#104129

ERL MAINTENANCE SUPPORT SDN BHD

(Company No. 498574-T)

E-MAS

Your Railway Operations & Maintenance Specialist

ROLLING STOCK DEPARTMENT

IN-HOUSE TECHNICAL INSTRUCTION

GEARBOX TEST BENCH OPERATING INSTRUCTION

Doc. No. D10.OMR.M83000.PT.1001.B

Certified to ISO 9001 : 2008
Cert. No. AR 2874

Release

	Name	Dept./Position	Date	Signature
Released:	Ham MW	MTN HoD	03 06 09	
Checked:	Mohd Jamil	RST HoD	03 06 09	
Checked:	Mohammad.J	RST QMR	08.06.09	
Author:	Vijendran Veeraya	RST Engineer	~~14/05/09~~ 03/06/09	

Amendments or additions to this procedure must be indicated with a vertical black line in the adjacent left margin.

Change Record and Configuration Control

Revision	Date	Modification	Name
B	03/06/09	Relevant changes carried out after gearbox trial runs	VJV
A	14/05/09	New	VJV

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1 Purpose

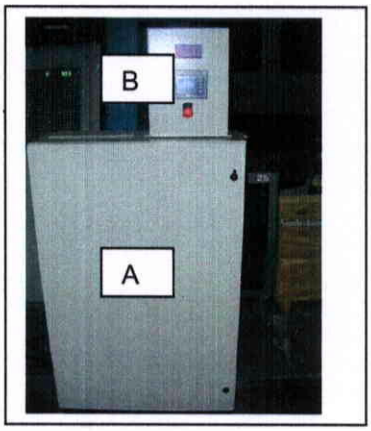
The purpose of this document is to provide the user of the usage of SZ16 gearbox test bench for the purpose of verifying the results of the gearbox overhaul

2 Scope, Distribution & Access

The scope of this work falls under RST maintenance. The distribution is open to all RST Maintenance staffs. The access to this document will be made available to all RST staffs via department online folder.

3 Gearbox Test Bench

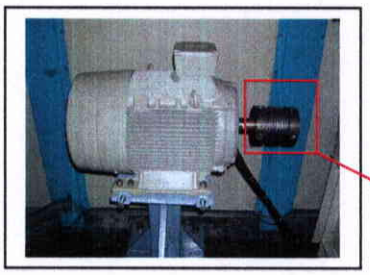
Below are the equipment of the test bench



Picture 1

A - Main Control Panel

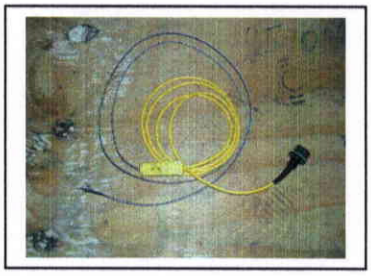
B - Human Machine Interface (HMI) Panel



Picture 2

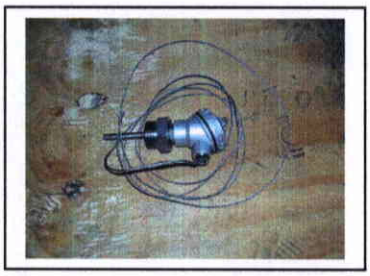
Siemens 22kW motor

Flexible Coupler



Picture 3

Magnetic Head Temperature Sensor x 10



Picture 4

Sump Temperature Sensor. x 1

Picture 5

Vibration Sensor

Picture 6

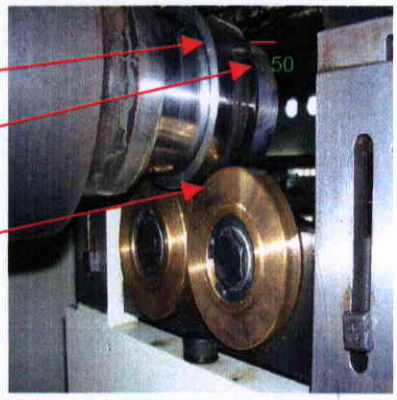
Data Logger Hioki 8421-51

4 Procedure

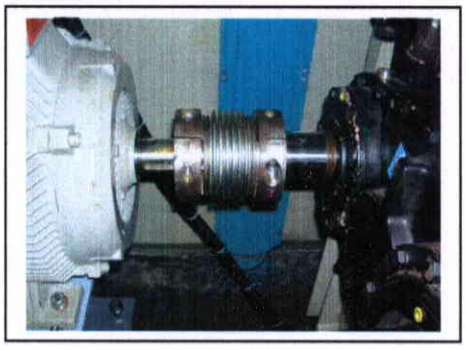
4.1 Gearbox Setting

Attention: Gearbox Stand and Axle Preparation

1) *Mount dedicated set of inner rings to the axle.*
2) *Place inner ring – 50mm from the edge of axle*
3) *Replace the crowned rollers with bronze material rollers*
4) *The gap between the axle and fiber holder – 1 mm*
5) *The rollers & inner rings needs to be oiled before starting*



A. Ensure the gearbox with axle is placed correctly on the balancing machine stand. The inner ring sits on the top of the bonze rollers. Work shall be carried out cautiously as to avoid damage to axle.
B. Bring forward the Siemens 22kW operating motor and couple with the gearbox shaft with flexible coupler.
C. The flexible coupler shall engaged at least 30mm on both shafts and shall be tightened properly by hand. (refer to picture 7)



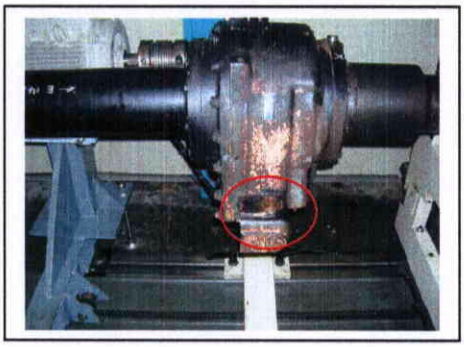
Picture 7
Engaging both shafts with flexible coupler

D. Perform shaft alignment using the shaft alignment tool (SKF TEMA 2). This tool shall only be operated by trained personnel. Refer attachment 2 for the list of trained personnel.

E. The deviation shall not be more than the below value. It will be shown in the screen
   1) 0.05 – angle between center line (top of display)
   2) 0.03 - parallel off-set of the two center line (2nd top of display)

F. Attach the magnetic thermocouples to the location in accordance with the attached drawing. (attachment 1)

G. Replace the oil sump nut (picture 8) with the oil sump thermocouple. Ensure the sump is filled with gearbox oil.



Picture 8

Red-circled area is the location of oil sump nut

H. The table below shows the descriptions and connections for the measuring equipments

No	Equipment	Description	Location	Cable Type.	Cable No. & Connection Ch. at data logger	Measurement Range
1	HMI panel input on speed. (RPM)	RPM measurement	Cable connection from HMI panel	Blue wire cable	P01 to Ch.1	1 volt = 750 rpm (Max = 6000rpm)
2	HMI panel input on current. (Amps)	Current reading	Cable connection from HMI panel	Blue wire cable	P02 to Ch.2	1 volt = 13 amps
3	Magnetic Thermocoupler	Measuring bearing temperature	Pos. 3 as in drawing in attachment 1	Thermo couple wire	P03 to Ch.3	Type K Temp. range. (–200C – 1100C.)
4	Magnetic Thermocoupler	Measuring bearing temperature	Pos. 4 as in drawing in attachment 1	Thermo couple wire	P04 to Ch.4	Type K Temp. range. (–200C – 1100C.)
5	Magnetic Thermocoupler	Measuring bearing temperature	Pos. 5 as in drawing in attachment 1	Thermo couple wire	P05 to Ch.5	Type K Temp. range. (–200C – 1100C.)

6	Magnetic Thermocoupler	Measuring bearing temperature	Pos. 6 as in drawing in attachment 1	Thermo couple wire	P06 to Ch.6	Type K Temp. range. (–200C – 1100C.)
7	Magnetic Thermocoupler	Measuring bearing temperature	Pos. 7 as in drawing in attachment 1	Thermo couple wire	P07 to Ch.7	Type K Temp. range. (–200C – 1100C.)
8	Magnetic Thermocoupler	Measuring bearing temperature	Pos. 8 as in drawing in attachment 1	Thermo couple wire	P08 to Ch.8	Type K Temp. range. (–200C – 1100C.)
9	Sump temperature sensor	Measuring sump oil	Pos. 9 as in drawing in attachment 1	Thermo couple wire	P09 to Ch.9	Type K Temp. range. (–200C – 1100C.)
10	Magnetic Thermocoupler	Measuring ambient temperature	Place at the side of access door	Thermo couple wire	P10 to Ch.10	Type K Temp. range. (–200C – 1100C.)
11	Vibration sensor Power Supply From vibration device tapped from HMI power supply	Measuring the general vibration of the gearbox	Pos. 11 as in drawing in attachment 1. <u>Controller to gearbox</u> Connection at -DC (17), SIG (20), and Com (21) white wire (vibration sensor wire)	Vibration sensor White wire from Vibration controller to sensor Blue wire from controller to data logger	<u>Controller to data logger</u> Connection at –10v and +10v Blue wire to Ch.11	2mms/V

* Thermocouple cable polarity – Red is positive and black is negative

4.1.1 Setting-up Datalogger

A. Connect the power supply and switch on the datalogger via the toggle switch located at the side of the datalogger
B. Wait and let the datalogger boot and stabilise
C. Press setup (purple key on the top left)
D. Press down arrow key (black with no words printed on) to highlight system at the bottom of the screen
E. Press the grey arrow key on the left of the black arrow keys, this will bring to the next screen

F. Change to the Setting tab, using the blue fast forward keys
G. Using the black arrow keys, go to No.1 SZ16 Gearbox and highlight "Load", then press the grey arrow key, follow by the green "start" key.
H. Exit the system screen by pressing the purple setup button
I. Ensure the print paper is aligned properly to its outlet slot, if needed, press the black "Feed" button
J. The datalogger is now ready for use

4.2 Power Supply Set-up

A. Plug the operating motor plug in the 3-phase power socket located at the beam. (refer picture 9)

Picture 9

Operating Motor 3 phase connector and socket

B. Switch the main-power ON inside the main control panel.
C. Check to see if the main inverter and vibration sensor controller power up Switch "ON"

4.3 Start-up

Attention: Safety Instruction Before Start-up

1) Before any start-up in auto or manual mode, manually run the machine at 300rpm. The machine shall be inspected for any abnormalities.

2) If any abnormally found, including unusual sound or movement of the any part of the test bench and axle being tested. The test shall be discontinued until investigation and rectified are carried.

3) During the initial spin, apply a coat of oil on the surface of the inner ring.

4) Close the door before proceeding with the auto test.

5) No one is allowed within the cubicle of the test bench when test is under progress.

6) Maximum speed setting shall not exceed 6000 rpm

A. Select "Fix Mode" on the HMI panel
B. Select Auto or Manual for Auto Mode or Manual Mode
(select "Main Page" to return to previous screen)
C. Press "start" on the datalogger first

4.3.1 Auto Mode

A. Select Auto Page, and press Start button.
B. Ensure the datalogger start to show the graph
C. The motor will now run at the following speed automatically
   1) 0 – 2000rpm movement counter clockwise (CCW) hold for 250 seconds
   2) 2000 – 4000rpm movement CCW hold for 300 seconds
   3) 4000 CCW – 2000rpm clockwise (CW) hold for 300 seconds
   4) 2000 – 4000rpm CW hold for 300 seconds
   5) 4000 – 6000rpm CW hold for 700 seconds
   6) 6000 CW – 6000rpm CCW hold for 700 seconds

   Ramp-up rate at 40rpm/s
   Ramp-down rate at 80rpm/s
   Total Running time is approximately 54minutes

D. At the end of the cycle (6), the motor will start braking and come to a stop.
E. The datalogger will automatically stop at the 55th minute.
F. Upon seeing the below message at the data logger
   1) Storage finish
   2) Saving data
   3) Making Waveform

   The storage is complete.
G. Tear off the print out from the datalogger to include it as part of the overhaul documentation. Record down the remaining paper length on the print paper of the machine. A minimum length of 400mm is required. Otherwise, replace paper role
H. Press the black "Card" key
I. Look for the last file saved – the files are saved with the date and timestamp. Write down the filename with prefix of SZxx.mem on the print out. When done, press "setup" to exit.
J. Switch off all units

4.3.2 Manual Mode

Manual mode is used for low spin cycle only (below 1000rpm). If there are any deviations of use, user shall obtain prior approval from RST HoD

A. Select Manual page
B. Manual Page screen appears
   (Select "Main" to return to previous screen)
C. Manually insert the desired speed and time frame.
D. Press the start button

4.4 Stopping the Test

The test shall be stopped if

A. There are any abnormally or loud/unusual sounds
B. Heavy yibration on the stand or axle, reading exceeds 12.5 mm/s
C. Temperature reading at the data loggers exceeds 90 degree Celsius

Press the stop button on the HMI panel to stop the sequence

Use the emergency stop push button for emergency purpose only, the buttons are located at:

A. 1 unit is located on the HMI panel
B. 1 unit is located at the fence, nearby the motor
C. I unit is located at the fence, nearby the oil sump

The emergency stop switch immediately cut-off the running sequences and stops the motor.

4.5 Results interpretation

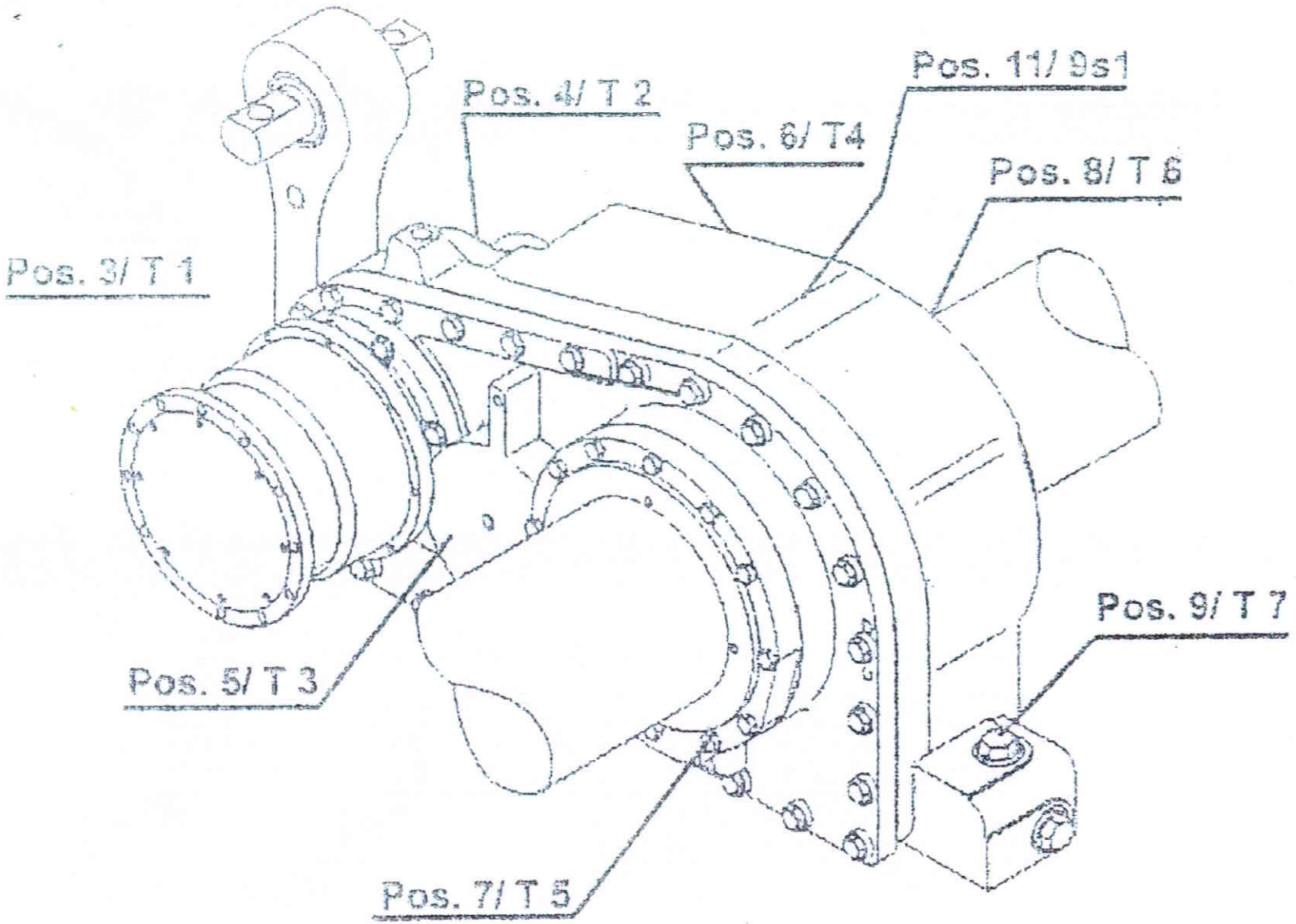
This test at the test bench is a comparison test. It is the intention to collect at least 5-6 units of gearbox data before a realistic benchmark can be established. Overall, the rate of temperature increase will be the tale telling sign if a particular gearbox has been overhauled correctly. Therefore, a quicker than usual rising temperature may indicate a potential problem.

Attachments

Attachment 1: Drawing of Gearbox with sensor positioning
Attachment 2: List of Personnel Trained on TEMA Alignment Tool
Attachment 3: Data Logger Channel Set-up parameters

Appendices

1. Gearbox Vibration Test Bench (Contractors Manual) – D00.DWE.M83550.NZ.1001.A
2. Siemens MicroMaster 440, Operating Instruction and Parameter List – D00.DWE.M83550.NA.1001.A and D00.DWE.M83550.NA.1002.A



Pos. 3 - 8 Lagertemp./ bearing temp., Pos. 9 Sumpftemp./ Sump temp.,
Pos. 10 Raumtemp/ ambient temp., Pos. 11 Schwingungsaufn./ Vibration

Attachment 2

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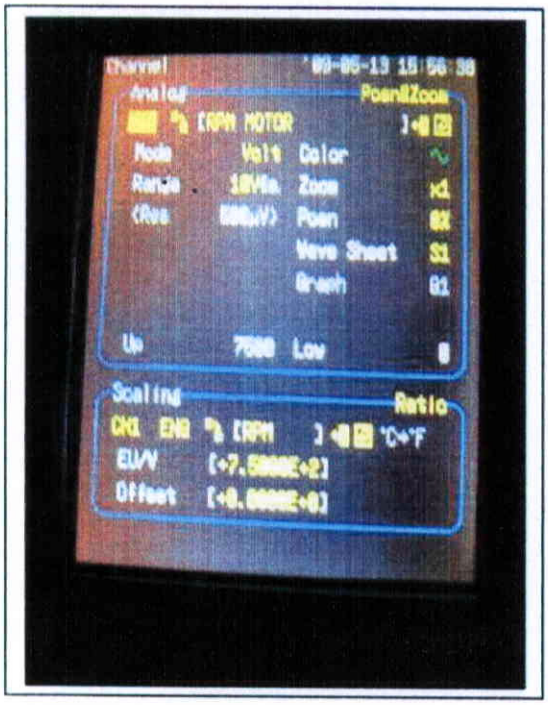
Attachment 2: List of RST Personnel Trained on TEMA Alignment Tool

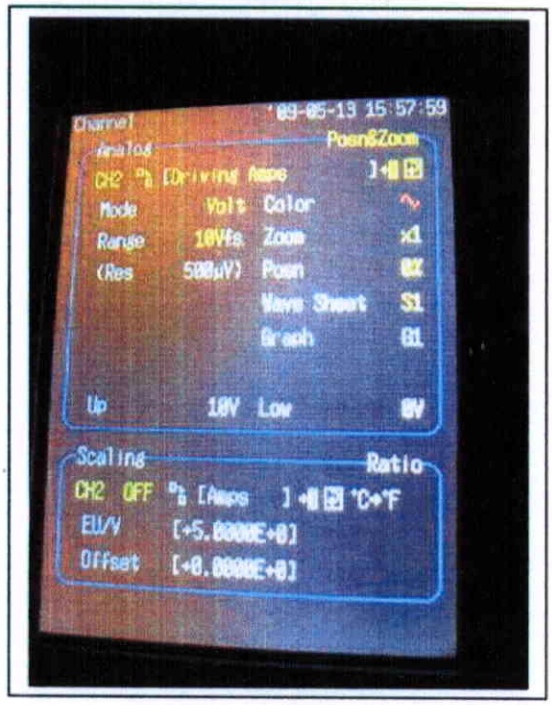
No	ID No	Name	Trained date
1	200166	Mohd Azhar	Trained during product delivery.
2	200234	Mohd Nurul	Trained during product delivery.
3	200250	Khairunizam	24/04/09
4	200224	Mohd Shamsul	24/04/09
5	200282	A. Hisham Rusdi	24/04/09
6	200247	Saifullah Paujan	24/04/09
7	200167	Abd. Muiz	24/04/09
8	200217	Addi b. Yassin	24/04/09

Attachment 3

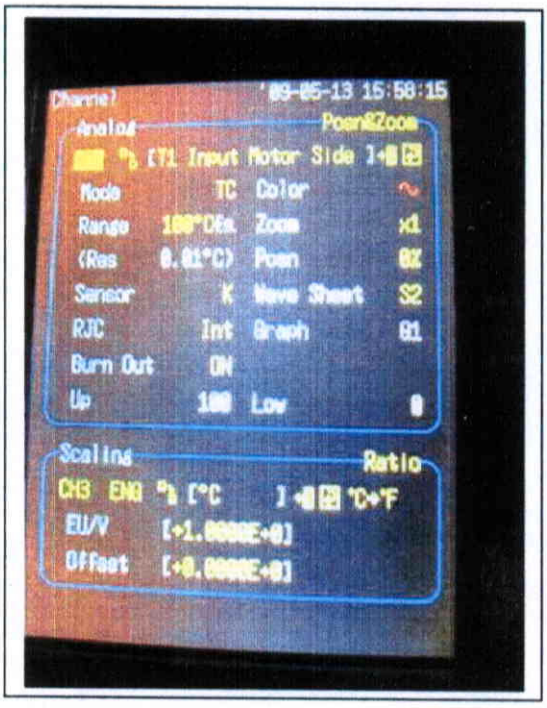
ERL Maintenance Support Sdn Bhd (Company No. 498574-T)



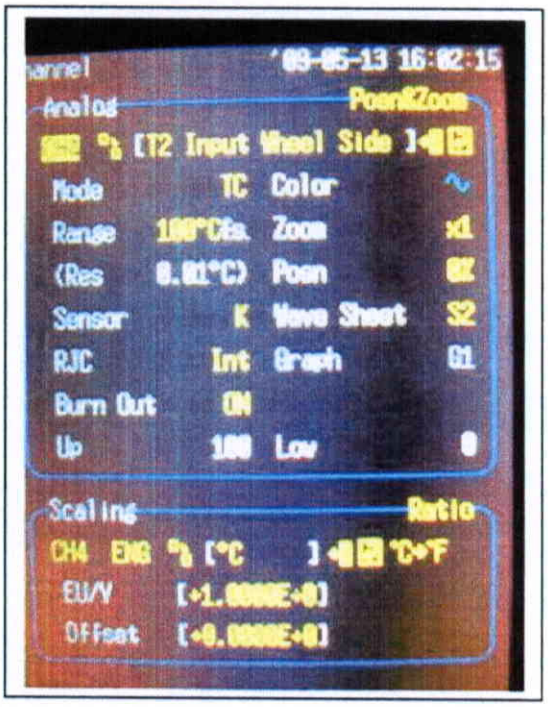
Channel 1



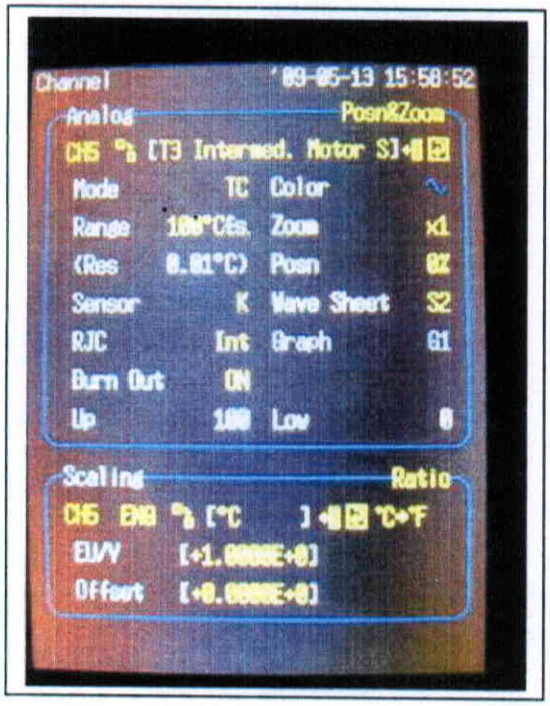
Channel 2



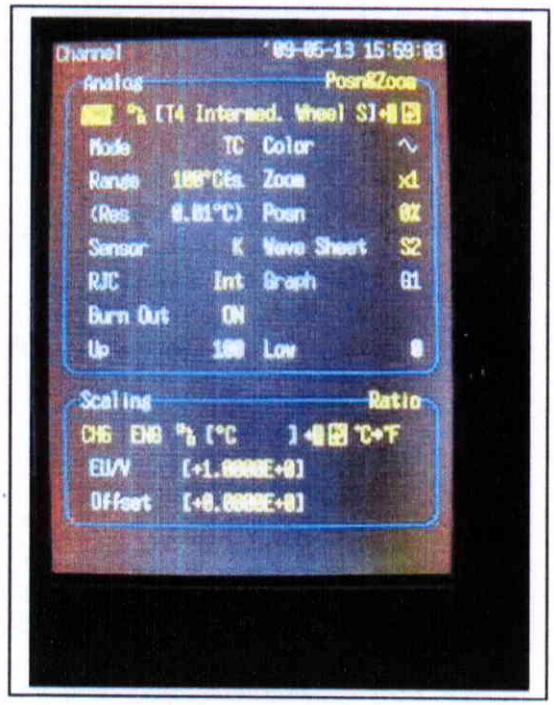
Channel 3



Channel 4



Channel 5



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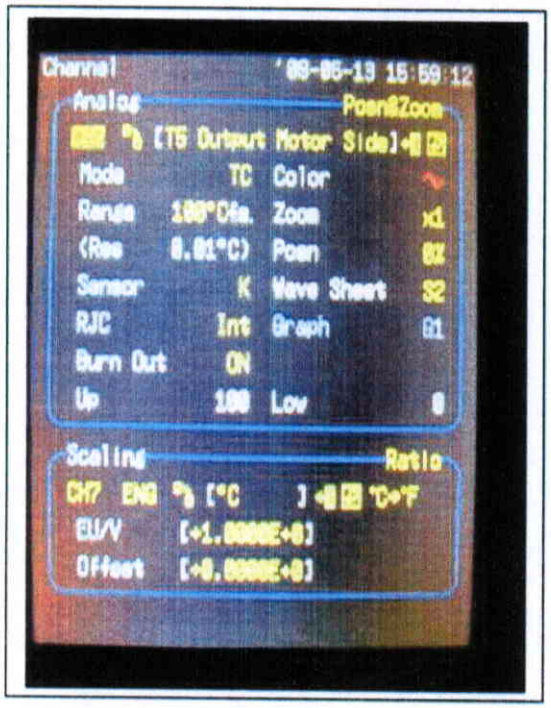

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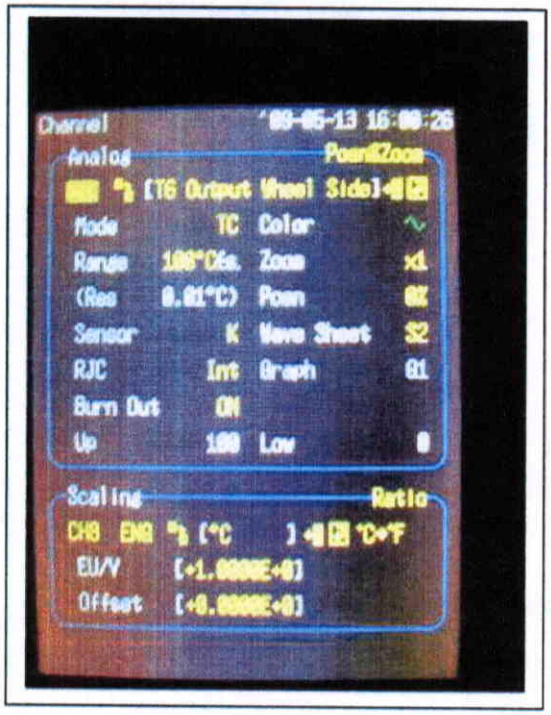

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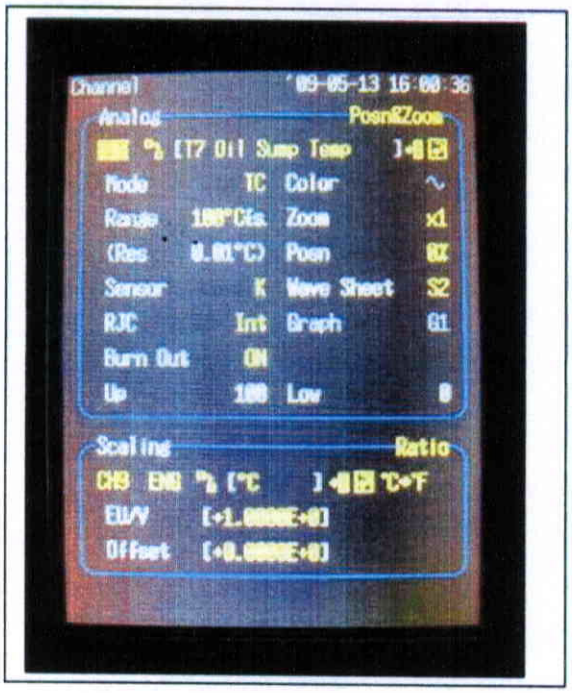

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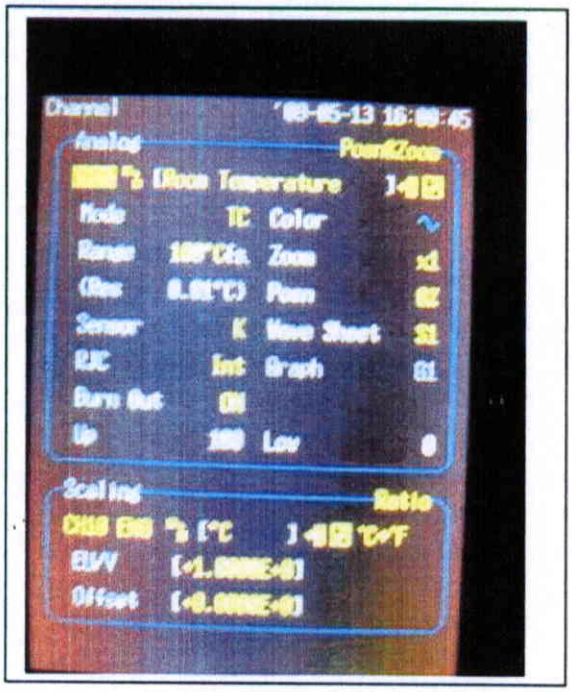
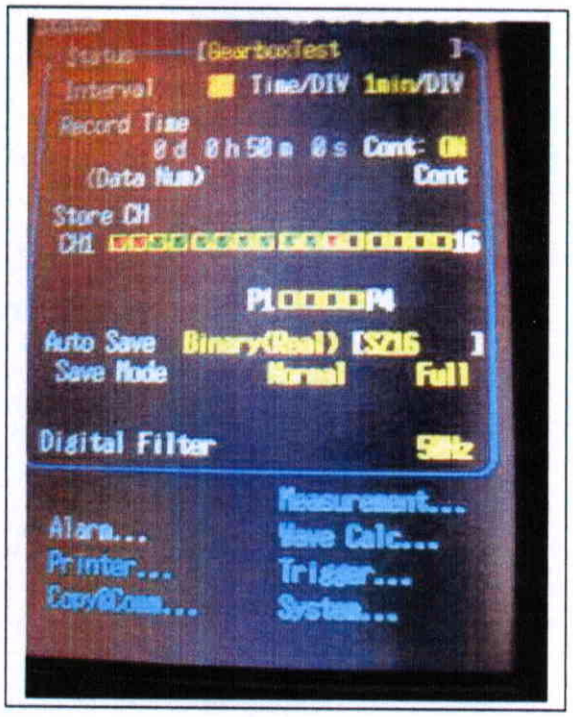
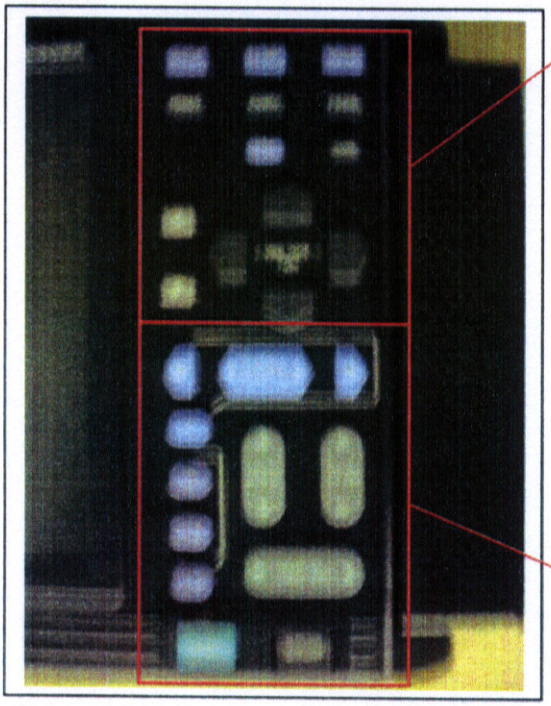


Channel 10

Channel 11



Set Up Page



Keypad

Upper Part of Keypad

Lower Part of Keypad