

RG NDT INTERNATIONAL INC

RaycoLog 3500/6000 EMI  
Tubing & Casing Inspection System

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User Manual

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## **GENERAL OVERVIEW**

**The inspection desk is dedicated to the inspection of Tubing & casing for the inspection of Transverse and longitudinal three dimensional flaws and wall or metal loss.**

Eight flaw detecting shoes contain small coils to detect flux leakage caused by flaws and the two longitudinal shoes. The detected signals are amplified, digitized and processed via a Z2120 single board computer. The largest indication from the ODD channels is extracted and displayed (output number 3) and the largest indication from the EVEN channels (output number 4) is extracted and displayed. The display is on too medium: a thermal recorder and a laptop computer. The electronics also feature a signal "hold" card to assure that the computer recognizes the significance of every indication.

The wall monitoring station employs an encircling array of Hall effect devices that monitor the product traveling through the station. These non-contact transducers detect metal loss and material grade changes. Changes in metal thickness and grade permeability changes are detected and processed via a second Z2120 single board computer. This second computer provides also two (2) outputs, the first output indicates the average wall thickness (trace Number 1) and the second output indicates the minimum wall or the greatest change in permeability (trace Number 2). Note that Drill Pipe and Tubing metal hardness alters magnetic wall thickness indications.

The electronic desk houses: two (2) computers, flaw detection preamplifiers, flaw peak detectors, an interface card for magnetic wall, electronic power supply, magnetizing power supply, a four (4) channel thermal recorder, and a four (4) channel computer interface. The controls allow the operator to set sensitivity and linearity. Alarms are both audible and visual. Tracking numbers can be placed on the chart through a special keyboard and streamlined to memory.

## **THE FLAW DETECTING AND PROCESSING SYSTEM**

The Z2120 has the following seven (7) control keys:

1. A right arrow key to move the a cursor to the right,
2. A left arrow key to move the cursor to the left,
3. An Up arrow key to move the cursor up,
4. A down arrow key to move the cursor down,
5. A “+” key to increase the gain,
6. A “-“ key to decrease the gain,
7. An “enter” key to lock the desired setting.

In addition:

1. A ten (10) turn potentiometer labeled REJECT allows linear rejection of small noise indications from the thermal recorder and the laptop computer screen,
2. A switch labeled ALARM enables the audible alarm,
3. A switch labeled FAST enables fast operation while disabling the display screen. This switch should be in the FAST position while inspecting pipe.

The Z2120 features a display (122x32 LCD) screen that is both graphical and alpha numeric. Vertical bars labeled 1 through 8 indicate the flaw signal levels. A vertical bar labeled Y, with a dashed line on top indicates the Questionable threshold. A vertical bar labeled R, with a dashed line on top indicates the REJECT threshold. The right hand of the display contains the alpha numeric information.

The first line indicates the program version “inspect 3”.

The second line allows moving from the RUN mode to the (CAL) mode and to the reset (RST) mode. This is accomplished when the FAST/RUN switch is in the RUN mode and the cursor is addressed through the “UP” arrow to the RUN<CAL<RST line. The RIGHT and LEFT arrows buttons allow moving from one mode to the other. The action should be followed up with the RETURN BUTTON.

The RUN mode allows seeing all channels in a slower inspection mode.

The CAL mode allows a single scan to be stored on the computer screen.

The RST mode allows return to default gain settings.

Each mode should be followed by RETURN button!

The next line contains the Master gain of the system. From a default level of  $M=1.0$  the master gain allows raising the gain (with the + button), or lowering of the gain (with the - button). This button effects all channels. Its range is from 0.1 to 9.9.

The fourth line contains eight (8) individual channel sensitivity adjustments  
The channels are addressed with the horizontal arrow keys. Channel 1 is to the left followed by channel 2, followed by channel 3 etc. after channel 8, the Y (questionable) and R (Reject) can be addressed.

The R and Y settings are indicated by dashed lines across the screen. The numerical number indicate the threshold as a percentage of full screen.

In the CAL mode the individual gains can be set after a careful one scan operation.

The RIGHT and LEFT keys allow moving from one channel to the other. The respective gain is displayed and can be increased or decreased with the "+" and "-" keys only when the channel is selected. A RETURN key should be used to lock any setting. Note that the Questionable and REJECT threshold level settings are to the right of channel 8.

Signals from the coils in the shoes are cabled to preamplifiers via a 17 pin plug, processed via a peak detector and scaled by the computer. The operator can select any specific channel and alter its sensitivity with the "+" or "-" keys. A RETURN assures that the selected sensitivity is maintained. The sensitivity of a channel is shown as "G1=010", for example. This label can be read as Gain of channel 1 is set to 10%. A display indication of "G3=015" shows that the Gain of channel 3 is set to 15%.

Address the channel, and increase or decrease the sensitivity with the "+" and "-" keys, locking the sensitivity with the RETURN key. The "N= 1.0" allows raising or lowering the sensitivity of all channels.

Two alarm thresholds are provided. One is the yellow "Y=" threshold and the second is the red "R=" threshold. The threshold levels are shown on the display. The threshold level are changed with the "+" and "-" keys and should be locked with the return key. After the sensitivity, and two (2) alarm thresholds are set the screed can be switched to the FAST mode to speed up processing of data.

Switches are provided to disable/enable individual channels. LEDs are featured to indicate when a signal exceeds the red threshold values. The led is timed to flash for 2 seconds on each detected flaw. If a shoe opens the

Red light also trigger for 2 second and the display on both the chart recorder

And the laptop will indicate a maximum high level until the respective switch is disabled and/or the faulty shoe replaced.

When all the channels are adjusted a reject potentiometer allows rejection of noise (unwanted signals) from the thermal recorder and the laptop computer.

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A RST cursor position followed by the ENTER key resets all gain to the default settings of the computer (10% of each channel gain and the overall gain M to 1.00). This is indicated, for example, as G1=010, G2=010 ....N=1.00.

The gain can be changed at 1% increments from 1% to 99% (G1=001 to G1=099). Once the desired gain setting is reached it should be secured with the RETURN key and the computer will “remember” the settings (until in a RESET position followed by the RETURN button is activated).

The “Y” (questionable) threshold are set via the keyboard by addressing the Y (to the right of channel 8) and selecting the “Yellow alarm level” with the “+” and “-“buttons, securing it with the RETURN key.

The “R” (reject) alarm level is to the right of the Y alarm level. The + and – Keys can be used to adjust the REJECT position. Exceeding the REJECT Position triggers the respective red indicating LED and sounds the ALARM If the ALARM switch is ON.

Only when an indication exceeds the R alarm level does the respective LED and sound alarm activate. The LED is timed to indicate for 2 seconds for every occurrence

An audible alarm is activated when the switch is the ALARM position and a flaw exceeds the reject threshold.

Use FAST-INSPECT mode while inspecting.

A REJECT potentiometer allows removal of small stray signals. Make sure that the desired signals are at least twice the size of the rejected noise.

*Calibration Suggestion:*

Set the MAG current to 0.8 amp for every .100” of wall thickness.

(1.6 amp for wall of 0.200”, 2.4 amp for wall of 0.300” etc.).

Adjust individual channel sensitivity to indicate bars that are about 90% of the screen.

Set the questionable level to 50% of screen and the reject level to 70% of the screen.

Move to the RUN mode and verify calibration.

Switch to the FAST position.

## **THE WALL DETECTING AND PROCESSING SYSTEM**

The Z2120 has the following seven (7) control keys:

1. A right arrow key to move the a cursor to the right,
2. A left arrow key to move the cursor to the left,
3. An Up arrow key to move the cursor up,
4. A down arrow key to move the cursor down,
5. A “+” key to increase the gain,
6. A “-“ key to decrease the gain,
7. An “enter” key to lock the desired setting.

In addition:

1. A ten (10) turn potentiometer labeled BIAS allows bringing various thicknesses to the operating range of the computer,
2. A switch labeled ALARM enables the audible alarm,
3. A switch labeled FAST-INSPECT enables fast operation while disabling the display screen.

Signals from the array of Hall elements are preamplifiers at the inspection buggy and cabled to be processed and scaled by the computer.

The operator can select any specific channel and adjust the “wall readings” when a standard product is within the magnetic field. The “CAL\_HI” position allows for such individual adjustments. The “CAL\_LO” position allows for calibration using a reduced body wall section. Addressing the desired channel with the cursor and altering the reading to a number related to the thickness with the “+” or the “-“ buttons will serve as a calibration procedure. A return key activation secures the selected sensitivity.

The “BIAS” potentiometer allows the adjustment needed to bring various different thicknesses to the operating range of the computer. Changes in wall thickness can be monitored on a small 122x32 LCD screen when in the “RUN” mode. In the “FAST-INSPECT” mode the display screen is deactivated to allow for faster processing. The graphic display part of the screen is deactivated also in the “CAL\_HI” and “CAL\_LO” modes.

An ALARM level is selected at the R= position. Inputs below this alarm level will trigger the audible and visual alarms for the duration of the occurrence. Switches are provided to disable/enable individual channels.

The scale of the screen is automatically adjusted to 120% of the NOMINAL pipe thickness that was selected at the N= nominal wall position. The default value of the R= is calculated to be 80% of the nominal wall thickness. The R= default level can be altered with the "+" and "-" buttons. Note to secure the number with the RETURN key.

One toggle switch controls the audible ALARM, and another toggle switch allows selection of the "FAST-INSPECT" mode (when the computer is completely engaged in the inspection process and the screen is not updated) or the "RUN" mode (when the graphic display is activated).

The keys of the Z2120 computer are similar to the keys of the previously described Flaw Detector system.

**DESK CONTROLS**

One (1) Elgar/Sorenson power supply furnish the current for the magnetizing coil. It allows a one potentiometer adjustment to dial the desired current. A switch enables/disables the supply. The power supply is operating in a constant current mode. It will supply up to 150V or 7 amp whichever is exceeded first.

A Minarik regenerating power supply furnishes the power to propel the buggy. The speed is adjusted with an on board potentiometer. A bi-directional switch allows reversal of scan direction.



**DIRECTION OF MAG CURRENT**

The proper direction of magnetic current is so that the initial readings on the display are decreased in amplitude with an increase in magnetic current.

If the readings are increasing with an increase in magnetic current, turn off magnetic supply and reverse the magnetic current direction by switching the two leads from supply to the coil.

Turn on magnetic supply and verify that the readings are decreasing with an increase in magnetic current.

Computer programs are sole property of RG NDT Int., inc. Houston, Texas. Any change or abuse voids all warrant.

**RG NDT international** warrants that the **Raycolog IV** will be free from defects in material and workmanship and that it will perform substantially in accordance with this written document for a period of **SIX MONTHS** from the day of purchase.

The warranty for the inspection heads, transducers and cables is limited to 90 DAYS from day of purchase.

RG NDT will repair or replace, at its sole option and **free of charge** to the original customer, any equipment that is found to be defective provided that the customer returns the defective instrument or system to RG NDT with transportation prepaid. This warranty is **void** if the defects, based on the sole judgment of RG NDT, resulted from misapplication, accident, abuse, negligence, **tampering** or modification of the product by persons not authorized by RG NDT.

Within the SIX MONTH warranty period RG NDT will repair returned equipment that was damaged accidentally or by misapplication, at cost plus 40%.

Equipment damaged due to **abuse, tampering, or modification to the electronics will not** be repaired and will be shipped back to customer.

In no event will RG NDT be liable for any indirect, incidental or consequential damage or loss of revenue arising from the use or failure of this product. Purchaser agrees to indemnify, hold harmless and defend, including but not limited to attorney's fees, court costs travel cost, RG NDT from any claims or lawsuits that arise from the use of this product.

RG NDT reserves the right to make any changes in design or construction without incurring any obligation to retrofit units previously delivered.

This Equipment is NOT certified to be used in hazardous areas.