 0005)Introduction

Viewing Mode enables the user to see all the settings available in the Engineer Mode and the QA Inspector Mode, but does not allow any alteration of these settings.

None of the security codes that may be set in the above two modes are visible inside the Viewing Mode.

A security code for the Viewing Mode can be setup from the Engineer Mode.

The sequence of displays is shown on the flow chart Figure 19.

Each display can be viewed in turn by pressing the soft key adjacent to ETC.

Note:
In the Viewing Mode it is only possible to see product related settings, such as phase and sensitivities, for the currently selected product number. Similarily, frequency dependent settings will only be seen for the current frequency of operation.

The product number cannot be changed from the Viewing Mode.

Remember to record all settings on the Settings Sheets at the rear of the manual.

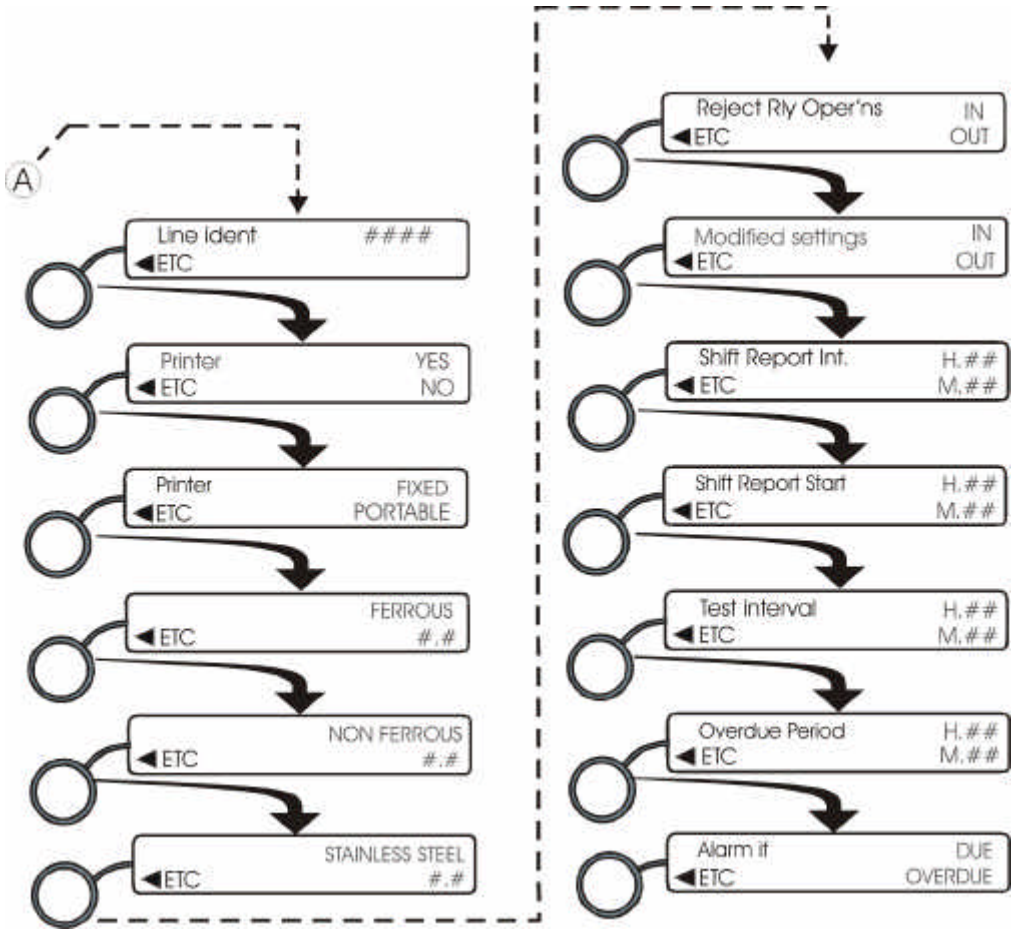


Fig 16 (b) View Mode Flow Chart

Timed Audible Alarm	OK	N/A	N/A
Conveyor Stop	OK	N/A	N/A
Gravity Fall Systems	OK	N/A	N/A

Instant Reject with

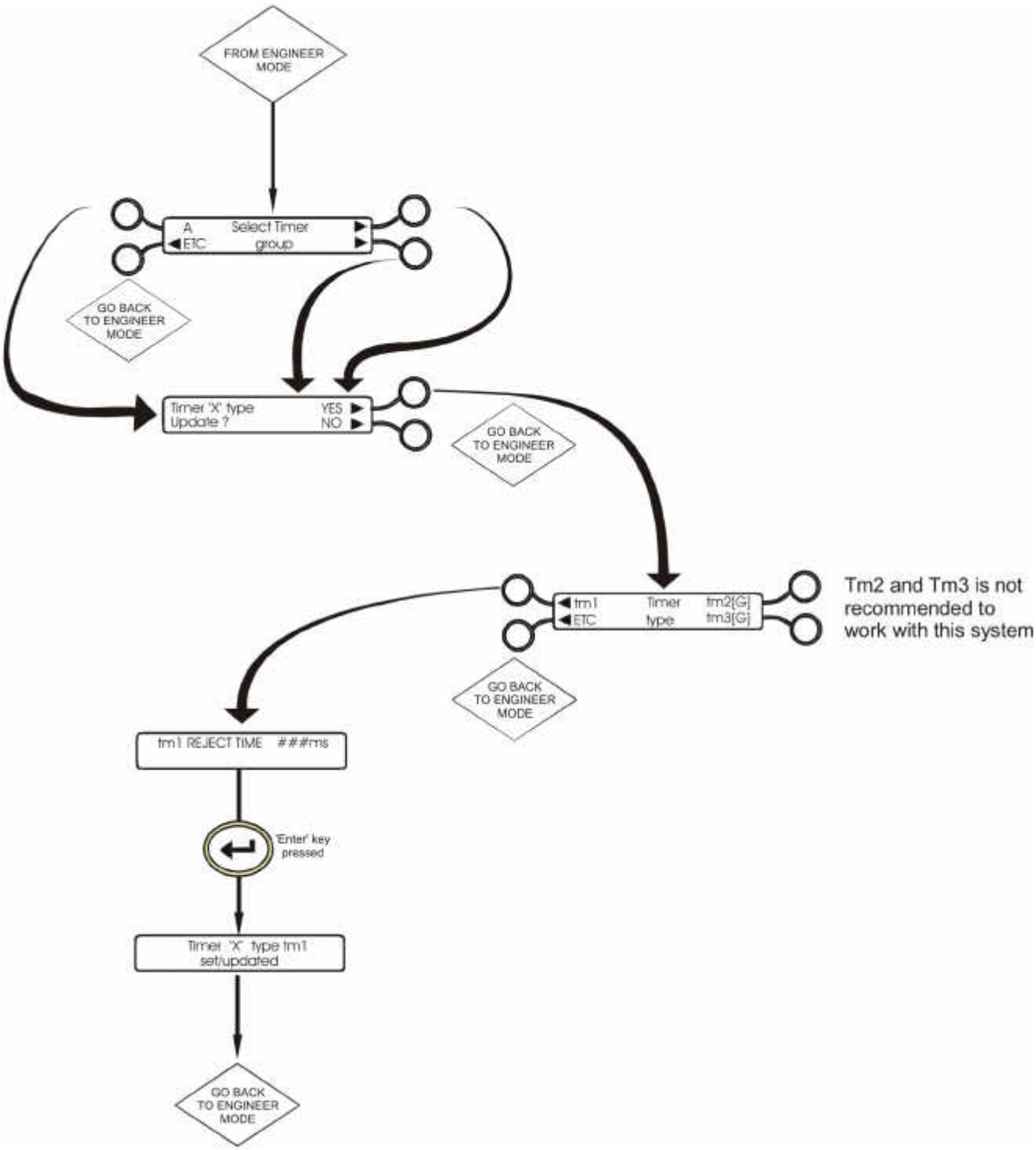


Fig 17 Timer tm1 Flow Chart

tm1 TIMER

CAUTION

Ensure you have read the REJECT TIMERS INTRODUCTION section.

Remember to record all settings on the Settings Sheets at the rear of the manual.

Introduction

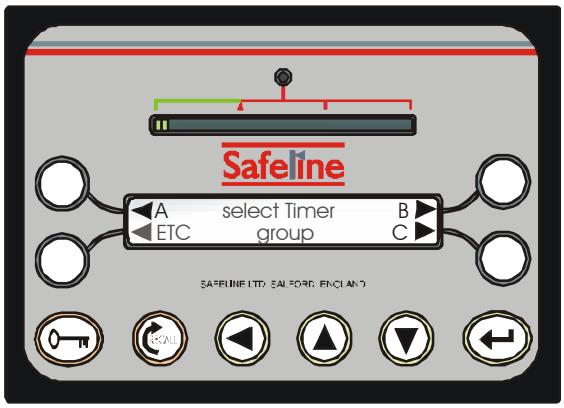
The tm1 timer is the only timer type used in the tablet detector, this is required for instant rejection of contaminated product.
Note. Tm2 &Tm3 are available but not suitable for this product

tm1 settings

a) Reject Time
This is the time required by the reject device to reject the contaminated product.

Setting Timer type tm1

The display opposite may be used to either:
a) Select which timer group the current product number should use,
or,
b) Select which timer group the current product number should use AND adjust the timer group settings such as timer type, reject time, etc.



The currently selected timer group will be indicated by a flashing cursor appearing over the group letter.

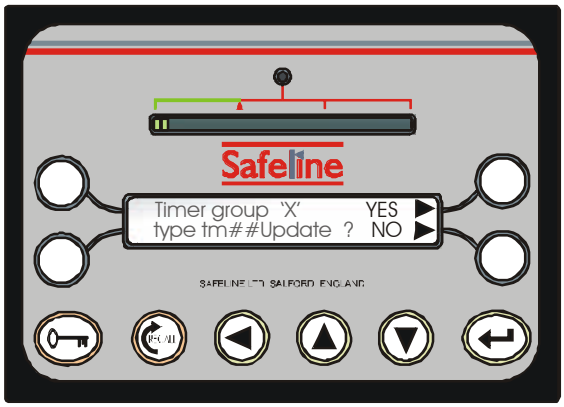
REMINDER

1) Press the soft key adjacent to the required letter ,A,B Aor C

2) If you only need to select the timer group for the current product number and not adjust any of the timer group properties then
   a) Select the soft key adjacent to NO, and go back to the Engineer Mode section.

CAUTION

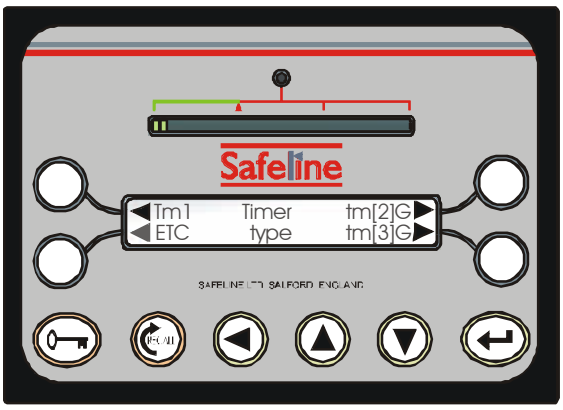
Although NO was selected the group will be changed to the group letter selected in 1). Else
   b) Select the soft key adjacent to YES, and proceed to step 3)



In the following displays 'X' represents the timer group A, B or C as selected at step 1); tmxx represents the timer type that is currently selected for this timer group.

Note:
All timer groups are available A,B,C but only Tm1 timer is suitable for tablet rejection.

3) Press the soft key adjacent to tm1

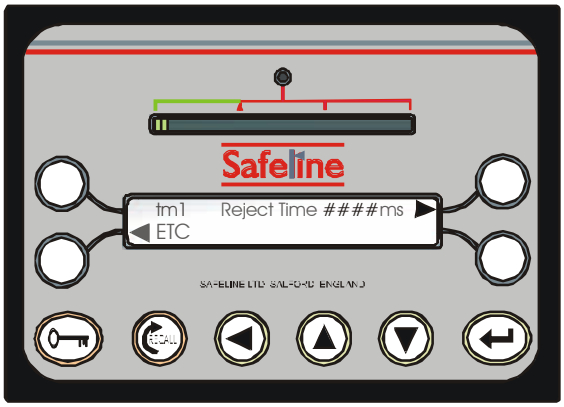


Note:
Select timer Tm1 only,Tm2 & Tm3 are available but not suitable for this product.
If Tm2 or Tm3 are used accurate rejection cannot be achieved.

---

4) Press the soft key adjacent to REJECT TIME

5) Use the cursor Up and Down keys to adjust the Reject Time to the required value.

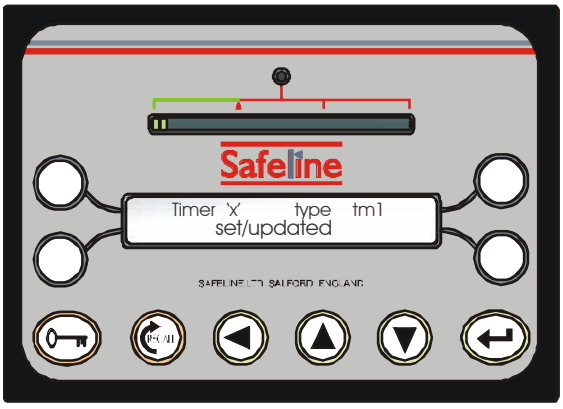


6) Press the Enter key to accept the new settings.
7) Press the Enter key a second time to proceed to the next display.

NOTE *****
Reject time must not be set to less than 200ms for correct operation of the reject.

* Be sure to select Tm1 only.

Testing the Reject Device



8) The display shown opposite will appear for five seconds before returning to the Engineer Mode display

9) Check the reject device operates correctly with different sizes of metal contaminant.

10) If for any reason the setting of the tm1 timer is not correct return to step 1) and repeat.
Note: Select Tm1 timer only.

REJECT CONFIRMATION UNIT
(Default security code = 0003)

Introduction

The Reject Confirmation Unit (RCU) on loose product applications confirms that the reject mechanism has responded at the correct time. On packaged product applications the RCU confirms that the contaminated product has been successfully rejected.

The RCU achieves this by knowing when the Reject Mechanism is to be activated and deactivated. Following reject deactivation the RCU waits for a signal generated via the Reject Mechanism or the rejected product to confirm reject operation. This signal is produced by a suitably positioned sensor, called a Reject Confirmation (RC) Sensor.

NOTE

The RCU can not be used on stop / start applications

Remember to record all settings on the settings sheet at the rear of the manual.

RC Sensor

The RC Sensor should be in one of two positions;

a) On loose product applications the RC Sensor should confirm that the reject mechanism has reached its full reject position.

b) On packaged product applications the RC Sensor should confirm that the product has entered the reject bin.

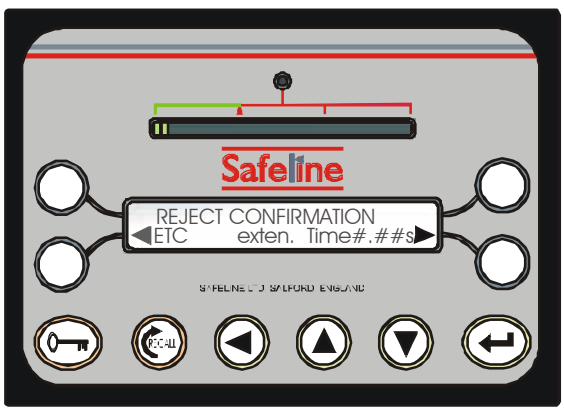
RCU Settings

Depending on the timer type selected one of two displays are available to allow the user adjustment.

Timer Types - tm1

The detector needs to be told how long it must wait from releasing the Reject Mechanism, to receiving a signal from the RC Sensor.

This period plus a small safety margin is known as the RC Extension time and must be entered by the user.

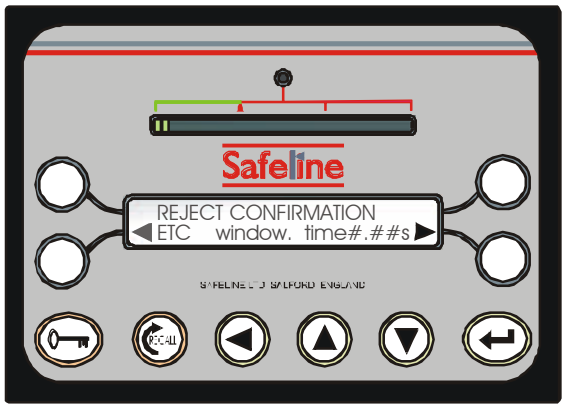


Timer Type

The detector needs to be told the time taken for a contaminated product to travel from the centre of the detector aperture to entering the reject bin. This period plus a small safety margin is known as the RC Window time and must be entered by the user.

NOTE

The RC Window time must be set with the product running at its slowest rate.



Important Notes

1) The reject timer (i.e A, B or C) must have been set-up prior to adjusting the RC extension/ window time

2) Small size metal contaminants (test samples) should be used to set the RC extension/ window time. The use of large test samples will produce errors in the setting. If this is not possible use the smallest test sample available and adjust the sensitivity so that the test sample gives an indication of 2 or 3 red bars on the bar graph display.

3) For packaged product position the test Sample on top of the pack at the front/leading edge.

Loose Product, Fixed Speed Applications

1) From the running mode display press PROG/EXIT key

2) Enter the Engineers security code

3) Press ETC soft key until the reject confirmation display is reached.

4) Press the RC exten. Time soft key.

5) Set the extension time to 100ms.

6) Pass a test sample through the detector aperture to trigger the detector.

The reject mechanism will respond according to its settings. When the reject mechanism is released and moves from reject back to the pass position the RC sensor confirms reject operation, providing the extension time setting is long enough.

7) If the detector goes into reject fault condition, increase the extension time by a further 100ms

8) Repeat step 6 and 7 until the detector signals no fault condition

9) Increase the extension time by 200ms and press the ENTER key to enter the new value into memory

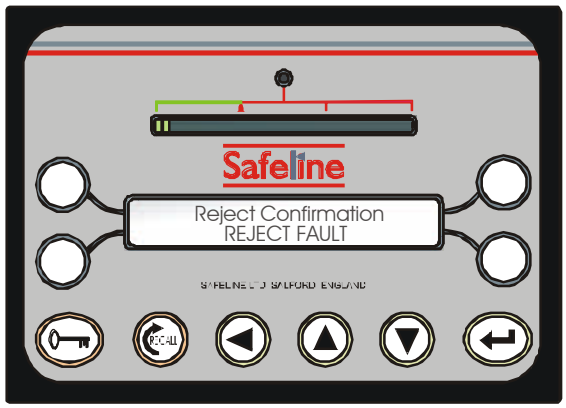
RCU Fault Reporting.

The Module will display one of two RCU fault conditions.

The fault displays will be shown from the running mode display only, and will not prevent the Module from operating. To draw attention to the problem the buzzer will be driven.

Reject Fault.

This fault display indicates that the RCU has signalled a reject fault condition.



Assuming the RC extension window time has been set correctly, the fault condition could be due to either or both of the following;

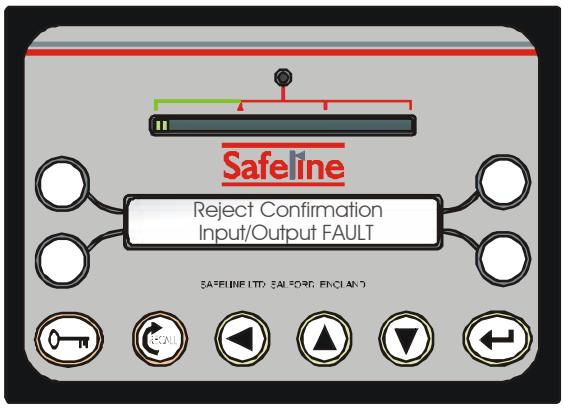
a) The Reject Mechanism has failed to operate or failed to operate at the correct time.

b) The RC Sensor has not signalled the RCU to confirm reject operation.

The detector will clear the display when the RCU is reset.

Input/output Fault

This display indicates that a fault has occurred in the input output circuitry from the Module to the RCU, this could be a connection or I.C fault within the Detector Head or Module. It is more likely to be one of the following;



a) The RCU cable connection from the Detector Head to the P/S Connection PCB is not connected correctly.

b) The RCU board is not in situ.

The Module will not clear the display until the Detector Head is switched off and back on again.

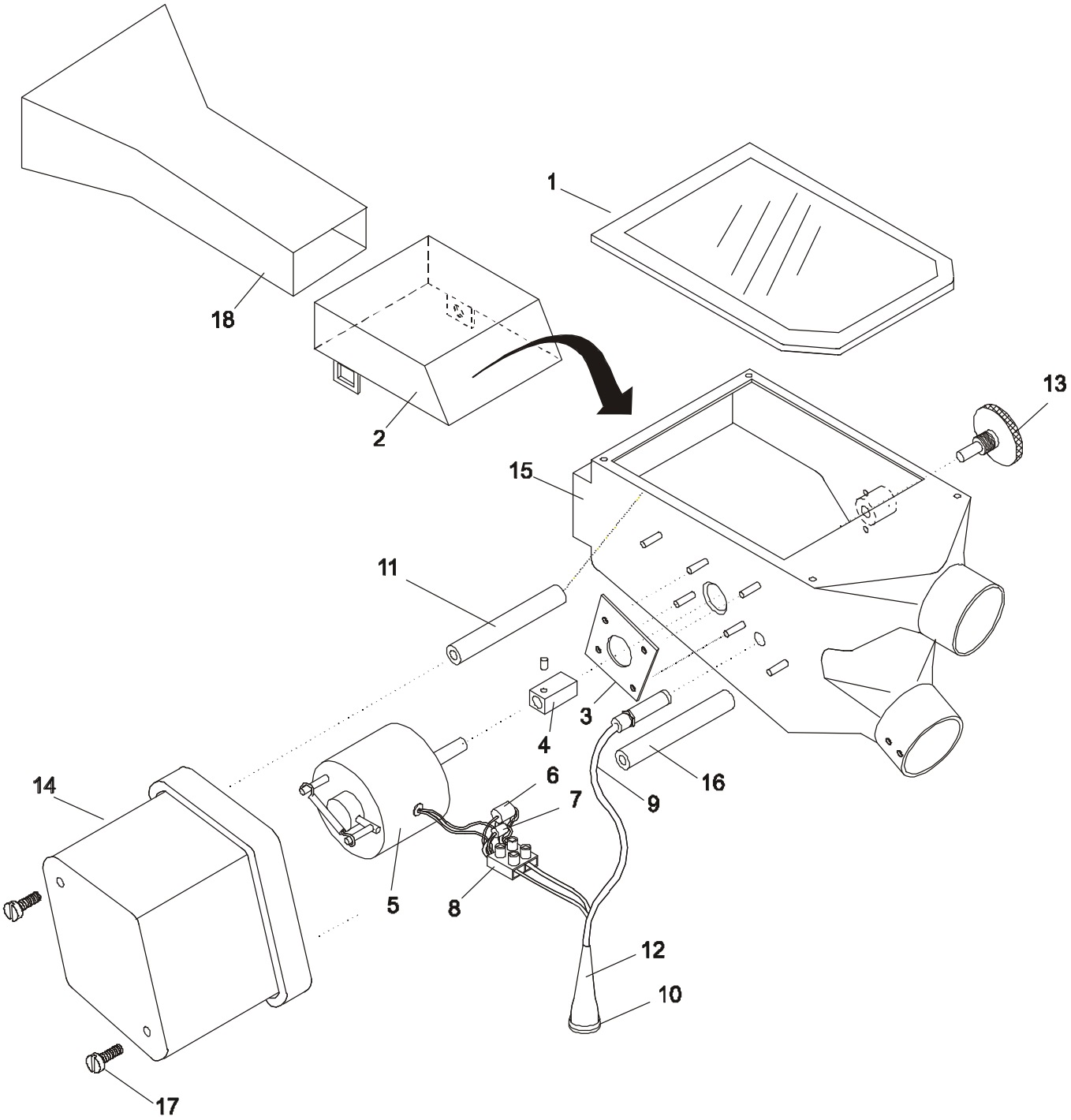


Fig 18 Drop Flap Diverter General Assembly

Ref Parts For Fig 18

REF	REPLACEMENT PARTS	SAFELINE STOCK No. or SUPPLIER
1	WINDOW COVER 76x22 & 76x38	4700-239
	WINDOW COVER 95x38	4700-249
2	REJECT CHUTE 76x22	4700-227
	REJECT CHUTE 95x38	4700-242
3	INSULATOR	4700-244
4	ROTENOID SHAFT	4700-228
5	ROTENOID	4700-204
6	CAPACITOR 0.1Uf	2804-601
7	TRANSZORB 1.5KE47CA	2801-067
8	TERMINAL BLOCK	2809-803
9	RCU SENSOR	2811-014
10	PANEL MOUNTING PLUG	2809-513
11	METAL SPACER 100 Lg	2140-084
12	HEAT SHRINK (ADHESIVE LINED)	2808-545
13	PIVOT SHAFT	4700-229
14	ROTENOID COVER	4700-243
15	REJECT HOUSING 76x22	4700-236
	REJECT HOUSING 76x38 & 95	4700-241
16	NYLON SPACER M4x100Lg	2140-083
17	SCREW M4X8	2110-206
18	PH CHUTE 76x22	4700-252
	PH CHUTE 76x38	4700-253
	PH CHUTE 95x38	4700-254

1.1 REMOVING THE REJECT CHUTE ON DROP FLAP DIVERTER [20/2]

Note! References shown thus [*/*] are the Figure/Part Ref. Nos.

Step No.	Action	Notes
1.1.1	**Start Of Work:**	
1.1.2	Verify that the electrical supply is isolated.	
1.1.3	Remove window cover	
1.2.2	**Remove Rotenoid cover: [20/14]**	
1.2.3	Remove the Rotenoid/insulator [20/5].[20/3]	
1.2.4	Remove pivot shaft [20/13].	
1.2.5	Slide out the diverter [20/2].	

2.1 REPLACING THE REJECT CHUTE ON DROP FLAP DIVERTER [20/2]

Note! References shown thus [*/*] are the Figure/Part Ref. Nos.

Step No.	Action	Notes
2.1.1	**Start Of Work:**	
2.1.2	Slide the diverter inside the housing [20/2].[20/15]	
2.1.3	Refit pivot shaft [20/13].	
2.1.4	Refit the Rotenoid/insulator [20/5].[20/3]	
2.1.5	Refit Rotenoid cover [20/14]	
2.1.6	Reinstate the electrical supply	

3.1 REMOVING THE REJECT DIVERTER ON SIDE DIVERTER [21/1]

Note! References shown thus [*/*] are the Figure/Part Ref. Nos.

Step No.	Action	Notes
3.1.1	**Start Of Work:**	
3.1.2	Verify that the electrical supply is isolated.	
3.1.3	Remove window cover	
3.1.4	Remove the reject chute [21/1]	

3.2 REPLACING THE REJECT DIVERTER ON SIDE DIVERTER [21/1]

Note! References shown thus [*/*] are the Figure/Part Ref. Nos.

Step No.	Action	Notes
3.2.1	**Start Of Work:**	
3.2.2	Refit the diverter [21/1]	
3.2.3	Refit window cover [22/17]	

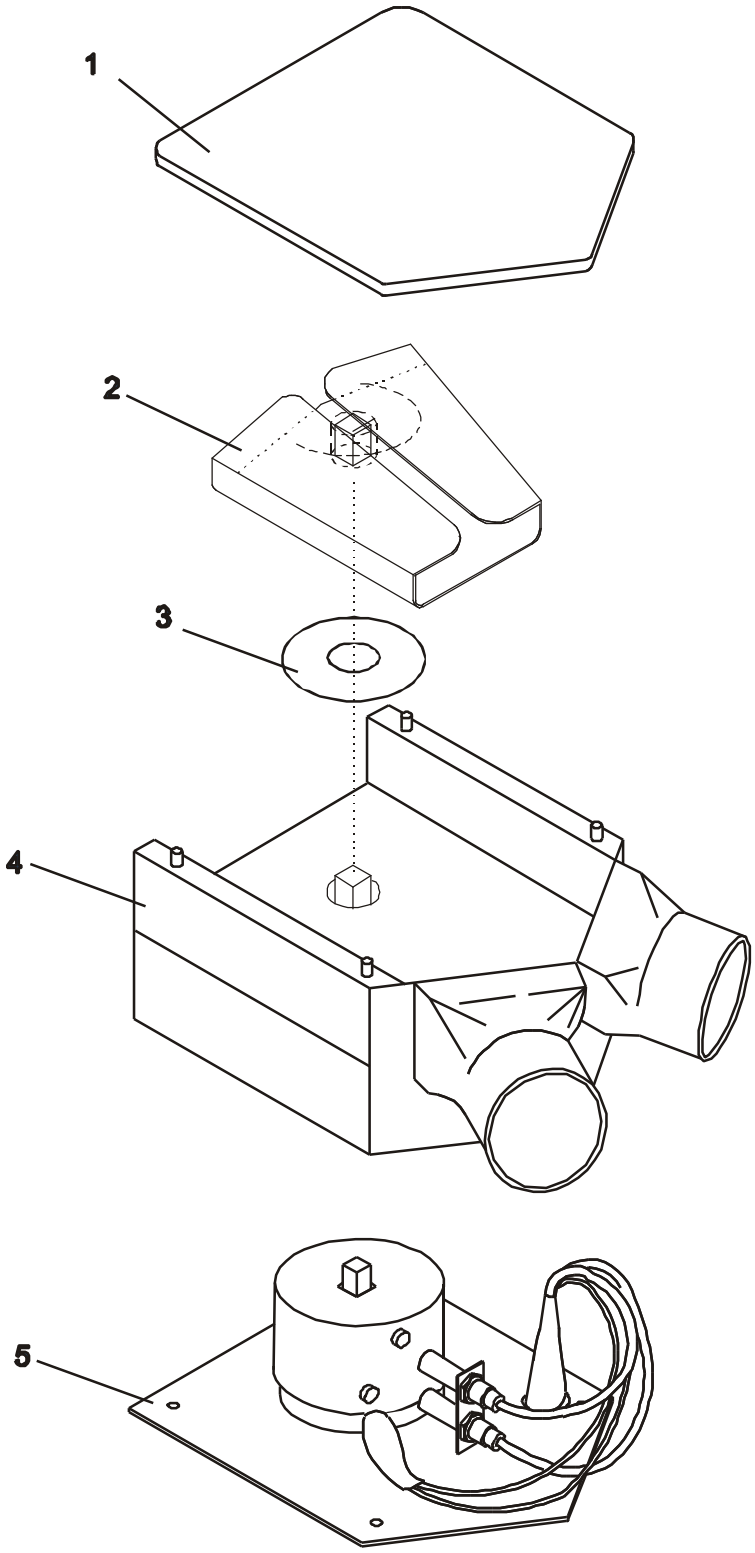


Fig 19 Side Diverter General Assembly

Ref Parts For Fig 19

REF	REPLACEMENT PARTS	SAFELINE **STOCK No. or SUPPLIER**
1	WINDOW COVER	4700-269
2	DIVERTER 76x22	4700-207
	DIVERTER 76x38	4700-247
	DIVERTER 95x38	4700-248
3	HOUSING SEALING DISC	4700-270
4	REJECT HOUSING 76x22	4700-206
	REJECT HOUSING 76x38 & 95x38	4700-255
5	ROTENOID DRIVE ASSY	4700-126

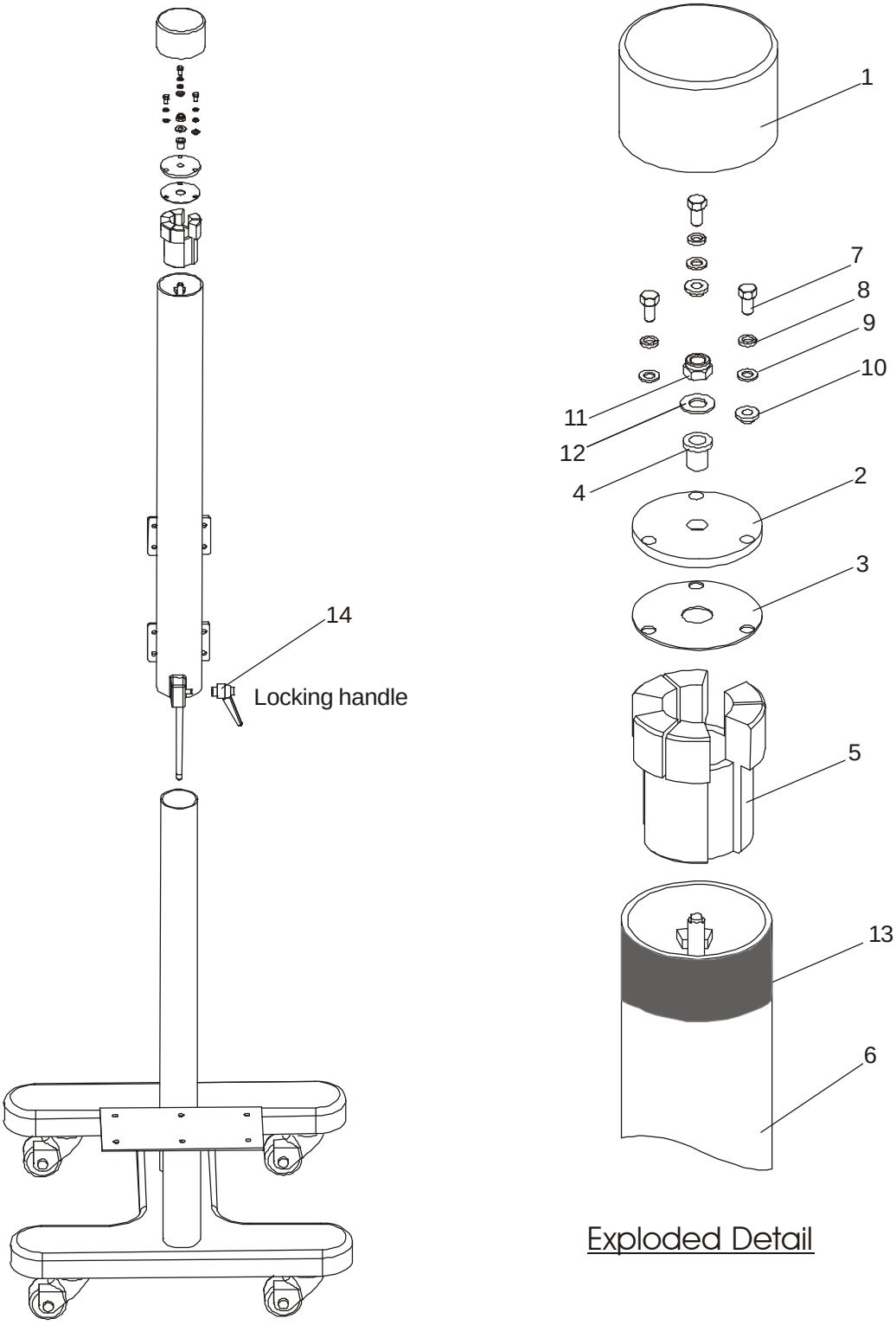


Fig 20 Upper Housing Assembly

Ref Parts For Fig 20

REF	REPLACEMENT PARTS	**QTY**	SAFELINE **STOCK No. or SUPPLIER**
4	M8 TOP HAT INSULATOR	1	2140-004
5	TABLEX UPPER HOUSING RING	1	4700-217
6	TABLEX UPPER HOUSING	1	4700-276
7	M5 STAINLESS ST. HEX 16mm SCREW	3	2110-307
8	M5 STAINLESS ST. SPRING WASHER	3	2122-152
9	M5 STAINLESS ST. FLAT WASHER	3	2122-205
10	M5 TOP HAT INSULATOR	2	2140-026
11	M8 STAINLESS ST. NYLOCK	1	1720-013
12	M8 STAINLESS ST. FLAT WASHER	1	2122-210
13	50mm WIDE BLACK INSULATION TAPE	1	1710-007
14	LOCTITE 415 50ml BOTTLE LOCTITE BOTTLE NOZZLE	1 1	1720-013 1720-077

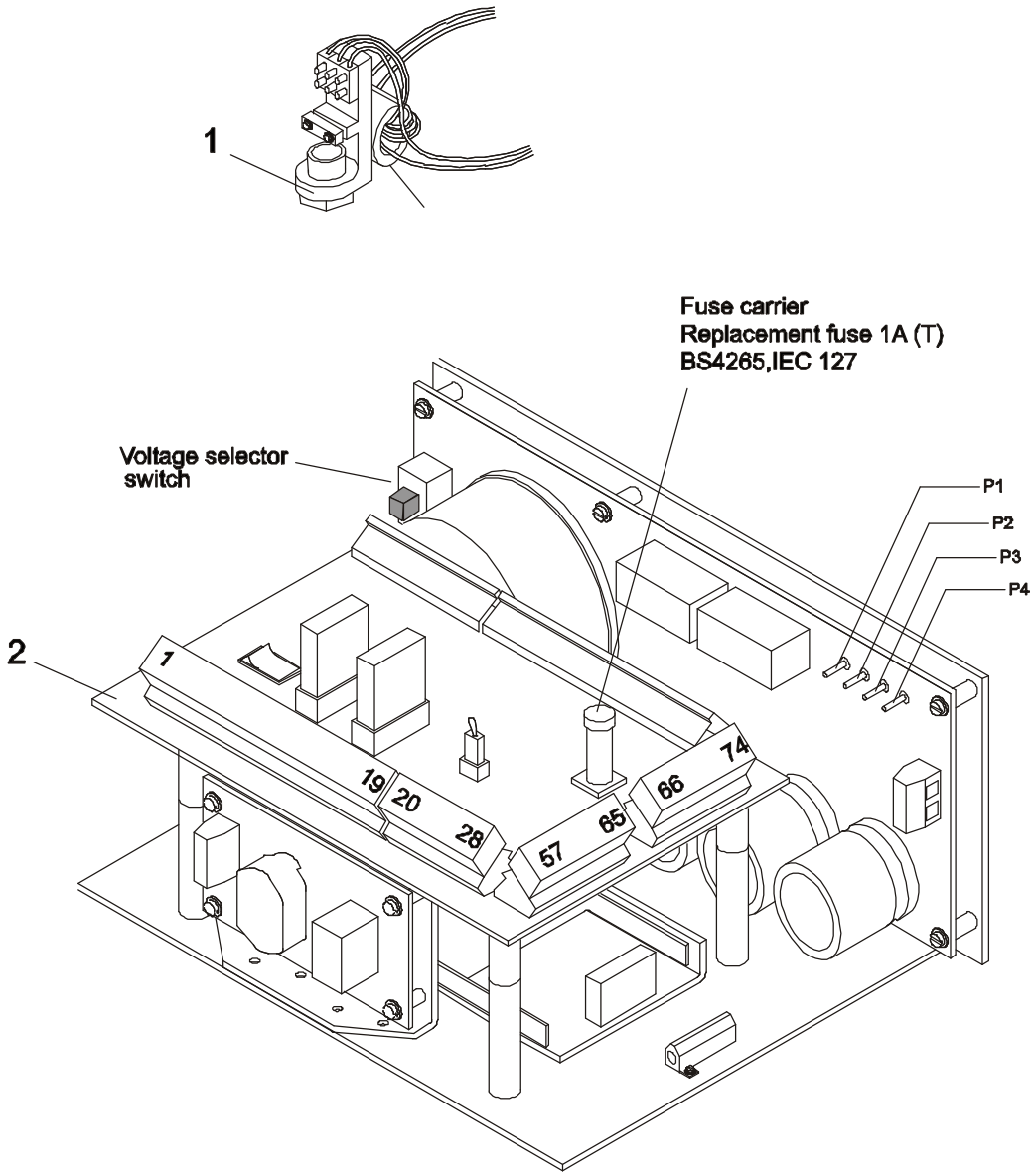


Fig 21 Power Supply

Ref Parts For Fig 21

REF	REPLACEMENT PARTS	SAFELINE **STOCK No. or SUPPLIER**
1	CON CLAMP	2808-624
2	POWER SUPPLY	4701-120

BEFORE COMMENCEMENT OF THE FOLLOWING PROCEDURES ENSURE ADEQUATE SAFETY PRECAUTIONS HAVE BEEN TAKEN - OVERALLS AND SAFETY FOOTWEAR MUST BE WORN.

ENSURE ALL COMPONENTS ARE IN THE REPLACEMENT KIT, AS PER THE REPLACEMENT KIT OF PARTS SHOWN ON PAGE 6.

4.1 UPPER HOUSING REPLACEMENT PROCEEDURE

Step No.	Action	Notes
4.1.1	**Start Of Work:**	
4.1.2	Verify that the electrical supply is isolated.	CAUTION
4.1.3	Ensure that all four castors are in their locked position.	
4.1.4	Remove product throughput chute.	
4.1.5	Disconnect the reject cable and remove reject mechanism using the quick release handle.	See Pictures 1,2.
4.1.6	Utilising the gas strut height adjustment, raise the metal detector and reject mechanism to their highest operating position.	CAUTION Fully extend the gas strut to avoid any sudden upward movement.
4.1.7	Lock the upper housing in position using the locking handle, ensuring the upper housing cannot rotate. [Fig 1 Item 14]	
4.1.8	Release and remove locking handle or lock nut that secures the detector, ensure the detector is well supported. Remove detector head and carefully place on floor (with appropriate protection to prevent damage / scratching) without placing undue stress on the detector cables.	CAUTION **HEAVY** Note. Ensure the metal detector is securely supported prior to removing from the support bracket. See Picture 3, 4 & 7
4.1.9	Remove support arm by removing the M8 nuts, washers and top hat insulators.	See Pictures 5 & 6

4.2 REMOVING THE UPPER HOUSING		Note!
Step No.	**Action**	**Notes**
4.2.1	**Start Of Work:**	
42.2	Remove upper housing cap [Fig1 item 1] this can be achieved by hand by twisting the cap and pulling upwards at the same time.	
4.2.3	Remove insulating tape and discard. [Fig 1 item 13]	
4.2.4	Remove the central M8 nut & washer [Fig 1 items 11,12]. Note the top hat insulator [Fig 1 item 4] can be left in place. (These parts can be discarded)	See Picture 8
4.2.5	Remove outer three M5 screws, washers and insulators [Fig 1 items 7,8,9,10] (These can be discarded). This will release the upper housing closing plate [Fig 1 item 2] and insulating disc [Fig 1 item 3]	See Picture 9
42.6	Ensure the upper housing is supported then loosen the upper housing locking handle [Fig 1 Item 14] to release the housing from the main stand. [Fig 1 Item 6]	 CAUTION
4.2.7	Before the upper housing [Fig 1 item 6] can be removed the upper housing ring [Fig 1 item 5] will have to be removed. This can be done by lifting the housing with a quick upwards motion. This will dislodge the upper housing ring and allow the upper housing to be removed from the lower support stand.	
4.2.8	Remove clamping handle & washer [Fig 1 Item 14]	
4.2.9	Assemble clamping handle to new upper housing.	

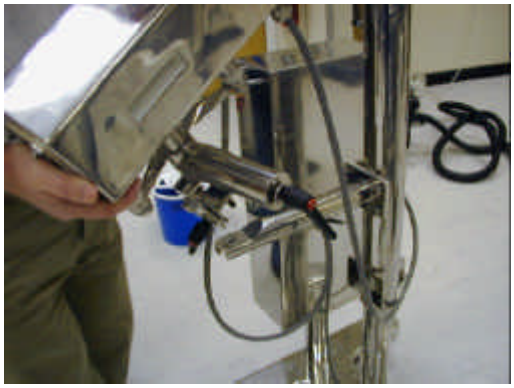
4.3 REPLACING THE UPPER HOUSING		Note!
Step No.	**Action**	**Notes**
4.3.1	**Start Of Work:**	
4.3.2	Place the new upper housing [Fig 1 item 6] onto the support stand allowing the upper housing to sit on the base of the support stand.	
4.3.3	Before inserting the upper housing ring [Fig 1 Item 5] into the support stand use the glue provided to ensure the ring is securely bonded in position. Apply Loctite glue to the three surfaces of the housing ring which make contact with the inside of the upper housing tube.	CAUTION Follow warning instructions on bottle See Pictures 10.
4.3.4	Replace the upper housing ring [Fig 1 item 5] The ring is pushed into the support stand by passing the ring through the top of the upper housing [Fig 1 item 6]. The upper housing ring needs to be pushed into the support stand until the head of the ring sits directly on top of the stand tube.	See Picture 11
4.3.5	Carefully lift housing to its maximum height. Lock upper housing in position using the locking handle ensuring upper housing cannot rotate [Fig 1 Item 14]	CAUTION Take care not to dislodge the upper housing ring. See picture 12
4.3.6	Replace the insulating disc (Fig 1 item 3) then fit housing closing plate [Fig 1 item 2] using the M5 screws, washers and insulators [Fig 1 items 7,8,9,10] supplied in the replacement kit.	See Pictures 13,14
4.3.7	Unlock the upper housing [Fig 1 items 6] and lower it onto the gas strut allowing the M8 stud of the gas strut to protrude through the closing plate.	

4.3 REPLACING THE UPPER HOUSING cont….		Note!
Step No.	**Action**	**Notes**
4.3.8	Fasten upper housing [Fig 1 item 6] to the gas strut using the M8 nut, [Fig 1items 11,12,4] washer and insulator.	See Picture 8
4.3.9	Fit insulating tape [Fig 1 item 13] around top of support frame with new insulating tape provided, and replace upper housing cap with a twisting downwards motion [Fig 1 item 1]	10mm above top of tube, 1 turn.
4.3.10	Replace the support arm using the M8 bolts, washers and top hat insulators ensuring the white rectangular insulator is placed between the support arm and the upper housing.	See Pictures 5 & 6
4.3.11	Replace the metal detector complete with all supporting brackets and refit the four M8 bolts securing it to the upper housing.	
4.3.12	Replace the metal detector complete with bracket and secure in place using the locking handle or lock nut. Refit the reject system and throughput tube.	See Pictures 3 & 4

Picture 1

Picture 2

Picture 3
Quick release handle or locknut



Picture 4

Picture 5

Picture 6

Picture 7

Picture 8

Picture 9

Picture 10

Picture 11

Picture 12

Picture 13

Picture 14

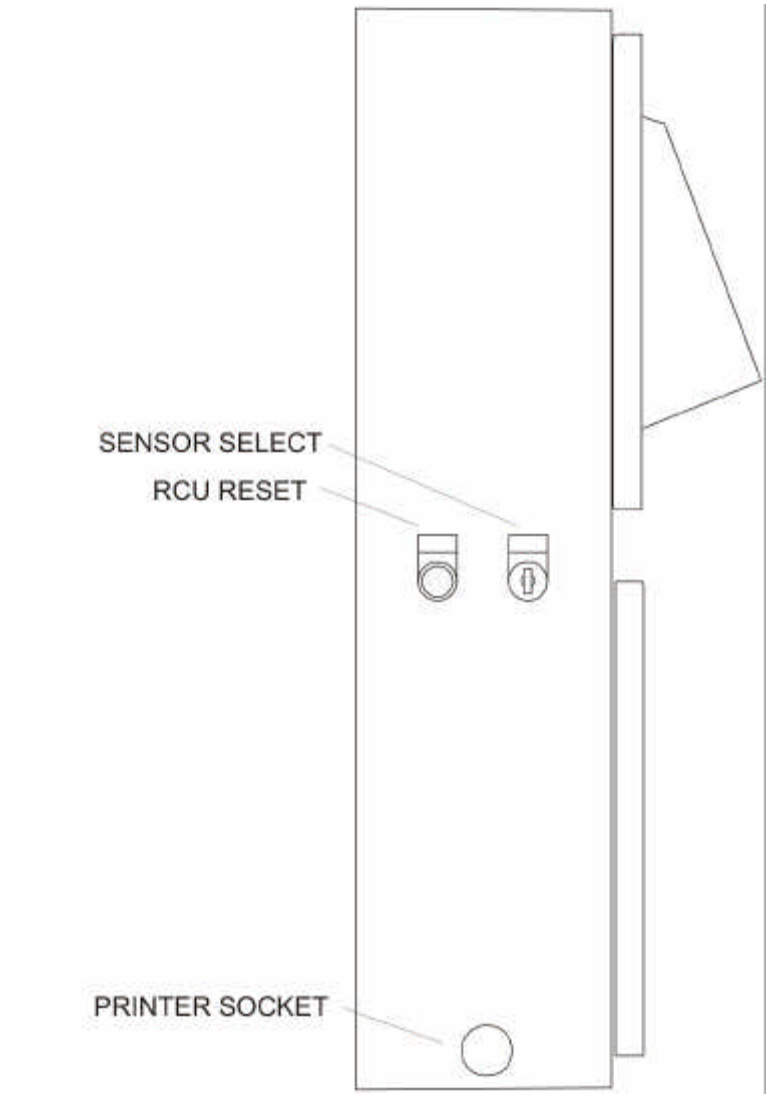


Fig 22 Positions Of Switches And Printer Plug

NOTE

Two sensors are fitted on the reject device but only one is used at one time the selector switch allows you to change reject position to left or right.

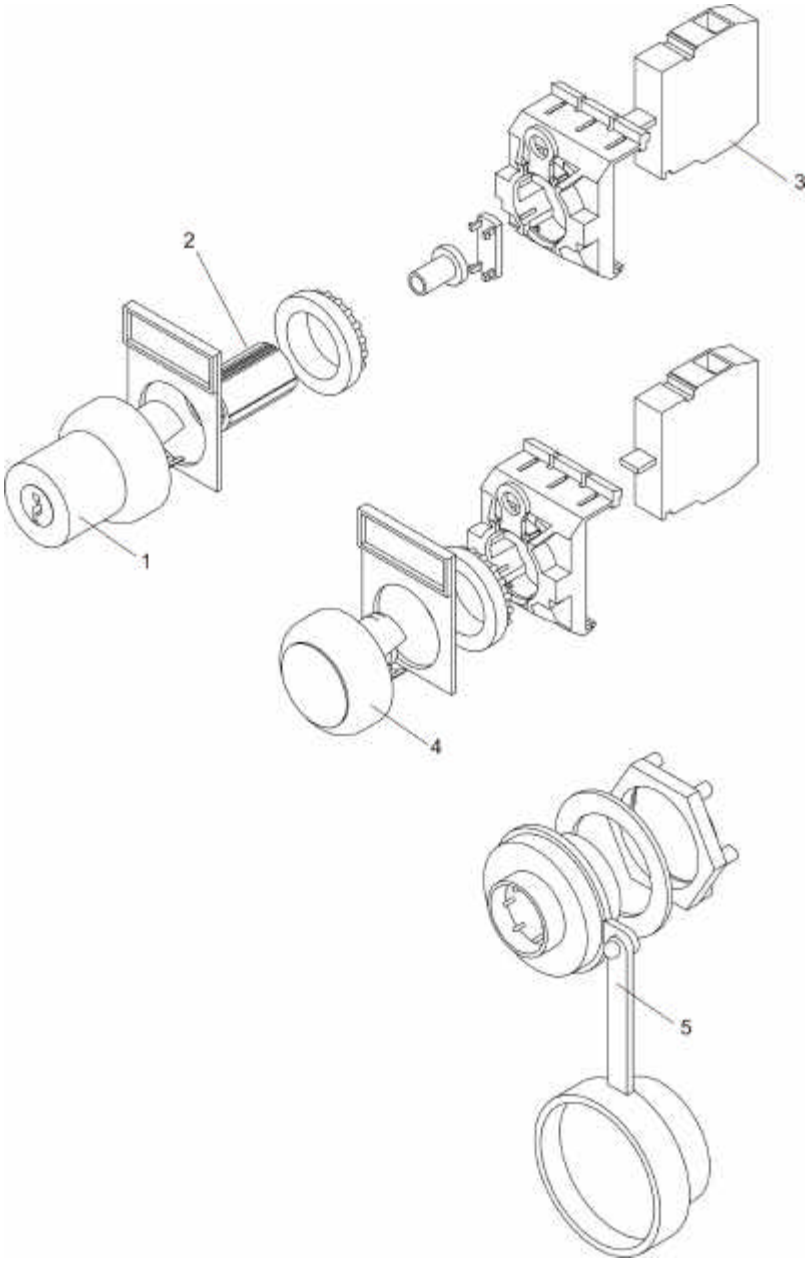


Fig 23 Printer Socket and Slector Switch and RCU Reset Assembly

Ref Parts For Fig 23

REF	REPLACEMENT PARTS	SAFELINE **STOCK No. or SUPPLIER**
1	KEYSWITCH	2813-059
2	CODING ADAPTORS	2813-067
3	N.O. & N.C. CONTACTS	2813-089
4	RESET BUTTON ASSY	2813-128
5	PRINTER PLUG	2809-437

Printer

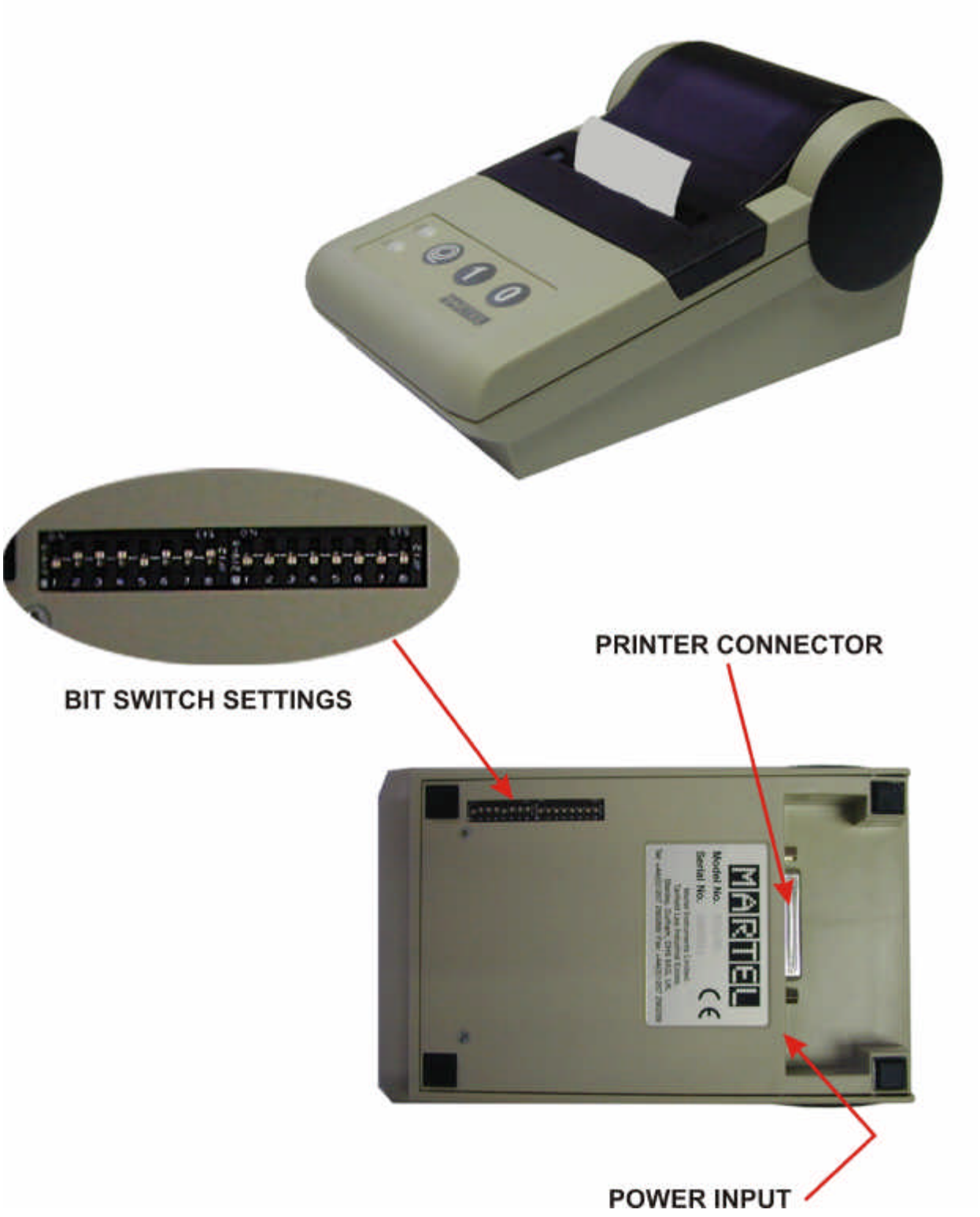


Fig 24 Printer Bit Switch Settings

Fig 25 Printer Dimensions (mm

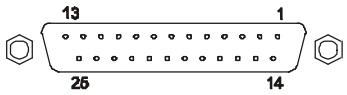
Serial Interface

The RS232 standard is used, and the baud rate is selectable from 110, 300, 600, 1200, 2400, 4800, 9600 and 19200 bits per second via the DIP switches. The detector was 9600 for operation.

The printer is fitted with a 25-way D-type socket (Fig. 1 illustrates the pin numbers for the connector), the pin assignments and interface signals are defined below.
A cable is supplied for connection to the metal detector (see page 79).

PIN	Signal	I/O	Definition
1	FGND	N/A	Frame Ground
2	TxD	O	Transmitted data to host
3	RxD	I	Received data from host
4	RTS	O	(+10V via 1K)
5	CTS	I	Clear to send
7	GND	N/A	Signal ground
20	DTR	O	Data terminal ready
6,8-19,21-25	n/c	N/A	No connection

Fig. 1 Pin Numbers for Serial interface
Interace Connector



Power Supply

Power is supplied to the printer from a 4.8V internal Nickel-Cadmium battery pack. The mains adapter will trickle charge the batteries when the printer is turned on or off (charge time approx. 16 hours). *Fast charge is available as an option (charge time approx. 1 hour when the printer is turned off).* The Status indicator will light to show that the battery pack is nearly exhausted.

Power consumption

Standby	35mA
Running – Min	300mA
Ave	600mA
Max	2A

Note : The peak current can reach a maximum of 5A.

Battery pack

Capacity	600mAH
Charge current	60mA (800mA optional fast charge)
Weight	100g

Battery life Approx. 1 hour of continuous operation

The MCP6701/2 should only be used in conjunction with an MPS101,MPS102 or MPS103 power adapter. Users wishing to provide their own power source must consult Martel. ***The use of an unapproved source will void the printer's warranty.***

Battery-charging

Connect the printer to the MPS power adapter and recharge the batteries as soon as the Status indicator lights continuously during the printing.

If the batteries in the printer become exhausted, printing will become faint, erratic or not possible at all. ***Turn off*** the printer and recharge the batteries for at least one hour before attempting further printing. The MPS adapter cannot supply the full power requirements during printing, so the batteries must be partially charged before printing is possible.

When the printer is first delivered there may be little or no charge in the printer's batteries. The printer should be ***turned off***, connected to the MPS adapter and allowed to charge for 16 hours before it is used for the first time.

Although it is permissible to leave the printer permanently connected to the MPS power adapter, constantly charging the printer's batteries between printouts, this is not recommended as battery capacity will gradually reduce due to the memory effect associated with NiCd batteries. If the printer is used in this way then the battery pack should be discharged and recharged every 2 to 3 months. Disconnect the power adapter and leave the printer turned on until the batteries are completely discharged (power LED goes out – approx. 15 hours), then ***turn off*** the printer, reconnect the power adapter and recharge for 16 hours before further use.

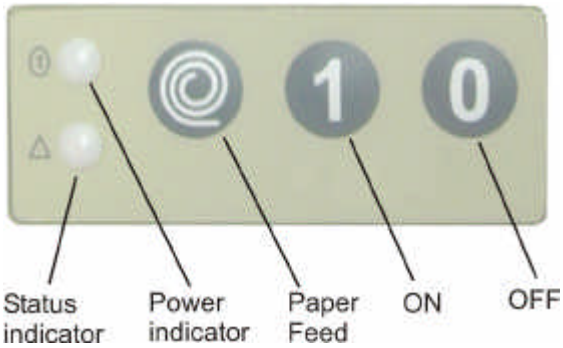
Power On Self Test

The self test procedure is initiated by turning on the printer with the Paper Feed button pressed. Release the Paper Feed button and the self test procedure will start. This will check most of the printer functions, except for the serial interface, i.e. Printer mechanism, Control circuitry, Firmware version, DIP switch settings, Print quality.

Power On Procedure

Switches

Check the batteries are sufficiently charged. Open the paper cup lid and ensure that paper roll is present and that there are no foreign objects inside the paper cup. Close the lid, ensuring that the paper passes through the paper exit slot. Switch on the printer using power switch located on the front panel of the printer. The Power Indicator will light and the printer mechanism will reset



Trickle charging will take place when the printer is ON or OFF.
Fast charge (if fitted) will only take place when the printer is OFF.

Modes of Operation

Text mode, is the default mode of operation for the printer. In this mode text characters can be printed In normal, double width, double height, inversed, reversed, and underlined format. Graphics can also be printed using the 'ESCK' sequence.

Hex mode causes all incoming characters to be printed as their hexadecimal value. Printing occurs after eight characters have been received or when the paper feed button is pressed. Seven data bit parity errors are indicated by the hexadecimal value being underlined.

1000 Emulation mode causes the printer to emulate the native mode of the 1000 series printers. This mode is only offered to provide backward compatibility with these printers and is not recommended for new designs.
Diagnostic mode is used to perform various tests on the printer hardware using a terminal device connected to the serial port. This mode is only intended for use by Martel.

Replacing Paper Rolls

If the paper roll needs replacing, open the paper cup lid and remove the remaining paper using the paper feed button, ***do not pull paper out of the rear of the printer mechanism.*** Reel off a few centimeters from a new paper roll and check that the end has a clean straight edge (see Fig. 3). Slide the leading edge of the paper through the paper entry slot, with the leading edge of the paper feeding forwards from the bottom of the roll, until you feel resistance. Press the paper feed button to feed the paper through the printer mechanism (see Fig. 4). Keep the paper feed button depressed until enough paper is fed through the printer mechanism to pass through the paper exit slot. Sit the new paper roll in the paper cup and close the lid.

FIG. 3 Cut the end off the paper roll so that he end has a clean straight edge

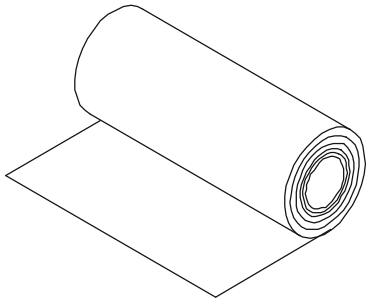
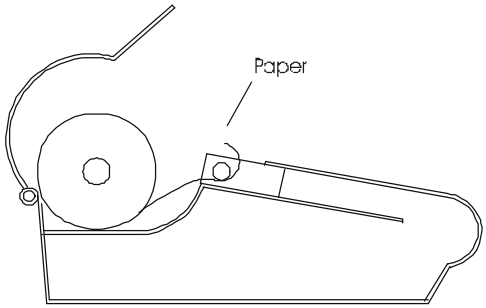


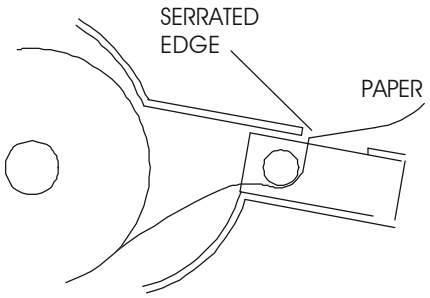
Fig. 4 Position of paper roll in printer



Paper Tear Procedure

When removing printout from the printer, pull the printout toward the front of the printer and tear from one side to the other across the serrated edge (seeFig. 5).

Fig. 5 Using serrated edge to tear paper



Auto Wake Up/Auto Power Down

The printers incorporate an auto wake up/power down facility which minimises the printer's power consumption.If auto power down is enabled, the printer will turn itself off after one or five minutes of inactivity on the receive data line. If auto wake up is enabled, the printer will turn itself on when activity is detected on the receive data line. These two functions can be disabled or enabled separately to give the user maximum flexibility.

To wake the printer up, the user should ignore the status of the DTR line and send a NUL character (OOH) to the printer. The user should then wait at least 0.7 seconds for the printer to initialize before sending further data. Once the printer has initialized, handshaking should be resumed.

Since the NUL character is non-printable, this procedure may be followed even if the printer is awake and will not cause unwanted characters to be printed. To enable the auto power down facility, place DIP SW2-7 in the ON position. If the switch is in the OFF position the printer will remain operational until turned off via the OFF switch

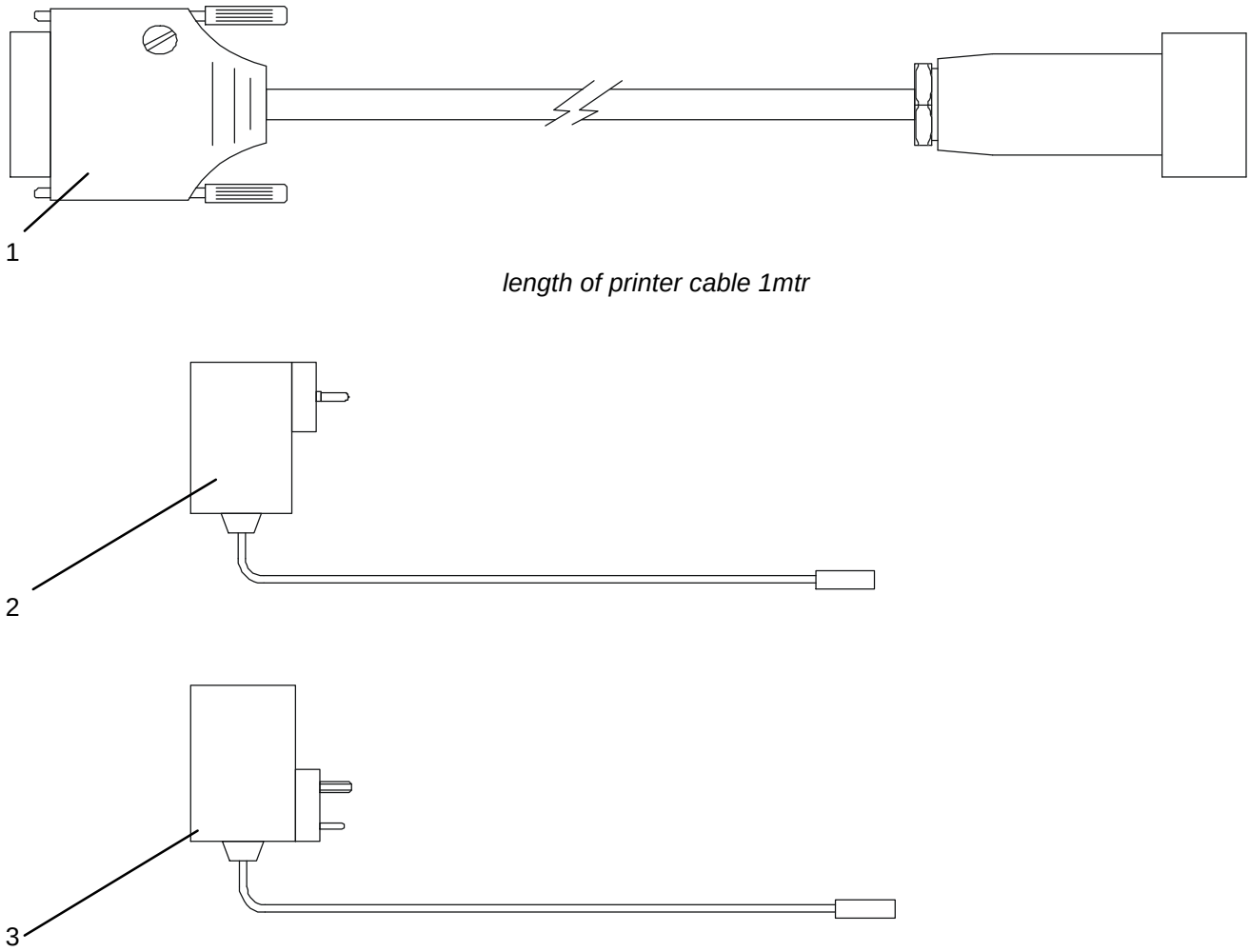


Fig 26 Printer cable/Power Packs

Ref Parts For Fig 26

TYPE	REPLACEMENT PARTS	**SAFELINE STOCK No. or SUPPLIER**
	PRINTER	2814-524
1	PRINTER CABLE	4610-032
3	POWER SUPPLY FOR UK (230V INPUT) 50-60Hz 9V DC 800mA	2814-525
2	POWER SUPPLY FOR EU (230V INPUT) 50-60Hz 9V DC 800mA	2814-526
2	POWER SUPPLY FOR USA (120V INPUT) 50-60Hz 9V DC 120mA	2814-529

Setting Up And Connecting A Printer To The Metal Detector

General

Information transmitted by the metal detector may be transferred directly to paper by using a printer.

Alternatively it may be collected by other types of 'intelligent' equipment such as a terminal computer.

This appendix is intended for users who wish to use their own printer or intelligent equipment. All references in this text assume a printer is being used, it applies however equally to any data collection device.

Requirements Of Your Serial Printer

Currently the printer driver supplied as standard with the metal detector is designed to drive either a dot matrix type or an Epson TML60 II printer.

The format of the information being output by the metal detector is in columns of up to 42 characters.

The serial communication parameters of your printer must be setup as follows:

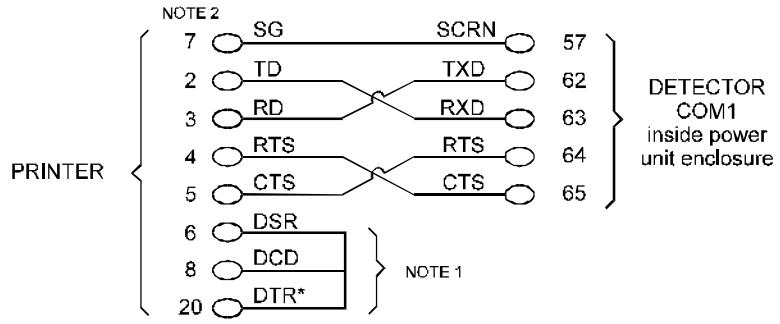
Baud rate : 9600

Data bits :	8	-	TML60 II printer
	7	-	Dot matrix printer
Start bits :	1		
Stop bits :	1		
Parity bits :	1 Odd		

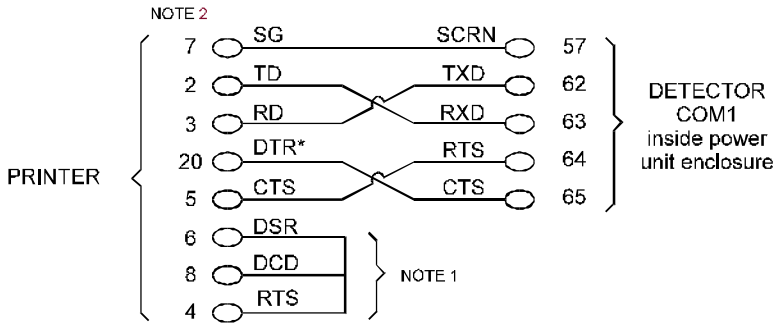
The printer ideally will use hardware handshaking although X-ON and X-OFF software handshaking is supported but must be selected from the Engineer mode.

Connection of Printer to Detector

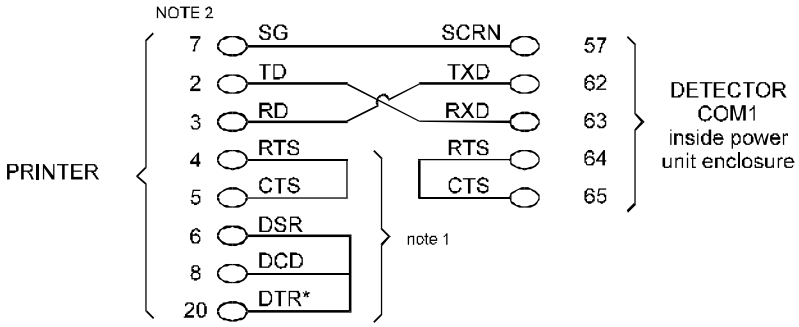
1) Hardware handshake connection (recommended)



2) Hardware handshake connection (printer does not use RTS line)



3) Software handshake connection for X-ON/X-OFF control



* Certain printers use SSD (pin 11) as an alternative printer-ready line.

NOTES

1) Certain printers do not require CTS, DSR or DCD to be at active levels. However it is accepted good practice to connect these signals together as shown.

2) The printer pin numbers shown are for an RS232 25-way D-type connector - if your printer uses a 9 way D-type connector consult the printer manual for the correct pin numbers.

Sample Print Reports

Note: Individual printouts will vary according to the settings stored in the metal detector

Metal Detector Current Settings Printout

** SETTINGS**

Date Time
01 Feb 96 13:41:47

Serial No ; 0000
Machine ID ; 110303
Line ID ; 0000

Detector Settings

Prod	Name
00	NAME..... 00
01	NAME..... 01
02	NAME..... 02
03	NAME..... 03
04	NAME..... 04
05	NAME..... 05
06	NAME..... 06
07	NAME..... 07
08	NAME..... 08
09	NAME..... 09
10	NAME..... 10
11	NAME..... 11
12	NAME..... 12
13	NAME..... 13
14	NAME..... 14
15	NAME..... 15
16	NAME..... 16
17	NAME..... 17
18	NAME..... 18
19	NAME..... 19
20	NAME..... .20

Prod	Sens	Phase	Timer
00	170	000.00	A
01	170	000.00	A
02	170	000.00	A
03	170	000.00	A
04	170	000.00	A
05	170	000.00	A
06	170	000.00	A
07	170	000.00	A
08	170	000.00	A
09	170	000.00	A
10	170	000.00	A
11	170	000.00	A
12	170	000.00	A
13	170	000.00	A
14	170	000.00	A
15	170	000.00	A
16	170	000.00	A
17	170	000.00	A
18	170	000.00	A
19	170	000.00	A
20	170	000.00	A

Prod	Freq	Inverse	Power	P.S.C.	Tracking
00	1	NO	HIGH	---	---
01	1	NO	HIGH	NO	NO
02	1	NO	HIGH	NO	NO
03	1	NO	HIGH	NO	NO
04	1	NO	HIGH	NO	NO
05	1	NO	HIGH	NO	NO
06	1	NO	HIGH	NO	NO
07	1	NO	HIGH	NO	NO
08	1	NO	HIGH	NO	NO
09	1	NO	HIGH	NO	NO
10	1	NO	HIGH	NO	NO
11	1	NO	HIGH	NO	NO
12	1	NO	HIGH	NO	NO
13	1	NO	HIGH	NO	NO
14	1	NO	HIGH	NO	NO
15	1	NO	HIGH	NO	NO
16	1	NO	HIGH	NO	NO
17	1	NO	HIGH	NO	NO
18	1	NO	HIGH	NO	NO
19	1	NO	HIGH	NO	NO
20	1	NO	HIGH	NO	NO

Timer Group ; A
Type ; TM1
Reject Time ; 100ms

Printout (Continued)

```
Timer Group     ; B
Type            ; TM2
Reject Time     ; 100ms
Sig Delay       ; 200ms

Timer Group     ; C
Type            ; TM3
Reject Shift    ; 100
Sig Shift       ; 010


Ref Phase 1                 ; -18.66
Ref Phase 2                 ; -17.34
Buzzer          ; ON
Pack sensor                 ; YES
Sensor distance ; 1000 mm
Speed range     ; NORMAL
Product speed   ; 001.0 m/min
Reject Inhibit  ; NO
Reject confirm  ; YES
Reject confirm  ; 1000 ms
Auto. Track rate ; 2.00
Auto. Track span ; 30.00
Auto. Track damp ; 5
Boost           ; NO
Printer handshake ; SW
Current
Prod No         ; 00
```

QA Settings Printout

```
* QA Settings *

Line ID             ; 0000
Printer             ; YES
Printer             ; FIXED
Relay Rpt           ; YES
Settings Rpt        ; YES
Report Int          ; 00:00
Test Int            ; 0:00
Overdue Int         ; 0:00
Alarm               ; DUE

Prod No     Fe      N/Fe    S/S
  00        0.0     0.0     0.0
  01        0.0     0.0     0.0
  02        0.0     .0.0    0.0
  03        0.0     .0.0    0.0
  04        0.0     .0.0    0.0
  05        0.0     .0.0    0.0
  06        0.0     .0.0    0.0
  07        0.0     .0.0    0.0
  08        0.0     .0.0    0.0
  09        0.0     .0.0    0.0
  10        0.0     .0.0    0.0
  11        0.0     .0.0    0.0
  12        0.0     .0.0    0.0
  13        0.0     .0.0    0.0
  14        0.0     .0.0    0.0
  15        0.0     .0.0    0.0
  16        0.0     .0.0    0.0
  17        0.0     .0.0    0.0
  18        0.0     .0.0    0.0
  19        0.0     .0.0    0.0
  20        0.0     .0.0    0.0
```

Shift Report Printout

```
** SHIFT REPORT START **
Line  ID          ;  0000
Date        Time
21 Oct 95       10:30:15

*Reject Relay Operated*

Date        Time
21 Oct 95       09:00:45
21 Oct 95       09:00:45
21 Oct 95       09:00:46
21 Oct 95       09:00:47
21 Oct 95       09:00:48
21 Oct 95       09:31:03
21 Oct 95       10:05:59
21 Oct 95       10:06:00

*Modified Settings*

Date        Time
21 Oct 95       09:01:15

Prod No    ; 01
Sens             ; 180
Timer            ; C

Rej Count ; RESET

Pack Count      ; RESET

Current
Prod No    ; 00
```

```
Date        Time
21 Oct 95       10:25:15

Prod No    ; 02
Sens             ; 185
Timer            ; A
Reject Inh       ; YES

Current
Prod No    ; 01

Date        Time
21 Oct 95       10:27:46

Reject Inh       ; NO

Current
Prod No    ; 01

**SHIFT REPORT END**
```

Performance Check Printout

```
* Performance Check *

Date        Time
21 Jan 95       10:45:00


Line ID     ; 0205
Operator    ; QA INSPECTOR
Prod No     ; 01
Sens            ; 156
Phase       ; 05.00
Timer           ; B

Material    ; FERROUS
Size        ;1.5mm
Detection   ; YES
Reject Rly      ; YES
Result      ; PASSED

Material    ; STAINLESS STEEL
Size        ; 1.5mm
Detection   ; YES
Reject Rly      ; YES
Result      ; PASSED
```

Metal detector serial communications link

Introduction

This link is a three wire serial connection allowing information to be transferred to and from the detector.
Via the link it is possible for a host to monitor and change the detector settings, using a predefined set of commands.
The information obtained in this way may be used for Quality Control and Assurance records.

Host computer or intelligent equipment

The equipment to which the detector is connected must be programmed to recognise the received data which is in a strict format and protocol. Information transmitted from the host to the detector must also be in the same format and protocol for the detector to respond.

Specification of the serial link.

This is specified in accordance with the ISO 'Open-Systems-Interconnection' (OSI) layered model for communications systems.

Physical layer specification (OSI layer 1)

The physical layer is based on the RS232 voltage levels.
3 wire connection with no hardware flow control.
1 start bit
7 data bits
1 odd parity bit
1 stop bit
Transmission rate 9600 baud
Note.
The maximum recommended RS232 cable length is 15 meters.

Data-link layer specification (OSI layer 2)

Here is the message representation as seen at the output of the data-link layer :-

(STX)**G**(VALUE)**M**(VALUE)(COMMAND)[(COMMAND)...](ETX)(CRC)

1. The message starts with STX (HEX 02) indicating start of message.
2. G and M are identifiers that are contained in every message.
3. (COMMAND) is made up of (IDENTIFIER)(VALUES LIST).
   (IDENTIFIER) is one of a series of letter or letter-number combinations detailed in the tables below.
   (VALUES LIST) are decimal values, with leading-zero suppression (unless otherwise specified), separated by comma's and terminated by the next command or ETX.
   Note that more than one (COMMAND) may be sent in a single message.
4. The message ends with ETX (HEX 03) indicating end of message.
5. This is followed by a cyclic redundancy code (CRC) of the characters contained between STX and ETX inclusive. Transmitted as a 4 digit hexadecimal number with leading zeros, high nibble first. See separate " CRC Generation ".

On receiving a good packet of information the response of the receiving equipment is to send an ACK (HEX 06). See figures D-1 to D-6.

On receiving a bad packet of information the response of the receiving equipment is to send a NAK (HEX 15).

Packets of information may be initiated by the Host at any time the serial link is idle. The serial link's idle state is when any prior messages have been completed including all outstanding acknowledgements or timeouts.

Up to 10 retransmissions will be attempted if a NAK is received after each transmission. If no Acknowledgement is made or received the retransmission will occur after a timeout period of 250 milliseconds. Again up to 10 retransmissions will be attempted.

All data is represented as ASCII characters.

Application layer specification (OSI layer 7)

The application layer operation can be split into various types of messages :-

1. Event driven messages.
   These messages are prompted by an event occuring inside the detector. These events can be one of the following list and are given in their order of priority when passed to the data-link layer for transmission :-
   a) Faults, extended faults (see command identifiers ‘e’ & ‘F’).
   b) Signal Transmissions, (‘A’n and ‘R’n when enabled by ‘g’0 command).
   c) Logins using a security code at the keypad / Logout via PROG/EXIT key (or time out).
   d) Reserved for future development.
   e) Detector settings altered at the keyboard by an operator.
   f) Detector settings altered by a communications command.

2. Host commands.

These are messages, initiated by the host, to change the settings of the detector or to read the settings of the detector.

3. Detector responses to host commands.

4. These messages are responses to host commands, and are sent by the detector.

If, in the unlikely case of the serial output buffers being filled, higher priority messages will be transmitted at the expense of lower priory messages.

Test Mode

For the purpose of checking the serial link, the detector will double echo any character sent as long as the serial link is idling. The following character should not be sent, as they are recognised as part of a normal communication transmission:- STX, ACK, NAK.

Priority of Host-Computer Vs Detector

The Host Computer or Intelligent equipment always takes priority over the detector when changing detector settings. If the user is logged into the detector via its control panel and the Host Computer or Intelligent equipment changes one of the detectors settings, the detector will be forced to log off and return to its running mode display.

Valid message identifiers

Table D-1 Table of identifiers

Command [1 2]	Direction [3]	Description	Type [4]
'A' m	out	Bargraph reading m = A signed number representing the value being sent to the bargraph of the detector. A four digit number in the range [±0..2047].[5]	**X**
'a' n 'a?'	in/out in	Operator access n = 0 : LIMITED n = 1 : FULL Operator access ?	**X**
'B' n 'B?'	in/out in	Buzzer enable n = 0 : NO n = 1 : YES Buzzer enable ?	**X**
'b'	----------	*SEE LATER FOR DETAILS OF IDENTIFIER 'b'*	***X***
'C' n ',' s1 ',' c1 ',' t ',' a 'C?' n	in/out in	Preset Product Settings. n = Product number, two digit number, in the range [0..20] s1 = Sensitivity, three digit number, in the range [0..199] c1 = Phase setting, five digit fixed point number, in the range [000.00 ... 180.00], resolution is 0.02. t = Timer group t = 0 : Timer group A t = 1 : Timer group B t = 2 : Timer group C a = Frequency offset , single digit number in the range [0..1]. Note. If parameter n is 0 then c1 must be 00.00 Product Settings ?	**P**
'c'n 'c?'	in/out	Printer Handshake n = 0 : HW n = 1 : SW Printer Handshake?	**X**
'D' d ',' c 'D' d ',' c 'D?'	out in in	Counter values. d = reject counter, four digit number, in the range [0..9999] c = pack counter, eight digit number, in the range [0..16777214] d = 1 : Reset reject counter c = 1 : Reset pack counter Counter Values ?	**X**

Command [1 2]	Direction [3]	Description	Type [4]
‘d’ s ‘,’ m	out	Serial number and Model number of the detector. s = Head serial number of the device, five digit number, in the range [0..65535]. *s is read only, any value transmitted to the detector is ignored.* m = Model number of the device, a six digit number. Note: Only the last five digits can be set by the host. The first digit is ignored by the detector when received. *(See instruction manual for details of this number)*	**F**
‘d?’	in	Serial and model number ?	
‘E’	---------	*SEE LATER FOR DETAILS OF IDENTIFIER ‘E’*	***X***
‘e’ n ‘,’ o	out	Extended-fault codes n : A sum of some of the following numbers when the extended-faults are present. n = 0 : No extended-fault reported , (transmitted when last extended-fault clears, or on request with the ‘e?’ identifier if no extended-faults are present). n = 1 : FAULT 01 n = 2 : FAULT 02 n = 4 : *Reserved for future development.* n = 8 : FAULT 03 n = 16 : FAULT: Phase value out of limits. n = 32 : FAULT 05 n = 64 : CAUTION: Date/time not set up. n = 128 : Overdue for performance check. n = 256 : Request for performance check. n = 512 : Inverse-detect must be deselected. n = 1024 : Timer must be gated for this option. n = 2048 : FAULT: Pack sensor blocked. n = 4096 : CAUTION: Pack sensor not selected. n = 8192 : Ensure no product is passing the pack sensor. n = 16384 : CAUTION: Auto. tracking disabled. n = 32768 : Power drive failed. o = 1 : CAUTION: P.S.C has been disabled. o = 2 : P.S.C. not captured, use the automatic setup. o = 4 : CAUTION: Stored signal cleared. o = 8 : WARNING: Vibration is too high. o = 16 : P.S.C. not available with variable speed. o = 32 : Automatic tracking is not available with variable speed.	**X**
‘e’ n	in	Acknowledge the extended fault code n. n : A sum of some of the following numbers when the extended-faults are present, [1,2,4,8,16,32,64] where these numbers correspond to an error number given above.	
‘e?’	in	Current extended-fault codes ?	

Command [1 2]	Direction [3]	Description	Type [4]
‘F’ n	out	Fault Codes n : A sum of some of the following numbers when the faults are present. n = 0 : No faults reported , (transmitted when last fault clears, or on request with the ‘F?’ identifier if no faults are present). n = 1 : Balance fault - CONTACT SUPPLIER. n = 2 : FAULT 08 n = 4 : FAULT 09 n = 8 : *Reserved for future development.* n = 16 : WARNING 02 n = 32 : WARNING 03 n = 64 : WARNING 04 n = 128 : EPROM checksum fault. n = 256 : Reject Confirmation, Reject error. n = 512 : Reject Confirmation, Input/Output error. n = 1024 : Data collection unit not ready. n = 2048 : Data Collection unit not configured. n = 4096 : WARNING 07 n = 8192 : Balancing - please wait. n = 16384 : *Reserved for future development.* n = 32768 : One or possibly more extended-faults are present, use the ‘e?’ command to ascertain which extended-faults are present.	**X**
‘F?’	in	Current fault status ?	
‘f’ m ‘,’ n	in/out	Inverse detect m = product number, a two digit number in the range [0..20] n = 0 : NO n = 1 : YES	**P**
‘f?’ m	in	Inverse detect (for product number m) ?	
‘G’ n	in/out	Message Length The number of characters, (or bytes), from after ‘G’n to (but excluding) ETX in every communications message. n = A two digit number with leading zeroes, in the range [0..99]. For example, the host transmission of the ‘a?’ command. The message format, (assuming XXXX = 4 digit message number), would be :- (STX)**G07**MXXXXa?(ETX)(CRC) where: **G** is the message length identifier, and where n=**07** is the total number of characters in the ‘MXXXXa?’ part of the message.	**X**
‘g’ n	in/out	Bargraph and detection comms switch n = 0 : Disable the ‘A’n and ‘R’n identifiers from automatic transmission n = 1 : Enable the ‘A’n and ‘R’n identifiers for automatic transmission	**X**
‘g?’	in	Bargraph Comms switch ?	

Command [1 2]	Direction [3]	Description	Type [4]
'H' n 'H?'	in/out in	Speed setting. n = 0 : NORMAL speed n = 1 : VARIABLE speed n = 2 : FAST speed n = 3 : Reserved for future development Speed setting ?	**X**
'h' n 'h?'	in/out in	Power-on / Reset flag n = 0 : Flag is reset n = 1 : Flag is set. Note. This flag is **set** immediately after reset or power-on and is only reset by the host sending the command, 'h0'. Power-on / Reset Occurred ?	**X**
'I' n 'I?'	in/out in	Reject Inhibit n = 0 : NO n = 1 : YES Reject Inhibit ?	**X**
'J' n 'J?'	in/out in	Reject Confirmation. n = 0 : NO n = 1 : YES Reject Confirmation ?	**X**
'j'	---------	*SEE LATER FOR DETAILS OF IDENTIFIER 'j'*	
'K'n 'K?'	in/out in	Reject Confirmation (Extension or Window) time. n = Reject Confirmation window time, a four digit number in the range [100...9900] - with timer types tm1, tm2 and tm2G, [0 60000] - with timer types tm3 and tm3G, (all times in milliseconds). Reject Confirmation (Extension or Window) time ?	
'L' n, o 'L?' o	in/out in	Power high/low setting n = product number, a two digit number in the range [0..20]. o = 0: LOW n = 1: HIGH Power high/low setting?	**P**
'M' n	in/out	Message number. n = A four digit number, with leading zeroes, in the range [0..9999]. This number is incremented for each message sent, (wraparound to zero). The detector will treat consecutive messages with the same message number as being a repeat of each other.	**X**
'N' n 'N?'	in/out in	Language n = 0 : English n = 1 : French ... n = 8 : Japanese Language ?	**X**

Command [1 2]	Direction [3]	Description	Type [4]
'O'n	out	Active mode n = 0 : Running mode (no security code has been entered at the keyboard) n = 1 : Supervisor mode. n = 2 : Engineer mode. n = 3 : Viewing mode. n = 4 : QA Inspector mode. n = 5 : QA Operator 1 mode. . . n = 13: QA operator 9 mode.	**X**
'O?'	in	Which mode is active ?	
'P' n	in/out	Product Number. n = The value of the detectors product number. A two digit number, with leading zeroes, in the range [0...20].	**P**
'P?'	in	Current product number ?	
'Q'	---------	*SEE LATER FOR DETAILS OF IDENTIFIER 'Q'*	***X***
'q' m ',' n	in/out	Automatic tracking enable m = product number, a two digit number in the range [1..20] n = 0 : NO n = 1 : YES	**P**
'q?' m	in	Automatic tracking enabled (for product number m) ?	
'R' n	out	Detection status n = 0 : Normal n = 1 : Detection	**X**
'R?'	in	Detection Status ?	
'r' n	in/out	Pack sensor fitted n = 0 : NO n = 1 : YES	**X**
'r?'	in	Pack sensor fitted ?	
'S' a ',' b ',' c ',' d	in/out	Security codes Each of these is a four digit number in the range [0..9999]. a = Supervisor code b = Engineer code c = Viewing code d = QA Inspector code	**X**
'S?'	in	Security codes ?	
's' n	in/out	Pack sensor calibration n = 0: Pack sensor calibration finished. n = 1: Pack sensor calibration start *Note* *The host sends 's1' to start calibrating. The detector will respond 's1' during calibration and 's0' when calibration is finished.*	**X**
's?'	in	Pack sensor calibration	

Command [1 2]	Direction [3]	Description	Type [4]
'T' t ',' n ',' r ',' d ',' p ',' w	in/out	Timer Settings[6] t = Timer group t = 0 : timer group A t = 1 : timer group B t = 2 : timer group C n = Timer type n = 0 : Timer type tm1 n = 1 : Timer type tm2 n = 2 : Timer type tm2G n = 3 : Timer type tm3 n = 4 : Timer type tm3G r = Reject time, a five digit number in the range [50..60000]. d = Signal delay, a five digit number in the range [50..60000]. p = Sync delay, a five digit number in the range [50..60000]. w = Window time, a five digit number in the range [50..60000]. **Note.** For timer types tm3 and tm3G the titles and range of acceptable values differ from those shown, refer to the instruction manual for details. **Note.** The resolution on all timer settings is 2ms.	**X**
'T?' t	in	Timer Settings ?	
'U' y ',' m ',' d	in/out	Date y = The year, a two digit number in the range [0..99]. m = The month, a two digit number in the range [1..12]. d = The day of the month, a two digit number in the range [1..31]	**X**
'U?'	in	Date ?	
'V' f ',' n	in/out	Sensitivity limit f = Frequency offset, a single digit number in the range [0..1]. *(Must be 0 for single frequency heads)* n = Sensitivity limit, a three digit number in the range [0...199].	**F**
'V?'f	in	Sensitivity limit	
'W' h ',' m	in/out	Time, See Note 2. h = The hour, a two digit number in the range [0..23] m = The minute, a two digit number in the range [0..59]	**X**
'W?'	in	Time ?	
'w' m ',' n',' o ',' p	in/out	Automatic tracking setup m : Automatic tracking maximum rate, a five digit, fixed point, number in the range [1.00...5.00]. n : Automatic tracking maximum span, a four digit, fixed point, number in the range [3.00...45.00]. o : Automatic tracking damping, a single digit number in the range [1... 9]. p : Reserved, always zero.	**F**
'w?'	in	Automatic tracking setup?	

Command [1 2]	Direction [3]	Description	Type [4]
'X' m ',' n	in/out	Product signal cancellation m = product number, a two digit number in the range [1..20] n = 0 : DISABLE n = 1 : ENABLE	**P**
'X?' m	in	Product signal cancellation (for product number m)?	
'Y' n ',' t	in	Window timer calibration n = 1 : Start the window time calibration t = Timer group t = 0 : timer group A t = 1 : timer group B t = 2 : timer group C	**X**
'Y' n	out	Window time calibrating n = 0 : NO n = 1 : Calibration in progress	
'Y?'	in	Window time calibrating?	
'y' m, p	out	Automatic tracking sensitivity & phase m = Tracking sensitivity 3-digit number, in the range [0..199]. p = Tracking phase, five digit, fixed point number, in the range [0.00...180.00], resolution is 0.02.	**P**
'y?'	in	Automatic tracking sensitivity & phase?	
'Z' n	in/out	Detection Method n = 0 : Amplitude only n = 4 : Amplitude + Boost .	**X**
'Z?'	in	Detection Method ?	
'z01,' p ',' s	in/out	Product name p = product number, a two digit number in the range [0...20] s = A string of alphanumeric characters. s must be 14 characters long	**P**
'z01?' p	in	Product name?	
z02	---------	*SEE LATER FOR DETAILS OF IDENTIFIER 'z02'*	***X***
'z03,' v	in/out	Product speed v = A fixed point number of the speed (m/min) in the range [0.5...200.0] *U.S. version only* *v = A fixed point number of the speed (feet/min) in the range [1.6...656.1]*	**X**
'z03?'	in	Product speed?	
'z05,' d	in/out	Sensor distance d = Sensor distance in mm. A four digit number in the range [10...9999] *U.S. version only* *d = Sensor distance in inches. A three digit number in the range [1...400]*	**X**
'z05?'	in	Sensor distance?	

NOTES

1 Those characters shown inside single quotes ‘ ’, are to be sent as shown in the identifier column (ASCII representation of characters is used).

2 **xx?** is a request to the detector for information, (where **xx** is one of the identifiers in the identifier tables).

3 The direction that the identifier may be transmitted is with reference to the detector. (**out** = transmitted by detector, **in** = received by detector).

4 The “Type” field in the above table is used to categorise the identifiers into their sphere of influence. Thus :-
F: Factory Setting
P: Product dependent setting.
X: Neither of the above.

5 Note on bargraph values
A count of ten in the bargraph reading transmitted by the detector is equivalent to 1 bargraph led illuminated. Thus for all bargraph segments to be illuminated a minimum count of 200 would be necessary.

6 Note on timer types.
Not all the timer types use all the parameters that are transmitted with the ‘T’ identifier.
However, the host must always send the correct number of variables to the detector, and similarly, the detector always responds with the correct number of variables. To alleviate this restriction the detector will accept the value 0 for those values unused by the selected timer type when transmitted from the host. The detector in turn will send the current state of these values in its responses, independent of the timer mode.

Command Identifier - 'b' Automatic setup Procedure

The Automatic setup procedure can be started remotely by the host or from the front panel keypad, in either case the front panel display and the communications commands would be in synchronisation. If the host starts the Automatic setup procedure remotely, with the commands given below, then the display will operate just as if the Automatic setup procedure had been started from the front panel keyboard.

Commands the host can transmit

The host can send any of the following messages :-

'b1' [1, 2] This starts the automatic setup procedure operating for the current product number.

'b?' This returns the current state of the automatic setup procedure (see the 'b'n command description below).

'b14' This command should be sent when the detector is in a state where a YES or NO decision is made. Transmitting this command is equivalent to selecting YES on the keypanel.

'b90' This command should be sent when the detector is in a state where a YES or NO decision is made. Transmitting this command is equivalent to selecting NO on the keypanel.

'b99' This command is sent when the host wishes to abort the automatic setup procedure and return to normal operation. This is equivalent to pressing the front panel key 'PROG/EXIT' during the automatic setup, and will cause the same action to occur in the metal detector.

For a description of the states see the 'Auto Setup Flowchart

Commands the metal detector may transmit

The following command will be transmitted in response to a 'b?' command above, or automatically during the operation of automatic setup.

'b'n n is a number indicating the state of the automatic setup's progress, the number, n, corresponds with the displays normally on the front panel display as shown on the next page.

Note the special case n = 0 means that automatic setup is not running.

Notes

1 During an Auto Setup procedure, initiated by the host, the transmission of the bargraph and detection messages ('A'n and 'R'n), will be suppressed. After completing the automatic setup, these messages will be
resumed if they had been enabled prior to entering the automatic setup.

2 The command 'b1' cannot be sent if the current product number is 0. Automatic setup is not available on product number 0

.

1

Change the frequency
please wait....

2

Ensure NO product is
passing through aperture.

3

Pass product through
aperture....

4

Product signal too large
please wait....

5

please wait....

6

Adjusting
Phase....

7

Adjusting
Sensitivity....

8

WARNING The phase setting
may be in errort....

9

Product cancellation YES ▶
NO ▶

10

Product cancellation
NOT operating

11

Product adjustment
completed

12

Obtaining product
information 1...

13

Obtaining product
information 2....

14

Setup without the
additive.

15

Setup with the
additive.

16

Repeat the tests with an additive? YES ▶
NO ▶

95

WARNING
Pack sensor not fitted.

96

Automatic setup
FAILED

98

Automatic setup
timed out.

99

Automatic setup aborted
via the keyboard or comms.

Command Identifier - 'E' Error Codes

In the case of an error in a received message being decoded at the detector, an error message would be returned to the host. This message would take the following form :-

'E' e **','** m

where e is the major error number. This can have one of the following values:-

Table D-2 Major error codes

e (major error)	Type of error	Description of error
0	No Error, OK	Received command was OK.
1	Protocol Error	The detector tried to send too many commands, within a single message, and caused a buffer overflow, (see later).
2	Identifier Error	An unknown identifier was received. Please refer to the tables of acceptable identifiers.
3	Value-list Error	A comma was missing, wrong value type, letter instead of number in the received command, etc
4	Bounds Error	A value was outside acceptable limits. Please refer to the previous tables for the range that values can take.
5	Not used	Reserved for future development

'm' is the minor error number, and takes on a different meaning dependent upon its preceding major error number.

Table D-3 Minor error codes

m (minor error)	Description of error
0	No Error, this is sent only with the major-error number set to 0.
1	Buffer Error, this is sent with the Protocol Error major number. This means that the transmit buffer inside the detector, (256 bytes long), was filled.
Decimal number	This number is the decimal representation of an ASCII character. In the case of an Identifier Error this character was not recognised as an acceptable identifier. In the case of a Value-list Error this character or number caused the Value-list Error. In the case of the Bounds Error this character is the identifier whose value(s) were outside the acceptable range.

Command Identifier - 'j' Automatic sensitivity limit procedure

The Automatic sensitivity limit procedure can be started remotely by the host or from the front panel keypad, in either case the front panel display and the communications commands would be in synchronization. When the host starts the Automatic sensitivity limit procedure remotely, with the command 'j1'given below, then the display will operate just as if the Automatic sensitivity limit procedure had been started from the front panel keyboard.

Commands the host may transmit:

The host can send any of the following messages :-

',j1' [1,2,3] This starts the automatic sensitivity limit procedure operating for the current product number.

'j?' This returns the current state of the automatic sensitivity limit procedure (see the 'j'n command description below).

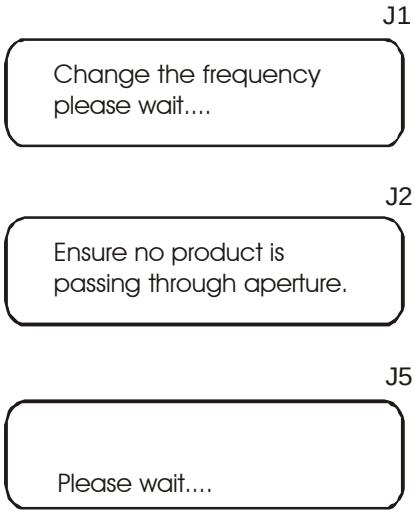
'j99' This command is sent when the host wishes to abort the automatic sensitivity limit procedure and return to normal operation. This is equivalent to pressing the front panel Security key during the automatic sensitivity limit, and will cause the same action to occur in the metal detector.

Commands the metal detector may transmit

The following command will be transmitted in response to a 'j?' command above, or automatically during the operation of automatic sensitivity limit.

'j' n n is a number indicating the state of the automatic sensitivity limit's progress, the number, n, corresponds with the displays on the front panel display as shown below.

Note the special case n = 0 means that automatic sensitivity limit is not running.



Notes

1 During an automatic sensitivity limit procedure, initiated by the host, the transmission of the bargraph and detection messages ('A'n and 'R'n), will be suppressed. After completing the automatic sensitivity limit, these messages will be resumed if they had been enabled prior to entering the automatic sensitivity limit.

2 The command 'j1' cannot be sent if the current product number is 0. Automatic sensitivity limit is not available on product number 0.3 The command 'j1' cannot be sent if either Automatic Speed or Automatic setup is running.

Command Identifier - 'Q' QA Lists and Displays

All QA relevant displays (see 'QA Operator Mode' and 'QA Inspector Mode' flowcharts in the manual) will be represented as a separate subseries from the main protocol letters. The elements of the subseries would be identified by a number corresponding to the numbered position in the flowcharts mentioned. Thus the subseries would be identified primarily by its letter 'Q' and then by its position within the 'Q' subseries by a number.
In the following table both the leading letter and the subseries element number are shown:

QA Operator commands

Command[1,2]	Direction[3]	Description	Type[4]
'Q01,' m ',' n ',' o	in/out	Test Sample Material m = product number n = Sample n = 0 : Ferrous n = 1 : None - Ferrous n = 2 : Stainless Steel o = Test Result o = 0 : Failed o = 1 : Passed	**P**
'Q01?'	in	Request last values of m, n, and o used by the detector.	
'Q02' .... 'Q09'	----------	Reserved for later use	**X**

QA Inspector commands

Command[1,2]	Direction[3]	Description	Type[4]
'Q10,' n	in/out	Printing n = 0 : Print(ing) all settings n = 1 : Print(ing) shift reports	**X**
'Q11,' n	in/out	Line identification number n = 4 digits number	**X**
'Q11?'	in	Line Identification Number ?	
'Q12,' n	in/out	Printer Selected n = 0 : NO n = 1 : YES	**X**
'Q12?'	in	Printer selected ?	
'Q13,' m ',' n ',' o	in/out	Sample Size Registration m = Product number, a two digit number in the range [0..20]. n = 0 : Ferrous Sample n = 1 : None - Ferrous Sample n = 2 : Stainless Steel Sample o = Sample size in mm, a two digit number in the form X.X (E.g. 09 = 0.9 mm	**P**
'Q13?' m ',' n	in	Sample Size Registration ?	

Command[1,2]	Direction[3]	Description	Type[4]
'Q14,' n	in/out	Shift Report options n = 0 : Reject Relay Operations OUT Modified Settings OUT n = 1 : Reject Relay Operations OUT Modified Settings IN n = 2 : Reject Relay Operations IN Modified Settings OUT n = 3 : Reject Relay Operations IN Modified Settings IN	**X**
'Q14?'	in	Shift Report options ?	

Command[1,2]	Direction[3]	Description	Type[4]
'Q15,' h ',' m	in/out	Shift Report Interval Time h = Two digit number, of the hour, in the range [0..24]. m = Two digit number, of the minute, in the range [0..59]. Maximum shift report interval time is 24:00	**X**
'Q15?'	in	Shift Report Interval ?	
'Q16,' h ',' m	in/out	Shift Report Start Time h = Two digit number, of the hour, in the range [0..23]. m = Two digit number, of the minute, in the range [0..59]. Maximum shift report start time is 23:59	**X**
'Q16?'	in	Shift Report Start Time ?	
'Q17,' h ',' m	in/out	Test Interval h = Single digit number, of the hour, in the range [0..8]. m = Two digit number, of the minute, in the range [0..59]. Maximum test interval time is 08:59	**X**
'Q17?'	in	Test Interval ?	
'Q18,' h ',' m	in/out	Overdue Period h = Single digit number, of the hour, in the range [0..4] m = Two digit number, of the minute, in the range [0..59] Maximum overdue period must be less than half of 'Test Interval and less than 04:59	**X**
'Q18?'	in	Overdue Period ?	
'Q19,' n	in/out	Alarm if Due/Overdue Setting n = 0 : DUE n = 1 : OVERDUE	**X**
'Q19?'	in	Alarm if Due/Overdue Status ?	
'Q20,' n ',' o	in/out	QA Operator Number and Code n = Operator number, a single digit number in the range [1..9]. o = 4 digit code for the operator n, in the range [0..9999].	**X**
'Q20?' n	in	QA Operators code ?	
'Q21,' n	in/out	Printer type n = 0 : FIXED n = 1 : PORTABLE	**X**
'Q21?'	in	Printer type ?	

NOTES

1 Those characters shown inside single quotes ' ', are to be sent as shown in the identifier column. (ASCII representation of characters is used).

2 **xx?** is a request to the detector for information, (where **xx** is one of the identifiers in the identifier tables).

3 The direction that the identifier may be transmitted is with reference to the detector. (**out** = transmitted by detector, **in** = received by detector).

4 The "Type" field in the above table is used to categorise the identifiers into their sphere of influence. Thus :-

F: Factory Setting.

X: Neither of the above.

P: Product-dependent setting.

Command Identifier - 'z02' Automatic product speed procedure

The Automatic product-speed procedure can be started remotely by the host or from the front panel keypad, in either case the front panel display and the communications commands will be in synchronization. When the host starts the Automatic product-speed procedure remotely, with the command 'z02,1' given below, then the display will operate just as if the Automatic product-speed procedure had been started from the front panel keyboard.

Commands the host may transmit:

The host can send any of the following messages :-

'z02, 1'[1,2] This starts the automatic product-speed procedure operating for the current product number.

'z02?' This returns the current state of the automatic product-speed procedure (see the 'z02'n command description below).

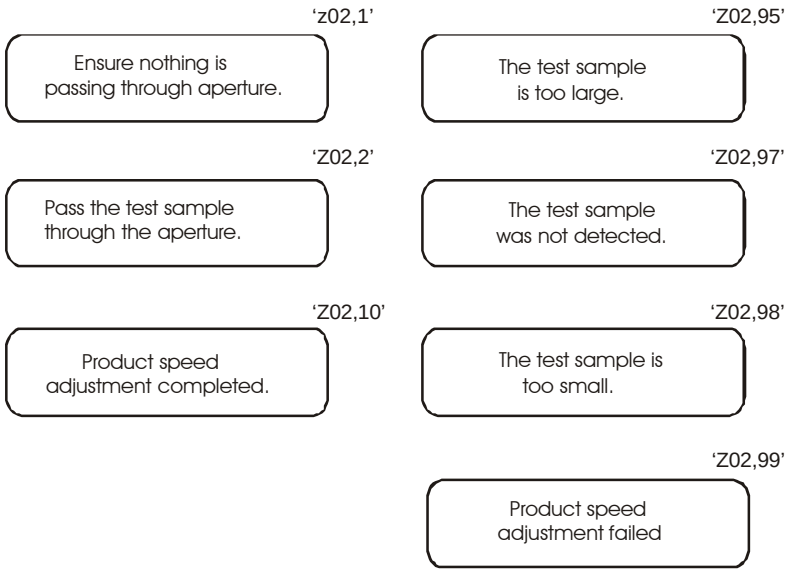
'z02,99' This command is sent when the host wishes to abort the automatic product-speed procedure and return to normal operation. This is equivalent to pressing the front panel security keyduring the automatic product-speed, and will cause the same action to occur in the metal detector.

Commands the metal detector may transmit

The following command will be transmitted in response to a 'z02?' command above, or automatically during the operation of automatic product-speed.

'z02,' n n is a number indicating the state of the automatic product-speed's progress, the number, corresponds with the displays on the front panel display as shown below.

Note the special case n = 0 means that automatic product-speed is not running.



Notes

1 During an automatic product-speed procedure, initiated by the host, the transmission of the bargraph and detection messages ('A'n and 'R'n), will be suppressed. After completing the automatic product-speed, these messages will be resumed if they had been enabled prior to commencing the automatic productspeed.

2 The command 'z02, 1' cannot be sent if either Automatic Setup or Automatic sensitivity limit is running.

CRC GENERATION

A sixteen bit cyclic redundancy code (CRC) is used in preference to the more common checksum technique to minimize the possibility of the detector responding to a corrupted transmission.

Method

A sixteen bit CRC accumulator is used, the data being transmitted over the link is four bytes of ASCII encoded hexadecimal with no leading zero suppression.

Polynomial used,
$G(x) = x^{16} + x^{12} + x^5 + 1$ (i.e CCITT)

Data is processed Least Significant Disc (LSB) of character first and transmitted high byte and high nibble to low byte and low nibble.

The CRC accumulator is initialized to FFFF before every packet is started.

Example CRC Numbers.

MESSAGE STRING	CRC (HEX)
T	1B26
THE	44BE
THE,QUICK,BROWN,FOX,0123456789	DF91

Note: The CRC does not include the terminating null character in the above strings.

Refer to the following C Program for a straightforward non-optimized CRC-CCITT routine.

C Program

```
/*
   Straightforward, non-optimized CRC-CCITT routine.
   Assumes 16-bit integer variables.
   MSB of integer is MSB of CRC result.
*/

#define  POLY              0x8408              /* Polynomial */

void  main(void)
{
        unsigned int crc;

        crc = 0xffff;
        printf("crc of 'T' is 0x%x\n", bytecrc("T",&crc) );

        crc = 0xffff;
        printf("crc of 'THE' is 0x%x\n", blkcrc("THE",&crc,3) );

        crc = 0xffff;
        printf("crc of 'THE,QUICK,BROWN,FOX,0123456789' is
        0x%x\n",blkcrc("THE,QUICK,BROWN,FOX,0123456789",&crc,30));

}  /* end main */


unsigned int  blkcrc(unsigned char *bufptr,  unsigned int  *crcres, unsigned int count)
{
        int    i;
        for (i = 1;  i <= count;  i++ , bufptr ++  )                    /* do for whole block */
                bytecrc(bufptr, crcres);                                /* do CRC for 1 byte */

        return  *crcres;

}  /* end blkcrc */

unsigned  int  bytecrc(unsigned char *bufptr,  unsigned int  *crcres)
{
        unsigned int     j, ch, Q;

        ch = (unsigned int) *bufptr;                                    /* get char to int format */
        for (j = 1;  j <=  8;  j ++ )
        {                                                               /* do each bit LSB first */
                Q = (*crcres & 0x0001) ^ (ch & 0x0001);
                        /*
                           Q = 1 if either crcres or data least significant bits are 1, but not both.
                         */
                if ( Q == 0x0001 )
                 {                                                      /*- Q is one */
                        *crcres = *crcres >> 1;                         /* shift right one */
                        *crcres = *crcres ^ POLY;                       /* XOR with POLYnomial */
                }
                else                                                    /*- Q is zero */
                    *crcres = *crcres >> 1;       /* just shift no XOR */
                 ch = ch >> 1;                    /* move next data into position */
        }
        return  *crcres;

}  /* end bytecrc */
```

TIMING DIAGRAMS FOR SERIAL COMMUNICATIONS

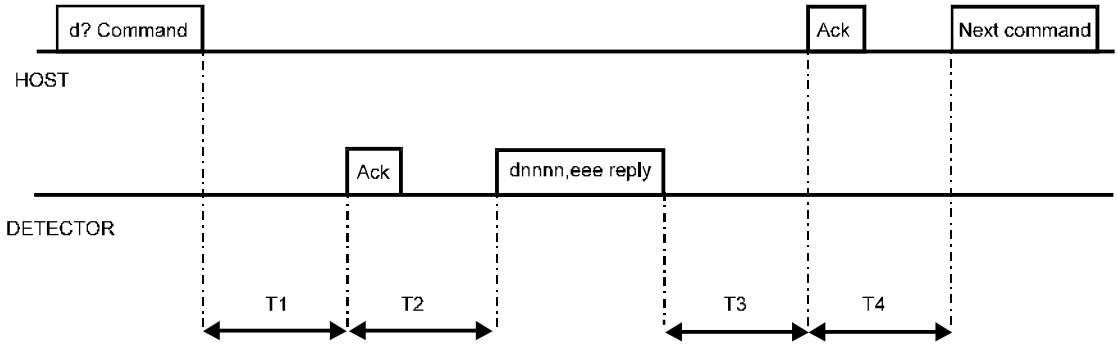


Figure D-1 Host query of detector

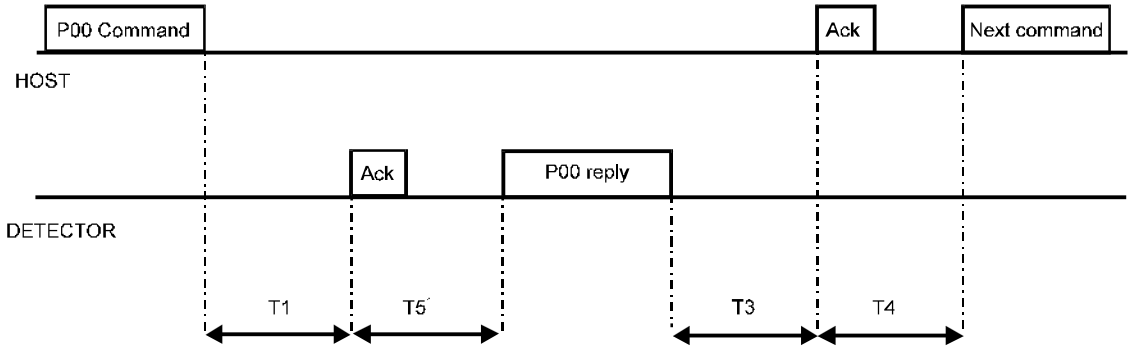


Figure D-2 Host command type 1, (causes change in value of detector variable)

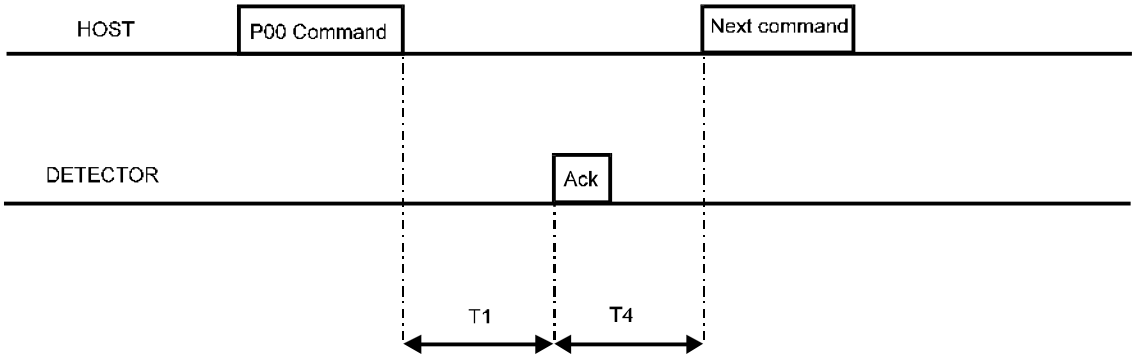


Figure D-3 Host command type 2, (causes NO change in value of detector variable)

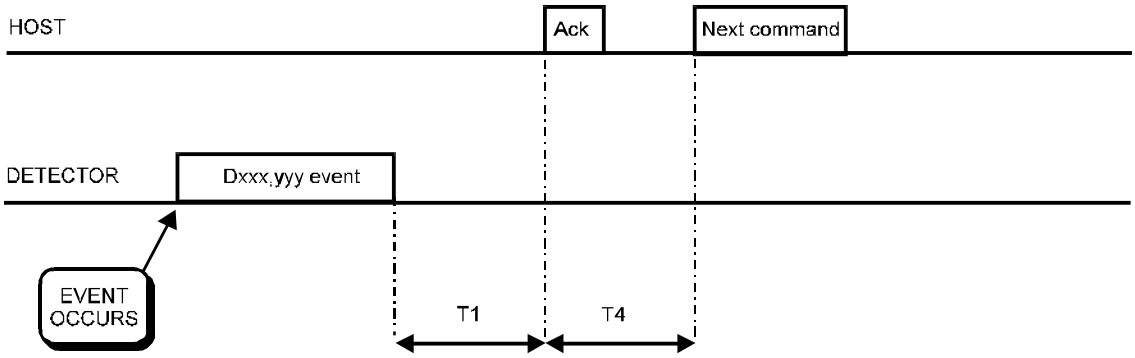


Figure D-4 Event occurence inside detector

Table D-4 Absolute maximum timings

Time	Minimum (ms)	Maximum (ms)
T1	0	250
T2	0	250
T3	0	250
T4	200	∞
T5	0	250

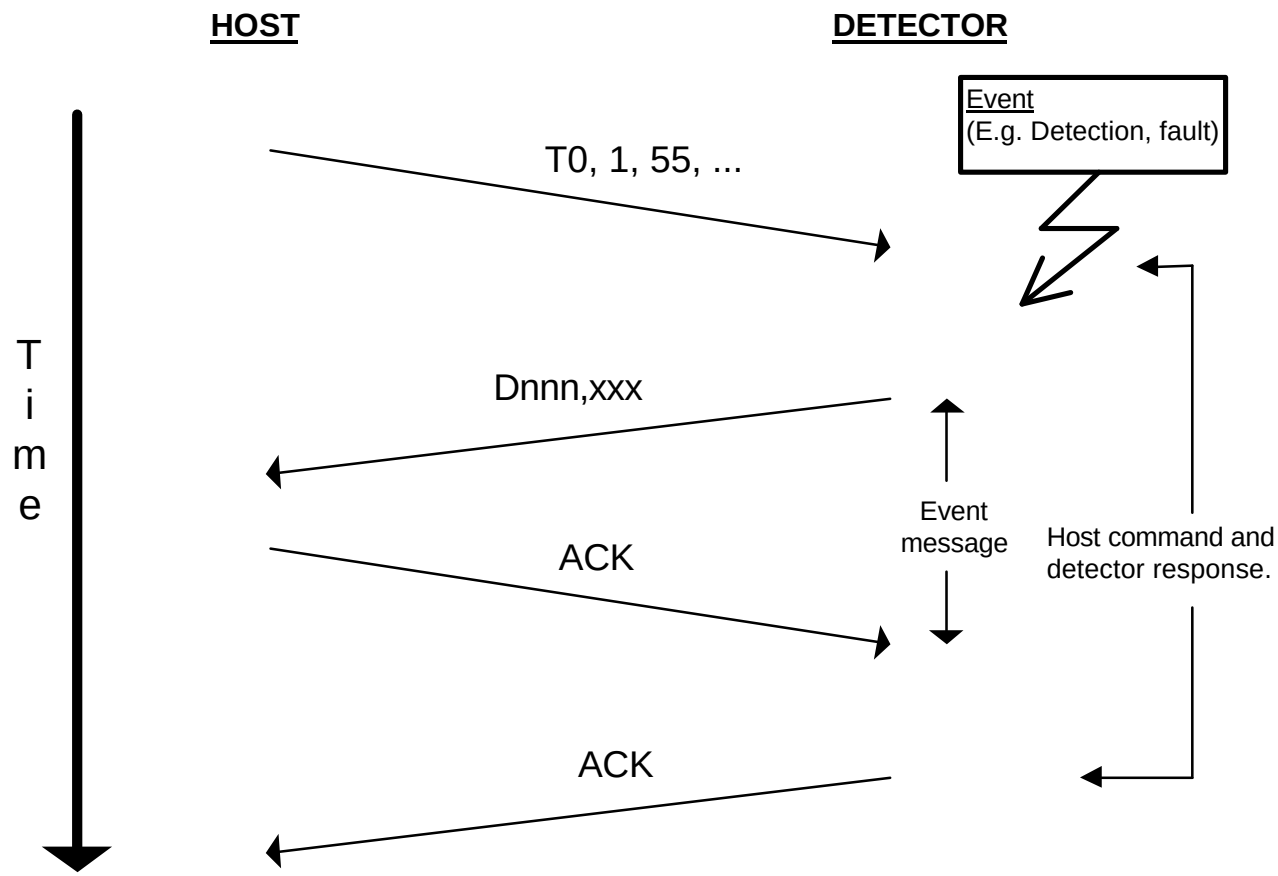


Figure D-5 Event driven message interrupting normal ACK/NAK response to the host

MAGNETIC LOOPS

The design and Construction of the metal detector support framework can influence the performance of the detector.

A metal detector with excellent vibration characteristics, if mounted on a structure containing magnetic loops can be made to look extremely poor and very sensitive to vibration.

Metalwork, even though positioned outside the normal metal free zone can still act as an aerial or receiver for the magnetic field from the detector,. making the whole framework susceptible, to loop effects.

The leakage magnetic field from the aperture of the detector can generate minute electrical currents that flow in the surrounding metalwork. They in turn influence the detector. An electric current will flow if a closed electrical path or loop exists.

A typical installation could be a metal detector mounted on a metallic frame with rollers positioned across the frame as shown in Figure 5 in the Installation Section.

The magnetic field from the detector can radiate into the conveyor frame, this in turn would create minute electrical currents which would flow through the closed path or loop created by the rollers mounted across the frame.

Problems with loops can be avoided by opening or closing the loop in a permanent manner. It is the intermittent nature of a loop path that causes intermittent triggering of the metal detector.

The frame itself should be of welded construction rather than bolted sections. A welded construction is an example of a permanently closed loop.

Any items bolted to the frame, particularly items positioned across the conveyor (eg guards) potentially create loops. To avoid difficulties insulate/isolate all items bolted to the frame.

Record all your settings here, (use the Viewing Mode and Engineer Mode).
Note in the table below items marked with an asterix, *, are optional items that may not be fitted in your detector.

Detector Details

Serial Number	
Model	
Software Version	

Notes

Product Details

Nr	Product name	Sens.	Phase	Operating frequency	Power Drive	Timer group	Inverse detect	Automatic tracking*	P.S.C.*
0			000.00					no	no
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

Engineer Mode Settings

Detection buzzer	
Operator access	
Detector speed	
Reject inhibit	
Reject confirmation*	
Reject confirm time*	
Boost mode	
Language	
Printer handshake*	
Maximum rate	
Maximum span	
Damping	

Timer Groups Setup

Group	Type				
A					
B					
C					

Sensitivity limit

Frequency	Sensitivity limit

Sample Sizes

Nr	Ferrous	Non Ferrous	Stainless Steel
0			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

Distributor use only

Com1	
A.S. reject inhibit	
Reject confirmation option	
Performance check option	
Product cancellation option	
Switched frequency	
Fe Phase	

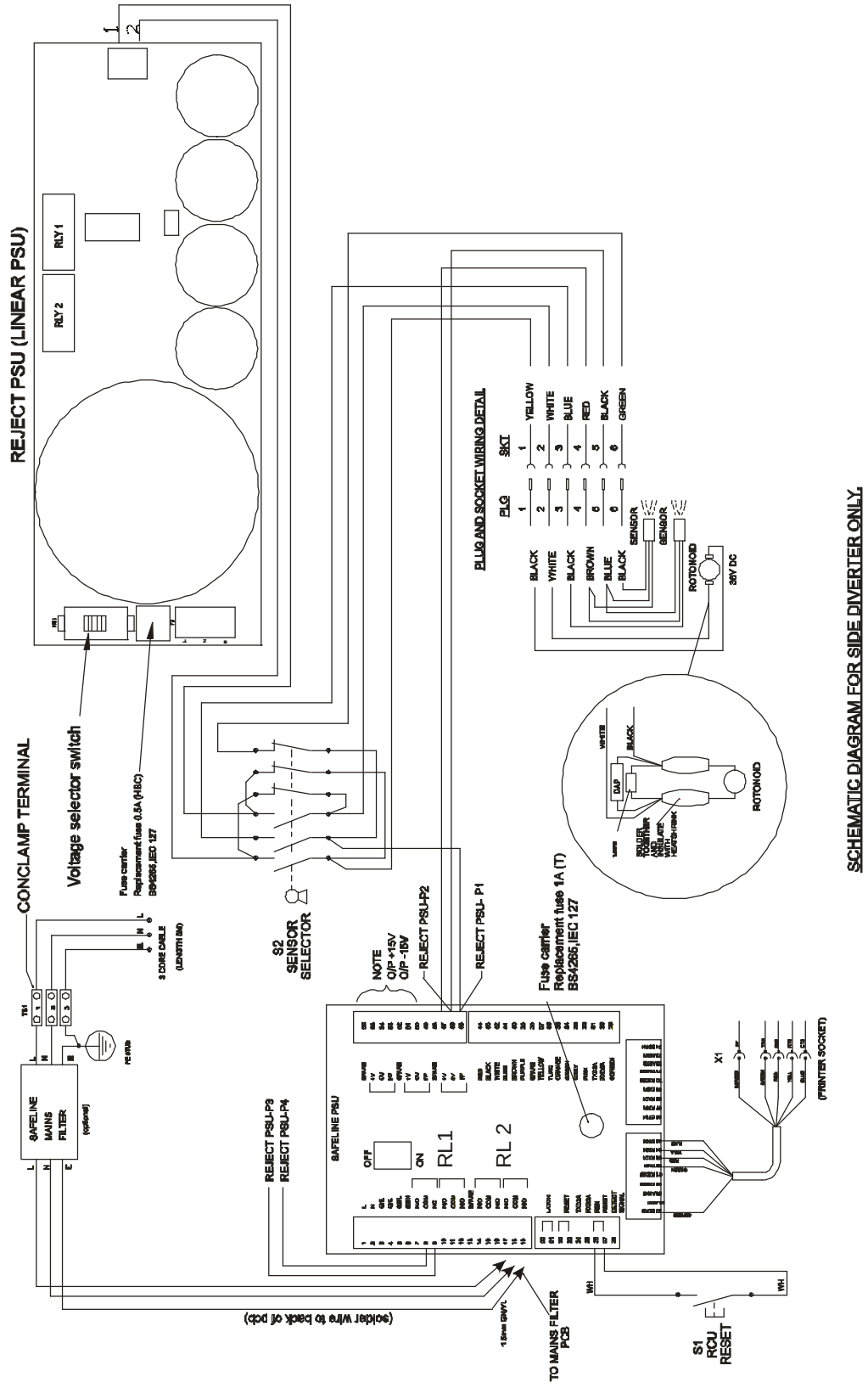


Fig 27 Schematic Diagram For Side Diverter

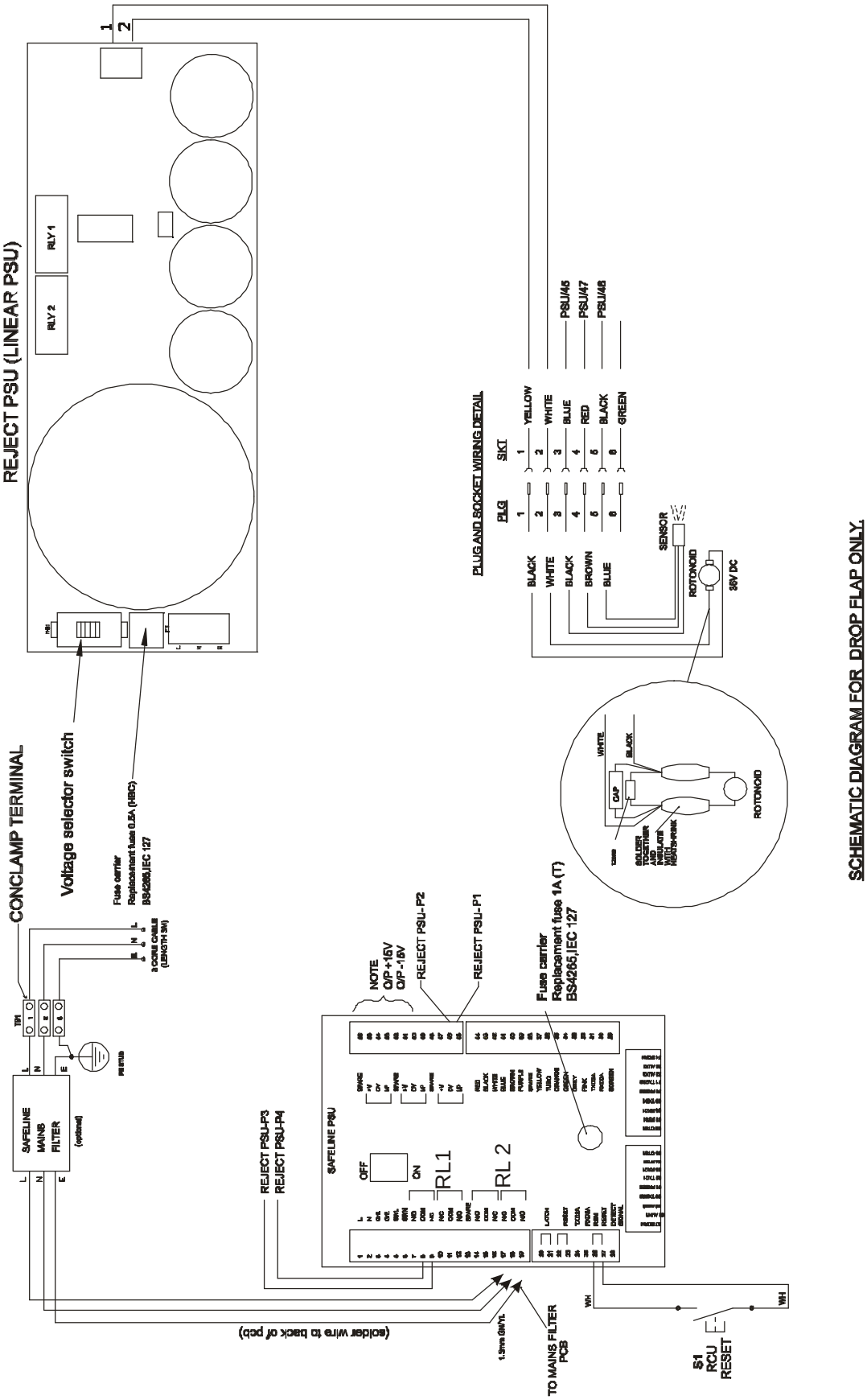


Fig 28 Schematic Diagram For Drop Flap