

## Series 1200E Pipeline Metal Detector



# INSTALLATION GUIDE AND OWNER'S MANUAL

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#### GENERAL INFORMATION

#### DESCRIPTION

The Advanced Detection Systems Series 1200E pipeline metal detector is suitable for the detection of ferrous and nonferrous metals in all types of pumped products such as food products, chemicals, plastics, or other products where metal can have an unwanted consequence. In addition to providing excellent product quality control, it provides protection for machinery by letting you know there is metal in your product before it causes costly damage.

Pipeline metal detector systems are used to inspect pumped products such as liquids or emulsions. It is very important that the temperature and pressure limits of the pipeline not be exceeded. Please see the burst pressure chart (Figure X) in this manual. Remember, the maximum operating pressure should not exceed ½ of the burst pressure.

The metal detector search head is manufactured to suit specific product requirements, thereby ensuring maximum sensitivity. It is essentially a single oscillator-driven loop with twin receiving coils. All three coils are mounted in a welded stainless steel enclosure and completely filled with epoxy for protection against water and vibration.

When correctly balanced, the signals in the two receiving coils cancel (i.e. they are equal in magnitude and opposite in sign). As metal passes between the oscillator and a receiving coil, the current induced in that coil changes. This causes an imbalance which is amplified and detected in the electronic control unit.

The Series 1200E metal detector uses surface mount technology and integrated circuits. All electronic components are mounted on a single circuit board. Automatic balance compensation eliminates the need for manual balancing. Internal timing circuitry controls reject and alarm devices, and can also be used to stop auxiliary equipment upon detection of metal.

The Series 1200E metal detector is an analog detector with a digital interface. All controls and adjustments are made with a push-button keypad and are shown on the LCD display. Product settings can be stored for quick line changeovers. Other features include dual password protection and built-in detect counter.

#### SPECIFICATIONS

AC Supply - 115/230 volts, 50-60 Hz, 40 VA All units are factory set at 115 VAC unless specifically requested. Voltage is selectable via an internal selection switch. Replaceable fuses as shown below. All are of the fast-acting type.

Main Power	LI - Hot line	3 amp
	L2 - Neutral line	3 amp
Output Power	F1 - Hot line	3 amp
	F2 - Neutral line	3 amp

Note: When a fuse blows it is usually an indication of a short circuit. The condition should be corrected before the new fuse is installed. **ALWAYS REPLACE BLOWN FUSES WITH A FUSE OF THE SAME CAPACITY**.

Stability - Suitable stability is maintained under the following conditions: 32-1150 F (0-450 C) 0-90% humidity ± 10% voltage variation

**Sensitivity** - Sensitivity varies with detector type, size, and product being inspected. As a result, it is quoted separately for each application.

#### INSTALLATION

#### MECHANICAL INSTALLATION

 $\lambda$  The detector must be bolted securely in position, but do not twist or strain it in any way.

 $\lambda$  Nothing should rest on the search head or touch the sides of it.

 $\lambda$  All cover screws, bolts, etc., in the vicinity of the detector must be tight for correct operation. Two pieces of metal making intermittent contact may cause false triggers.

 $\lambda$  Do not modify the metal detector or its wiring in any way.

 $\lambda$  Do not attach rollers, guide plates, markers, or electronic sensing devices to any part of the search head.

 $\lambda$  Product pipes with emulsions should pass through the center of the detector opening, without touching the walls of the aperture.

( If a remote control cabinet is used, the connecting conduit must be secured to prevent movement which could cause false triggers of the metal detector. We recommend fastening the conduit securely every 12".

#### METAL-FREE AREA REQUIREMENTS

( The metal detector should be installed away from all pulleys and motors. Keep all fixed and moving metal outside of the metal-free zone as described in Fig. 1.

( There should be no metal pipes, conduit, supports, or guides near or passing through the metal detector search aperture. Keep metal away!

#### ELECTRICAL INSTALLATION

WARNING: Whenever wiring is to be done to the terminal strip of the detector, make sure ALL sources of power have been disconnected. Terminals 3 through 9 may be powered from sources other than those supplying the metal detector. Caution should be used when working on machinery as components may stop and start automatically without warning.

The metal detector operates from a single phase supply, 115/230 VAC +10%.

Use a power feed that is free of motor start-up transients or other interference. A dedicated circuit is recommended but not required as long as the power feed is "clean."

All power supply grounds for the detector, conveyor, and reject devices must originate from a single point. Multiple grounds should be avoided to minimize electrical noise.

Electrical connections to the metal detector are made via a terminal strip housed inside of the control cabinet. A terminal connections chart is located on page 4 and on the inside of the detector's front cover.

Occasionally, because of excess electrical noise on the incoming power lines, it is necessary to use a constant voltage transformer to remove the interference. The transformer that we recommend, and its wiring diagram is show in FIGURE 8 near the end of this manual.

Main power is applied to the metal detector via Terminals LI, L2, and Gnd. The remaining terminals are used to wire conveyor stops, reject devices, and alarm systems. The rest of this section describes the wiring of such devices.

#### TERMINAL CONNECTIONS

WARNING: Whenever wiring is to be done to the terminal strip of the detector, make sure ALL sources of power have been disconnected. Terminals 3 through 9 may be powered from sources other than those supplying the metal detector. Caution should be used when working on machinery as components may stop and start automatically without warning.

TERMINAL	FUNCTION
LI	POWER INPUT - Hot line
L2	POWER INPUT - Neutral line
GND	POWER INPUT - Ground line
Fl	HOT LINE Output - FUSED – Can be used as a power source for unpowered contacts.
3 4	Output 1 - Isolated unpowered contacts. Keypad selectable as normally open or normally closed.
F2	NEUTRAL LINE Output – FUSED - Used as a return line for reject devices, light, or alarms.
5	Output 2 - Internally supplied power Output to control reject devices, lights, or alarms. Keypad selectable as normally open or normally closed.
F2	NEUTRAL LINE Output - FUSED - Spare.
6 7	Output 3 - Isolated unpowered contacts. Keypad selectable as normally open or normally closed.
8 9	Output 4 - Isolated unpowered contacts. Always configured as normally open. Delay and operate times not adjustable.
Α	+5V SUPPLY (.5A Max) – For use with external pulse generating circuits.
В	PULSE COUNTER INPUT - Used by variable speed conveyors to automatically correct the delay and operate time to compensate for changes in belt speed.
С	MANUAL RESET INPUT - Input for normally open external push-button used to manually reset metal detector after a detection.
D	COMMON - Used as a common input for pulse counter or manual reset controls.

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#### Outputs For Reject and Signal Devices

The detector has internal timing circuitry for the control of a variety of reject and alarm devices. Instructions for setting the reject delay and operate timing are given later in this manual.

The outputs that are configurable can be changed by using the keypad (see Menus 67 - 70 on the flow chart).

Three outputs are unpowered, or dead, contacts; in order to use them to control reject or alarm devices, a power source must be supplied. The customer may supply the source or use the fused 115 VAC source available at Terminal F1.

If the metal detector and pipeline system were ordered as a system on a support stand from the factory, all interconnections have already been made.

Output 1	Can be fully configured	Unpowered
Output 2	Can be fully configured	Fused 115 VAC source supplied by the detector.
Output 3	Can be fully configured	Unpowered
Output 4	Always normally open; cannot be adjusted for reject delay or operate time.	Unpowered

## Wiring for Auxiliary Equipment Stop on Detection of Metal See Fig. 2.

Instructions for setting the delay and operate timing are on page 18. Wire the equipment motor control relay in series with Output 1 Terminals 3 and 4. Check the front panel to confirm that Output 1 is configured as normally closed.

When metal is detected, Output 1 contacts 3 and 4 will open and cause the control relay in the motor starter to de-energize, thus stopping the external equipment. This occurs after the delay time has elapsed.

Use the delay time if you want the external equipment to stop after a certain period of time. If you want the equipment to stop immediately, set the delay time to zero. (Use the keypad and Menus 60 and 61.) The equipment may be restarted after the operate time has elapsed.

**WARNING:** Do not wire full motor voltage through the metal detector contacts. They should be used for control voltage only.

## Wiring for a Reject Device, Light, or Alarm See Fig. 3.

Verify that the device is rated for the correct voltage. Devices that activate when power is applied should use the normally open configuration. Devices that activate by an interruption of power should use the normally closed configuration.

Output 2, Terminal 5 is an internally supplied 115 VAC that can be used to activate various reject devices and alarms. The device should be connected to Terminal 5 and to either of the terminals labeled F2. Set the delay and operate times as required; instructions for setting the timing are included later in this manual. If the unit was purchased as a system from the factory, Output 2 is already pre-wired to the reject divert valve.

Alternate method: Outputs 1, 3, and 4 can also be used to control reject devices, lights, and alarms. However, these outputs are unpowered, or dead, contacts. A power source must be supplied by an external means or it may be supplied by the metal detector via terminal F1.

Connect the power source to:

Terminal 3 for Output 1, Terminal 6 for Output 3, or t Terminal 8 for Output 4.

The device can then be connecte Terminal 4 for Output 1, Terminal 7 for Output 3, or to Terminal 9 for Output 4.

0	Output Connections		
	OUTPUT	SOURCE	DEVICE
cte	1	3	4
	3	6	7
	4	8	9

The remaining side of the device is connected to Terminal F2 to complete the circuit. Set delay and operate times as required; instructions for setting the timing are included elsewhere in this manual. Note: Delay and operate times cannot be set for Output 4.

#### Front Panel Indicators

See Fig. 4.

**1 - PRODUCT TYPE** - Indicates the type of product the metal detector is set to inspect:

 $_{v}$  "On" indicates DRY products or products low in moisture, salt, or fat.

v "Off" indicates WET products or products high in moisture, salt, or fat. Use the keypad and Menus 52 and 53 to change product type.

2 - FIELD STRENGTH - Indicates the intensity of the inspection field: v "On" indicates HIGH intensity, which is appropriate for most products v "Off" indicates LOW intensity, which is used for very conductive products. They produce a large "product effect" signal even if metal is not present. To determine if your product should use high or low field strength, observe the calibration indicators as the product passes through the metal detector. If the lights brighten as the product passes, then the field strength should probably be set on low.

Use the keypad and Menus 49 and 51 to change field strength.

**3 - DETECT** - Indicates that the metal detector has detected metal. The indicator will come on immediately upon detection of metal and will remain on until the detector resets. The length of time the indicator remains lit is directly proportional to the size of the metal that was detected.

The DETECT indicator also shows the status of Output 4. The Output is active whenever the detect indicator is on.

4 - Output 1 - Indicates whether Output 1 is normally closed (on) or normally open (off).

Upon detection of metal, the indicator will change temporarily to show the condition of the

Output 1 relay.

Use the keypad and Menus 68 and 69 to choose "open" or "closed."

5 - Outputs 2 & 3 - Indicates whether Outputs 2 and 3 are normally closed (on) or normally open (off).

Upon detection of metal, the indicator will change temporarily to show the condition of the Output 2 & 3 relays.

Use the keypad and Menus 68 and 70 to choose "open" or "closed."

**6 - CALIBRATION** - Indicates the condition of the metal detector coil assembly.

Metal detectors operate at peak sensitivity when the sensing coils are tuned, or balanced.

In normal operation, indicator "A" should be on, "B" should be on but dim, and "C" "D" "E" should be out.

If the detector loses calibration, indicators "C" "D" "E" will light, in that order, and the balance adjustment should be attempted. See "Balance Adjust" on page 15. When indicator "C" becomes as bright as indicator "A," there has been a significant loss of detection sensitivity and the balance adjustment should be completed.

7 - LCD DISPLAY - A 20-character, four-line, backlit liquid crystal display used to show menu items and current metal detector operation.

8 - PUSH-BUTTON KEYPAD - A 12-key fully waterproof keypad used to enter menu selections and to change metal detector settings.

The Series 1200E keypad is mounted externally. On older models which have been retrofit, the keypad may be mounted on the inside of the door.

**9 - BALANCE ADJUST ACCESS** - This allows access to the balance adjustment screw.

#### NAVIGATING THE MENU

A "Menu Flow Chart" (Fig. 5) shows all of the possible commands which can appear on the display, and their relationship. We've tried to simplify the menu system by minimizing the number of screens and buttons. With a little practice, it should become quite easy to find your way around.

Each menu is numbered on the flow chart, and the connecting lines and arrows create a "highway" map to guide you through the system.

When power is applied, the metal detector will sequence through a number of self-test screens, ending with Menu 7. This screen is the "RUN" menu, and it will appear on the display whenever the detector is operational. The "RUN" display shows which product number the metal detector is ready to inspect. It also shows the number of detections that have occurred since the counter was last reset.

The top line indicates that the unit is in "RUN" mode, followed by a status indicator. If all is normal, the status will show "UNIT OK." During detection, the status will show "REJECT ACTIVE." If for some reason the output relays have been deactivated, the status indicator will show "NO REJECT." The top line will alternately flash with the time and date.

The bottom line of all menu screens will give the operator some indication of how to proceed if a change needs to be made.

The \* key is used to scroll through the items on the screen. Pressing the # key activates that item (wherever the cursor is), and moves you to the next menu.

If you need to enter a number, use the number keys. Then press the # key ("enter") and the new value will be entered. Pressing \* key ("escape") will allow you to leave that screen without changing the value.

#### SET-UP PROCEDURES

#### SETTING THE DETECTOR TO COMPENSATE FOR PRODUCT EFFECT

One of the basic principles that should be understood before adjusting the metal detector is product effect. Almost all products inspected are conductive to some degree, and create a signal which is picked up by the metal detector. This occurs without the presence of metal. This product effect will cause the detector to false trip, and must be suppressed in order to make reliable detection possible.

Product effect is caused mainly by moisture, but can also result from product acidity, fat, mass, temperature, or salt (when combined with moisture).

Products can be classified as wet or dry. Wet products, such as fresh meats, cheese, and pickles create large product effect signals.

Vegetables, bakery, and pasta produce a smaller signal but are still considered wet. Dry products, such as paper, plastic, rice, frozen items, and nuts, produce a small signal or no signal.

Metal detectors are designed to "tune out" or compensate for the signals created by the product. The following section describes how to set up the metal detector and compensate for product effect.

#### METAL DETECTOR AUTO-LEARN PROCEDURE (MENUS 31 THRU 41)

It is a good idea to read the following section "Tips for Successful Auto-Learn" before beginning the auto-learn process. For the following procedure, please refer to the menu flow chart.

Navigate to menu 31, select "Learn new product", and press "enter". At this point you must decide whether your "Product Type" is wet or dry and if the "Field Strength" should be high or low. An explanation of these screens is shown earlier in this manual. With pipeline type detectors the settings should almost always be High and Dry. The display will then progress to menu 34. Make sure the product pump is stopped and stand away from the detector while it learns the environment. During this time menu 35 will be shown on the display. After the environment has been learned the screen will automatically switch to menu 36. Now turn on the product pump. Press # and again stand clear while the metal detector gets a good idea of what type of product you will be inspecting. During this time menu 37 will be shown on the display. The detector will automatically progress through menu 38 and will stop on menu 39. At menu 39 press # and allow about a second's worth of product to pass through the detector. During this time menu 40 will be shown on the display. It is very important not to interfere with the metal detector during this period of time because it will adversely affect the learn function of the detector. After a second's worth of product has passed through the detector opening press the # key again. This completes one "pass" and menu 39 will reappear on the display. Because of the variety of different products it is not possible to determine the number of "passes" required for the detector to fully learn the product. It may require as few as three "passes" or as many as 12. When the detector has enough passes it will progress to menu 42 and then to menu 43. At menu 43 select the product number you wish to use for this product and press enter. This will return you to the "RUN MENU" and the detector will be ready to inspect the product. If for some reason the detector was unable to learn the product it will progress to menu 41 and then back to menu 31. A typical reason for failure would be that the "Product Type" or "Field Strength" was set incorrectly.

#### TIPS FOR SUCCESSFUL AUTO-LEARN

Follow these hints to assure the best results when learning product:

1. Pick a sample product that is representative of products that will be run during production.

2. Make sure the learn procedure is done under the same conditions as production. For example, if the product being inspected is at 40 degrees, make sure the sample used in learn is at 40 degrees. Variations in product temperature change the product signal a great deal.

3. Make sure the sample product is uncontaminated by metal. If, by chance, a contaminated product is chosen for the learn procedures, then the metal detector will "think" that metal contamination is acceptable, and not reject it.

4. Keep moving metal objects away from the metal detector head during learn. Putting hands near the detector aperture can cause poor results especially if the operator is wearing rings, watches, or other metal objects.

5. Remember that during the learn time the metal detector is learning what is acceptable. During this time keep vibration, metal, and any other items, including hands, away from the metal detector.

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#### MANUAL SET-UP

If for some reason you prefer to set up the metal detector manually, follow these steps to determine the best phase and sensitivity settings for your product. These will be the optimum settings for reducing the product effect, and can be stored in memory for later recall.

If a reject device has already been connected, disable the device while you're determining the product settings. Use Menus 57 - 58.

#### 1. Set "Wet" or "Dry."

Check that the wet/dry indicator is in the correct position. "Dry" is for non-conductive products; "Wet" is for conductive products. If you are uncertain of your product type, then begin with the indicator in the dry position. Use the keypad and Menus 52 and 53.

2. Set field strength to "High." Check that the field strength indicator is in the high position. It should be set to low only for very conductive products such as some fresh meats, cheese, and pickles. Use Menus 49 and 51.

3. Set sensitivity at 30 and phase at 0. Use Menus 46-48.

(Note: In the following steps the detector will trigger when the settings are changed. Allow sufficient time for the metal detector to reset after changing settings before determining if the detector is triggering on the product.)

4. Pass the product through the metal detector. See "Tips" elsewhere in this manual.

5. If the product is detected, increase the phase setting by 10 until a point is found that allows the product to pass without being detected. Record this setting on a chart as indicated in Fig. 6. If no setting can be found which allows the product to pass, follow procedures for "Set-Up of Difficult Products."

6. Continue to increase the phase setting by 10 until the detector again detects the product. On the chart, record the last setting that allowed the product to pass without being detected.

7. Increase the sensitivity to 40 and repeat Steps 3 through 6.

8. Continue this process, increasing the sensitivity by 10, until the product is detected at all phase settings. If you do not find this point, see "Adjustment of Sensitivity Range."

9. Ultimately a low and high phase setting will be determined for each sensitivity setting. Plot this on a graph, similar to Fig. 6.

After plotting, a curve will form. All points inside the curve indicate settings that allow the detector to overlook any product effect. Points outside the curve are settings which would result in false detects caused by the product itself.

The optimum settings are found at the highest sensitivity within the curve. It should be noted that the more consistent the product, the closer the settings can be to the lines of the curve. Less consistent products will cause the curve to move slightly with each product. When this occurs, the final settings should be well within the curve to prevent false detects from occurring due to the product differences.

#### Storing the settings in memory:

Once the optimum phase and sensitivity settings have been determined, they should be entered using Menus 46-48. Next, a product number of 1-100 should be assigned and stored in memory using Menus 52 and 54.

The settings for up to 100 products can be saved. For reference, a list of assigned product numbers should be maintained. The settings are saved permanently unless you choose to change them; loss of power will not affect product memory.

#### OPERATION

After product set-up has been completed, the detector is ready for operation and should have the "Run" menu (#7) on the display. Check that the product selection shown on the display is correct.

On detection of metal, the reject device, light, and or alarm will activate after the "delay" time has elapsed. This is caused by the detector's output relays changing state.

The reject and signal devices will continue to operate until the "operate" time has elapsed.

Similarly, any auxiliary equipment that has been wired to stop upon detection will do so after the "delay" time has elapsed. Unlike rejects, however, the auxiliary equipment usually must be restarted by depressing the start button on the equipment's motor starter. The equipment will not start until the metal detector operate time has elapsed. (Refer to "Wiring for Conveyor Stop"). If the device or equipment does not operate this way, the outputs may have been turned off via the keypad.

#### SET-UP FOR DIFFICULT PRODUCTS

If no phase setting can be found which allows the product to pass through the unit undetected, change the wet/dry indicator to the wet position (use Menus 52 and 53). Return to Step 3 of "Manual Adjust".

If a phase setting still cannot be found, set the wet/dry indicator to dry and the field strength to low. Use Menus 52 and 53 and Menus 49 and 51. Try Step 3 again.

Finally, if a phase setting still cannot be found, set the wet/dry indicator to wet and the field strength to low. Return to Step 3.

If you are still unable to find a phase setting that allows the product to pass undetected, see the pages on "Mechanical" and "Electrical Installation" and review them for possible problems. If no solution can be found, consult the factory.

#### ADJUSTMENT OF SENSITIVITY RANGE

NOTE: In the Auto-Learn mode the sensitivity range is automatically set by the metal detector.

The metal detector is supplied with the sensitivity range set to the correct value for the product being inspected and the sensitivity desired. On rare occasions the range may need altering if the metal detector has too little or too much sensitivity. Use Menus 49 and 50.

Increasing or decreasing the range value will cause the curve of the graph in Fig. 5 to shift upward or downward to allow for a proper phase setting. Raising the range value will increase the metal detector sensitivity and the curve will move downward. If the curve only partially appears on the graph, decreasing the range value will cause the curve to shift upward.

CAUTION: Be aware that raising the range value to increase the detector's sensitivity to metal particles will also result in the detector being more susceptible to outside interferences such as vibration, electrical noise, and moving metal. We do not recommend setting the sensitivity range higher than 8.

#### **REJECT AND SIGNAL DEVICES**

Normally open (N.O.)/Normally closed (N.C.) - Outputs 1, 2, & 3 can be configured as normally open (N.O.) for devices that require power to operate or as normally closed (N.C.) for devices that require an interruption of power to operate. Use the keypad and Menus 67-70.

**Reset Auto/Manual** - In "auto" mode, the delay and operate time will control when the metal detector outputs are activated and reset. This allows for unattended operation. In "manual" the operate time is disabled and the detector must be reset with an external push-button that is normally open. Use the keypad and Menus 57 & 59 to change from "auto" to "manual" modes.

**Reject On/Off** - Enables or disables all of the detector outputs. It is especially useful to have the reject device disabled during the product set-up process. Use the keypad and Menus 57 & 58.

**Delay Pulse/Time** - After metal has been detected the metal detector output can be delayed by timing circuits as described above. This works well for conveyor belts that move at a constant speed. In the case of variable speed drives or conveyors that stop and start occasionally another method of timing is required. A pulse counter circuit is the best alternative (see below). Use the keypad and menus 63 & 65 to select whether timing should be controlled by the pulse counter or by the detector's internal timers. Set Pulse Count - In the pulse mode the reject timing is controlled by a pulse generator attached to one of the conveyor pulleys. The generator creates 100 pulses per revolution of the conveyor pulley. The metal detector has internal circuitry that will count the selected number of pulses before the reject device is activated. Use the keypad and menus 63 & 64 to set the pulse count.

The metal detector is usually mounted on a conveyor that transports product to be inspected through the aperture of the search head. A reject device such as an air blast or sweep arm is located some distance from the metal detector. In order for the device to reject just the contaminated product, at the correct time, timing parameters need to be set:

**Reject delay time** - Sets the time between detection of metal and the activation of the reject device. It can be adjusted in tenths of a second from 0-30 seconds. For pipeline reject systems the product is usually moving fast enough that no delay time is needed. If the product is moving slowly then the delay time can be set using the keypad and Menus 60 & 61. 13

**Reject operate time** - Sets the time that the reject device stays activated. It can be adjusted in tenths of a second from 0-30 seconds. Use the keypad and Menus 60 & 62.

In general, longer reject operate times result in more product being rejected, and a greater insurance that the product containing the contaminating metal is diverted from the product stream. Shorter operate times save product from the reject bin at the cost of a greater chance of contaminated product not being rejected.

#### Setting the Timing of the Reject Device

To determine the settings for delay and operate timing, run a product with a metal contaminant sample through the detector.

For pipeline reject systems the product is usually moving fast enough that no delay time is needed. If the product is moving slowly then the delay time can be set using the keypad and Menus 60 & 61.

If the product is loose on the belt, or a continuous product such as in a pipeline, the reject operate time should be enough to allow "one metal detector depth" of product to be rejected. This is the amount of product that fits in the distance between the front edge of the metal detector and the back edge of the detector.

Enter these delay and operate times using Menus 60 thru 62. The times can be adjusted in tenths of a second from 0-30 seconds using the keypad

If you change product, be sure that the delay and operate timing is appropriate for the new product size.

#### ADDITIONAL FEATURES

#### DATE/TIME SET-UP

The metal detector has an internal "real-time" clock that keeps track of the current date and time. It is set at the factory and normally would not need to be adjusted. However, to compensate for different time zones and for changes in Daylight Savings Time, etc. use menus 66, 72 & 73 to change the detector's date and/or time.

#### PERFORMANCE VALIDATION

The metal detector can be set to stop all operations up to three times per day and wait for a sensitivity test before resuming normal operations. This will ensure that the detector is operating at the correct sensitivity for quality control. The validation times can be set using menus 22-24 or the feature can be turned off by using menu 21. A high level password is required to access the performance validation feature.

#### PRINT/REPORT FUNCTIONS

An optional portable printer is available to print various reports. The printer is plugged into a connector found on the metal detector control cabinet. We suggest the use of the printer supplied by Advanced Detection Systems. Other printers may not work correctly.

Using menus 12 & 13 two different reports are available:

Current product settings - This will print a list of the current sensitivity, phase, range, etc., setting for each of the products in the detector memory. The products printed are selectable using menu 14.

Event list - The metal detector will keep track of the last 100 "detect" events. This list can be printed using menu 13. The list can be erased after printing using menu 17 or directly using menu 16 & 17.

#### CONTRAST ADJUST

The contrast of the metal detector display can be adjusted by using menus 25 & 27. This is only true of the LCD type displays. The brighter vacuum florescent displays are not adjustable.

#### BALANCE ADJUST

In order for the metal detector to operate at peak sensitivity the receiver coils of the search head must be maintained at the correct balance. The detector has automatic circuitry built in to maintain the balance of the coils and this adjustment would not normally be required. On occasion balance adjustment may be necessary due to extreme changes in operating environment, physical changes, or aging of the metal detector components. To adjust the balance use menus 55 & 56 and the balance access hole on the front of the control panel. Rotate the balance adjust for the minimum reading on the display.

#### DETECT COUNTER

The detect counter is used to indicate the number of times metal has been detected since the counter was last reset. Reset the counter during product changeover for more accurate product run information. To reset the counter, use Menu 10.

#### PASSWORD PROTECTION

The Series 1200E is dual password protected to avoid unauthorized tampering. A low level password is required to move beyond the "Run" menu (#7) and a high level password is needed to access the performance validation feature or the product options and detector settings. All detectors are shipped from the factory with both passwords set at " 1234. " To install a custom password, use Menus 25-26 or Menus 74-75. NOTE: Once a password has been entered, access is granted for 20 minutes and the password need not be entered again until the time expires.

#### PRODUCT CHANGEOVER

Product changeover is a simple matter. If the settings for the new product have already been learned, use Menus 10-11 to select that product. If the settings have not been stored, use the setup procedures earlier in this manual.

#### **RESTORE DEFAULTS**

Menu 76 can be used to reset the entire metal detector memory to the factory settings, CAUTION should be used with this feature as it will reset all product settings, reject timing settings, etc., and all stored settings will be lost. The password will be restored to the default setting of 1200.

#### TROUBLESHOOTING

WARNING: Whenever wiring is to be done to the terminal stop of the detector, make sure ALL sources of power have been disconnected. Terminals 3 through 9 may be powered from sources other than those supplying the metal detector. Caution should be used when working on machinery as components may stop and start automatically without warning.

Most faults found with metal detector installations occur in the external system or in the surroundings of the machine. As a result, the best way to troubleshoot a detector is to go through the mechanical and electrical installation sections.

Remember:

There should be one ground to the detector, conveyor, and reject.

The metal detector should be installed away from pulleys and motors.

All support feet should be firmly on the floor to prevent rocking.

There should be no fixed or moving metal within the metal-free zone.

Nothing should be in contact with the inside of the metal detector aperture.

Voltage sags or surges greater than 10% can cause false triggers.

Two pieces of metal making intermittent contact in the vicinity of the detector will cause false triggers. Check for loose nuts and bolts.

#### INTERMITTENT FALSE TRIPS

Observe the surroundings.

When the detector trips, try to figure out what could be causing it.

Look for two pieces of metal making intermittent contact in the vicinity of the metal detector.

Look for starting/stopping of nearby machinery.

Verify that the electrical ground to the detector is making solid connection.

Check for static electricity around the metal detector. Control static by using an antistatic spray or by grounding the support frame and pipe.

If the detector has a remote mounted control cabinet, make sure that the connecting cable is securely fastened to prevent movement. Check to see if the rejection device is binding when it moves, causing excessive vibration.

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#### CONSTANT FALSE TRIPS

Check to make sure that the product being inspected has not changed in any way. If a product changes in moisture, temperature, or mass it will change the product curve and the current settings could fall outside of the curve, causing false triggers. If this occurs, return to the set-up portion of the manual and reset the detector for the new product parameters, or re-learn the product using Menu 31.

Observe the five calibration indicators on the front panel. If indicators "C" "D" or "E" are brightly lit, the detector is out of balance and you should call the factory.

Check to make sure that there are no devices in the area that are transmitters of radio frequencies. They will interfere with the detector and cause false triggers.

Check for metal in the metal-free zone.

Call the factory for support.

#### REPLACEMENT OF THE CIRCUIT BOARD

Failure of the circuit board is rare. Be sure that you have eliminated all other possible problems before proceeding. To replace the circuit board:

1. Turn off power to the metal detector. Be sure all additional sources of power to the output circuits have also been turned off.

2. Remove the aluminum cover plate by removing the six retaining screws. Newer detectors do not have an aluminum cover plate. The plate has been eliminated and the display has been mounted to the back side of the door assembly.

3. Disconnect the two large plugs near the top of the circuit board. Also unplug the display, keypad, and LED power cables.

4. Remove the wires from the terminals at the bottom of the circuit board. It's a good idea to tag each of the wires for easier relocation.

5. Remove the eight screws that hold the circuit board in place.

6. Remove the circuit board and put it in a safe place. The replacement circuit board is shipped in a conductive pouch. The defective circuit board should be placed into the pouch and returned to the factory for repair.

Installation is the reverse of the above.

FIGURE 1 METAL-FREE AREA REQUIREMENT



### FIGURE 2 ELECTRICAL SCHEMATIC FOR CONTROLLING AUXILARY EQUIPMENT ON DETECTION OF METAL

230 VAC





## FIGURE 3 ELECTRICAL SCHEMATIC FOR REJECT DEVICES

230 VAC



## FIGURE 4 FRONT PANEL LAYOUT



## FIGURE 6 SAMPLE SENSITIVITY GRAPH

Sensitivity	Phase	
	Low	High
S10		
S20		
S30	20	100
S40	40	100
S50	50	90
S60	50	80
S70	60	75
S80	60	75
S90	65	75
S100		



X = Optimum settings for consistent product  $\Box = Optimum$  settings for less uniform product

## Figure 7



## FIGURE 8 CONSTANT VOLTAGE TRANSFORMER

SOLA HD CVS SERIES, CATALOG # 23-22-112-2, 120 VA

#### CVS Hardwired Series - Constant Voltage Transformers

Superior voltage regulation of ±1% sets the CVS series apart from other power conditioning technologies on the market. Extremely tight regulation is accomplished by Sola/Hevi-Duty's patented ferroresonant transformer technology. The CVS recreates a well regulated sinusoidal waveform that is well isolated from input disturbances including:

Swells

Sags

- Impulses
- Brownouts
- Severe waveform distortion

No other power conditioning technology provides as complete a solution against these power quality disturbances. The CVS series is ideal for applications where even a small change in voltage level can lead to unscheduled downtime, misoperation, incorrect data or scrapped production.

#### Features

- Superior voltage regulation of ±1%
- Surge suppression tested to ANSI/IEEE C62.41, Class A&B Waveform
- Harmonic filtering
- Hardwired
- Acts as a Step-up/Step-down Transformer
- Galvanic isolation provides exceptional circuit protection.
- 25 year typical Mean Time Before Failure
- No maintenance required



#### Applications

- Industrial automation and control equipment PLCs
- Analytical laboratory and factory automating equipment
- Photo processing equipment
- Sound/recording systems
- Photographic enlargers
- Broadcast equipment





LAMINATION GROUND

INCOMING POWER GROUND, EITHER 120V OR 230 V SHOULD BE CONNECTED HERE. ALSO OUTPUT LEAD X2 SHOULD BE CONNECTED HERE.

#### PROCEDURE FOR BALANCING A MODEL 1200 SEARCH HEAD (Refer to the circuit board drawing and front panel layout drawing) Please read the entire instruction sheet before beginning.

Observe the five red "calibration" LED's on the detector's front panel. Normally, the LED on the left, and maybe the second LED, will be lit to full brightness and the center LED may or may not be lit, but should be at some brightness level less than full. The two LED's on the right will be unlit. If the center LED becomes bright or if either of the two LED's on the right becomes lit, the metal detector should be rebalanced. When the metal detector is first turned on, it will cycle through a "self test & calibration sequence". During this time there will be a "residual" value displayed on the screen. As the detector becomes more balanced, this number will begin to decrease. Make note of the lowest number seen on the screen before the detector moves on to the next display. If this number is above 500, then the unit should be rebalanced. The procedure is as follows:

Refer to the front panel layout and the circuit board drawing attached.

- 1. Remove screws from main door assembly. The keypad is attached to the detector by means of a ribbon cable. Remove the door carefully to protect the ribbon cable.
- 2. Remove the six screws from the front panel of the circuit board. The front panel is attached to the circuit board with two ribbon cables. Lean the front panel forward, being careful not to unplug either of the ribbon cables. CAUTION: There is live power on the terminal strip at the bottom of the circuit board. Make sure that nothing, including the front panel, comes into contact with the terminal strip.
- 3. On the circuit board layout drawing attached, locate jumper J6 and the Reset button SW1 (approximately in the center of the circuit board). In normal operation the J6 jumper is not jumpered across its pins.
- 4. Place the metal detector in "maintenance mode" by placing the J6 jumper across the two horizontal pins. Press and release the reset switch SW1. The onboard computer has now been restarted in the maintenance mode.

A flow chart of the maintenance menu is attached. The remainder of this procedure will be explained using menu numbers and will assume that you are familiar with moving from screen to screen using the \* key to scroll and the # key to enter.

5. Navigate through the menus to screen #12 and set the calibrate pot to 50. This is VERY important!! Even if the screen says that the current setting is 50, you should enter 50 as the new setting and press enter. Scroll through to find an exit and return to screen #3.

A brief description of the detector's circuits may be helpful at this time. Refer to the circuit board layout for the following explanation. The receiver section of the detector consists of two receiver coils. These coils are connected to the circuit board via the blue coaxial cable plugged into J3. One coil is connected between ground and TP2, the other is connected between ground and TP4 near the top right of the circuit board. The output of these coils must be exactly "balanced" for correct operation of the metal detector. The metal detector does have an automatic balance feature that will maintain this balance after the initial calibration has been set. The detector is factory balanced by installing resistors and/or capacitors between TP2 and TP7 and/or between TP4 and TP5. Sometimes, due to environmental changes, these values need refining. The capacitance can be varied somewhat by means of the trimmer and the resistance in order to regain the factory balance.

- 6. Observe the five red "calibration" LED's on the front panel. Think of the calibration LED's as a "bar graph" type display. The goal is to get the lights as dim as possible. You may also watch the "residual" reading on screen #3 to achieve the minimum numeric value.
- 7. Refer to the circuit board layout and locate the trimmer capacitor adjustment (top center, slight right, marked C1).
- 8. Adjust the trim capacitor to dim the LED's as much as possible or to get the lowest value on the residual reading. It is important to be careful when making this adjustment so that the screwdriver does not slip off of the adjustment and damage the trim capacitor. If this happens, the circuit board will normally need to be returned to the factory for repair. It is best to use an adjustment tool with a captive type adjuster at one end. Leave the trim capacitor set at the point where the LED's are at their dimmest.
- 9. Next, adjust the potentiometer while watching the LED's or the numerical value until the lights are at their dimmest or the numerical value is at its lowest.
- 10. Alternately adjust the trim capacitor and the potentiometer to get the LED's as dim as possible. If you can get the LED's to something less than the first three at full brightness or the numerical value below 500, this should be sufficient. However, try to get the number as low as possible.
- 11. Un-jumper the jumper at J6 and restart the detector by means of pressing the reset switch, SW1. Store the J6 jumper on one pin only for future use. The metal detector should go through its self-checking and should pass the self-balancing test.

#### NOTES

- A. If, during steps 8-10, you are unable to get the LED's to go dimmer or the numerical value to go below the maximum (approximately 1724), then reduce the field strength to low. This can be done by navigating to screen 24 and setting the Field Strength to "low". After completing step 10 with the setting at low, make sure that you go back and reset the field strength to high and complete steps 8-10 again.
- B. This balancing procedure will work for all Model 1200 metal detectors. If you have questions, please give us a call. If you are confident that you are doing the procedure correctly and are still not getting results, then there is probably something else wrong and either a service technician is required on site or the detector must be returned to the factory for repair.

#### **MAINTENANCE MENU FLOW CHART 1200**

