LOMA IQ^2

Service Manual

Search Head and Controls



Contents

Open Flash Memory Programming Supplement (only if present)

Amendment Record on page 2

Amendment Record

Module	Amendment	Issue
	Amendments record introduced	B
5092	Relative humidity amended, IP ratings removed. (UL requirements)	B
7026	Principles of Operation drawing quality improved.	B
8023	Warnings associated with the safety mesh cover over the PSU area of the control board improved. Information on gaining access to the ac input connector & reject relays added.	C
7026	"Configuration and Set up Information" New "ADC setup" menu chain added to the "Loma menu" for version 1.1 software. Details of individual ADC set up menus together with how & when to use them added. New "Step 6" (ADC set up) added to the "Step by Step" configuration sequence.	D
6022	Symbols for Run error & System Fault corrected, they were reversed.	E
7026	Symbols for Run error & System Fault corrected, they were reversed.	E
	Hyperlink to the Flash memory Programming Supplement added from manual front page.	E
3000	Loma Gmbh new address added.	E
Flash	Note on fitting a boot eprom added.	E
7026	Serial link 16-way chassis connector wiring amended to suit the new IQ2 serial link loom assembly.	F
7026	New IQ2 serial link loom assembly part number added.	F
8023	Section added on +/-12v DC protection fuses. Locations added to figure 2.	F
9095	Reference to +/-12v Dc protection fuses added to DC rail checks.	F
11050	New control & psu board and protection fuse part numbers added to spare parts list.	F
Flash	Step 9 re-written to recommend a cold start after flash memory programming is completed.	F
7026	38mm Pharmaceutical aperture size corrected	G
8023	Voltage free relay contact information contacts shown statement corrected to "de-energised".	G
3000	Loma France & Germany for service now call Loma bv	G
Flash	Step 9 re-written to instruct a cold start after flash memory programming is completed.	G
3000	New address & telephone numbers for bv, France & Germany Sales & Service	H
8023	Lethal Hazard. Note added about mesh removal whilst detector is powered.	H
8023	Control board removal instruction 3. Report/log package may be included with replacement boards.	H
8023	Control & PSU Board removal & refitting. Note on replacing with the same assembly part number added.	H
11050	New part numbers added for control boards with report/log package fitted.	H
11050	UL & non UL control board & PSU part numbers fitted with reports & logs package added.	H
3000	Telephone numbers for bv, France & Germany Sales & Service	J
8023	New PSU cover & main earth ground added	J
11050	New parts added, two piece safety cover & watertight glands	J
5092	Information added regarding immunity modifications for UHF walkie-talkie radios.	K

Module	Amendment	Issue
7026	Dual frequency & Auxiliary (Aux.) relay menu positions added	K
7026	Catalogue freefall & ferrous in foil coil gaps added	K
7026	Details of new trend type tracker added	K
8023	Dual frequency information aded	K
9095	Dual frequency balance & phase integrity checks added	K
11050	Dual frequency board part numbers added	K

1 The Loma Group Companies & Service Centres

2 Cautionary Advice

3 Product Description & Environment

4 Fault and Error Diagnosis

5 Configuration & Setup

6 Maintenance

7 Functional Testing

8 Wiring/Connection Diagrams

9 Spare Parts Lists

10 Service Returns Form

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CAUTIONARY ADVICE

CONTENTS

Safety Warnings 2

Lethal Hazard Electrical Supplies 2

Working on Equipment 2

Lifting Equipment 2

Moving a Search Head 2

Using a Crane 3

Using a Fork Lift Truck 3

Dealing with Fire 3

Safety Warnings

Listed below are safety warnings that are used throughout this manual. It is strongly recommended that personnel who are, or will be, responsible for maintaining or operating the equipment described in this manual should read and understand these warnings.

1. **LETHAL HAZARD – ELECTRICAL SUPPLIES.** A current of 100 milli-amps passing through the body for one second can kill. This can occur at voltages as low as 35V ac or 50V dc. The equipment described in this manual uses electrical power which can be lethal. Unless absolutely necessary, cleaning, inspection and maintenance must not be carried out without first isolating the equipment from all electrical supplies.

2. **WORKING ON EQUIPMENT.** If it is essential to work on the equipment with electrical power connected, the work must be undertaken only by qualified personnel who are fully aware of the danger involved and who have taken adequate safety precautions to avoid contact with dangerous voltages

3. **LIFTING EQUIPMENT.** Use only the correct slings and lifting tackle to move heavy items of equipment described in this manual. Inspect all slings and lifting tackle prior to lifting the equipment to ensure that:

   (a) The safe working load will not be exceeded.

   (b) There are no frayed or broken strands.

   (c) Hooks, rings, etc. are not damaged.

WARNING

MOVING A SEARCH HEAD. Some metal detector search heads are extremely heavy. Care must be taken when moving such a head to ensure that it can not fall or topple over. This could result in death or severe injury to an individual and/or severe damage to the head.

Depending on the size and weight of a head, either a crane or a fork-lift truck will be required to lift and move it into the final location.

Using a Crane

(a) Position the straps beneath the head so that it can not tilt when lifted. Attach the straps to the crane.

(b) Lift the head and carefully move it to the required location.

(c) Lower the head and remove the straps.

Using a Fork Lift Truck

(a) Position the forks beneath the head so that it cannot tilt. Raise the lift sufficiently to lift the head clear of the ground and any obstacles.

(b) Carefully move the head to the required location.

(c) Lower the forks and withdraw them from the head.

Dealing With Fire

4. In the unlikely event of fire occurring in an item of equipment manufactured by Loma Engineering, it is important that a fire extinguisher containing the correct type of extinguishing material is used. Fire on electrical equipment must be extinguished using a dry powder extinguisher (Blue in the United Kingdom).

PRODUCT DESCRIPTION AND ENVIRONMENT

CONTENTS

Search Head and Control Unit Technical Specification 2

Electrical Supplies 3

Spurious Triggering 3

EMC Interference 4

Radio Frequency Interference 5

Search Head and Control Unit

This section describes Loma IQ metal detector search head and control unit.

Technical Specification

Search Head ..... Loma IQ^2

Case Material ..... Stainless steel 304L, fabricated

Case Finish ..... Bead blasted

Environmental Protection ..... Dust and waterproof

Control Unit ..... Loma IQ^2

Mounting ..... On search head or remote

Voltage Standard Universal Input ..... 85-264V, single phase, 50/60Hz

Operating Temperature ..... -10°C to 40°C (+14°F to +104°F)

Relative Humidity ..... 80% up to 31°C (86°F) reducing to 50% @ 40°C (104°F)

The metal detector search head and control unit has been designed for use with continuous motion conveyor systems, pipeline, pharmaceutical and freefall metal detectors.

As standard, the control unit is secured at the end of the search head. This unit enables suitably trained personnel to set up, change, calibrate, and obtain results from the system through a menu-driven user interface. The control board can be fitted with an optional board providing the following serial link options – 1 x RS232 (hardware hand shaking). 1 x 20ma current loop, and 1 x RS422 (both software handshaking). See the "Serial link" on page 25 section later in this manual.

The control board can also be fitted with an optional external sensor board enabling the following functions to be supported - Product registration photoeye. Reject device actuation or confirmation of a rejected item entering a reject collection container, photoeye or a movement sensor can achieve this. Reject bin full sensing photoeye. Variable speed sensing using a shaft encoder. Remote calibration command uses a simple switch.

The control board can also be fitted with an optional reports package supporting an on board real time clock and date function together with a range of standard reports and logs as shown in the equipment user manuals.

The control unit is compatible with the following Loma communication packages.

LomaNet - Optional node, serial link board, reports and logs package and external connectors required.

LomaLink - Optional serial link board, reports and logs package and external connectors required.

Electrical Supplies

Electrical supplies are connected to the control unit directly into the bottom of the control unit via waterproof glands.

Control unit connection details can be found in the - “Connecting to a Power Source” on page 12 in the “Maintenance” section of this manual.

For specific wiring connection information including any conveyor wiring diagrams, please refer to the “Wiring Diagrams” package in your Customised User Manual.

Spurious Triggering

The Loma range of Metal Detectors is the product of many years' experience and development. They are inherently reliable. Provided a detector is set up as described in the setting up procedure, it is unlikely that any problem lies within the head assembly or control unit.

Sources of spurious or false triggering can be:

- Operator rings or watches.
- Belt contamination even by small particles of rust.
- Remember to clean the underside as well as the top surfaces you can see.
- Metallic belt clips even if plastic coated.
- Metallic guide rails particularly into the metal free area.

- A conveyor bolted together rather than welded (potential for Eddy Current Loops).
- Metallic inks or labels.
- Metallic frames to infeed or outfeed guards.
- Low grade or reclaimed cardboard packing materials that often contain metallised paper or foil.
- Particles of metal under the skid plate.

EMC Interference

All Loma equipment has been designed to operate under factory conditions, and has been tested to recognised international standards for Electro Magnetic Compatibility (EMC).

However, if your equipment is affected by unexplained false rejections that cannot be accounted for by any of the suggestions listed under Spurious Triggering, the equipment may be affected by excessive electrical noise via its supply or airborne (radiated) sources.

Guidance on EMC Considerations when installing your equipment is given in your User Manual. However, as a first step to eliminating EMC interference, the following considerations should be checked.

Electrical supply considerations

The unit should have its own dedicated supply, unless the line supply was known to be clean. The earth should be robust, of low impedance and noise free.

Any dedicated supply line should run in its own conduit/trunking away from other noisy supplies.

The input voltage should not be subject to voltage fluctuations outside the limits (BS EN 61000-6-2):

1. Minus 15% to plus 10% of the nominal supply voltage (230V or 110V).
2. Zero voltage for more than 20mS.
3. 50% of nominal voltage for more than 40mS.
4. 80% of nominal voltage for more than 100mS.
5. Operation outside these limits may cause loss of function until the supply condition recovers to within limits.

Other EMC Considerations

Any external sensor connected to the Metal Detector should be in screened cable, grounded at the point of entry into the metal detector control box and kept free from sources of electrical noise (e.g. mains supplies for large electrical machines).

The metal detector is a highly sensitive RF measuring device, which is well screened from outside interference and has excellent electronic discrimination against unwanted electromagnetic fields. However, due to it's sensitivity it is possible that other devices that emit high levels of RF noise at the operating frequency of the detector may cause interference, thereby degrading the performance of the detector.

NOTE

These guidelines are based on the PPMA EMC Code of Practice, which should be referred to if in doubt about any aspect of making external electrical connections to the detector.

Radio Frequency Interference

A metal detector is, essentially, a Radio Frequency (RF) receiver. As such it is sensitive to RF noise in the general vicinity of the detector location. While those frequencies not close to the operating frequency of the detector will usually be filtered out (this includes most 'walkie talkie' frequencies, unless the transmitter is held very close to the detector aperture). It is not uncommon for the control frequency (or a multiple of it), used in modern speed controllers, to cause interference.

To reduce the risks of such interference causing false rejects or other symptoms of undesirable operation at the metal detector, the following recommendations should be followed:

Always route speed controller input and output wiring away from the metal detector area. **NEVER** put speed controller wiring in the same conduit or on the same supply as the metal detector wiring.

Run speed controller wiring in the general vicinity of the metal detector in a rigid steel conduit or use other techniques to ensure 100% screening of the cable. Always follow the speed controller manufacturer's instructions for installation, wiring, screening and grounding.

In addition to following these guidelines, most speed controller manufacturers can supply input and output filters which can be fitted to the field wiring to dramatically reduce RF emissions if necessary.

All Loma metal detectors are designed, and tested, to meet the requirements of the FCC and the new stringent European regulations for RF emissions. Both in terms of not emitting excessive or being unduly affected by emissions from other equipment whose emissions also meet the standards?

This approach allows Loma to offer stable operation even in RF noisy environments, provided the other equipment is to the same standards and the field wiring is suitably 'hard'.

Hand Held Walkie-Talkie Radios

Interference from UHF walkie-talkie radios operating in the carrier frequency range of 403 - 470 MHz have been increasingly problematic because they can severely interfere with general-purpose metal detectors of all types and operating frequencies.

The interference occurs whenever the talk button is pressed or released resulting in, on occasion, very high signal readings often in the thousands leading to false triggering of the detector.

This effect can be eliminated by the addition of extra screening with connection filtering for the search headboard.

The suppression system was made available as standard build on Freefall detectors for the Americas and optional elsewhere from about March 2003.

If interference is experienced from this type of radio then contact your local service office with details of the affected detector/s. Due to the physical size of the modification it cannot be ordered or retrofitted for Pipeline or Pharmaceutical detectors.

FAULT AND ERROR DIAGNOSIS

CONTENTS

Cold Start 2

Run Errors 3

System Faults 4

Diagnostic Errors 6

LomaLink Diagnostic Errors 6

Cold start

Other than that initiated by the use of JP6 on the control board, will not normally occur under normal operating conditions. However, there may be circumstances such as a faulty power supply or a noisy main supply that may cause the control unit to lose its memory. Should this occur then the display would show the warning message +Not detecting+ located at the top of the Configuration menu.

Message	Cause	Solution
+Not detecting+	Spurious cold start	1. Establish and repair the cause of the problem for example carry out checks on the power supply DC rails as described in "DC Rails" on page 7 section in the "Functional Testing" section of this manual 2. Re-commission the control unit as described in the "Configuration" on page 4 section of this manual

To perform a "cold start" go to "Hardware Cold Starting" on page 8 in the "Maintenance" section of this manual.

Run Errors

Are classified as non-fatal but requires an operator's attention. When an error is generated the attention relay operates and subsequently any remote device connected to it. In addition the Run Error LED △ on the User Interface illuminates. If your detector is fitted with the Reports/Logs package the errors can be accessed in the Run Error menu "View errors". All errors are described as either passive (PSV), active (ACT) or as an event (EVT) the date & time accompany errors.

Message	Cause	Solution	LomaLink Error No.
PV test prompt	A programmed PVS test prompt has occurred.	1. Complete a PV Test.	22
Pec blocked	PEC has remained blocked for 5 consecutive pack lengths. Product registration photoeye only.	1. Check the PEC for blockage. 2. Check PEC is working. 3. Check pack flow length entry is adequate, ensuring an allowance is made for pack skewing. 4. Ensure correct belt speed is entered.	23
Neg delay exten	Reject dwell time setting problem. Variable speed systems only.	1. Check reject delay and dwell time settings.	24
Speed too fast	Belt speed is greater than the upper limit for existing filter resistors, coil gap and belt speed. Variable speed systems only.	1. Decrease belt speed. 2. Change filter resistors to lower value. Refer to "Belt Speed" on page 14 in the "Configuration & Setup" section of this manual	25
Speed too slow	Belt speed is less than the lower limit for existing filter resistors, coil gap and belt speed. Variable speed systems.	1. Increase belt speed. 2. Change filter resistors to higher value. Refer to "Belt Speed" on page 14 in the "Configuration & Setup" section of this manual	26
Reject too close	The reject system is still counting out the dwell for a reject when the next pack to be rejected comes along	1. Reduced the reject dwell time. 2. Improve the pack pitch. 3. If the reject is a retracting band or lift/drop flap, change the reject mode to pulse extension.	27
Reject disabled	The reject relay has been disabled.	1. Enable the reject relay using the Reject enable command.	29

Note: PEC = Photo Electric Cell or Photoeye. PVS = Performance Validation System.

System Faults

Are classified as fatal and require immediate action. When an error is generated the fault relay operates, permanently operating the reject device and/or stopping the conveyor transport. In addition the Fault Relay LED ⃠ on the User Interface illuminates. If your detector is fitted with the Reports/Logs package the faults can be accessed in the System Fault menu "View faults". All faults are described as either passive (PSV), active (ACT) or as an event (EVT) the date & time accompany errors.

Message	Cause	Solution
Osgo out of spec	The search head transmitter has failed or its value is less than 10v.	1. Check the head cable is properly seated in PL1 on the control board. 2. Check OSGO DC voltage as described in "OSGO" on page 5 in the "Functional Testing" section of this manual.
5v out of spec	5v rail is less than 4.75v	1. Check 5v rail as described in "DC Rails" on page 7 the "Functional Testing" section of this manual.
+12v out of spec	+12v rail is less than 11.40v	1. Check +12v rail as described in "DC Rails" on page 7 in the "Functional Testing" section of this manual.
+Powered up+	Logged every time the system is powered up.	No action required.
Verdict too late	A pack has arrived at the reject point before the detector has sent a reject decision.	1. Increase the reject delay time. 2. If in PEC Mode, reduce the pack length.
Verdict mismatch	The system has more reject verdicts than packs passed.	1. Power machine off and on.
Rej confirm fail	The reject system has attempted to reject a pack but could not confirm that the pack was removed from the line, within the specified time.	If the pack has been correctly rejected: 1. Check the Reject confirm sensor is working. 2. Check the Reject confirm timing parameters are correct.
Rej con wind fail	The reject confirmation system has received two packs in one reject confirm window.	1. If 2 packs were supposed to be rejected than reduce the Reject confirm window. 2. Reduce the Reject dwell time.

Message	Cause	Solution
Bin full	The reject bin full sensor has detected that the bin is full.	If the bin is not full: 1. Check the Bin full sensor is working correctly. 2. Check the Bin full sensor is wired in the correct sense.
Link corrupted	Data corruption has occurred between the detector and LomaLink PC/other controlling device. The operation of the detector is unaffected.	1. Check cabling and link connectors from remote device. 2. Check LomaLink PC/ other controlling device for reported errors.
Link failure	A break in communication between the detector and LomaLink PC/other controlling device. The operation of the detector is unaffected.	1. Check cabling and link connectors from remote device. 2. Check connections between the detector and LomaLink PC/other controlling device for loose or broken wiring/connectors
PV test timeout	A prompted for PVS test has either not been done or completed with the window time set.	1. Clear system fault. 2. Perform a PVS Test.

Note: Osgo = OScillator GOing.

PVS = Performance Validation System.

Diagnostic errors

Are classified as fatal and only occur in the unlikely event of an internal failure of the control board. Take immediate action. If your detector is fitted with the Reports/Logs package the faults can be accessed in the Loma menu "Diagnostics" "View diagnostics?". The date & time accompany errors.

The errors generated can be useful to Loma Service Engineer in the event of an intermittent problem. Do not erase the Log.

Message	Cause	Actions
Watchdog reset	The software has failed to restart the hardware watchdog timer circuits. The hardware watchdog timer circuit has timed out and reset the microprocessor.	Action sequence: 1, 2, 3, 4 then 5 if the problem has not been resolved.

Action Number	Action
1	If the error reoccurs and your detector is connected to a printer or PC, download the Diagnostic error log. If not then carefully record the log details associated with the error. The log can be found under "Loma Menu" on page 21, details of which are later in this manual.
2	Check 5V rail as described in "DC Rails" on page 7 section in the "Functional Testing" section of this manual.
3	Perform a hardware cold start as described in "Hardware Cold Starting" on page 8 in the "Configuration & Setup" section of this manual.
4	Replace the control board.
5	Contact your local Group Service Centre for assistance.

LomaLink

LomaLink is a two-way communications protocol that allows some remote control of the detector functions. If your detector is using LomaLink the following Diagnostic error messages may occur. Reference should be made to the LomaLink manual part number 811153 for further information.

Message	Cause	Actions
Remote link lost	The detector was under the control of a remote device when a remote control timeout occurred.	1. Check cabling and link connectors from the remote device. 2. Check the controlling device for reported errors.
Invalid msg type	The detector has received an unrecognised message.	1. Check the controlling device for reported errors.

Message	Cause	Actions
Unkn dataset req	The detector has received a request for an unknown data set.	1. Check the controlling device for reported errors.
Unkn dataset chg	The detector has received a change message for an unknown data set.	1. Check the controlling device for reported errors.
Unkn command no	The detector has received a command message indicating an unknown command.	1. Check the controlling device for reported errors.

CONFIGURATION AND SET UP INFORMATION

CONTENTS

Service Menu Map 2

User Interface 3

Step by Step Configuration 4

Variable Speed Systems 11

Calculating CTB Constant 12

Head Power (control lines) 13

Belt Speed 14

PEC Length Calculation 20

Loma Menu 21

Machine Details Menu 24

Serial Links 25

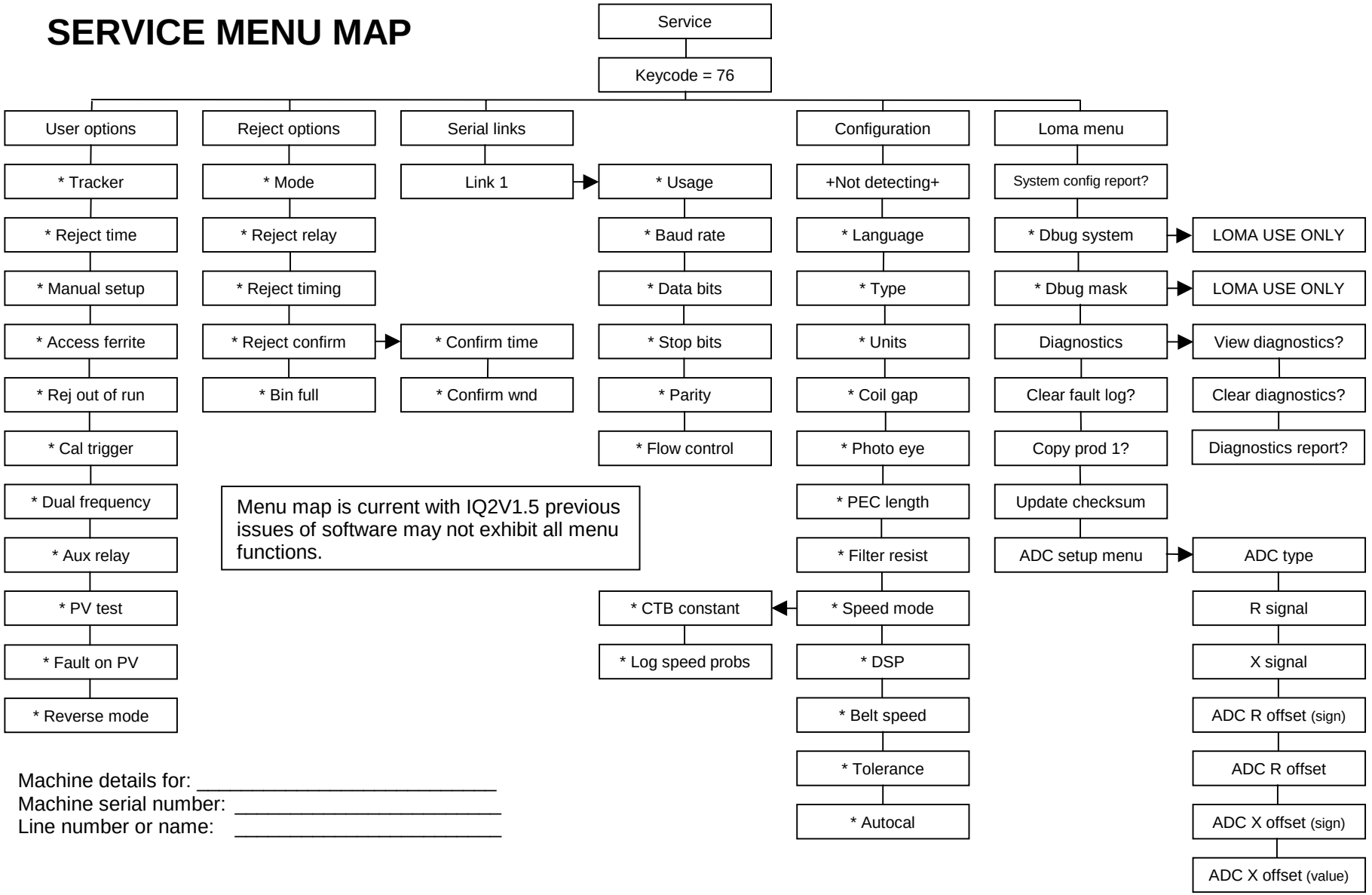
Remote Sensor Board 31

Reports/Logs Package Upgrade 32

Menu Definitions 34

Principles of Operation 41

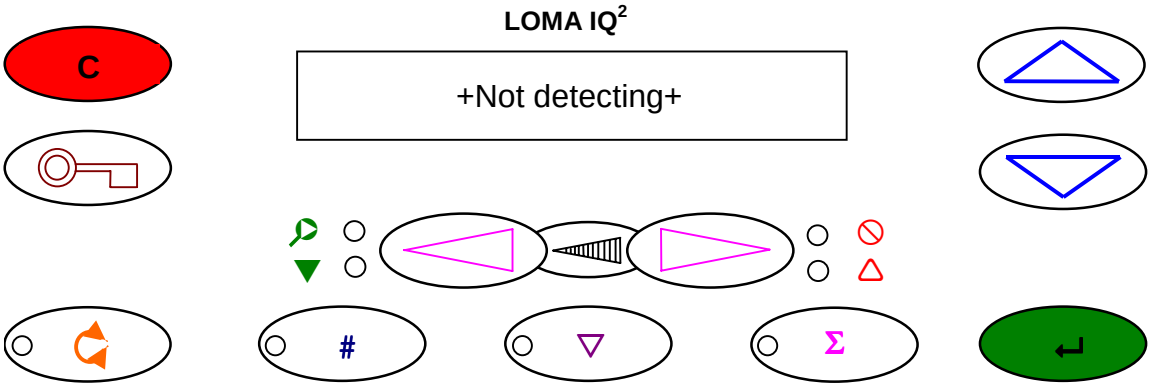
SERVICE MENU MAP



Machine details for: _____
Machine serial number: _____
Line number or name: _____

USER INTERFACE

Graphics based display



Main Menu Keys

Symbol	Function
	Change product number
#	Set up functions
▽	Calibrate product
Σ	Running product results
C	Cancel command
↵	Enter command
	Up arrow
	Down arrow
	Bar graph display mode only increase sensitivity
	Bar graph display mode only decrease sensitivity
	Lock keyboard

Status LED's

Symbol	Function
	The Run Detect LED indicates the detector is searching for metal
▼	The Calibrate LED indicates the detector is performing a calibration cycle
△	The Run Error LED indicates that a run error has been logged
⊘	The System Fault LED indicates that a system fault has been logged

STEP BY STEP CONFIGURATION

There are circumstances where it may be necessary for the end user to carry out the commissioning procedure for the control unit. Typically, this would occur when LOMA do not have enough information about the end application, such as the belt speed or reject details, too fully configure the machine. There are, in addition, other instances such as performing a software update, moving the detector to a different application, replacing a control card, etc. By following through the step by step configuration guide the unit can easily be set up from scratch as required. Alternatively, if only small changes are required to the configuration of the machine, then the menu entries within the Service menu can individually be adjusted. Refer to your User Manual for detailed menu information.

At the start of this chapter is a menu map for the Service menu upon which configuration details for the machine can be recorded. We suggest that you fill this in when you configure the system, then if ever a need to repeat the exercise occurs all the information will be ready to hand.

We also suggest that you record all product related data, then if ever a need to reprogram the detector occurs, for instance if a control board is replaced all the information will be ready to hand.

Step One

If the unit is not already at the top of the Configuration menu, displaying the +Not detecting+ warning message, go to this menu now by following this key sequence:

1. Press the [#] key once.
2. Press the [▽] key until the display shows “Service”.
3. Press the [↵] key once.
4. Press the [△] key until the password shows “76”.
5. Press the [↵] key once. The display should now show “User options”.
6. Press the down key three times, so that the display shows “Configuration”.
7. Press the [↵] key once.
8. The display should now be showing “+Not detecting+”.

Step Two

The correct parameters must now be entered into the configuration menu. To gain access to the parameters use the [△] and [▽] keys to move to the parameter, then press the [↵] key to accept the command. The [△] and [▽] keys will alter the parameter (notice how the “★” moves to the right and becomes either “<” or “>””when the display is in parameter edit mode). Once the correct parameter has been entered, simply press the [↵] key again to save the value.

Language: Select, the language required, from the following:

ENGLISH (default), FRANÇAIS, NEDERL, DEUTSCH, ESPAÑOL, ITALIAN, PORTUGES, KATAKANA.

Type: Select CONVEYOR, FREEFALL, PIPELINE or PHARM depending upon your system configuration.

Terminology

FREEFALL: Used when product is (drop through) gravity fed.

PIPELINE: Used when product is pumped (in line) through a piped system.

PHARM: Used with pharmaceutical detector.

CONVEYOR: Driven transport system.

Units: Select METRIC or IMPERIAL as preferred.

Photo eye: Select YES if a product registration photo eye located prior to the detector has been wired to the control board.

Coil gap: Enter the Coil Gap as shown on the machine details plate (inside control box), or by reference to Table 1.

PEC length: If the entry Photo Eye = Yes has been made, this entry will appear, and a value must be entered. The PEC Length is the distance from the centre line of the photo eye to the leading face of the detector + the coil gap "Rx" distance shown on the machine details plate.

Filter resist: Enter the filter resistor value as fitted on the main control board. Brown-plastic plug in module. Remove top to read value.

Dsp: If FRUN has been set in Speed mode this entry will appear, if your detector is a Catalogue FreeFall enter YES otherwise leave at NO.

Speed mode: Select FIXED, unless your system is variable speed or free running. For variable speed systems select VBLE, and for free running select FRUN. If in doubt about the required selection, refer to the Principles of Operation section.

Belt speed: If fixed speed mode has been selected this entry will appear, in which case enter the belt speed.

NOTE

VBLE: Will be used when the conveyor speed is variable or sometimes when the conveyor can be stopped as part of an overall line control system. See paragraphs on Variable speed systems later in this section.

FRUN: Will be used when the product is gravity fed.

CTB constant: If variable speed mode has been selected this entry will appear, in which case enter the CTB constant (the CTB constant is the number of pulses per metre/foot of belt travel from the shaft encoder in variable speed applications - see calculating CTB constant in this section).

Tolerance: Select the required level of tolerance to be adopted during auto-calibration. The lower the setting the more sensitive the detector, but the more prone it will be too false rejects if the product effect varies (phase dispersion). We recommend the default setting of LOW for most applications.

Table of Tolerance settings available:

Menu position	% of calibrated threshold added
MIN	15 % of calibrated threshold.
LOW	25 % of calibrated threshold.
MED	50 % of calibrated threshold.
HI	75 % of calibrated threshold.
MAX	100 % of calibrated threshold.

AUTOCAL: Select the desired auto-calibration period:

	Photo Eye	**No Photo Eye**
Short	8 packs	20 seconds
Long	20 packs	1 minute
Extra Long	N/A	2 minutes

Short is recommended for most applications, provided that at least eight packs can be passed during a calibration cycle.

Head Type	Coil Gap
Standard, full size rectangular or square	0.8 x minimum aperture dimension in mm
5" to flow (and CF) freefall	76mm
129mm catalogue freefall	93mm
173mm catalogue freefall	125mm
219mm catalogue freefall	174mm
Handtmann style units	50mm
6000/7000 slimline combo	76mm
20mm pharmaceutical	25mm
38mm pharmaceutical	30mm
Ferrous in Foil	76mm

Table 1 Computation of coil gap by head type and minimum aperture dimension

Step Three

The detector must now be set up for the desired user options. Unless you are completely familiar with the operation of the detector, it is recommended that all the options be left at their default values.

Press the [C] key once to move out of the Configuration menu, and then the [△] key enough times so that the display shows "User options" on page 34, an explanation of these options is listed in the Definitions section of this chapter. Press the [↵] key once to move into the User Options menu, and then set up your options are desired:

Tracker: Turning this facility on allows the user to select the tracker option for each of the products as required. See Tracker on page 34 for more information about the benefits of the tracker facility, and how it can be used. This option is only available if a photo eye is fitted.

Reject time: Leave this at the default option of ON to enable access to the reject timing information in the Product Setup menu. Only set this to OFF once the reject time has been correctly set, and you wish to prevent line operators access to it.

Manual setup: Turn this ON or OFF as required.

Aux relay: Change this to ERROR or RUN as required. This determines the whether the Attention relay operates on RUN or ERROR.

Access ferrite: This entry must be set to YES, in order that a ferrite tune can be performed - see step six.

Rej out of run: Set to YES or NO as required. Normally left at NO.

Cal trigger: Turn this ON or OFF as required. (Used with pipeline when pipeline option in configuration is selected).

Dual frequency: Only used on rectangular/square conveyor heads. Set to YES when the detector is built as a dual frequency. Setting to YES automatically fixes the function of the Auxiliary relay to DUAL.

Aux relay: Normally left at the default setting of IN RUN. However it can be set to REJECT to operate as a third set of reject relay contacts.

***PV test:** Set to YES or NO as required. YES will enable the Performance Validation System.

***Fault on PV:** Set to YES or NO as required. YES will cause the fault relay to operate if a Performance Validation System test is not done or completed in the time allowed.

***Reverse mode:** Set to YES or NO as required. YES will cause the detector to reject when there is no metal present in the product. NO is normal operation. The menu entry will only appear if Photo eye in the configuration menu is set to YES.

Exit the User Options menu by pressing the [C] key once.

Step Four

Move to the Reject options menu and set up the detector as required for your application. Reject options on page 39 are listed in the Definitions section of this chapter.

Press the [C] key once to exit the Reject options menu.

Step Five

If you are using any of the serial links, then you will need to configure the serial link. Configuration information can be found in the Serial link configuration on page 28 section of this chapter.

Step Six

For detectors using IQ2v1.1 software and above go to the Loma menu and follow the ADC Setup menu on page 22.

Exit the Service menu by pressing the [C] key four times.

Step Seven

The machine will now be looking for metal in your product, although the sensitivity will not be fully optimised, because the detector has not yet been calibrated for the product. Before any products can be calibrated, it will be necessary to perform a ferrite tune in order to minimise the effects of vibration when running products with no product effect (see section on Principles of Operation in your User Manual for more information).

The “TUNE FOR RESISTIVE” wand used to perform a ferrite tune is located inside the control box. Perform a ferrite tune as follows:

Change to product F (the Access ferrite entry in the User Options menu must be set to YES). To do this press the [C] key, then the [▽] key until “Ferrite F” is shown, now press the [↵] key to accept the setting.

To calibrate “Ferrite F” a Full calibration cycle must be completed. Before doing this check to see if the conveyor is fitted with a photoeye prior to the detector, if it is then return to the Configuration menu and set the Photo eye to NO (the speed will require re-entering before you will be allowed to exit this menu). This does not need to be done if there is no photoeye fitted. To perform a calibration, press the [calibrate ▽] key once, followed by the [▽] key twice, the display now shows “Full calibrate”. Pressing the [↵] key initiates the calibration cycle.

When the “Pass product” message appears on the display, move the end of the “Tune for Resistive Wand” with the ferrite piece back & forth through the centre of the aperture at a rate as near as possible to the product speed until the calibration cycle is completed. A temporary NON-METALLIC extension to the wand will prevent hands, rings or watches entering the aperture.

Do not forget to re-select Photo eye if it has been temporarily disabled during the ferrite calibration procedure. If the wand has been removed and cannot be found then the following options are available:

The compensation value for Product F can be re-entered manually by accessing the Compensation menu position in the “Manual Setup” menu for Product F. Reference your User Manual for details on the Compensation menu position.

The compensation value for Product F, if not recorded by you, can be obtained from your local Group Service Centre. When requesting information always quote the **Serial Number** of your equipment. The number is located on the Serial Number label inside the Control Unit on page 2 in the Service Return section of this manual.

Now go back to the User Options menu and disable the access to Product F (Access ferrite). The control unit is now fully commissioned for your application.

VARIABLE SPEED SYSTEMS

On systems employing variable speed conveyors, special hardware is required to drive the CTB (Conveyor Time Base) input on the micro control card. Conveyor systems supplied by LOMA will already have this hardware fitted and commissioned, but on head only sales the following information should be observed when using variable speed.

Overview

In order for the reject timing to work correctly, it must be supplied with information about how far the contaminant has travelled between the head and point of reject. This is achieved via a shaft encoder which supplies pulses to the CTB input of the micro control board - refer to the optional Connection Ladder diagram located in the Wiring/Connection Diagrams section of this manual.

The delay information, which is entered in the Product Setup menu, then counts the CTB pulses out to time the contaminated product to the reject point. For this reason the delay is measured in distance, and should be set at the fastest conveyor speed in order for the reject device to actuate in time. The dwell, on the other hand, should be set at the slowest belt speed to guarantee accurate rejection at all speeds. The dwell can be in units of time or distances depending upon the type of reject device.

CTB Constant:

This parameter is the number of pulses (ticks) per metre/foot of belt travel. To calculate this figure for entry into the "*CTB constant" menu position, use either the metric or imperial formula following:

Metric systems:

$$CTB = \frac{\text{Encoder pulses per revolution x 1000}}{\pi\, d}$$

Where: d = the diameter of the roller to which the encoder is fitted in millimetres.

Imperial systems:

$$CTB = \frac{\text{Encoder pulses per revolution x 12}}{\pi\, d}$$

Where: d = the diameter of the roller to which the encoder is fitted in inches.

The maximum allowable CTB rate must not exceed 100 pulses per second. The calculation to confirm this figure is as follows:

$$\frac{\text{Maximum belt speed x CTB constant}}{60} = < =100$$

The minimum allowable CTB rate to ensure accurate reject resolution must exceed 4 pulses per coil gap. The coil gap distance for your detector (Rx) can be found on the serial number plate located inside the control unit or from the coil gap chart located earlier in this section.

The calculation to confirm the minimum number of pulses is as follows:

Metric systems:

$$\text{Coil Gap x } \left[\frac{\text{CTB constant x minimum belt speed}}{1000}\right] > = 4$$

Where: The coil Gap is in millimetres. The minimum belt speed is in metres.

Imperial systems:

$$\text{Coil Gap x } \left[\frac{\text{CTB constant x minimum belt speed}}{12}\right] > = 4$$

Where: The coil Gap is in inches. The minimum belt speed is in feet per minute.

Variable Speed Errors

Because the detector can only work within a pre-determined speed range it is possible for the belt speed to move outside the limit of reliable operation of the machine. In these cases, speed-logging problems can be selected in the configuration menu that will generate either speed too slow or speed too fast run errors. The fitted filter resistor pack will require changing to a pack which encompasses both the slowest and fastest conveyor speeds required if possible. Refer to “Belt Speed” section of this section for available choices.

NOTE

Ensure that JP7 on the Control Board has the link fitted between 1 - 2.

(Failure to do so will render the calibration routines inoperative).

HEAD POWER

The detector is able to automatically adjust its sensitivity in response to product effect therefore enabling the best calibration and subsequent metal contamination sensitivity to be set. This is achieved by the use of electronic switches controlled by the software and hardware fitted on the control board. The actual switches and the functions controlled are part of the search head electronics board located behind the removable end plate on every detector.

The setting of these switches is decided by the Full calibration cycle carried out before running a product for the first time. But manual selection via the “Manual setup” menu position is allowed, but great care must be exercised before manual intervention as false rejects or reduced sensitivities to metal contamination may result.

The detector has 4 switches referred too individually as Control lines (Ctrl) but collectively as “Head Power”.

Following is a table detailing the switch settings.

Head Power	Ctrl 1	Ctrl 2	Ctrl 3	Ctrl 4
Max	OUT	OUT	IN	OUT
7	OUT	OUT	OUT	OUT
6	IN	OUT	IN	OUT
5	OUT	IN	IN	OUT
4	IN	OUT	OUT	OUT
3	OUT	IN	OUT	OUT
2	IN	IN	OUT	OUT
1	OUT	OUT	IN	IN
Min	OUT	OUT	OUT	IN

CONTROL LINE FUNCTIONALITY

OUT = +8V reference to 0V	IN + 0V reference to 0V

Following is a table detailing control line function and effect.

Control line	Function and effect
Ctrl 1 highest resistor value	Switches a resistor directly across the receiver search head amplifier. Reduces both product signal and metal contaminant signal regardless of mode of operation.
Ctrl 2	Switches a resistor directly across the receiver search head amplifier. Reduces both product signal and metal contaminant signal regardless of mode of operation.
Ctrl 3	Controls the gain of the resistive channel only. Reduces product effect for conductive products when detector is working in Reactive. Increases or reduces metal contamination signals for non-conductive products when the detector is working Dry or Resistive.
Ctrl 4 lowest resistor value	Switches a resistor directly across the receiver search head amplifier. Reduces both product signal and metal contaminant signal regardless of mode of operation. Normally associated with metallised film packaging or products that have very large/inconsistent product effects.

Control lines 1,2 & 4: Resistor values are standard factory set components that decrease in value, therefore increasing their effect.

Control line 3: The resistor values are standard factory set components.

BELT SPEED

The detector electronics use DSP Digital Signal Processing techniques in order to ensure optimum performance of the detector when a driven transport system is used. The control board has 4 identical resistors whose values are selected according to the speed at which the product travels through the aperture and the entered Coil Gap value, which is determined by the smallest aperture dimension.

Fixed “Fixed” or variable “Vble” speed driven systems i.e. “Conveyor” type systems require the speed of the transport system to be entered. The speed that can be entered is governed by the filter resistor value selected in the

"Configuration menu". The values range from 150 KΩ up to 1.5MΩ. The detector will not allow a speed to be entered that is outside the range allowed by the selected filter resistor value. Driven systems generally are detectors which are mounted on conveyor systems, however if the product is pumped and the speed at which it is pumped is known e.g. a Pipeline detector mounted after a Vacuum Filler, then a fixed speed can be entered.

The other option available "Frun" which is primarily used for gravity fed product i.e. "Freefall" or "Pharmaceutical" type systems or when a pump speed is not known. However there is still a maximum speed through the aperture, which if exceeded will reduce the detector performance. When this option is used two further filter resistor values will appear in the menu, 68 and 120 KΩ, these values allow faster speeds.

For example:

The smallest aperture dimension of my detector is 150 mm (6" rounded) and my conveyor speed is 50 m/min (164 fpm rounded). Therefore according to the table following I can use either 150, 180, 220 or 330 KΩ resistor packs. A suggested rule of thumb is to select the value whose range sets the speed required roughly central.

The resistor pack is factory set according to the specified speed. However if the speed of the conveyor is altered from the original then the value and menu entry should be checked to ensure it is still allowable with the existing filter resistors. If the value is to be changed then the recommended resistor type is

Metal film at 1% tolerance

The following pages detail the range of resistors available and the speed ranges allowed for fixed, variable and freerun systems.

The resistors are located on a removable plastic 8-pin header plug on the main control board. Refer to the Control/PSU Board component layout Figure 2 on page 6 for the location of the resistor pack in the maintenance section of this manual. The "Configuration" menu contains a position called "Filter resist" where the value of the resistors fitted is entered. The entered value must match the fitted value.

FILTER RESISTOR VALUE vs SPEED THROUGH THE APERTURE for FIXED and VARIABLE SPEEDS

The table shows the standard range of smallest aperture dimensions.
The dimensions are shown in millimetres. To convert to inches divide by 25.4 and round to the nearest whole inch.
The speed is shown in metres per minute. To convert to feet per minute multiply by 3.2808.
The resistor value 150 through 750 is in KΩ.
The resistor values 1 and 1.5 are in MΩ.

SMALLEST APERTURE DIMENSION fixed or variable speed - maximum & minimum																				
Filter Value	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550
150	69 10	92 13	115 16	138 19	161 22	184 25	207 29	230 32	253 35	275 38	299 41	322 44	345 77	358 50	391 54	414 57	437 60	460 63	483 66	505 69
180	61 8	81 11	102 13	122 16	142 19	163 21	187 24	208 27	229 29	244 31	270 34	291 37	312 40	325 41	353 45	374 47	395 50	408 51	437 55	458 58
220	50 7	67 9	84 11	100 13	117 15	134 17	153 20	170 22	187 24	201 25	221 28	238 30	255 32	258 34	289 37	306 39	323 41	335 43	357 45	374 47
330	34 5	45 6	57 7	68 9	79 11	91 12	102 13	113 15	124 16	135 18	147 19	158 20	170 22	182 23	192 25	204 25	215 27	228 29	238 30	249 32
470	23 3	31 4	39 5	47 6	55 7	63 8	71 9	79 10	87 11	95 12	103 13	111 14	119 15	127 16	135 17	143 18	151 19	159 20	167 21	175 22
750	15 2	18 3	24 4	29 4	34 5	39 5	44 6	49 7	54 7	59 8	64 9	69 9	74 10	79 10	84 11	89 12	94 12	99 13	104 14	109 14
1	11 2	14 2	18 3	22 3	25 4	29 4	33 5	37 5	40 6	44 6	48 7	52 7	55 7	59 8	63 8	66 9	70 9	74 10	78 10	81 11
1.5	7 2	10 2	12 2	15 3	17 3	20 3	22 4	25 4	27 4	30 5	32 5	35 6	37 6	40 6	42 7	45 7	47 7	50 8	52 8	55 8

FILTER RESISTOR VALUE Vs SPEED THROUGH THE APERTURE for PIPELINE

The table shows the standard range of detector apertures.
The dimensions are shown in millimetres. To convert to inches divide by 25.4 and round to nearest whole inch.
The speed is shown in metres per minute. To convert to feet per minute multiply by 3.2808.
The resistor values 68 to 750 are in KΩ.
The resistor values 1 and 1.5 are in MΩ.

PIPELINE APERTURE DIMENSION fixed speed - maximum & minimum					
Filter Value	90	100 Handtmann	112	130	140
150	82 12	57 8	103 15	119 17	129 18
180	74 10	52 7	93 12	108 14	116 15
220	61 8	42 6	76 10	88 12	95 12
330	40 6	28 4	51 7	58 8	63 8
470	28 4	19 3	35 5	41 6	44 6
750	17 3	12 2	22 3	25 4	27 4
1	13 2	9 2	16 3	19 3	20 3
1.5	9 2	6 1	11 2	13 2	14 3

PIPELINE APERTURE DIMENSION freerun - maximum speed					
Filter Value	90	100 handtmann	112	130	140
68	198	137	248	286	308
120	112	78	140	162	175
150	90	62	112	130	140
180	74	52	93	108	116
220	61	42	76	88	95
330	40	28	51	58	63
470	28	12	35	41	44
750	17	12	22	25	27
1	13	9	16	19	20
1.5	9	6	11	13	14

FILTER RESISTOR VALUE Vs SPEED THROUGH THE APERTURE for 6000/7000 SLIMLINE COMBO

The speed ranges available are the same for each of the standard aperture heights. Shaded and bolded values are only available on 6000 style Combos. The dimensions are shown in millimetres. To convert to inches divide by 25.4 and round to the nearest whole inch.
The speed is shown in metres per minute. To convert to feet per minute multiply by 3.2808.
The resistor values 68 to 750 are in KΩ.
The resistor values 1 and 1.5 are in MΩ.

6000/7000 fixed or variable speed maximum & minimum					
Filter Value	75	100	125	150	175
150	87 12	87 12	87 12	87 12	87 12
180	79 10	79 10	79 10	79 10	79 10
220	64 9	64 9	64 9	64 9	64 9
330	43 6	43 6	43 6	43 6	43 6
470	30 4	30 4	30 4	30 4	30 4
750	18 3	18 3	18 3	18 3	18 3
1	14 2	14 2	14 2	14 2	14 2
1.5	9 2	9 2	9 2	9 2	9 2

FILTER RESISTOR VALUE Vs SPEED THROUGH THE APERTURE for FREEFALL & PHARMACEUTICAL

The table shows the standard range of detectors apertures.
The dimensions are shown in millimetres. To convert to inches divide by 25.4 and round to nearest whole inch.
The speed is shown in metres per minute. To convert to feet per minute multiply by 3.2808.
The resistor values 68 to 750 are in KΩ.
The resistor values 1 and 1.5 are in MΩ.

PHARMACEUTICAL APERTURE HEIGHT freerun - maximum speed		
Filter Value	20	38
68	68	82
120	39	46
150	31	37
180	26	31
220	26	25
330	14	17
470	9	11
750	6	7
1	4	5
1.5	3	3

SMALLEST APERTURE DIMENSION or DIAMETER FREEFALL freerun - maximum speed												
Filter Value	75	Contained Field all aperture diameters	100	125	150	175	200	225	250	275	300	325
68	165	209	220	275	330	385	441	496	551	606	661	716
120	93	117	125	156	187	218	250	281	312	343	375	406
150	75	95	100	125	150	175	200	225	250	275	300	325
180	63	79	83	104	124	145	166	187	208	229	249	270
220	51	64	68	85	103	119	136	153	170	187	204	221
330	34	43	45	56	68	79	90	102	113	124	136	147
470	24	30	32	40	48	55	63	71	79	87	95	103
750	15	18	20	25	30	34	39	44	49	54	59	64
1	11	14	15	18	22	26	29	33	37	40	44	48
1.5	7	9	10	12	15	17	20	22	25	27	30	32

To calculate the speed through the aperture for gravity fed freefalling product, to ensure the correct filter resistor is selected and fitted the following formula can be used.

SPEED metres per minute = 60 X √ 20 X PRODUCT DROP HEIGHT in metres

PEC (PHOTO ELECTRIC CELL or PHOTO EYE) LENGTH

The detector can be configured to work with or without a product registration PEC. If a PEC is fitted, it can be mounted across the product flow or above the product flow in the case of product whose height is very small.

A PEC can only be used if the product is separate and presented in a single row. It is most commonly fitted when the reject system is a pusher plough blade to ensure accurate rejection irrespective of where a contaminant is located in the product length.

PEC's cannot be used with continuous product nor with discreet products presented to the detector in rows across the width of the transport system.

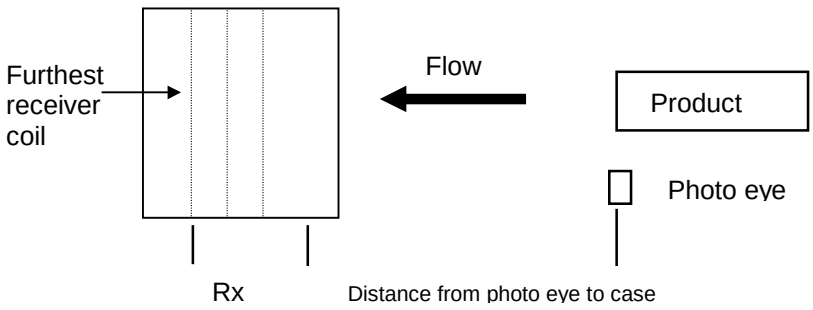
When a PEC is used, all detection decisions and reject timings are timed from the PEC. Therefore it is important that the detector knows exactly how far the PEC is positioned from the final point in the detection process, i.e. when the product has passed the farthest receiver coil.

When a PEC is used the distance from the PEC to the second receiver coil must be entered into the “PEC length” menu position. The value entered can be in metric (millimetres) or imperial (inches) depending upon the unit type selected.

The required length entry is calculated as follows:

The distance from the centre of the PEC to the input face of the detector case is measured and added to the distance that the second receiver is located from the same case face.

The distance of the case to the second receiver can be found on the serial number plate for the detector located inside the control box labelled “Rx”



If "Photo eye" is set to NO then this entry does not appear in the menu structure.

LOMA MENU

The following list details the individual menu positions.

System config report?	This will only appear if the reports/logs package is in fitted. The report contains the set up information for the detector.
*** Dbug system BBAL**	Loma use only and contains no useful user information.
*** Dbug mask 0**	Loma use only and contains no useful user information.
Diagnostics	Loma use only and contains no user information. Press [↵] to access the diagnostic menu options (provided the reports/logs package is fitted). Pressing the [C] key to return to “Diagnostics”.
View diagnostics?	Pressing [↵] to access Diagnostic error messages.
Clear diagnostics?	Pressing [↵] will clear down the Diagnostic error log.
Diagnostics report?	Pressing [↵] will transmit the contents of the log down the serial link if the “Reports package” is used.
Clear fault log?	Pressing [↵] will clear down the System error log provided the reports/log package is fitted.
Copy product 1?	Pressing [↵] will cause the contents of product memory 1 to be copied to all other product memories, over writing all previously stored data.
Update checksum?	Pressing [↵] will cause the Eprom “Epr checksum” display in the “Machine details” menu to display the checksum associated with the currently fitted software.

There are no more menu positions for IQ2v1.0 software. For IQ2v1.1 **continued on next page**.

IQ2V1.1 and upwards software

ADC setup menu	Pressing [↵] to access the ADC setup menu for the devices fitted.
ADC type	Displays the device type fitted. Press [↵] to view the live R channel signal.
R signal	The ambient channel signal is displayed on the right hand side of the display. Press [↵] to view the live X channel signal.
X signal	The ambient channel signal is displayed on the right hand side of the display. Press [↵] to view the R channel offset direction.
ADC R offset (sign)	The offset direction can be selected here either POS or NEG. Press [↵] to view the R channel offset value entry.
ADC R offset (value)	A dc offset can be applied by entering a number. Press [↵] to view the X channel offset direction.
ADC X offset (sign)	The offset direction can be selected here either POS or NEG. Press [↵] to view the R channel offset value entry.
ADC X offset (value)	A dc offset can be applied by entering a number.

HOW TO ADJUST THE ADC

The ADC setup menu positions allow the ambient noise signal level to be monitored and then adjusted to move symmetrically about 0v, normally this will be factory adjusted. Any adjustments must be made before product calibration.

If adjustment of either channel is required, for instance when a board is replaced the following steps should be followed:

- Select an unused memory position and ensure the "Head power" found under "Manual setup" is set to MAX.

- Monitor the R channels signal, the numbers will be continually moving. Observe the numbers and their sign to determine if the average movement is symmetrical about 0 or if it is biased in a negative or positive direction. If the direction is biased one way try to estimate the symmetrical point of that bias. This number will be the starting value entered into the adjustment menu position.

- If the numbers observed after averaging are symmetrical then no adjustment is required. Repeat for the X channel.

- If the direction is biased one way then step down to the ADC R offset (sign) menu and select the direction that is in the opposite to the signal bias.

- Step down to the ADC R channel (value) menu and enter the estimated number required to return symmetry to about 0v. Return to the R signal menu and observe the effect of the offset entry. This is a trial and error set up therefore several changes to the offset value entry may be required.

- When satisfied that the average is symmetrical. Repeat the set up process using the X channel ADC menu positions.

MACHINE DETAILS MENU

The following list details the individual menu positions sitting below the “Machine details menu” and their use.

Machine details	Press [↵] to access the menu options following.
*** Machine**	This menu position allows you to enter the serial number of the detector found on the serial number label located inside the control cabinet. Or a line identification name or number. Information is entered in the same manner as for “Product name”.
Software fitted	The software version fitted to your detector is displayed. **Note**: The Software version fitted to your detector control board will also be displayed for approximately 0.5 seconds each time the detector is switched on.
Epr chksum	The computed checksum for your fitted software is displayed

There are no further menu positions in this section.

SERIAL LINKS

The serial link menu position operates in conjunction with an optional board that supports a single RS232 (hardware handshaking), RS422 and 20mA current loop (software handshaking Xon-Xoff) and the reports/logs package.

Handshaking is the method by which the source device and the receiving device control the flow of data.

Only one system may be used at any time, system selection is by fitting a combination of links in JP1, JP4 & JP5 found on the optional board. If the 20mA current loop system is chosen then further links are required in LK1 & 2.

The detector can be configured to run Reports, LomaLink, or LomaNet depending upon the link type chosen.

Following is a guide to their usage and information on how to configure the hardware aspect of the links. For information on setting the drive protocols required please refer to your User Manual supplied with your detector.

To be able to connect any external devices to these links, your detector will require an additional serial link loom assembly on page 30, unless initially supplied with your detector. Please contact your local Group Service Centre with your requirements.

If the link is used to drive LomaLink then reference to the Serial Communications Handbook Loma is required to enable the correct interface protocol to be written. This can be emailed to you upon request.

Link selection, 20mA configuration settings and JP2 header and detector chassis connector wiring is given in Figures 8 on page 27, 9 on page 27 & 10 on page 27 in this section.

The serial link board and how to fit it is shown in Figures 11 on page 29 and 12 on page 29 in this section.

RS232 for devices no more than 25 metres (82 feet) from the detector.

The link is a 5 wire system supporting hardware handshaking.

If the detector has a LomaNet module fitted then it will be driven from this link.

If the link is to be used with a remote printer it must be mounted to the detector conveyor system and grounded to the detector control box.

If the environment in which the printer is to be fitted is hostile, then some form of environmental protection will be required for the chosen printer.

The link will only support simple dot matrix type printers such as the Epson LX range, but can be used with single sheet feeder attachments.

Most printers have a parallel interface as standard, which is not compatible, the chosen printer must have an optional RS232 serial interface supporting hardware handshaking fitted.

RS422 for devices no more than 1000 metres (1093 yards) from the detector.

The link is a 4 wire system supporting software handshaking.

This link cannot support LomaNet.

If the link is to be used with a remote printer that can be sited in an office the need for extra protection against a hostile environment is removed.

The link will only support simple dot matrix type printers such as the Epson LX range, but can be used with single sheet feeder attachments.

As most printers have a parallel interface as standard, which is not compatible, the chosen printer must have an optional RS422 serial interface supporting software handshaking fitted.

20mA current loop

The link is a 4 wire system supporting software handshaking. The board has user configurable links LK1 & 2 depending upon whether the detector is to be the active or passive device, the recommended setting is to make the detector “active” and the device “passive”.

This link cannot support LomaNet.

If the link is to be used with a remote printer that can be sited in an office the need for extra protection against a hostile environment is removed.

The link will only support simple dot matrix type printers such as the Epson LX range, but can be used with single sheet feeder attachments.

As most printers have a parallel interface as standard, which is not compatible, the chosen printer must have an optional 20mA serial interface supporting software handshaking fitted.

SERIAL LINK SELECTION

Communications selection links			
Link	JP4 RXD	JP1 TXD	JP5 Power
RS232	1-2	1-2	1-2
RS422	3-4	3-4	3-4
20mA	5-6	5-6	5-6

Figure 8 Communications selection details

20mA Link Detector Active					
	A	B	C	D	E
LK1 TX	IN	OUT	IN	OUT	IN
LK2 RX	IN	OUT	IN	OUT	IN
20mA Link Detector Passive					
LK1 TX	OUT	IN	OUT	IN	OUT
LK2 RX	OUT	IN	OUT	IN	OUT

Figure 9 20mA Configuration setting details

JP2 Header Connector		Link Type			16 Way Chassis Connector	
PIN	FUNCTION	RS232	RS422	20mA	PIN	COLOUR
1	Rx loop +			RX+	14	Orange
2	Tx loop -			TX-	11	Grey
3	Rx loop -			RX-	3	White
4	Tx loop +			TX+	13	Brown
5	Rx_422+		RX+		5	Violet
6	Rx_422-		RX-		6	Black
7	Tx_422+		TX+		7	Pink
8	Tx_422-		TX-		8	Yellow
9	Gnd	GND			9	Green
10	Gnd	GND			10	Green
11	Cts_232	CTS			2	White
12	Rts_232	RTS			12	Yellow
13	Tx_232	TX			4	Red
14	Rx_232	RX			1	Blue

Figure 10 JP2 Header board and 16 way chassis connector wiring

Serial link menu configuration

The serial link menu protocol for link 1 is configured as follows:

Link 1 may be set to one of the following options. Press [↵] to select the usage list then again and use the [▽] to select one of the uses below.

USAGE - “NOT USED” is the default setting

LOMALINK - For use with LomaLink control protocol.

or - For use with LomaView management systems.

REPORTS - For use with LomaNet or a single printer.

Press [↵] to accept.

When LomaLink or Reports is selected further menu entries within the link allow the protocol to be set.

Press the [▽] key to step down the menu below.

* Baud rate - 150, 300, 600, 1200, 2400, 4800, 9600

* Data bits - 7 or 8

* Stop bits - 1, 1.5 OR 2

* Parity - ODD, EVEN or NO

* Flow Ctrl - NONE, CTS-RTS or XON-XOFF

Pressing the [↵] key in any menu position changes the “*” to a “>“, use the “[△][▽]” keys to select entry required then press [↵] key again to accept.

Pressing the [**C**] Key will exit the menu without making any changes.

NOTES

Please refer to the Displaying and printing reports in your user manual if using the

report option, or appropriate LomaView, LomaNet or LomaLink information.

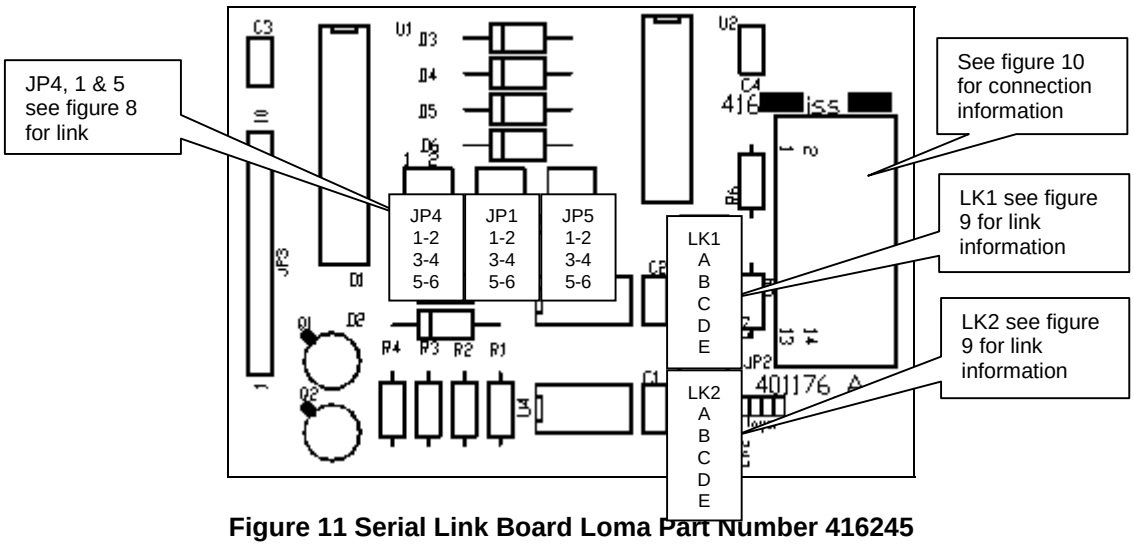


Figure 11 Serial Link Board Loma Part Number 416245

Fitting the Board

The board locates into connector JP1 and supported by 2 pillars the board will only locate one way round. Refer to Figure 12 below.

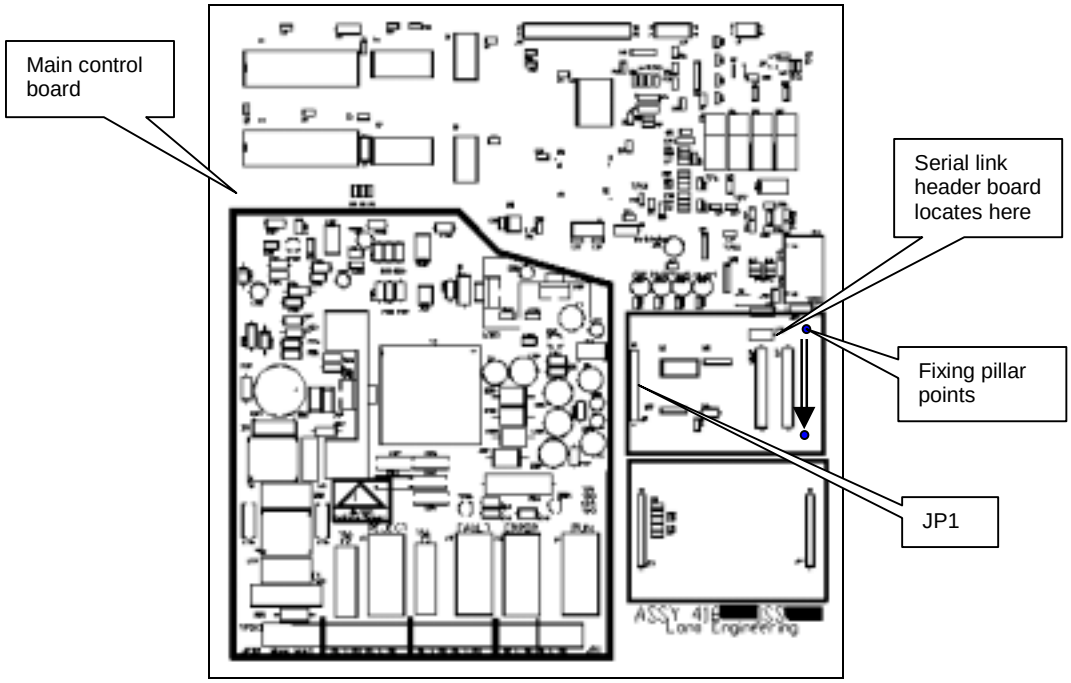


Figure 12 Serial Link Board Location

Fitting the Serial Link Loom Assembly

In order to make a connection to an external device your detector control box will require the fitting of a serial link loom assembly Loma part number 516517. The loom connects between the 14 way header plug found on the serial link board, with the 16 way external connector located in the second from right gland hole when facing the control box.

Fitting the 16 way external connector will require the drilling of 4 x 3mm clearance holes to accommodate the connector fixing screws. It is suggested that the connector be used as a template for marking out the hole positions prior to drilling. When assembling, the connector cable is inserted through the gland hole, ensure the gasket is located between the connector and the outside face of the control box. Secure with the screws provided; screw heads to the outside.

Serial Link Wiring Tips

When connecting printers to your detector the following advice should be followed:

- Always use screened cable when making connections between any printer and the detector. The screen should be a 360° Faraday shield type.

- Do not create ground loops with the communication wiring down which earth returns from electrical machinery could flow. Ideally the screen connection should be made at one end only, normally at the source i.e. the detector.

ADDING A REMOTE SENSOR BOARD

The remote sensor board and how to fit it is shown in Figures 13 below and 15 on page 32 in this section.

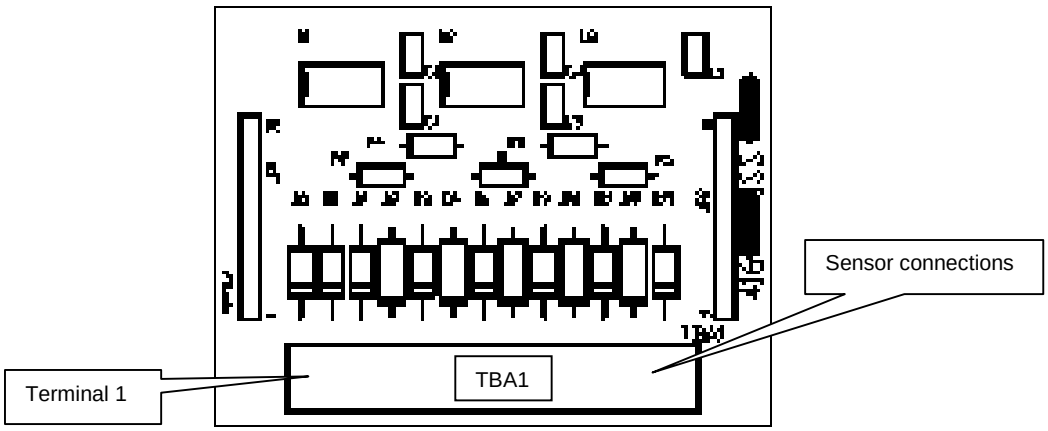


Figure 13 Remote Sensor Board Loma Part Number 416244

The Optional External Sensor Connection Ladder Diagram on page 2 for this board can be found in the Wiring/Connections section of this manual. TBA1 connector identifiers can be found in Figure 14 below.

Connector TBA1	Function
1	+ EXT
2	- EXT
3	Binfull
4	PEC (Photo-eye)
5	Reject Confirm
6	Remote Calibrate
7	+ Shaft Encoder
8	- Shaft Encoder
9	+ EXT
10	- EXT

Figure 14 Remote Sensor Board Loma Part Number 416244

Fitting the Board

The board locates into connectors JP3 and JP4 the board will only locate one way round, external connections are made using TBA1. Refer to Figure 15 on page 32 in this section.

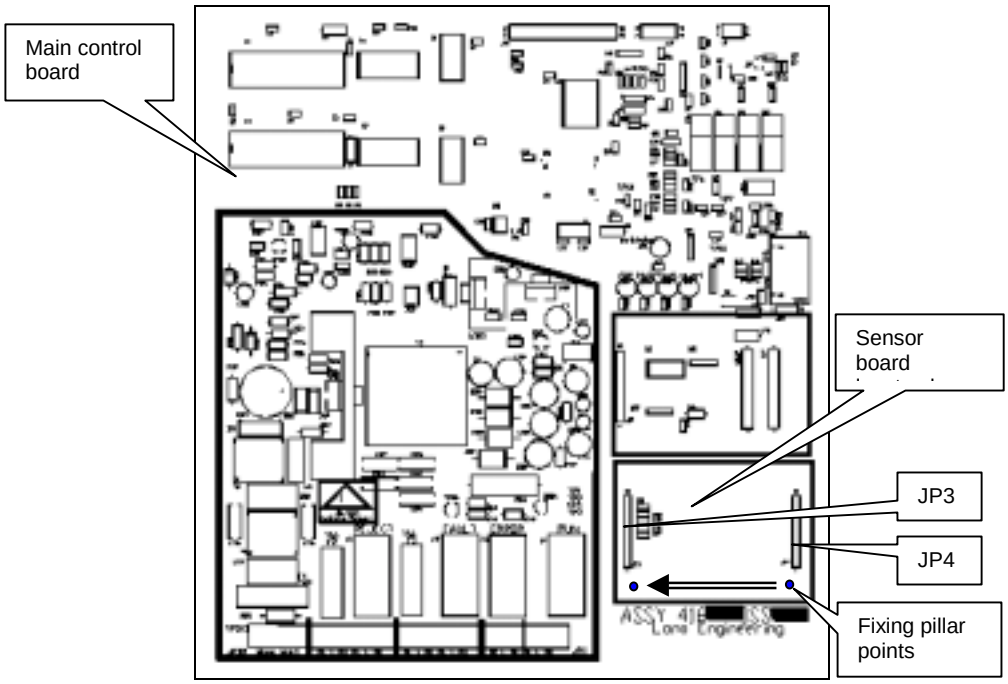


Figure 15 Remote Sensor Board Location

REPORTS/LOGS PACKAGE UPGRADE

The location of the reports/logs component is shown in Figure 16 on page 33 in this section.

To enable the reports/logs option an additional component is required Loma part number 411210. The device fits into a socket U4 located on the control board.

Before fitting the reports/logs option integrated circuit ensure the legs of the chip are straight and correctly formed to ensure positive location into its base. Only proprietary tools should be used to minimise the risk of damage. Failure to observe this simple preparation may result in a poor insertion into the base. This could result in permanent damage to the device and/or operational failure of the detector.

Once fitted the menu positions associated with this device are automatically enabled. Reference can now be made to your User Manual for information on setting up the real time clock and the logs that are available. If it is intended to use the reporting function or LomaLink then the additional serial link board and associated cabling will be required.

The fitting and connection of the serial link board can be found in the "Configuration and Set up" section of this manual, the serial link protocol set up can be found in the "Serial link Configuration" on page 28.

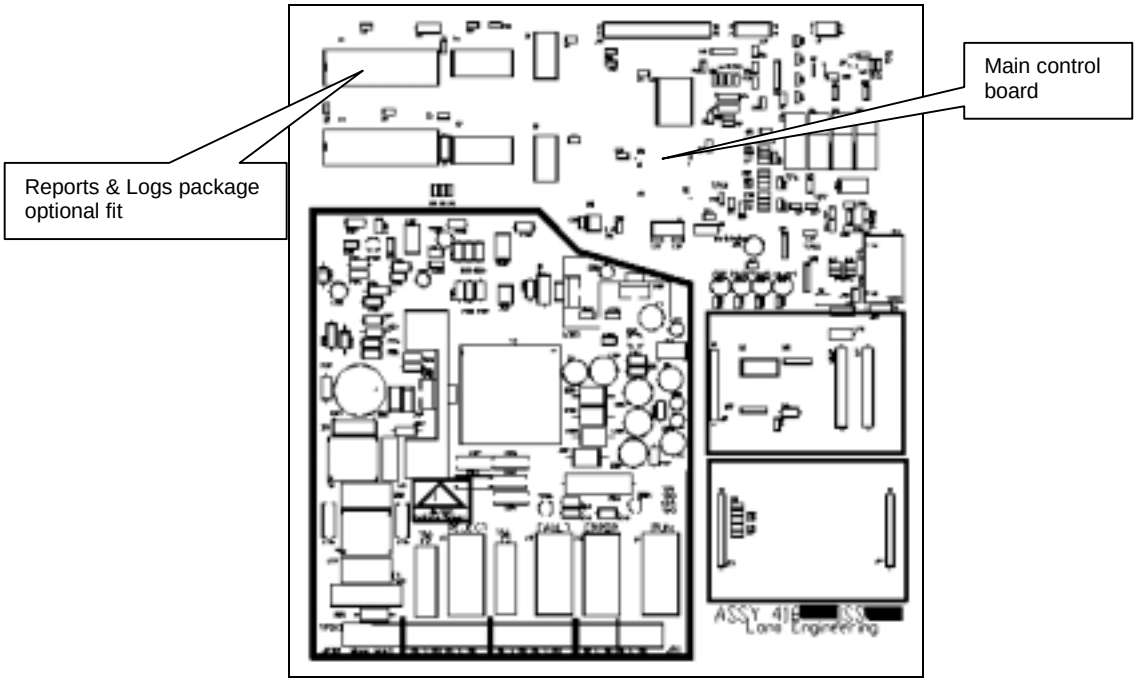


Figure 16 Reports/Logs Package Integrated Circuit Location

MENU DEFINITIONS

User options

Tracker

The following explanation applies only to software version 1.4 and below.

Enables two working thresholds to be set. The working threshold selection is automatic and is used for frozen product that is subject to slight thawing effects. Tracking limit (V1.4 & below) on page 36 information is listed in the Definitions section of this chapter.

The following explanation applies only to software version 1.5 and above.

Tracker is now trend-based system that allows the working threshold to go up or down between two predetermined limits. Thus following small changes in the product effect from frozen product that is subject to slight thawing effects. This allows the sensitivity of the detector to be optimised for situations where the product signal drifts up and down. Product Signal Tracking on page 37 set up (V1.5 & above) information is listed in the Definitions section of this chapter.

Reject time

Please refer to the Installation and Guide to Commissioning section of this manual for details on the use of this feature.

Manual setup

Turning this on allows the user to make manual adjustments to the calibration of the unit via the Manual setup menu.

Auxiliary relay (Aux relay)

The relay marked Attention on the power relay PCB has two different functions: select Run, in order that the relay is energised whenever the detector is in run, i.e. it is looking for metal; select ERROR, in order that the relay is energised when a run error occurs.

Access Ferrite

Turning this on allows the user to gain access to product F, either via the Change Product or Product setup menus. For more information, please refer to the Installation and Guide to Commissioning Section of this manual on performing a ferrite tune for minimum vibration.

Reject out of run

Turn this to ON if no product is to be allowed down the line without being checked for metal. This has the effect that it will not be possible to disable the reject mechanism via the disable reject menu and in addition, provided a photo eye is fitted to the system, that product will be rejected during a full calibration cycle.

Cal trigger

Turn this facility on if product calibration is to be initiated after the signal level exceeds a preset value (set by Trigger thrsh in the Manual setup menu). Only appears if no photo eye is used or if FRUN' (free run) speed mode is selected in the configuration menu.

Dual frequency (V1.5 & upwards)

Setting YES if the detector has dual frequencies allow the selection of either a high or low operating frequency as part of the product setup menu. Each product memory can be set individually thus allowing for instance dry operation at the HIGH frequency when there is no product signal to run on the same conveyor system as for instance a wet electrically conductive product that requires a LOW frequency. E.G. polyfilm and metal film packaging. Dual frequency detectors have a single minimum ferrite memory that is only available when the frequency option is set to HIGH.

Auxilliary (Aux) relay (V1.5 & upwards)

The function of the attention relay can now be selected according to need. If the detector is a dual frequency system then the relay is set to DUAL and cannot be changed. However if the detector is a single frequency then the function of the relay can be selected as IN RUN (default) or REJECT giving a third set of reject relay contacts.

PV test

Selecting YES for this feature enables the Performance Validation System (PVS) or (PV testing). A number of additional menu positions will appear, which require data input to set-up for PV testing to operate. Please refer to the relevant menu positions in your user manual for help in setting up. Selecting NO disables PV testing.

Fault on PV

Selecting YES for this feature enables fault relay operation when a System fault is generated by failure to complete a prompted for PV test. When the conveyor belt motor controls are wired through this relay the conveyor will stop. Selecting NO disables the system fault relay operation only.

Reverse mode

Feature only appears if photo eye is set to YES in the configuration menu, Tracker is set to OFF, Cal trigger is set to OFF and PV test is set to NO.

Selecting YES enables the Metal Detector “Reverse Mode” option.

This will then cause an extra menu position to appear in the Product setup menu, which enables the Metal Detector to be set to operate either in NORMAL or REVERSE mode for the product selected.

NOTE

Wherever possible, LOMA will have set the entries within this menu to those required by your application before the dispatch of your system, or during a commissioning visit by a Loma engineer as applicable.

Tracking Limits (V1.4 & below)

This facility allows the detector to automatically adjust its threshold between two preset limits, so that the sensitivity of the machine can be optimised in situations where the product signal drifts up and down as the product effect changes.

For instance, for a frozen product the product effect signal is very small when the product has just come out of the freezer, so that a low threshold can be used to give high sensitivity. However, if the line stops for any reason then the product could thaw slightly, or build up a layer of moisture on the packaging, creating a significant product signal. In this event, the threshold will have to be raised to allow the product to be passed, without false rejection. However, this means that the sensitivity will become degraded when the product again becomes hard frozen, as there will be a large difference between the product signal and threshold. Turning the tracker facility on allows the machine to automatically switch the threshold between two upper and lower limits, thereby optimising the sensitivity.

The Tracker works by looking at the product signals from the last 100 packs, according to the following conditions. If the threshold is working at the lower limit and there are five or more packs, within the last 100, that have product signals between the lower and upper limits, then the threshold will switch to the upper limit. If the threshold is working at the upper limit and all of the last 100 packs have product signals less than the lower limit, then the threshold will switch to the lower limit.

Press the [↵] key to give access to the product signal tracking menu.

Tracking

This menu entry allows the tracker facility to be turned on or off for the product.

Upper thrsh

This menu entry allows the upper threshold limit to be set. The value should be set as low as possible, so that when product is running with high product signal no false rejects occur.

You should check that the detector will detect the minimum contaminant sizes for your company QA specification, under all production conditions, when the detector is working with this threshold value.

Lower thrsh

This menu entry allows the lower threshold limit to be set. This value should be set as low as possible, so that when product is running with low product signals no false rejects occur.

NOTES

This menu is only accessible if the tracker facility has been enabled in the User options menu.

For this facility to be operative, a photo eye (PEC) must be fitted for product registration purposes.

This menu is product relative, i.e. there are on/off, upper limit and lower limit values for each of the 100 products.

Tracking is initialised to the upper limit on a product change, a power up, if the reject is enabled or the tracker limits are changed.

On completion of a calibration the threshold derived by the automatic calibration will be used until tracking takes place, at which point either the upper or lower limit will be used.

Product Signal Tracking (V1.5 & above)

When product is hard frozen (-18ºC) the product effect is very small when the product has just come out of the freezer, allowing a low working threshold level to be used giving a high sensitivity to metal contaminants. However, if the line stops for any reason then the product could thaw slightly, or if the product were not fully frozen, a significant product signal increase would result. In this event the working threshold will have to be raised to allow the product to be passed, without false rejection. Raising the working threshold to allow softer product to pass without false rejection will reduce the sensitivity to metal contamination, i.e. larger pieces of metal will now be detected. If the product becomes hard frozen whilst the raised working threshold is still set the sensitivity to metal contamination will remain reduced because the working threshold is higher than it now needs to be.

Tracking works by recording the product signal for each pack. From the values read the working threshold continuously trends upward or downward between an upper and a lower limit. The rate and amount by which the working threshold changes together with limits between which it operates are controlled by user entered parameters.

It must be understood that this type of system may allow metal contamination that would otherwise be detected when the product is fully frozen, to be accepted if product softening has forced the working threshold to rise.

Operating conditions:

The **Tracking limits** menu is only available if **Tracker** has been set to **ON** in the **User options** menu. For this option to be available, a photo-eye must be fitted for product registration purposes.

Tracking is product relative, i.e. the function can be turned on or off for each of the 100 product memories each memory can contain unique settings.

Tracker initialisation will occur whenever:

The detector is powered on:

The running product is changed.

The **Tracking limits** parameters are changed.

Upon completion of the product calibration routine the derived working threshold will be used unless the product signal initiates a change.

The following table describes the Tracking menu:

Menu	**Description**	**Advice**
*Tracking	Turns the tracker option on or off.	Can be set on a per product basis.
*Min limit	Lowest tracking limit.	Commences at the calibrated working threshold. The value cannot be set less than the calibrated working threshold but may be increased up to the value of the Max limit.
*Max limit	Highest tracking limit.	Commences at twice the calibrated working threshold. The value cannot be set less than the calibrated working threshold but may be increased up to the value of your choice. However it is strongly advised to set this value to just greater than the typical amount by which the product signal is expected to change. All signals that exceed this value will be rejected.
*Max limit	Maximum limit value lock/unlock	Once the highest tracking limit value has been entered the value can be locked to prevent a change should a re-calibration occur.
*Adjustment	Factor by which the threshold changes.	The factor range is 0 - 9 where 9 is the largest. The default value is 1.
*Number of packs	Number of packs included in the tracker calculations	The rolling pack number included within the tracker calculations. The range is 1 - 100 where 100 is the finest control. The default value is 10.

Reject options

Pulse:

When a contaminated package is detected the reject delay time is counted down, in order for the package to travel from the photo eye to the reject device, where upon the reject is turned on for a time equal to the reject dwell time. Typically, this mode of reject would be used for air blast or pusher type rejects for the accurate rejection of small packages at high speed. This option is only available if a photo eye (PEC) is fitted for product registration.

Pulse extension:

This mode of reject is the same as pulse mode, described above, except that the dwell time is extended if a second contaminated product reaches the reject point before the dwell time from the first contaminated product has timed out. This could typically be used with an air blast or retracting band reject device, but not a pusher type device. This reject mode is always available, whether or not a photo-eye is fitted.

Toggle:

When a contaminated package is detected the reject delay time is counted down, in order for the package to travel to the reject device, where upon the reject device state is toggled. No Reject dwell entry will appear in the Product setup menu for this mode of operation, as it is not required. This reject mode is only available if a photo-eye is fitted.

Dwell extension:

When a contaminated product is detected the reject device is immediately activated, and stays activated for a time equal to the reject dwell time. If a second reject product is detected before the dwell time has timed out, then the dwell time is counted down from the beginning again. This mode cannot be used if a PEC has been fitted for product registration purposes, and that no Reject delay entry will appear in the Product setup menu.

Reject till accept:

When a contaminated product is detected the delay time is timed out, at which point the reject device becomes activated. The reject device will then stay activated until an uncontaminated product reaches the reject point. This reject mode can only be selected if a photo-eye has been fitted to the system.

Reject relay

The reject relay can be set to be either normally energised or normally de-energised (the normal state is the not rejecting state). For failsafe applications the relay-state should be normally energised, shown as ENERG on the display, so that if the power fails to the system the relay will drop out causing rejection of non-inspected product.

Reject timing

The reject timing can be selected to be either product relative or universal. Product relative means that each of the products can have different dwell/delay times, whereas universal means that they will all be the same. If universal timing is selected, then when the reject timings are adjusted for one product, then all the others will automatically be updated to the same values.

Reject confirm

Select this to YES if reject confirmation facility is fitted to your system, and you wish a system fault to be generated on a confirmation failure.

If reject confirmation is set to ON, then the entries confirm delay if a photo eye is fitted & confirm window will appear in the menu list. These entries allow a time window to be set up in which a reject confirmation signal must be received when a contaminated pack is rejected.

For example, if the confirmation signal should occur within 50 to 150ms of the reject device being activated, set the confirm delay to 50ms & the confirm window to 100ms.

Bin full

Select this if a bin full facility has been fitted to your system, and you wish a system fault to be generated if the reject bin becomes full.

For failsafe operation, the fault relay should be wired into the conveyor drive or reject circuitry to ensure that no contaminated product can pass in the event of a reject or bin full failure.

Dwell unit

This option will only appear if vari-speed operation has been selected. Select either time or distance depending upon the sort of reject device that has been fitted to the system.

NOTES:

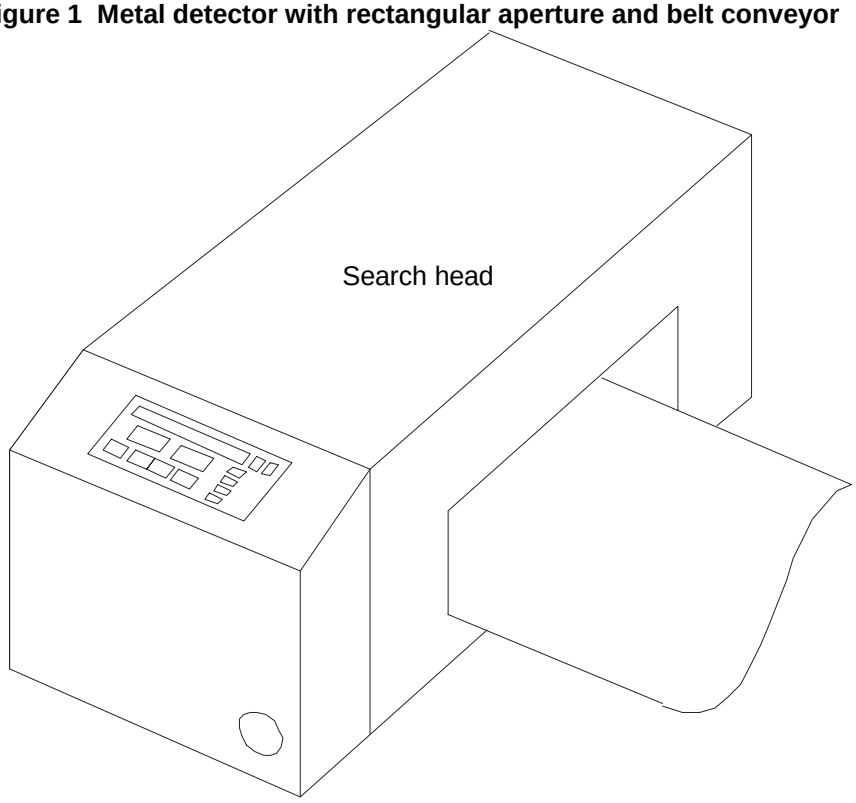
Wherever possible the necessary settings will be selected before the unit is dispatched by LOMA.

Specific hardware requirements are needed for some of the options to be operational, such as bin full detection.

PRINCIPLES OF OPERATION

Inside the metal detector an electromagnetic field is used, operating at a similar frequency to that used in AM broadcasting, through which the product passes. This field interacts with both the product and any metal contamination within it, in such a way that the interaction is measured to determine whether or not the product is contaminated.

Figure 1 Metal detector with rectangular aperture and belt conveyor



A typical detector is shown in Figure 1. It consists of a metal box with an aperture through which the product passes, and a control unit that processes the signals. Inside the metal box, referred to as the search head, there are three coils surrounding the aperture arranged as in Figure 2. A central (transmitter) coil is driven by a powerful oscillator to generate a strong magnetic field within the aperture, through which the product passes.

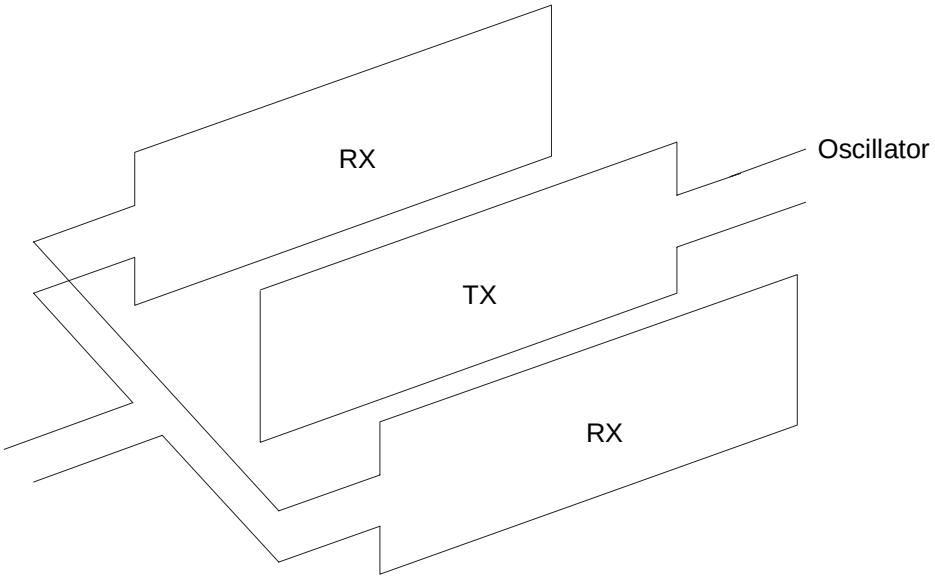


Figure 2 Coil arrangement in search head

Spaced equally on each side of the transmitter are two "receiver" coils. These coils act as aerials to pick up the magnetic field, so that a large voltage can be measured across the coils. Without product passing the voltage in each coil will be equal, because they are both an equal distance from the transmitter coil, so the two voltages can be subtracted from one another to give zero.

Any conductive object moving into the aperture will interact with the magnetic field, so as to produce differing voltages in each of the receiver coils as it moves through the search head. Subtracting the voltages from each of the coils will then no longer give zero, such that the interaction of the object with the magnetic field can be measured as it moves through the head.

The differing signal picked up after subtracting the two receiver voltages will vary depending upon how conductive the object is. For instance, different types of metal will give different interactions, as will different types of foodstuffs. Not only does the material type matter, but so does its size and orientation. The interaction of the product with the magnetic field is known as the product effect.

With suitable processing of the signals, detailed below, the control unit can tell the difference between those harmless interactions produced by the product, and those produced by harmful metal contamination.

Resistive and Reactive Components

The search head produces two signals, known as the resistive and reactive signals (R and X), that tell the control unit about the interaction of the product with the magnetic field.

In general terms, dry products only produce a small reactive signal, whereas wet or fresh products such as cheese produce mainly resistive signals. Metal contamination can produce an interaction that produces both considerable reactive and resistive signals.

Figure 3 shows the typical signals, which would be traced out, on an oscilloscope as a block of cheese moves through the search head. A graph can be plotted of the reactive signal (X) against the resistive signal (R), known as a locus plot, and this is shown in Figure 4.

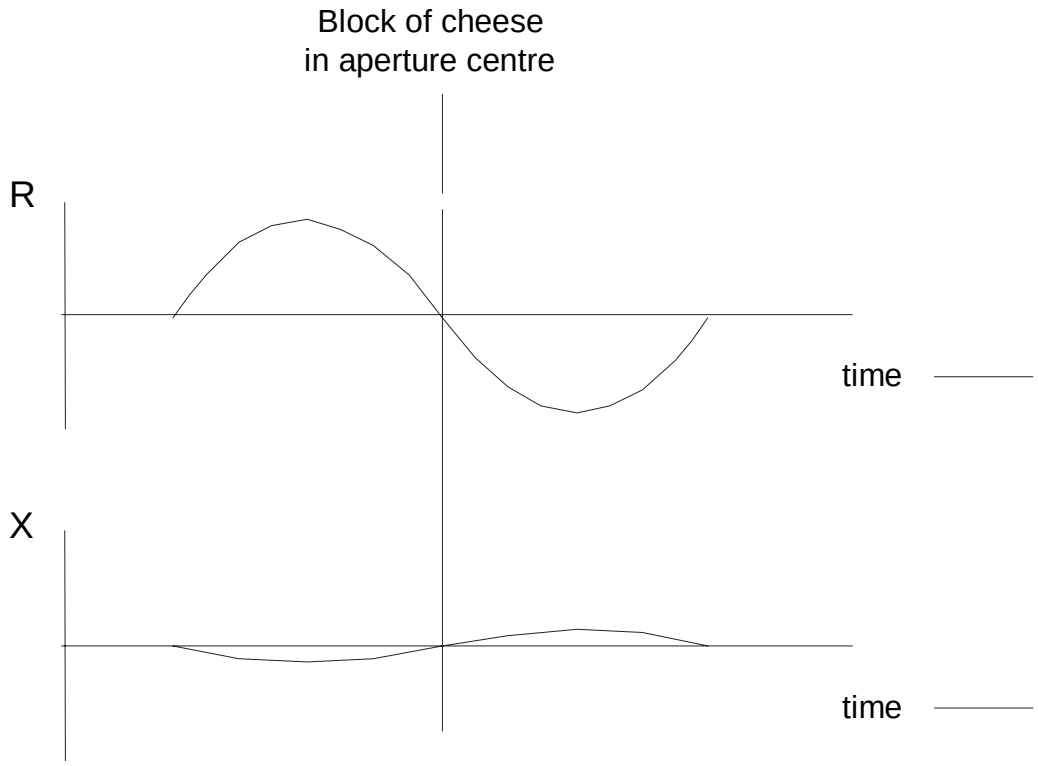


Figure 3 R and X signal as a block of cheese passes through the search head

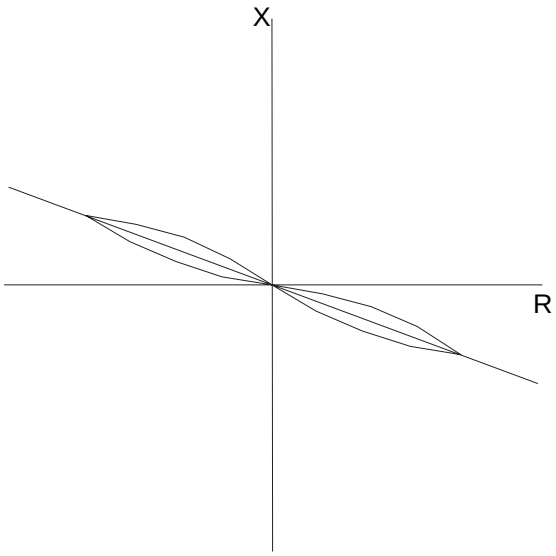


Figure 4 Locus plot of X against R for the block of cheese

Product Compensation

These so called locus plots can give us a valuable understanding of how the metal detector works, and how it must be set up for optimum performance in different applications. Consider Figure 5, which shows the locus plot both for a tub of frozen ice cream and a 2mm Ferrous sample. In this example, if the control unit is set to look at the R signal only, then when the R signal increases it must be due to contamination, as the ice cream gives little R signal.

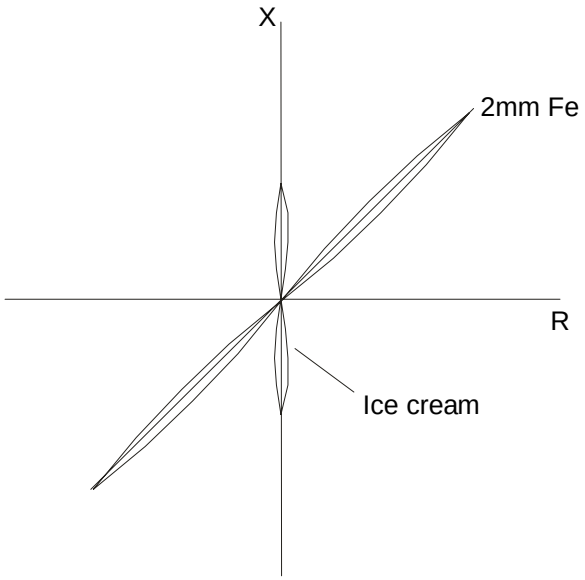


Figure 5 Locus plots for Ice cream tub and 2mm ferrous sample

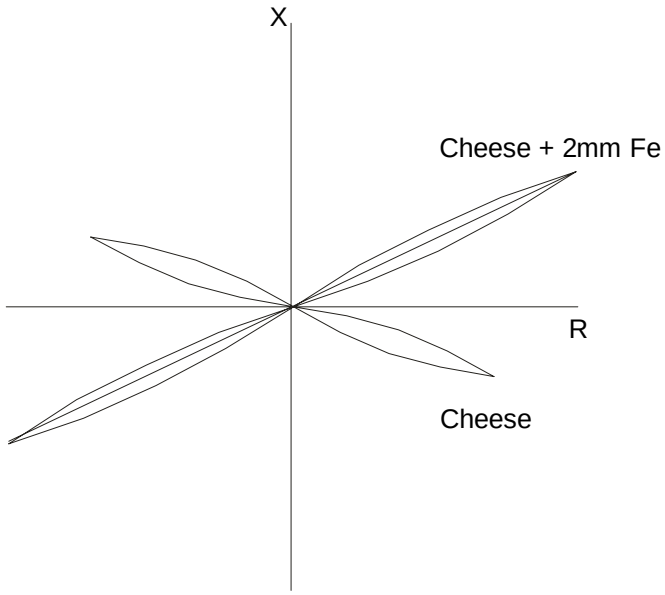


Figure 6 Shows how the cheese locus is “swung round” and made bigger by the 2mm ferrous contamination

If we consider Figure 6, this shows the locus plot for a block of cheese with and without the 2mm ferrous contamination. Clearly this produces a considerable R signal, because of its large product effect, so it is no longer sufficient just to look at the R signal to determine whether there is metal in the product or not - we can't tell the difference any more between metal and product. It is now necessary to look at the X signal as well, but again if we look at only the X signal it will be difficult to see small pieces of metal as the cheese produces small X signals, the same as a small ferrous contaminant will.

In order to see small pieces of metal it is necessary to combine the R and X signals to attempt to eliminate the product effect, known as compensating out the product. Applying the correct product compensation to the locus in figure 6, the cheese plot, has the effect of "swinging" the locus around to produce Figure 7. The vertical axis is now referred to as the product signal axis (S). Now in order to detect small pieces of metal the product signal is monitored, and when it increases above a certain level, known as the threshold, the product is known to be contaminated.

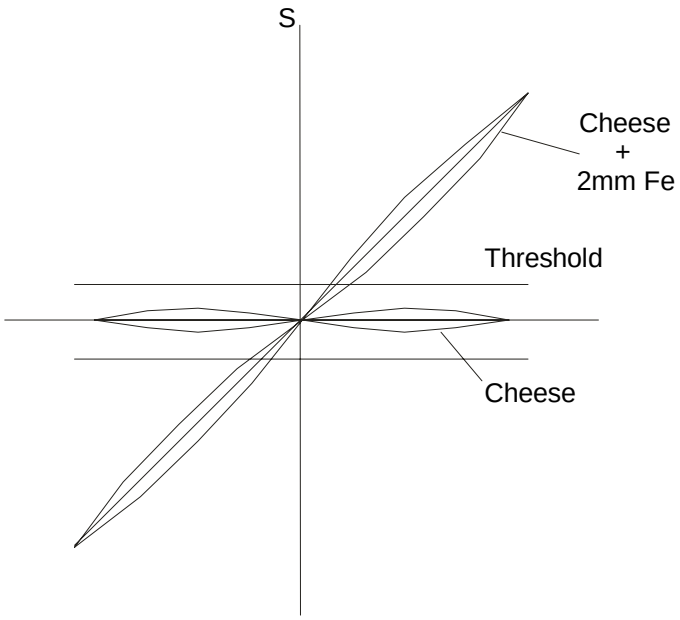


Figure 7 Locus plot after compensation applied

The compensation and threshold values are automatically set by the detector, during a calibration cycle, but can be altered manually if so desired. The top menu position on the display shows the product signal level against the threshold.

Working Modes of Operation

There are three working modes of operation, Resistive, Reactive and Dry. Generally speaking, Dry mode is used for products with little or no product effect, due to their negligible conductivity.

Reactive mode is used for products with considerable moisture content where the water can conduct, thereby leading to considerable R signals (large product effect). Resistive working is limited to those products with a little moisture content, such that they have sufficient product effect so as not to allow them to work dry, but that the R signal is not large enough to let them work reactively.

As examples of working modes, tea and coffee would work Dry because of their low moisture content. Frozen foods will also work Dry, because water cannot conduct when it is frozen. Cheese, fresh meat, hot bread will work Reactively, because of the conductive moisture content. Resistive working only applies to a few products, such as dry ones with iron fortification, or bulky products with a slight moisture content (flour).

Dry operation is preferred wherever possible, because this minimises the effects of vibration on the detector - see below. In the event that during a calibration cycle the unit detects that the product has significant product effect, i.e. it is not dry, then a suitable mode of working (Reactive or Resistive) and compensation value is derived to compensate out the product effect.

For products with no significant product effect a compensation value can be applied that minimises the effect of vibration, as the product does not require compensation itself (Dry mode of working). This minimum vibration compensation value could be obtained by compensating out the R and X signals produced when the search head is vibrated, but the mechanical construction is so good that extreme vibration would be needed to produce big enough signals to compute the compensation. This problem has been overcome by using a ferrite wand, which produces signals very similar to those caused by excessive vibration and can therefore be used as a reference to compensate out those signals. When the unit determines, during a calibration cycle, that Dry mode working is required the compensation value adopted is that from the ferrite wand reference (this reference value is determined and saved in the unit during a "ferrite tune" - see commissioning section).

Product Dispersion

Some products, which are uniform in size and composition, will compensate out very well. Others, more variable in shape and non-uniform in nature, cannot be completely compensated out (known as phase dispersion). Here product compensation will be a compromise, and a lower level of sensitivity may have to be accepted. There will also be some remaining product signal due to the phase variability from product to product.

Phase dispersion varies critically with operating frequency and the detector may have to be operated at reduced sensitivity settings to avoid triggering from the remaining product signal. This problem manifests itself as a higher product signal, requiring a higher threshold so as not to generate any false rejects.

However good the detector design the performance can be limited by the nature of the product itself, and detection of some samples up to twice the size of those in dry operation may be the best that can be achieved.

Sensitivity

The sensitivity of a detector is normally specified as the smallest diameter of sphere that can be detected when passing through the centre of the aperture (the least sensitive area). Sensitivity varies with aperture size, so siting the detector to give minimum aperture height is an important factor in obtaining good performance. For instance, a detector required for large cartons will give poor sensitivity when compared to one designed for inspecting individual small packs.

A sensitivity of 1mm (ferrous and non-ferrous) is normally possible per 100mm of aperture height (or width if smallest) for most dry applications.

For other applications where product effect may be a limitation the achievable sensitivity that is possible depends greatly upon the choice of operating mode and operating frequency.

Shape and Orientation

So far we have been referring to the detection of spherical samples. These are commonly used as a standard for testing and comparing the performance of metal detectors because they present a regular shape to the aperture irrespective of their orientation.

With irregular shapes the detectability will vary greatly with orientation since the sample will present a different cross-section to the magnetic field in the search head according to its orientation. Furthermore, these effects differ in relation to non-ferrous metals compared with ferrous metals.

For magnetic materials the effect is related more to bulk, but with non-ferrous metals it is the area of the magnetic field interrupted by the cross-section of the material that matters. Thus a long thin non-ferrous wire lying along the axis of travel has little more effect than a sphere of the same diameter.

Placed at right-angles to the direction of motion, the same wire will be much more detectable, since it is now presenting a much larger cross-section. The same applies to small scraps of aluminium foil. Lying flat, the cross-sectional area presented to the field is minimal and a small piece may pass undetected. Face on, however, the same small piece may give an enormous signal.

To overcome these problems Loma offer differently constructed units, such as cross field and twin angled systems, where necessary.

MAINTENANCE

CONTENTS

Cautionary and General Advice 2
Display Board Replacement 3
Keyboard Overlay Replacement 4
Control & PSU Board Replacement 7
Filter Resistor Pack 8
Hardware Cold Starting 8
Control Board Links and Test Points 9
Power Supply 10
Connecting to a Power Source 12
End Plate Removal and Refitting 14
Search Head Board Single Frequency 16
Receiver Interface Board Single Frequency 20
Dual Frequency Detectors 21

CAUTIONARY & GENERAL ADVICE

WARNING

The control box electronics use devices that are sensitive to static discharge. Incorrect handling of any of the boards or individual components could cause permanent damage.

General Advice

Following are a few simple precautions and general information items that should be read prior to performing any maintenance functions.

1. Always ensure the unit is disconnected from the mains power source before commencing.
2. Always ensure the unit is disconnected from any air supplies before commencing.
3. The use of a proprietary wrist-grounding strap is recommended.
4. Retain any anti-static packaging to enable safe storage of removed boards or components.
5. The use of a container in which to place individual items such as screws, washers, nuts that are removed during any of the operations is recommended. This will help prevent loss and reduce the risk of metal contamination of any product.
6. Metric threads are used throughout the detector.
7. Clear Silicon rubber will be required if a keyboard overlay is to be replaced.
8. The following simple tooling should enable most maintenance to be successfully carried out.
   - Terminal flat bladed screwdriver.
   - Medium sized flat bladed screwdriver.
   - Set of flat/ring spanner/wrench set 3mm to 10mm.
   - Flexible thin bladed straight edged palette knife.
   - Set of 3mm to 10mm nut spinners/nut drivers.
   - Small and large pliers.
   - Small torch/flashlight.
   - 25W soldering iron.
   - 22 SWG solder.

- Antistatic wrist strap.
- Proprietary integrated circuit chip leg preparation tool.
- Thin stiff cardboard (for wet silicon removal).
- Torque wrench with 10mm socket set to 4 Newton metres (3 pounds/feet).

Control Box

The control box is supplied “specific to usage” and may be remote from the search head.

Keyboard Overlay & Display Board

There is no specific user test or repair available for these items, therefore if the overlay is damaged or the display is faulty then they must be removed and replaced.

An exploded assembly diagram is given in Figure 1.

Display Board Removal & Refitting

1. Using the 5mm allen key supplied with your equipment, unscrew the 2 front hinged door screws on the control box and open the door.
2. Unplug the display board drive connector from its mating plug on the control board and unclip the ribbon cable from behind its 2 retaining clips
3. Undo and remove the 6 metal M3 pillars that secure the display board to the back of the keyboard overlay. Refer to Figure 1 on page 5 in this section for their location.
4. Ensure all removed fixings are retained.
5. Replacing the display board with your new board is the reverse of its removal. The connector is polarised and can only be inserted one way.

Keyboard Overlay Removal & Refitting

If the overlay requires replacing then the overlay and display board can be removed as follows:

NOTE

The watertight seal between the keypad and the control box face is very strong. Care must be taken whilst attempting to break the seal. Excess force may damage the control box causing a potentially poor seal between the new keypad and control box.

1. Remove the display board from the overlay as described in "Display Board removal and refitting" on page 3 in this section. There is no requirement to unplug or unclip the connector and ribbon cable for this purpose. Place the removed display board carefully in the bottom of the door.
2. Undo the 10 hex M3 pillars that secure the overlay to the control box door.
3. From the outside of the control box, using a thin bladed palette knife gently insert into the seal around the overlay and the control box, carefully break the seal by working the knife sideways around the full circumference of the seal.
4. Remove the overlay.
5. Clean off any old seal material remaining on the control box door prior to replacing the new overlay.
6. Re-apply a new seal to the front of the overlay as shown in Figure 1 on page 5 in this section.
7. Fit the overlay into the control box and replace and tighten the 10 pillars. Ensure squeezed silicon can be observed around the full circumference of the overlay. Excess silicon can be removed by folding a piece of thin stiff cardboard into a V and gently running it around the seal removing the silicon.

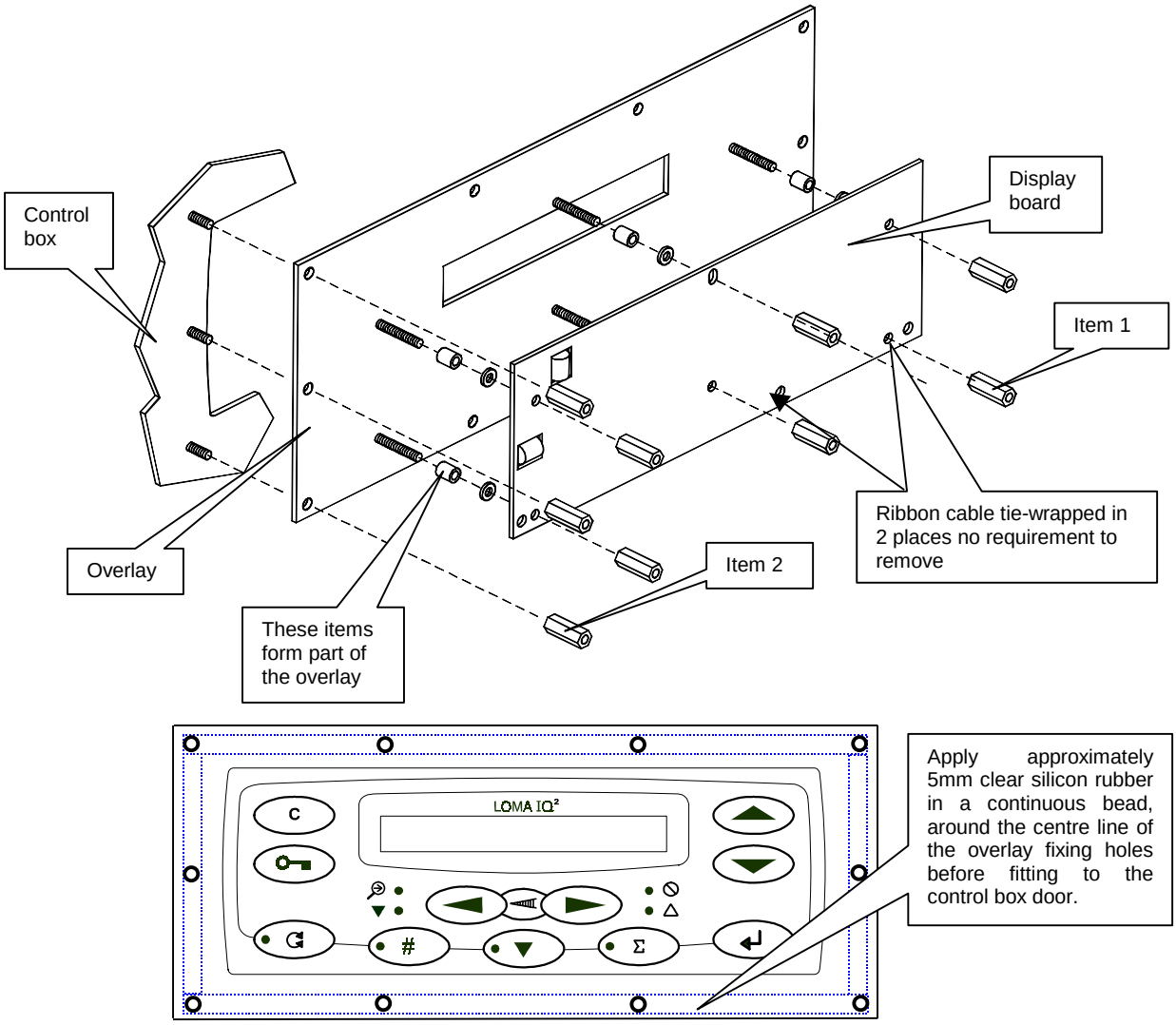


Figure 1 Control Panel Display Board and Overlay

Item Number	Quantity & Description	Part Number
1	6 off M3 x 15 hex threaded pillar	124141
2	10 off M3 x 15 hex threaded pillar	124141

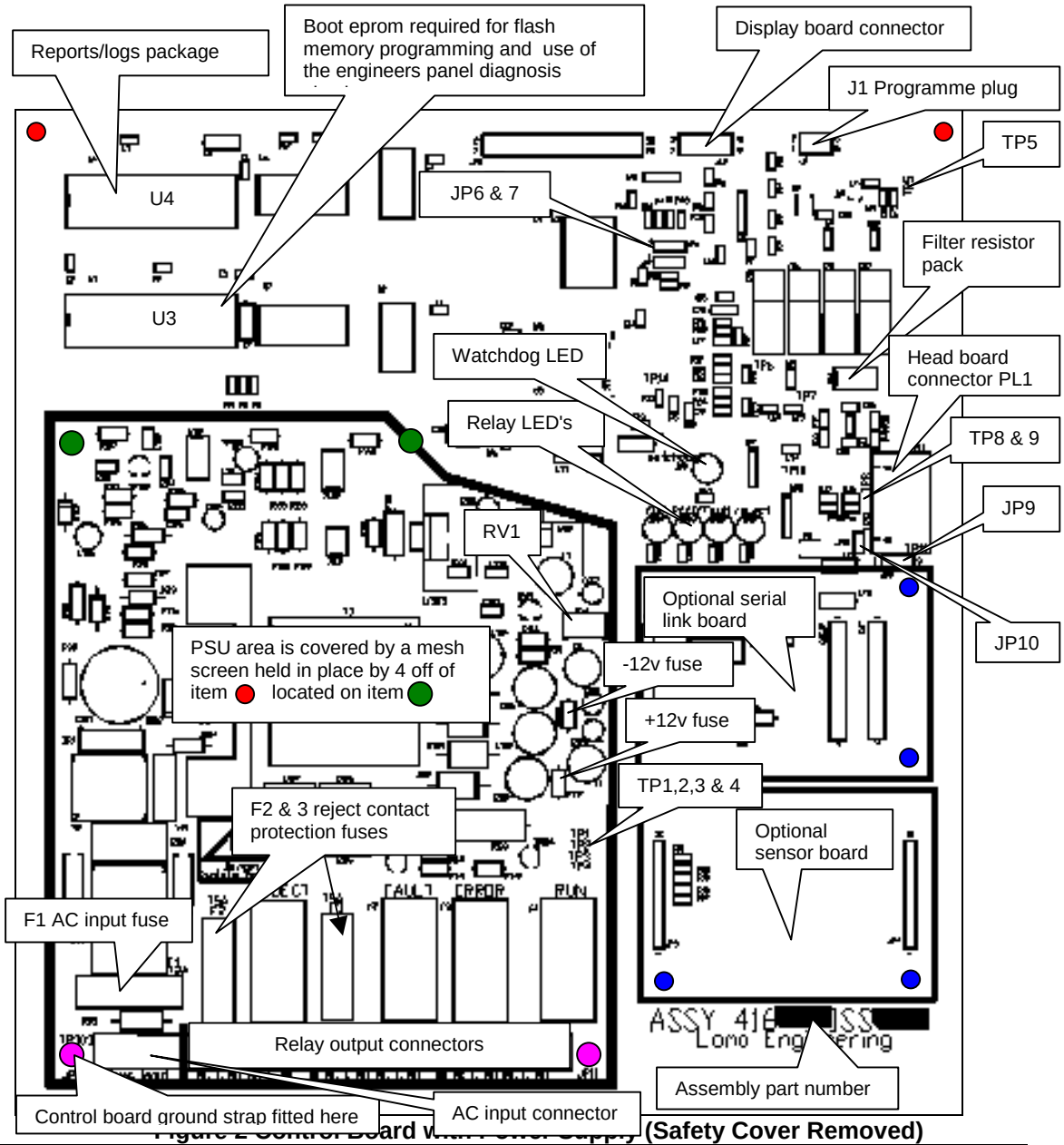


Figure 2 Control Board with Power Supply (Safety Cover Removed)

Item	Quantity & Description	Part Number	Comments
●	2 off M3 x 50 hex threaded pillar	124140	Single piece cover uses 4 off
●	6 off M3 x 15 hex threaded pillar	124141	May be 4 x M3 half nuts on PSU cover
●	2 off M3 x 12 hex threaded pillars	124139	Two piece cover only.
●	4 off M3 x 12 hex threaded pillar	124139	
	Link jumper socket for JP links	421092	

Control & PSU Board Removal & Refitting

WARNINGS

Read carefully before commencing any work.

LETHAL HAZARD - The control board and power supply are combined on a single board that contains high AC/DC voltages. A grounded mesh screen cover protects the power supply area of the main control board. Failure to fit or refit this cover securely may expose the user to a risk of electric shock or may result in permanent damage to the detector. Under no circumstances must the mesh cover be removed whilst the detector is powered. This is both hazardous and will damage the power supply should the mesh come into contact with any components. Removal of the mesh under these circumstances will invalid any warranty given.

LETHAL HAZARD - ELECTRICAL SUPPLIES. A current of 100 mA passing through the body for one second can kill. This can occur at voltages as low as 35V ac or 50V dc. **ISOLATE -** All power to the detector system before commencing work on the control board and power supply.

A general component layout diagram is given in Figure 2 on page 6 in this section to help locate items referred to below. Replacement Control Board must be the same assembly numbered part.

Remove the board for replacement purposes as follows:

1. Using the 5mm allen key supplied with your equipment, unscrew the 2 front hinged door screws on the control box and open the door.
2. Undo and remove the 4 M3 pillars or nuts securing the PSU safety mesh screen cover and carefully remove. The cover is connected via a ground wire to the control box; there is no requirement to remove this connection. The wire is of sufficient length to allow the placing of the cover in the bottom of the hinge door.
3. Remove any optional items that you may have fitted to your original board that are not present on the new board. These may include the reports/logs package U4, serial link and/or remote sensor boards. There is no requirement to remove the wiring from optionally fitted boards. Carefully place them in the bottom of the control box.
4. Unplug the display, ac power, relay and head board cable connections from the board, all connections are made using various plug and socket arrangements.
5. Remove the filter resistor pack, four identical resistors mounted in a removable brown header plug.
6. Record all fitted link positions.

7. Undo and remove the 10 M3 pillars that secure the control board into the control box.
8. Ensure all removed fixings are retained.
9. Carefully remove the board.
10. Replacing the control board with your new board is the reverse of its removal.

The new board will come pre-programmed with the current revision of operating software only.

1. Check all fitted link positions on the new board match those of the removed board.
2. Fit the filter resistor pack from the old board.
3. Refit any optional items removed from the old board. Before fitting the reports/logs option integrated circuit ensure the legs of the chip are straight and correctly formed to ensure positive location into its base. Only proprietary tools should be used to minimise the risk of damage. Failure to observe this simple preparation may result in a poor insertion into the base. This could result in permanent damage to the device and/or operational failure of the detector.
4. The new board will require configuring with all search head set up data and all applicable product data. Guidance in configuring the search head is given in the "Configuration and Set up Information" on page 4 of this section. It is essential that a hardware “Cold Start” be performed to ensure the detector settings are returned to their default values before commencing any data re-entry. Refer to “Hardware Cold Starting” below in this section for guidance.

FILTER RESISTOR PACK

The filter resistor pack is not polarised; therefore it does not matter which way round it is fitted.

If the transport speed has been changed, then the new speed must be entered into the “Belt Speed” on page 6 menu in the Configuration menu. Look in the "Belt speed" on page 14 charts in the “Configuration & Set up” section of this manual to check if a change to the fitted filter resistors is required.

HARDWARE COLD STARTING

Performing a cold start erases all stored set up and product data and returns to set up default values. Once completed the detector will require re-configuring as described in the Step by Step Configuration on page 4 in the Configuration & Setup section of this manual together with the re-entry of all product related data.

To force a hardware cold start the following sequence of events must be followed.

- Switch off the detector power.
- Fit link 1-2 on JP6.
- Switch on the detector power.
- The display will show + Not detecting +
- Power down.
- Remove the link.
- Power up.
- Re-configure the detector menus.

If the link is not removed then a warning message + Warning JP6 + will be displayed and exit from the “Configuration” menu will be denied until the link is removed.

CONTROL BOARD LINKS AND TEST POINTS

Figure 2 on page 6 in this section shows all user link and test point information. For clarity user links and test points together with their uses are referred to in the relevant sections through out this manual.

Following are tables of the remaining control board links that are shown only for completeness of information.

Link	Use	Default setting
JP7	Time base source selection	Link 2-3 (internal)
JP10	0V signal Ground	IN

Following is a table of the control board test points that are shown only for completeness of information.

Test Point	Use
TP1	Reject relay drive monitor
TP2	Fault relay drive monitor
TP3	Attention relay drive monitor
TP4	In run relay drive monitor
TP5	ADC reference voltage
TP6	R channel ADC input
TP7	X channel ADC Input
TP8	R channel head board output
TP9	X channel head board output
TP10	PSU switching frequency
TP11	Head balance
TP14	Not used

POWER SUPPLY (Fuses)

WARNINGS

LETHAL HAZARD - ELECTRICAL SUPPLIES. A current of 100 mA passing through the body for one second can kill. This can occur at voltages as low as 35V ac or 50V dc.

LETHAL HAZARD - The control board and power supply are combined on a single board therefore this board contains high AC/DC voltages. A grounded mesh screen cover protects the power supply area of the main control board. Failure to fit or refit this cover securely may expose the user to a risk of electric shock or may result in permanent damage to the detector.

ISOLATE - All power to the detector system before commencing work on the power supply unit.

WARNING - For continued protection against the risk of fire replace only with the same type and rating of fuse.

Incoming AC Protection Fuse

The power supply forms part of the main control board, it is fitted with a single protection fuse F1 located in the incoming ac supply circuit see Figure 2 on page 6. In the fuse blows on start up then it may be replaced however should the fuse blow a second time then further replacement is not recommended, as the most likely cause is an internal power supply fault.

F1 - T2A Loma part number 517033

If the power supply requires replacement follow the instructions for replacing the control board.

Reject Relay Protection

The protection fuse locations are shown in Figure 2 on page 6 in this section.

ISOLATE - All power to the detector system before commencing work on the power supply.

A fuse located in each of the contact sets protects the reject relay.

The reject relay circuit fuses are:

F2 - T5A Loma part number 517026

F3 - T5A Loma part number 517026

Before replacing the fuses it is recommended to check the circuitry connected to the reject relay to ascertain the reason for the fuse blowing.

Access to the fuses can be gained as follows:

1. Using the 5mm allen key supplied with your equipment, unscrew the 2 front hinged door screws on the control box and open the door.
2. Undo and remove the 4 M3 pillars or nuts securing the PSU safety mesh screen cover and carefully remove. The cover is connected via a ground wire to the control box; there is no requirement to remove this connection. The wire is of sufficient length to allow the placing of the cover in the bottom of the hinge door.
3. The fuses are located on either side of the reject relay.
4. Once replaced assembly is the reverse of the above.

+/-12v DC Rail Protection Fuses

Early issue control & psu boards are fitted with a replaceable soldered fuse link located in positions R337 (+12) & R338 (-12) Figure 2 on page 6 if the loss of either rail is due to an open circuit fuse then it is possible to replace these items. If it is desired to attempt a replacement then the later re-settable fuse type should be used. Loma part number 517104.

Later issue control & psu boards are fitted with the re-settable fuse as standard located as above. In the event of a loss of either rail the main power to the detector should be turned off for a minimum period of 10 seconds to allow the fuses to reset.

Before attempting to replace the non re-settable types please observe the **WARNINGS** at the start of this section. Removal of the control & psu board is required in order to unsolder the fuse/s to be replaced see control & psu removal and replacement on page 7.

Replacement or resetting of these fuses may not result in the restoration of the DC rail.

Relay Contact Information

Connections are made depending upon detector application, refer to your customised wiring diagrams in your User Manual supplied with the detector. Contacts are shown are for relays when de-energised (failsafe).

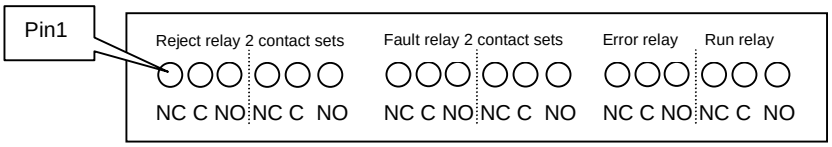


Figure 3 Relay contacts

Access to the relay connections is as access to the incoming ac protection fuse & reject relay protection fuses paragraphs 1, 2 & 4 apply on page 11 for boards protected by a one piece safety mesh cover. For boards with the two piece cover only the angled terminal cover access plate requires removal.

AC POWER CONNECTION INFORMATION

The location and wiring connection is shown in Figure 4 on page 12 in this section.

WARNINGS

LETHAL HAZARD - ELECTRICAL SUPPLIES. A current of 100 mA passing through the body for one second can kill. This can occur at voltages as low as 35V ac or 50V dc.

LETHAL HAZARD - The control board and power supply are combined on a single board therefore this board contains high AC/DC voltages. A grounded mesh screen cover protects the power supply area of the main control board. Failure to fit or refit this cover securely may expose the user to a risk of electric shock or may result in permanent damage to the detector.

AC wiring colours will vary according to territory.

North America	Black	=	HOT
110/120v	White	=	NEUTRAL
	Green/Yellow	=	EARTH
All Others	Brown	=	LIVE
200/240v	Blue	=	NEUTRAL
	Green/Yellow	=	EARTH

Power cabling must be rated at no less than 5A current carrying capability and be routed into the control box by a suitable watertight gland. The power input gland hole is on the extreme left of the control box when facing the controls.

Access to the ac input connections is as access to the incoming ac protection fuse & reject relay protection fuses paragraphs 1, 2 & 4 apply on page 11 for boards protected by a one piece safety mesh cover. For boards with the two piece cover only the angled terminal cover access plate requires removal.

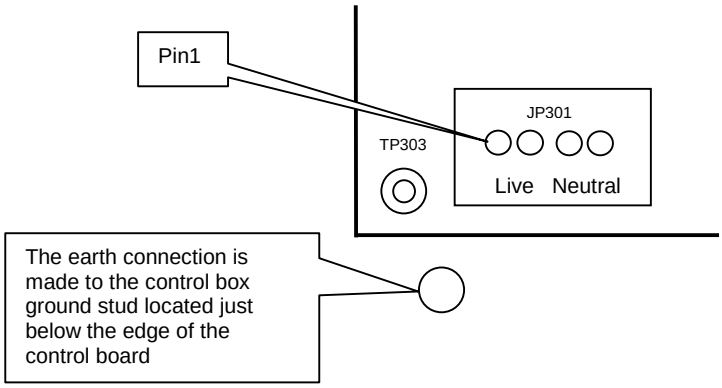


Figure 4 AC Power/Ground input connection units built before November 2001

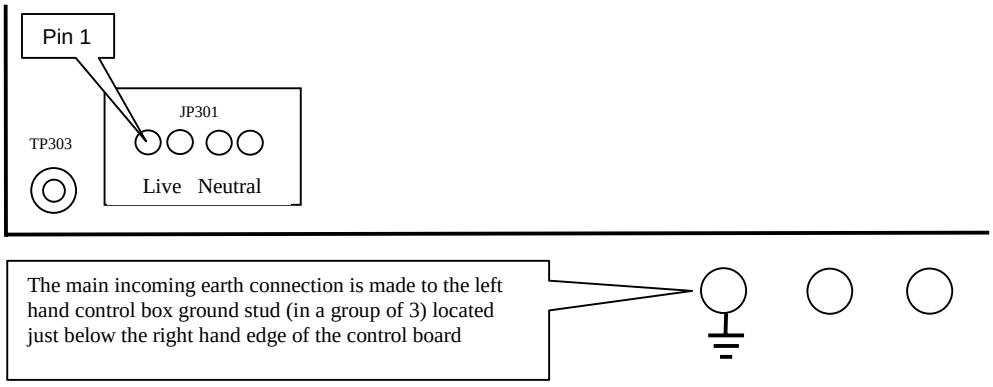


Figure 4 AC Power/Ground input connection units built after November 2001

END PLATE REMOVAL AND REFITTING

The end plate located on the search head case is designed to be removable to allow access to the electronic boards located inside.

There are no user replaceable parts inside, however if the plate is removed then the following instructions should be followed.

Incorrect fitting of the plate may result in either water ingress or random triggering of the detector due to loops of indeterminate electrical resistance “Eddy Current Loops”.

A diagram showing a typical end plate is given in Figure 5 on page 15 in this section.

WARNING

SAFETY - HEAVY End plates can be very heavy, great care must be taken when removing or refitting the plate.

Removal

1. Loosen and remove all the plate retaining bolts except the top centre bolt with the “O” ring seal washer.
2. With the end plate securely supported to prevent falling vertically downwards remove the final bolt, the plate will then lift away from the case. Ensure all bolts, insulating and “O” ring seal washers are retained.

Refitting

1. Align the plate with the fixing holes, ensuring the insulating/water tight gasket edge is visible around the full circumference of the case. Replace only the top centre bolt together with its “O” ring seal washer to secure and prevent the plate falling. Do not fully tighten this bolt as it is removed later to allow an insulation continuity test to be carried out.
2. Locate and partially tighten all the remaining bolts and their insulating bushes, slight movement of the plate facilitates easier bolt alignment. The longest length bolts are used on the vertical sides.
3. Tighten all bolts to a torque setting of 4 Newton metres (3 pounds feet) in a clockwise rotation with the exception of the bolt with the “O” ring seal.
4. Using the DMM set on the 2K ohm range or equivalent measure the resistance between the end plate and the case, this should be > than 250 ohms.
5. Replace the centre bolt and seal washer and tighten to correct torque.
6. The presence of the end plate has a large effect on the normal balance value setting of your search head. It is therefore advised that a “Balance” check be carried out to ensure the balance value is within specification. Information can be found in the "Balance" on page 2 in the "Functional testing" section of this manual.

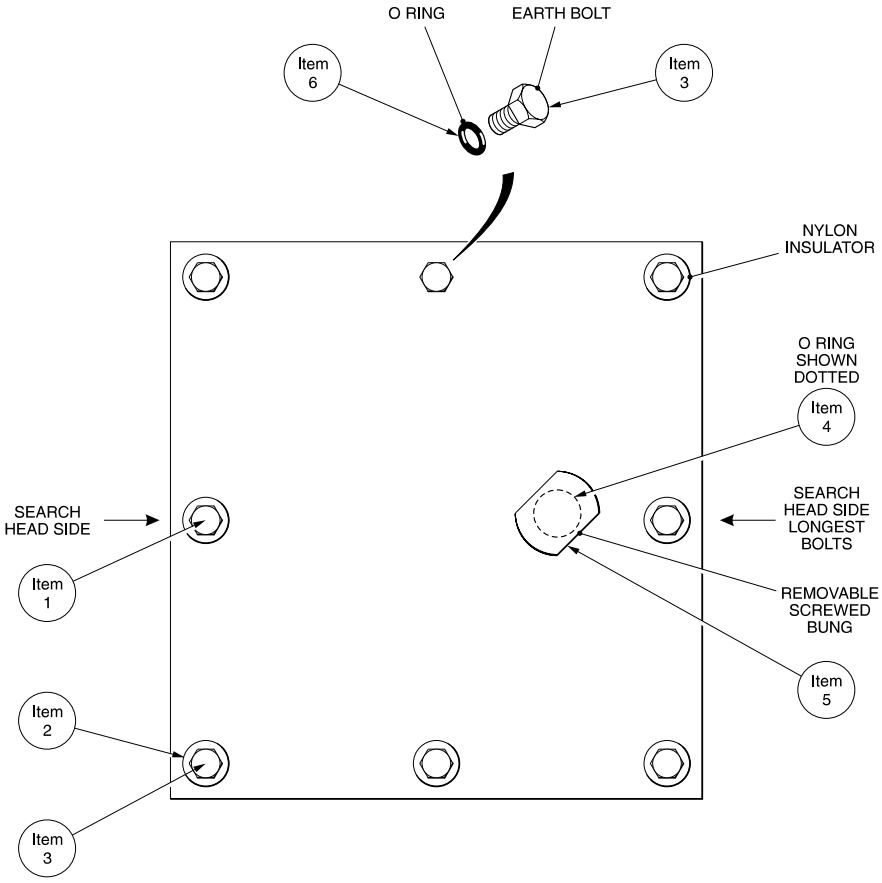


Figure 5 End Plate

Item Number	Quantity & Description	Part Number	Comments
1	M6 X 25 hex head bolts	108068	Quantity is end plate size dependent
2	Nylon shoulder washer	116036	Quantity is end plate size dependent
3	M6 X 20 hex head bolts	108064	Quantity is end plate size dependent
4	1 x O ring seal	106004	
5	1 x Balance access hole bung	227014	Style may vary
6	1 x Sealing washer	114022	

SEARCH HEADBOARD REMOVAL & REFITTING

Located behind the removable end plate of your detector search head case is a further electronics board. This board supplies the drive to the central transmitter coil and initially processes the signals received from the two symmetrical receiver coils.

Since every board is customised to suit the particular detector it is fitted into, there are a variety of components that must be checked, and possibly swapped between the old board and the new board. There are also two power rails that will need to be checked and adjusted as required. If Loma has provided the board for a specific serial numbered detector then some of these components may already be correctly fitted.

This section serves as a guideline for replacement of the detector search headboard. While working with the circuit board an antistatic wrist strap should be worn.

The process described seeks only to cover the minimum requirements needed to ensure a successful board replacement and does not cover the full set up process. Once completed the detector will be functional, however if any fine adjustment is required, which may be indicated by a slight loss in performance then contact your local Group Service Centre to arrange a service call.

The components that must be checked to ensure a successful board replacement are described in the replacement paragraphs on page 18. The board is shown in Figure 6 below the mounting arrangement in Figure 7 on page 17 with the wiring connections in Figure 8 on page 17 all in this section.

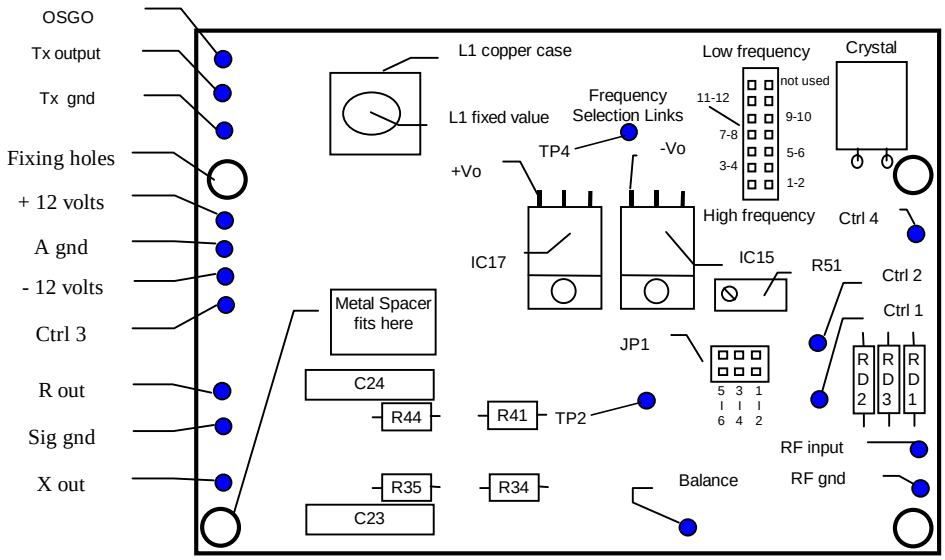


Figure 6 Search Headboard

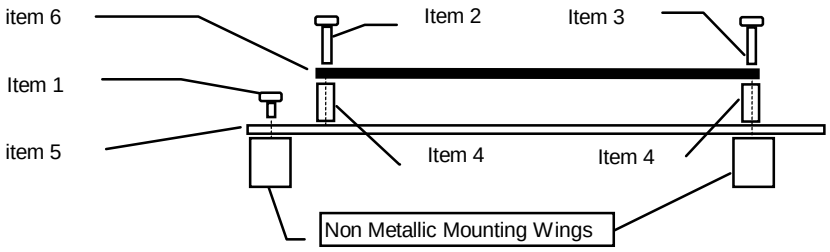


Figure 7 Search Headboard Mounting

Parts List

Item Number	Quantity & Description	Part Number	Comments
1	2 off 1/4" x No. 4 pan head self tapping screw	122011	
2	3 off M3 x 12 pan head self screws **or** 3 off No. 4 x 5/8" pan head self tapping screws	122011 122043	1 off used to secure P clip cable clamp not shown
	P clip cable clamp	511001	
3	2 off M3 x 16 pan head screws	108006	
4	4 off M3 x 7 long metal spacers	124123	
5	Metal screen plate	225472	
6	Search head board	416180	Dedication required

Connection Name (12 core cable)	Wire Colour
Ctrl 2 (control line 2)	Orange
Ctrl 1 (control line 1)	Pink
R out (resistive channel)	Black
X out (reactive channel)	White
A gnd (analogue ground)	Blue
OSGO (oscillator going)	Yellow
Ctrl 3 (control line 3)	Grey
Ctrl 4 (control line 4)	Turquoise
Balance	Brown
+ 12 volts	Red
- 12 volts	Violet

Sig gnd (signal ground)	Green
Tx output (Transmitter)	Red (twisted)
Tx gnd (Transmitter ground)	Blue (twisted)
RF input (Receiver input)	Red (screened)
RF gnd (Receiver ground)	Blue (screened)

Figure 8 Search Headboard Connection Details

The search headboard can be replaced as follows: A general component layout diagram is given in Figure 6 on page 16 and a diagram of the board fixing is given in Figure 7 on page 17.in this section to help locate items referred to below.

1. Isolate the AC power to the detector.
2. Remove the end plate as described in "End Plate Removal & Refitting" on page 15 earlier in this Maintenance section.
3. Carefully unsolder and remove all 16 wires connected to the board.
4. Remove the board and the metal plate to which it is fitted by removing the 4 fixing screws securing the plate to the detector.
5. Remove the board from its metal plate by removing the 4 fixing screws, spacers & nuts.
6. Take the board to a safe location and lay it on some anti-static packaging; refer to it now as a reference to ensure the replacement board is properly configured.

   Configure as follows: Reference Figure 6 on page 16 in this section for component locations.

   - Carefully unsolder the L1 inductor, which may be either a fixed value (small tubular) or a variable copper cased type. This MUST be done to avoid having to completely re-tune the transmitter after a board change. If it is a copper cased type the adjustable core/slug inside MIUST NOT be adjusted.
   - Check the crystal frequency on the new board (even if it has one) against the crystal on the old board. If necessary, carefully swap the crystal from the old to the new.
   - Check the frequency selection link position on the new board (even if it has one) against the link on the old board. If necessary fit a link into the same position on the new board.
   - Check the link position on JP1 on the new board (even if it has one) against the link on the old board. If necessary fit a link into the same position on the new board.

- Check the values of resistors RD1, 2 & 3. The values are 4.7KΩ 220Ω & 2.2KΩ respectively as standard, but the values on the old board may have been changed to accommodate an excessive product signal. If they have been changed then copy the changes to the new board.

- Check the values of capacitors C23 & C24. These are both 1.0µF as standard but may have been changed to 2.2µF to optimise sensitivity at slow belt speeds. If they have been changed then copy the changes to the new board.

- Check the values of resistors R35 & R44. These are both 470KΩ as standard but may have been changed to 1 MΩ to optimise sensitivity at very slow belt speeds. If they have been changed then copy the changes to the new board.

- Check the values of resistors R34 & R41. These are both 47KΩ as standard but may have been changed to 100 KΩ to optimise sensitivity at very slow belt speeds. If they have been changed then copy the changes to the new board. This modification is usually done in conjunction with R35 & R44.

- Re-fit the new board to the plate and the plate to the detector, ensuring the metal spacer is fitted to the correct corner. Reference Figure 7 on page 17, in this section.

- Carefully solder the wires back onto the new board in their original positions.

- Turn on the power to the detector. Connect the DMM set on the 20v DC range or equivalent between (+ Vo and A gnd) and adjust R51 for a voltage of 9v +/- 0.05 V. Move the DMM lead from (+ Vo) to (- Vo) and check the voltage is 9 V +/- 0.3 V. Switch off the power to the detector.

- Refit the end plate as described in “End Plate Removal & Refitting” on page 15 earlier in this section.

Restore the power to the detector and carry out a head balance check as described in “Balance” on page 2 in the “Functional Testing section” of this manual, before re-calibrating for good product.



Figure 10 Control Board Termination PL5

RECEIVER INTERFACE BOARD

Located behind the removable end plate of your detector search head case is a receiver interface board.

This board contains a user adjustable ferrite core that can be used to adjust the balance signal when the detector is in its quiescent state.

Removing the screwed metal bung located on the removable end plate on the search head case accesses the ferrite core. Instructions as to its use are in the “Testing” section of this manual.

There are no user replaceable components located on this board. Should the board develop a fault it will require replacing. Contact your local Group Service Centre for help.

A simplified diagram showing the ferrite core position follows:

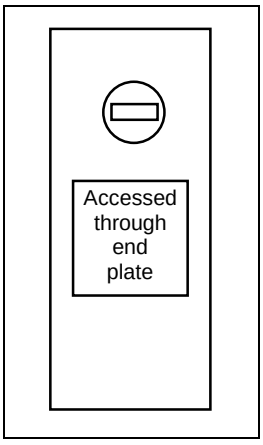


Figure 11 Receiver Balance Core

DUAL FREQUENCY DETECTORS

A dual frequency detector is capable of operating at two different frequencies that are selectable from within the Product setup menu Frequency menu position. Selection is on a per memory basis giving the flexibility to change operating frequency upon a change of product. Selection is simply HIGH or LOW.

Having the ability to work with two different frequencies enable a much wider mix of product type, packaging & operating mode to be accommodated by a single detector.

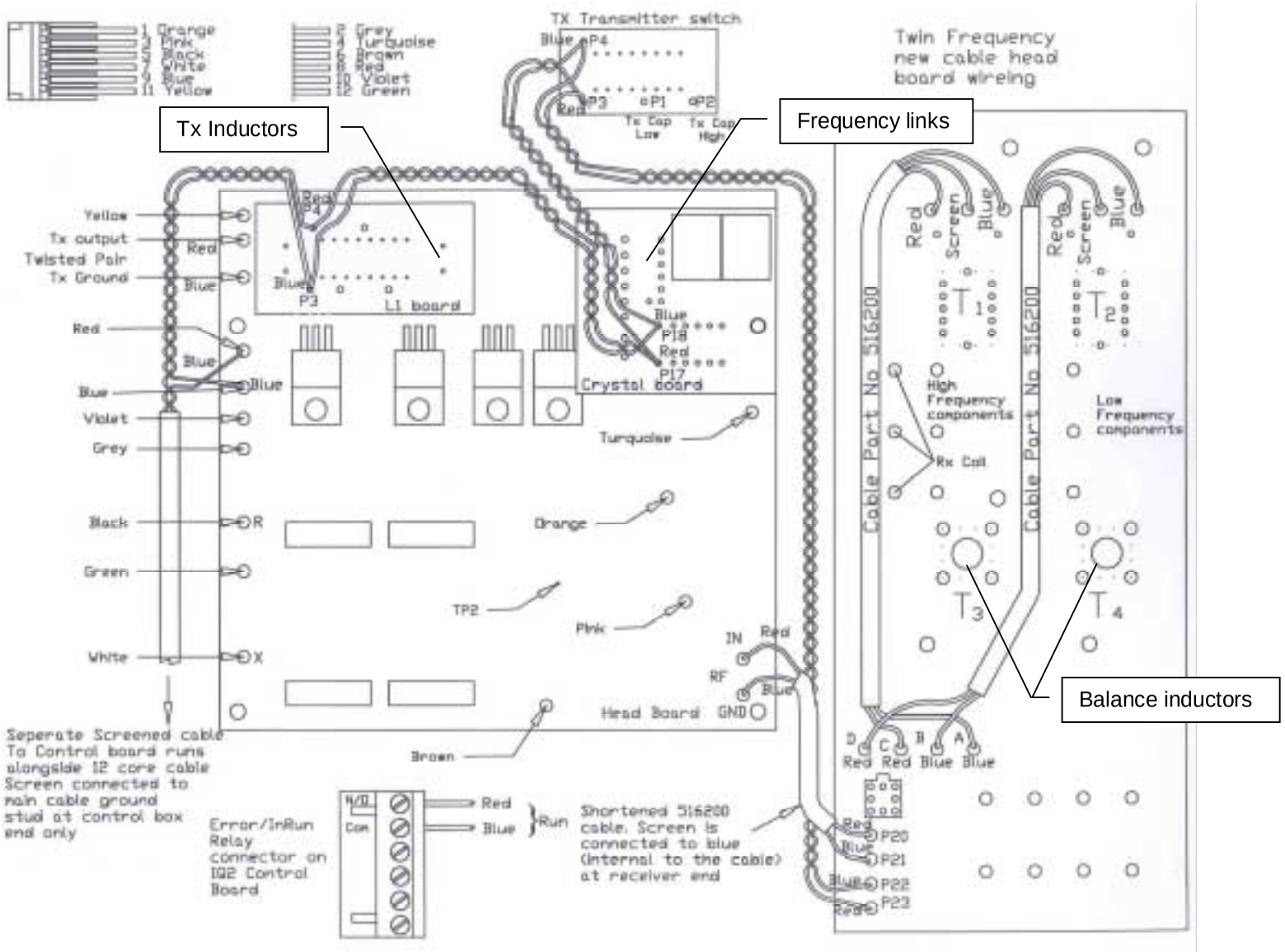
Located behind the removable end plate of your detector search head case are a modified search headboard and a dual receiver interface board.

There are no user replaceable components located on either board. Should the boards develop a fault they will require replacing. Contact your local Group Service Centre for help.

As with a single frequency detector the receiver board contains a pair of user adjustable ferrite cores one for each operating frequency that can be used to adjust the balance signal when the detector is in its quiescent state.

Removing the screwed metal bungs located on the removable end plate on the search head case accesses the ferrite cores. Instructions as to its use are in the “Functional Testing” section of this manual.

A simplified diagram showing the ferrite core position follows:


Tx Inductors
Frequency links
Balance inductors
TX Transmitter switch
Twin Frequency new cable head board wireing
Cable Part No 516200
High Frequency components
Low Frequency components
Rx Coil
L1 board
Crystal board
Head Board
Yellow
Tx output
Twisted Pair
Tx Ground
Red
Blue
Violet
Grey
Black
Green
White
Turquoise
Orange
Pink
TP2
Brown
Separate Screened cable To Control board runs alongside 12 core cable Screen connected to main cable ground stud at control box end only
Error/InRun Relay connector on IQ2 Control Board
Run
Shortened 516200 cable. Screen is connected to blue (internal to the cable) at receiver end

FUNCTIONAL TESTING

CONTENTS

Recommended Test Equipment 2

Balance 2

Reactive and Resistive Channels 4

Phase Integrity and Channel Noise 4

OSGO 5

DC Power Rails 7

RECOMMENDED TEST EQUIPMENT

Dual Beam Oscilloscope, 100 MHz bandwidth minimum.

x1 probe

3.5 Digit - Digital Multimeter (DMM).

Static safe wrist strap

Plastic trim tool

Penlight/flashlight

WARNING

Before commencing any test work ensure that you are wearing a correctly grounded wrist strap.

BALANCE (single & dual frequency detectors)

The detector uses a pair of equally spaced receiver coils located within the search head case. The signals received by the coils when the detector is in its normal state, i.e. no product or metal present should be sinusoidal at a value of less than 1V peak to peak. If the detector is of a dual frequency type then the balance will require checking and adjusting if necessary for each operating frequency. In the unlikely event of the balance value increasing beyond this point, which a gradual loss of metal sensitivity or an increase of product effect may indicate. The balance can be checked and adjusted as follows:

NOTE

No metal or product should be present in the aperture whilst this check is in progress.

1. Using the 5mm allen key supplied with your equipment, unscrew the 2 front hinged door screws on the control box and open the door.
2. Select an unused product memory position and set the “Head power” to “MAX”.
3. If the detector is a dual frequency type then initially select HIGH for the frequency menu position in the product memory chosen.
4. Remove the balance ground link from JP9 on the control board.
5. Connect the oscilloscope via a x1 probe to TP11 shown highlighted in Figure 1 on page 1; connect the probe earth clip to the adjacent control board mounting hex pillar.

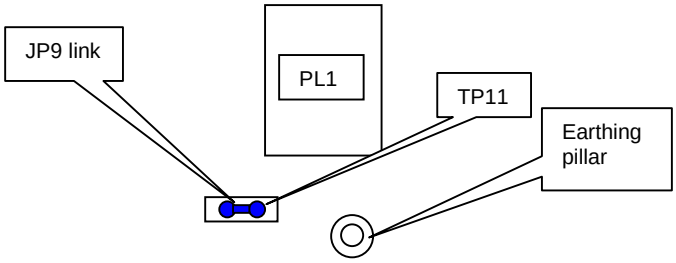


Figure 1 Exploded View of JP9, TP11 and Earthing Pillar

6. Adjust the oscilloscope time base until a sine wave can be seen and the volts per centimetre to a setting of 50 mV.

7. When reading the amplitude from the oscilloscope multiply the reading by a factor of 10, this is because the search headboard contains a x10 multiplier on the remote balance check line.

   - For example: If the reading was 80mV peak to peak then the balance value is actually 800mV peak to peak.

8. If the reading is greater than 100mV peak to peak then the balance should be adjusted.

9. Remove the screwed bung in removable end plate on the rear of the search head case. If the detector is a dual frequency type then remove both screwed bungs. High frequency balance adjustment is through the left-hand access hole.

10. Using the non - metallic trim tool inserted into the ferrite core immediately below the access hole, a small penlight/flashlight may be of assistance in locating the core. Adjust the core until the reading is as small as it will go.

11. If the balance cannot be adjusted to 100mV or below then contact your local Group Service Centre for help.

12. To check the second balance for dual frequency types then change the frequency selection to LOW in the frequency menu position for the product memory chosen. Low frequency balance adjustment is through the right-hand access hole.

13. Carefully withdraw the trim tool and refit all removed parts. Ensure the screwed bung/s are fully tightened.

14. Replace the ground link at JP9

REACTIVE AND RESISTIVE “X” & “R” CHANNELS

Your detector converts the change in balance caused by either product or metal into two distinct signals called Reactive and Resistive signals, this technique is known as phase detection.

The correct setting of these channels can be quite simply checked by the user, however in the unlikely event of the settings being incorrect there is no user adjustment available. If the detector is of a dual frequency type then this check will require repeating for both operating frequencies. If any problems are encountered and cannot be resolved please call your local Group Service Centre.

Poor metal sensitivity or unexpected product effect changes may be a symptom of phase integrity.

NOTE

No metal or product should be present in the aperture whilst this check is in progress.

Checking Phase Integrity and Channel Noise (single & dual frequency detectors)

1. Using the 5mm allen key supplied with your equipment, unscrew the 2 front hinged door screws on the control box and open the door.

2. Select an unused product memory position and set the “Head power” to “MAX”.

3. If the detector is a dual frequency type then initially select HIGH for the frequency menu position in the product memory chosen.

4. It is advisable to check the “Balance” value is within specification before checking, an excessive out of balance signal can effect the phase integrity.

5. Connect the oscilloscope via a x1 probe to TP9 “X” channel (or use the white wire connection pin on PL1) shown in Figure 3, connect the probe earth clip to the adjacent control board mounting hex pillar.

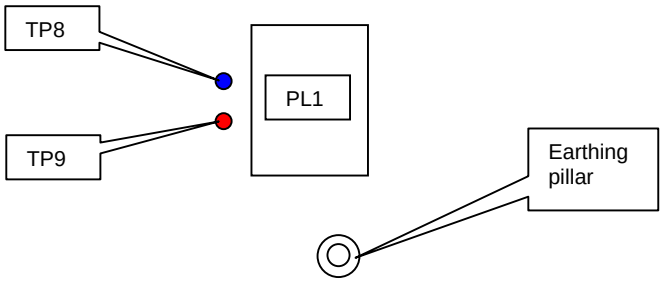


Figure 3 Exploded View of TP8 & 9 and Earthing Pillar

1. Adjust the oscilloscope time base until the white noise is clearly visible and the volts per division to 100mV.

2. The channel noise level should be less than 500mV peak to peak.

3. Adjust the oscilloscope time base to its slowest setting and the volts per division to a setting of 1V.

4. Using the “Tune for Resistive Wand” supplied with your detector, pass the wand back and forth through the centre of the aperture and record the peak to peak voltage value seen.

5. Transfer the probe to TP8 “R” channel (or use the black wire connection pin on PL1) shown in Figure 3. Repeat the test for white noise and the test wand, the peak to peak value observed for the test wand should not be > than 1/5th of the recorded “X” channel voltage.

6. To check the phase integrity for dual frequency types then change the frequency selection to LOW in the frequency menu position for the product memory chosen. Repeat all the above tests for the lower operating frequency.

OSGO

One of the many features of your detector is automatic fault monitoring of basic detector functions, one of those functions is monitoring of the transmitter voltage.

The transmitter provides the high powered signal required to enable the detection of metal, should that signal fail then the detector would no longer detect metal of any size.

Your detector continuously monitors the presence of this important signal via a circuit called OScillator GOing.

The AC signal is converted to a DC signal that can be found on pin 11 “yellow wire” on PL1. If this voltage falls below 1V then a “System fault” is generated, that causes the “Fault Relay” to operate and in turn the “Reject Device” so that no product will pass undetected.

In the unlikely event of an OSGO generated System fault, transmitter failure confirmation can be made by using the DMM set on the 20V DC range or equivalent to measure the voltage at PL1 with respect to the adjacent control board mounting hex pillar. Figure 10 on page 20 in the “Maintenance” section of this manual shows the connections for PL5. If a failure is confirmed then please call your local Group Service Centre.

DC POWER SUPPLY RAILS

The continuous monitoring of the basic DC power rails required to operate your detector is another function of the fault monitoring circuits.

In the unlikely event of any of the primary +12V, -12V analogue (AN) or +5V digital (DIG) rails go out of specification a “System fault” is generated resulting in the same sequence of events as generated by an OSGO failure.

The voltages can be checked for specification as follows:

1. Using the 5mm allen key supplied with your equipment, unscrew the 2 front hinged door screws on the control box and open the door.

2. Using the DMM set on the 20V range or equivalent measure the voltages at the links between JP305 and JP5 on the control board with respect to their own ground connection. The links are located underneath the Serial Link Board. If this board is fitted, it will need to be temporarily removed.

Primary Rail	Nominal Voltage	Upper Tolerance	Lower Tolerance
+ 5V Pin 1 (ref. Pin 2)	5.00	5.25	4.75
+ 5v ground Pin 2			
+/- 12V grounds Pin 3			
+ 12V Pin 4 (ref. Pin 3)	12	12.60	11.40
- 12V Pin 5 (ref. Pin 3)	12	10.80	13.20
+ EXT Pin 6 (ref. Pin 7)	12	10.80	13.20
- Ext (ground) Pin 7			

1. Adjustment can only be made to the +/- 12V rails using RV1 located in the power supply area of the control board. Refer to Figure 2 on page 6 in the "Maintenance" section of this manual for its location.

2. If either rail is not present then protection fuse may be open circuit see +/- 12v DC Rail Protection Fuses on page 11 in the "Maintenance" section of this manual for information.

3. Adjustment is carried out by connecting a DMM set on the 200V DC range with the positive probe connected to Pin 4 and the other to Pin 5. RV1 Is adjusted until the reading is 24V.

4. To ensure each rail is within its individual specification check each rail in turn with respect to Pin 3 (+/- 12v ground). Minor adjustment to RV1 may be required.

WIRING/CONNECTION DIAGRAMS

CONTENTS

Figure 1 Optional External Sensor Connection Ladder Diagram 2

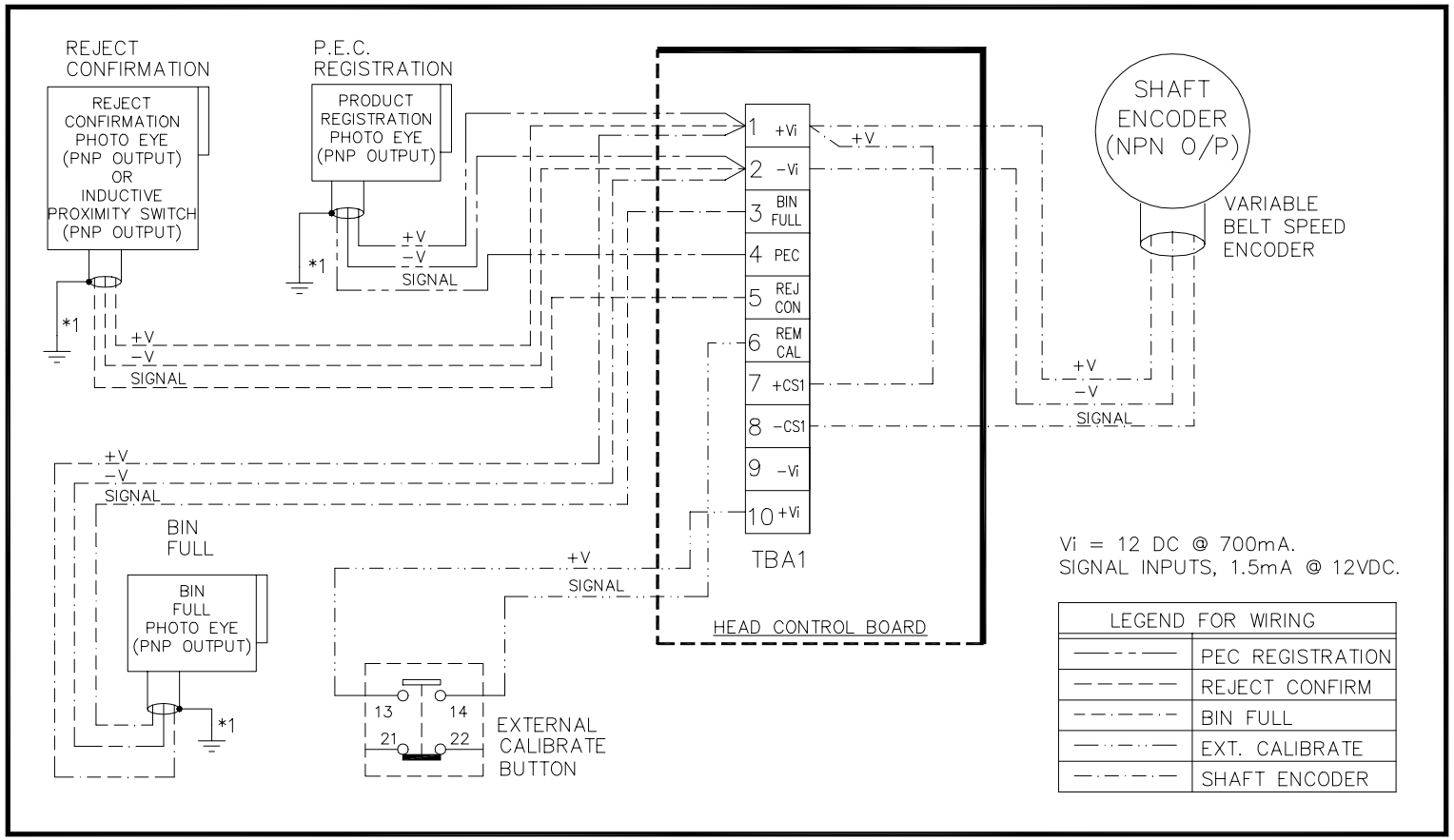


Figure 1 Optional External Sensor Connection Ladder Diagram

SPARE PARTS

CONTENTS

Spare Parts Lists 2

Suggested Holding of Major Items Spare Parts List

Part Identification	Part Number	Suggeted Holding	Comments
Display Board Assembly includes Keyboard Overlay	419205	1 per site	Can be split to enable replacement of either the display or overlay
Control & PSU Board with Reports & Logs package fitted	416265	1 per site	UL approved Control Board
Control & PSU Board with Reports & Logs package fitted	416243	1 per site	Non UL approved Control Board
Search head Board Single frequency	416180	1 per site	Requires dedicating
Dual frequency Transmitter switch daughter board	416284		Contact your group service centre special items that require factory dedication.
Dual frequency Crystal daughter Board	416282		
Dual frequency L1 daughter board	416283		
Dual frequency search head board	416180	modified	
Dual frequency receiver board	416289		
Serial Link Board	416245	1 per site	Only if fitted to equipment
External Sensor Board	416244	1 per site	Only if fitted to equipment
Control Box Door Seal	114088	1 per site	
5 mm Allen Key	809125	1 per site	
Harsh Environment Keypad Cover	205297	1 per site	Only if fitted to equipment
Reject relay protection fuses	517026	5 per site	
Incoming AC supply protection fuse	517033	3 per site	Replacement is limited
+/- 12v DC rail protection fuse	517104	2 per site	Re-settable type
Silicone Rubber	804006	1 per site	Used to seal the keyboard overlay only if required
Hex pillar (12mm)	124139	5 per site	
Hex pillar (15mm)	124141	5 per site	
Hex pillar (50mm)	124140	5 per site	
Hex pillar (12mm)	124139	5 per site	
Plastic gland hole plug (20mm)	116085	2 per site	Seals unused gland holes
Water tight gland hole plugs (20mm)	116120	2 per site	Seals unused gland holes
Nut for 20mm gland plug	116123	2 per site	
Water tight gland hole plugs (16mm)	116119	2 per site	Seals unused gland holes
Nut for 16mm gland plug	116122	2 per site	
PSU Safety Cover	215593	1 per site	Only if required
PSU Terminal Cover	205812	1 per site	
Two piece PSU Safety Cover upgrade kit	6120PL873		Replaces single piece cover
If your unit has a lamp stack fitted			
Green lens	415146	1 per site	Which lenses are stocked will depend upon the lamp stack combination fitted
Blue Lens	415144	1 per site	
Amber Lens	415143	1 per site	
Red Lens	415145	1 per site	
Bulb	415148	4 per site	

SERVICE RETURNS FORMS

CONTENTS

Instructions 2

Form 3

INSTRUCTIONS

For goods to be returned to Loma, the user must complete the Returns Form. Please photocopy the laminated form.

Please ensure that the following is entered on the form:

1. Company Name
2. Date
3. Description of the goods being returned
4. Reason for return - please provide a reasonable description of the fault condition.
5. Serial Number of the item if applicable.

Details can be found on the label that is located inside the Control Unit, on one of the side sections (an example of a typical label is shown below)

Please refer to 'The Loma Group Service Centres' information at the front of this manual for the correct addresses of the respective service centres for the UK, USA, Canada etc.

An agreement of the carriers used must be agreed with Loma.

North American Customers please phone your local Group Service Centre for a return authorisation number.

LOMA SYSTEMS

METAL DETECTOR

Manufactured by :
Loma Group PLC
Farnborough, Hampshire, U.K.
Tel : 01252-893300

Perfect Inspection Solutions

Model :		Frequency :	
Head Serial No :		Coil Gap :	
Control ID No :		Rx Distance :	
Date of Manufacture :		Filter Values :	R
Aperture Size :	W x H	PEC Length :	
		Power :	85-265V, 50-60Hz

For Sales & Service please consult your User or Service manual

RETURN FORM

Customer:		Date.	
Serial No.			
Description of Item:			
Description of Fault:			
Authorisation Number North America only			