

# NOVALYNX CORPORATION

MODEL 210-4110-A  
THERMOGRAPH

INSTRUCTION MANUAL



REVISION DATE: NOV 1997

## Receiving and Unpacking

Carefully unpack all components and compare to the packing list. Notify NovaLynx Corporation immediately concerning any discrepancy. Inspect equipment to detect any damage that may have occurred during shipment. In the event of damage, any claim for loss must be filed immediately with the carrier by the consignee. Damages to equipment sent via Parcel Post or UPS require the consignee to contact NovaLynx Corporation for instructions.

## Returns

If equipment is to be returned to the factory for any reason, call NovaLynx between 8:00 a.m. and 4:00 p.m. Pacific Time to request a Return Authorization Number (RA#). Include with the returned equipment a description of the problem and the name, address, and daytime phone number of the sender. Carefully pack the equipment to prevent damage or additional damage during the return shipment. Call NovaLynx for packing instructions in the case of delicate or sensitive items. If packing facilities are not available take the equipment to the nearest Post Office, UPS, or other freight service and obtain assistance with the packaging. Please write the RA# on the outside of the box.

## Warranty

NovaLynx Corporation warrants that its products are free from defects in material and workmanship under normal use and service for a period of one year from the date of shipment from the factory. NovaLynx Corporation's obligations under this warranty are limited to, at NovaLynx's option: (i) replacing; or (ii) repairing; any product determined to be defective. In no case shall NovaLynx Corporation's liability exceed product's original purchase price. This warranty does not apply to any equipment that has been repaired or altered, except by NovaLynx Corporation, or that has been subjected to misuse, negligence, or accident. It is expressly agreed that this warranty will be in lieu of all warranties of fitness and in lieu of the warranty of merchantability.

## Address

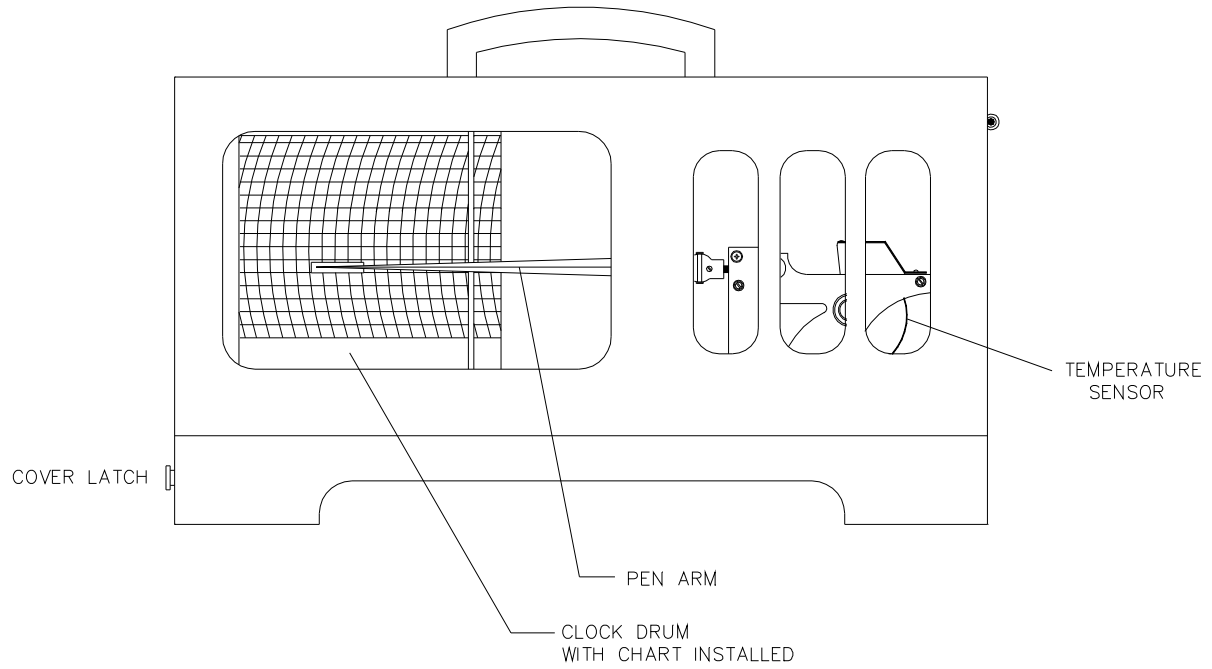
**NovaLynx Corporation**  
**4055 Grass Valley Highway, Suite 102**  
**Auburn, CA 95602**  
**Phone: (530) 823-7185**  
**Fax: (530) 823-8997**  
**Email: [nova@novalynx.com](mailto:nova@novalynx.com)**  
**Website: [www.novalynx.com](http://www.novalynx.com)**

Copyright © 1997 by NovaLynx Corporation

# TABLE OF CONTENTS

Section No.	Page No.
1.0 INTRODUCTION .....	1
2.0 SPECIFICATIONS .....	2
3.0 INSTALLATION .....	2
3.1 GENERAL UNPACKING .....	2
3.2 INSTRUMENT UNPACKING .....	3
3.3 CLOCK UNPACKING .....	3
3.4 CHART PAPER INSTALLATION .....	4
3.5 CLOCK INSTALLATION .....	5
4.0 OPERATION .....	6
4.1 TEMPERATURE SENSOR .....	6
4.2 DRUM RECORDER .....	6
5.0 CALIBRATION .....	7
5.1 TEMPERATURE SENSOR .....	7
6.0 MAINTENANCE .....	7
7.0 LIST OF CHART PAPER .....	8

# MODEL 210-4110-A EQUIPMENT CONFIGURATION AND IDENTIFICATION



# **NovaLynx Corporation**

## **Model 210-4110-A Thermograph Instruction Manual**

### **1.0 INTRODUCTION**

NovaLynx Corporation distributes the Model 210-4110-A Thermograph. A thermograph measures and records air temperature. The Model 210-4110-A uses a simple mechanism for measuring the temperature of the surrounding air. These measurements are then recorded onto a rotating paper chart. A rotating drum is driven by a precision electronic clock powered by two AA alkaline batteries. The recorded chart paper is removable. The Model 210-4110-A has been designed for use in sheltered areas. For outdoor use, to measure atmospheric conditions, the instrument's case must be located inside an instrument shelter such as the Cotton Region style shelter, NovaLynx Model 380-605.

Previously, the 210-4110-A Thermograph had several model numbers covering different clocks, spring wound and electric, with weekly or monthly rotations. The latest thermograph supplied by NovaLynx has a single model number, 210-4110-A, and is distinguished by the electronic clock. The electronic clock includes a selector switch for switching drum rotation from one day (26 hours), to seven days (176 hours), or to 31 days. Additional time is provided in the clock rotation and on the chart paper to overlap the data whenever the chart is not replaced within the normal time period. The three different settings on the clock require that the chart paper matches the time setting. A list of available chart paper by model numbers is provided at the end of this manual.

The electronic clock eliminates changing drive gears whenever the clock rotation time is changed. For earlier models, the changing of the clock drive gears was critical. Improperly installed gears often resulted in lost data and sometimes in damaged clocks. The need to store and to keep track of the different drive gears has been eliminated by the electronic clock.

The chart paper used on the drum recorder has a single calibrated sections for recording temperature. The zero or low-scale is at the bottom edge of the calibrated section and the full-scale or high-scale is at the upper edge. The chart paper wraps around the clock drum and is marked by a cartridge ink pen. The temperature ranges of the chart paper and the time base are selected at the time of purchase. One pack of charts is supplied with each instrument. Additional chart paper of the same type or chart paper with different temperature spans or different time bases may be ordered at any time from NovaLynx. Some customers find that charts with a different temperature range or a different time base need to be used during different times of the year depending upon the use of the recorded information. More than one thermograph recording site may be required in some instances. The chart paper has space in the margin for station identification and the date.

A properly maintained thermograph will provide many years of useful service. Refer to the maintenance section of this manual for information regarding the care of the instrument. Contact NovaLynx for additional assistance and for repairs and replacement parts.

## 2.0 SPECIFICATIONS

### SENSOR

Temperature: Aged Bi-metal Assembly

### MEASURING RANGE

Temperature: 110 F ( 60 C )  
Air Temperature

### ACCURACY

Temperature:  $\pm 0.5$  C

### CHART RESOLUTION

Temperature: 2 F, 1 C typically  
Recording Method: Cartridge Ink Pen

### CLOCK

Type: Precision Electronic Drive  
Power: 3.0 VDC, 2 each AA batteries  
Rotation: 26 Hours, 176 Hours, 31 Days, Selectable

### CASE

SIZE: 12.5 x 8 x 6 inches (l x h x w)  
(318 x 203 x 152 mm)

WEIGHT: 9 lbs (4 kg)

SHIPPING WEIGHT: 15 lbs (7 kg)

## 3.0 INSTALLATION

### 3.1 GENERAL UNPACKING

NovaLynx will ship the thermograph inside two cartons, an inner one and an outer one. Two cartons provide maximum protection of the instrument during shipping. Whenever more than one instrument is being shipped, several thermograph cartons are packed into a large carton.

Before or immediately after opening the outer carton, inspect both cartons for shipping damages such as holes in the carton, and dented or crushed corners and sides. Report any signs of damage to the carrier, preferably before he leaves the area. There may be

hidden damage inside the instrument that may not become visible until everything has been opened and closely inspected. Any claims against damaged equipment must be made immediately to the carrier. NovaLynx may be able to assist the customer in handling damaged equipment. It is the responsibility of the receiver of the goods to take care of any problems caused by the carrier.

The inside carton containing the thermograph has been customized with styrofoam inserts to provide maximum protection for the instrument. Save the inside carton and the styrofoam inserts in case there is a need to ship the instrument to NovaLynx or to use during long term storage.

Lifting off the top section of styrofoam will expose the clock and the thermograph. Carefully remove both items and place them onto a flat surface. Close up the carton and store it away.

### **3.2 INSTRUMENT UNPACKING**

Open the thermograph case by pressing the release button on the end of the case and, at the same time, lifting gently upward on the handle. The top of the case will swing upward and to the side away from the latch. The latch release button is opposite the sensing elements. With the window facing toward the operator, the latch should be on the left side and the sensors on the right side.

With the case open notice that the pen arm is fastened to the upright bar by a small clip. The clip keeps the pen arm from moving during shipping and must be removed for normal operation. To remove the pen clip, press inward on the curved piece of the clip to open it. Slide the clip upward. Rotate the edge of the pen arm into the open part of the clip. Slide the clip down past the pen arm. The clip may be left on the bar or taken off and stored in the shipping carton. Notice that the upright bar has a knob that can be rotated. The bar is used to raise and lower the pen onto and off the chart paper to avoid smearing the ink and to prevent extraneous marks on the chart.

Several pieces of packing material may be located around the edges of the instrument case. These pieces will fall out or become loose as the case is opened. Remove these pieces of packing and store them with the shipping carton.

### **3.3 CLOCK UNPACKING**

The clock is shipped wrapped inside a plastic bag. Remove the clock from the bag. A nickel plated chart clip should be on one side of the drum. If the clip is not on the clock search the carton. The clip may become loose during shipping or may be placed into the carton separately. If there is no chart clip notify NovaLynx immediately. If the clip is on the clock, slide it upward and remove it from the drum. The main shaft has been shipped inside the clock and not on the base of the thermograph. Remove the shaft from the clock and install it onto the base. The shaft is removed from the clock by loosening and removing the brass thumb nut located inside the top of the clock drum. Slide the shaft down and out of the clock. Place the shaft onto the base. Be sure to put

the aluminum spacer between the large gear and the base of the instrument. From below the case, install the lock washer and the two hex nuts. Tighten the hex nuts so that the shaft will not rotate or wobble.

Open the clock drum by grasping the bottom of the clock with one hand and the brass drum with the other hand. Be careful. There may be sharp edges that can cut. Look closely at the bottom edge of the clock drum. There should be three small pins that hold the drum onto the bottom plate. Notice the position of each slot around the pins. Rotate the two clock pieces in opposite directions to separate them. The rotation of the top of the clock will be in the direction required to move the pin in the slot. Typically, the clock drum will be rotated in a counter-clockwise direction while the bottom plate rotates clockwise.

With the brass drum removed, the battery holder will be exposed. Insert the two, AA batteries into the battery holders. Batteries are not normally supplied with the instrument by NovaLynx due to lower prices and availability from local sources. In special situations and when requested, batteries may be supplied by NovaLynx. Notice the polarity markings on the plastic battery holders. Check to be sure that the batteries face correctly as they are being inserted. Also, notice that the batteries are wired in series to produce the 3.0 volts needed to operate the clock.

Upon completion of the battery installation, look at the top of the clock assembly. One of the three LEDs should be flashing to indicate the clock is operating. If an LED is not flashing check the batteries to make certain that they have power and that they are facing correctly in the holders. If the clock does not appear to be working contact NovaLynx for assistance or for a replacement clock.

If the LED is flashing and the clock appears to be working properly, replace the clock drum onto the bottom plate. Notice that the chart clip notch in the drum must be in line with the slot in the bottom plate when the clock is put back together. Rotate the two pieces together until the pins are against the front edges of the slots.

### **3.4 CHART PAPER INSTALLATION**

The chart paper is installed easiest with the clock removed from the thermograph. To install the chart paper, first remove the chart clip from the clock drum. Select the chart paper that is to be installed onto the drum. Check to see that the blank lines for the station ID number and the start date of the chart have been filled as required. If the chart information has been written onto the end of the chart, fold down the end margin exactly along the end line of the calibrated portion of the chart. The fold will place the station ID and the date under the chart.

Slide the chart clip between the folds of the chart. The edge of the clip must sit in the crease of the fold. Hold this end of the chart in one hand. With the other hand, take the left hand edge of the chart paper and wrap it around the clock drum. The paper should be positioned so that the end of the chart will line up with and slightly overlap the chart clip slot located on the bottom plate of the clock.



Holding the end of the chart paper against the drum, slide the chart clip into the slot on the bottom plate and insert the top of the clip into the notch on the upper edge of the drum. Notice that when inserting the chart clip, the edge of the chart with the clip will overlap the end of the chart being held against the drum. Press firmly on the free end of the chart to prevent it from slipping out as the chart clip is put into place. Several attempts at loading the chart paper may be necessary until familiarity with the procedure is attained.

A properly loaded chart paper will be tightly wrapped around the drum of the clock. The folded edge of the paper will be seated against the chart clip. The free end of the paper will be underneath the chart clip and aligned with the overlapping portion of the chart paper. If the chart paper slips or moves during the insertion of the chart clip, it may be necessary to start over in order to properly align the edges of the chart. The bottom edge of the chart paper must be touching the bottom plate of the clock. With the chart paper properly installed, the ink pen will be able to write on all of the chart and will travel easily over the chart on top of the chart clip.

### **3.5 CLOCK INSTALLATION**

The clock is placed over the shaft located on the case of the thermograph. First, the brass nut at the top of the shaft must be removed. Place it to one side since it is used last to fasten the clock into place. There is a spacer located between the shaft and the case. The spacer must be in place and the shaft must be securely fastened to the case in order for the clock to properly operate. If the spacer appears to be missing notify NovaLynx for a replacement. Check the shaft to make certain that it does not rotate or move. If it appears to be loose, tighten the nuts located underneath the instrument case. If everything appears to be correctly placed, slide the clock over the shaft and secure it to the shaft on the top side using the brass thumb nut. Do not over-tighten the brass nut. Finger-tight should provide plenty of force to keep the clock on the shaft. The clock should rotate freely around the shaft.

Check at this point to ensure that the pen is lifted away from the chart paper surface. To begin recording data, rotate the clock in a clockwise direction until the correct time line appears beneath the ink pen. For weekly and monthly charts check to ensure that the day of the week has been correctly selected.

Before placing the ink pen onto the chart notice that each pen has a white plastic protective cap covering the pen tip. Remove the cap to expose the fiber tip of the pen. To extend pen life, save the cap and recover the pen whenever it is not being used.

Lower the pen onto the chart paper by rotating the pen lifter bar. Move the pen gently by hand, up and down a small distance to make a mark on the chart paper. Look at the mark to see whether it has been written on top of the correct timing mark. If necessary move the clock to correct the position until the pen is at the timing mark. Rotate the clock only in a clockwise direction. Due to back lash in the clock gear mechanism, there will be some loss of time if the clock is moved in a counter-clockwise direction. The clock will not move until the back lash slack is recovered.

For initial set-up of the thermograph, let the instrument operate for some time to ensure that the clock is operating properly and to see that the pen is writing properly. For weekly and monthly charts, the clock will rotate very slowly and it will take at least one or two days to check the clock operation. Try to do the clock operation test before permanently installing the thermograph and before trying to collect critical data. During the clock operation test, also check the temperature readings to ensure that the calibration settings are proper. If the calibration needs adjusting, refer to the steps for making those adjustments.

Final installation of the thermograph involves placing the instrument into an outdoor instrument shelter or onto an indoor shelf or table. The instrument should be as level as possible. In locations where there may be dripping water, place a protective panel above the instrument to prevent water from dropping directly onto or next to the instrument case. Water should never splash onto the temperature sensor. Avoid placing the instrument in locations where there may be direct sunlight exposure unless the direct sunlight temperature is being measured.

## **4.0 OPERATION**

### **4.1 TEMPERATURE SENSOR**

The thermograph measures temperature by using dissimilar metals. A curved, bimetal element bends and straightens as the air temperature around it changes. The bending of the curved element moves the temperature pen arm and results in the recording on the chart paper. The bi-metal element is able to make measurements over a range of 110°F (60°C). The 110 degree span may be shifted up or down providing a variety of calibrated ranges to cover different applications. An adjustment knob enables the span to be shifted to match the chart paper range. Fine tune the temperature calibration by using the adjustment knob.

### **4.2 DRUM RECORDER**

Temperature is recorded onto a paper chart. Physical changes in the sensing element is translated into upward and downward motion of the pen arm. As the pen arm moves, ink traces of the movement are printed onto the chart paper. The chart paper drum rotates beneath the pen and is powered by the internal clock mechanism.

The clock mechanism is driven by a precision, crystal controlled, electronic clock. The clock produces pulses that are translated into movement through an electric motor. The motor drives the gears of the clock producing the rotation of the drum and chart paper. The drum and clock are fastened onto a fixed shaft and rotate around the shaft. Clock rotation is selected through the slide switch located on top of the clock assembly. Rotation can be set for periods of 1 day, 7 days, or 31 days. The settings are imprinted into the switch. A flashing LED sits above each switch position to indicate that the clock is operating and to show the selected rotation time.

## **5.0 CALIBRATION**

### **5.1 TEMPERATURE SENSOR**

The calibrated span of the temperature element is set at the time of manufacture of the instrument. For most customers, there should be no need to adjust the span after receiving the instrument. If, however, the sensing element has been replaced then the span will need to be corrected. The following steps describe the span adjustment. A dramatic loss of temperature span may be the result of a sensor element failure requiring replacement of the element.

5.1.1 Verify the temperature span setting by varying the temperature of the air around the sensor. A temperature difference of at least 50°F must be used to accurately check the temperature operation. After each temperature change, allow 15 to 30 minutes for the sensor to stabilize. Use an accurate mercurial thermometer to verify the temperature of the air. The thermometer should be placed near the sensing element of the thermograph. A room or a chamber with a controlled, stable temperature is best for testing the temperature of the instrument.

5.1.2 If the span is out of adjustment or out of the range needed, adjust the pen arm linkage. The horizontal arm of the pen arm linkage may be shortened or lengthened. Shortening the arm increases the span and lengthening the arm will decrease the span. Only slight adjustments should be attempted at first. Movement of the linkage by 0.012 inches changes the span by 1°F. After changing the position of the arm, measure and keep a record of the arm length.

5.1.3 After adjusting the span, the pen position must be set to correspond to the chart paper range. Pen adjustment will not affect the span setting and can be done under ambient conditions if necessary. Again, use an accurate thermometer to verify the reading of the thermograph. The pen position is adjusted using the large knob located on the side of the sensing element frame. A slight rotation of the knob produces a considerable displacement of the pen arm. Make small adjustments and verify the new reading after waiting for at least 15 minutes for stabilization. Adjust the knob until the pen reading is within 1 degree of the thermometer reading.

## **6.0 MAINTENANCE**

The thermograph is typically used outdoors to measure atmospheric conditions. Even when installed inside a louvered shelter, the instrument tends to get dirty over time and in the case of high humidity will become corroded. General maintenance is relatively simple and, when performed regularly, can extend the life of the instrument.

The chart paper will require changing at specific intervals, based upon the time base of the chart, daily, weekly or monthly. It is during the chart changing that general maintenance should be done. Simply brush off any dust or dirt, spider webs, leaves, and any other debris that have settled onto the instrument case. If there is excessive

moisture, take some dry cloths and dry off the case. At least once every 6 months, 3 months in harsh environments, clean all pivots and bearing points with a solvent. Apply a light coating of instrument oil to the pivots and bearings. Use a small brush to apply one or two drops of the oil.

Check the clock batteries for corrosion and if possible test them for power left to help avoid battery failure between visits. If rechargeable batteries are being used, exchange the batteries regularly, keeping fresh batteries in the clock whenever possible. If standard alkaline batteries are being used in the clock, they should be replaced at least every 6 months.

Be sure to brush dust and dirt off the temperature sensing element.

Pen traces become faint as the pen cartridge approaches the end of its life. It is recommended that at least two additional pen tips be kept as spares for replacement as needed. The old pen is slid off the end of the pen arm and the new one is slid on in its place. When replacing pens, grasp the pen arm without bending it and carefully but forcefully pull the old pen off and push the new pen on. If the pen arm becomes bent, carefully bend it back into its original shape. Severely damaged pen arms should be replaced. The pen arms are held in place by a small circular plate and two screws. The pen arm is clamped onto a small post by the plate and screws.

For locations experiencing high humidity, the chart paper can become acclimated by storing all or some chart paper in the shelter next to the instrument. This method of storage helps keep the chart paper from changing size rapidly after it is placed onto the clock drum. The amount of ink absorbed by the paper will also be affected since a drier chart paper will take more ink than does a more moist paper.

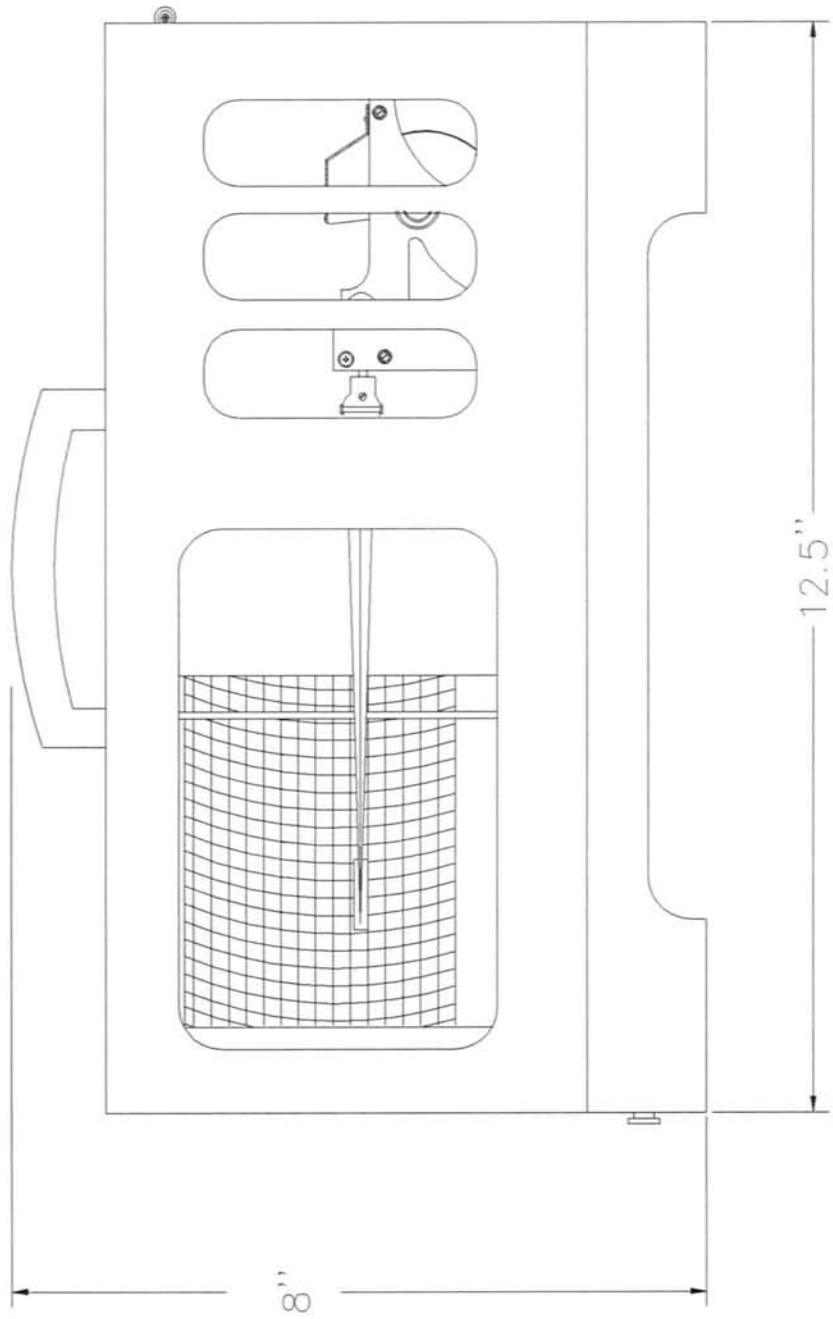
Drawings are provided with this manual to assist in the identification of major parts. Should a replacement part be required that is not shown in detail please contact NovaLynx for assistance or send a sketch showing the part and its general location.

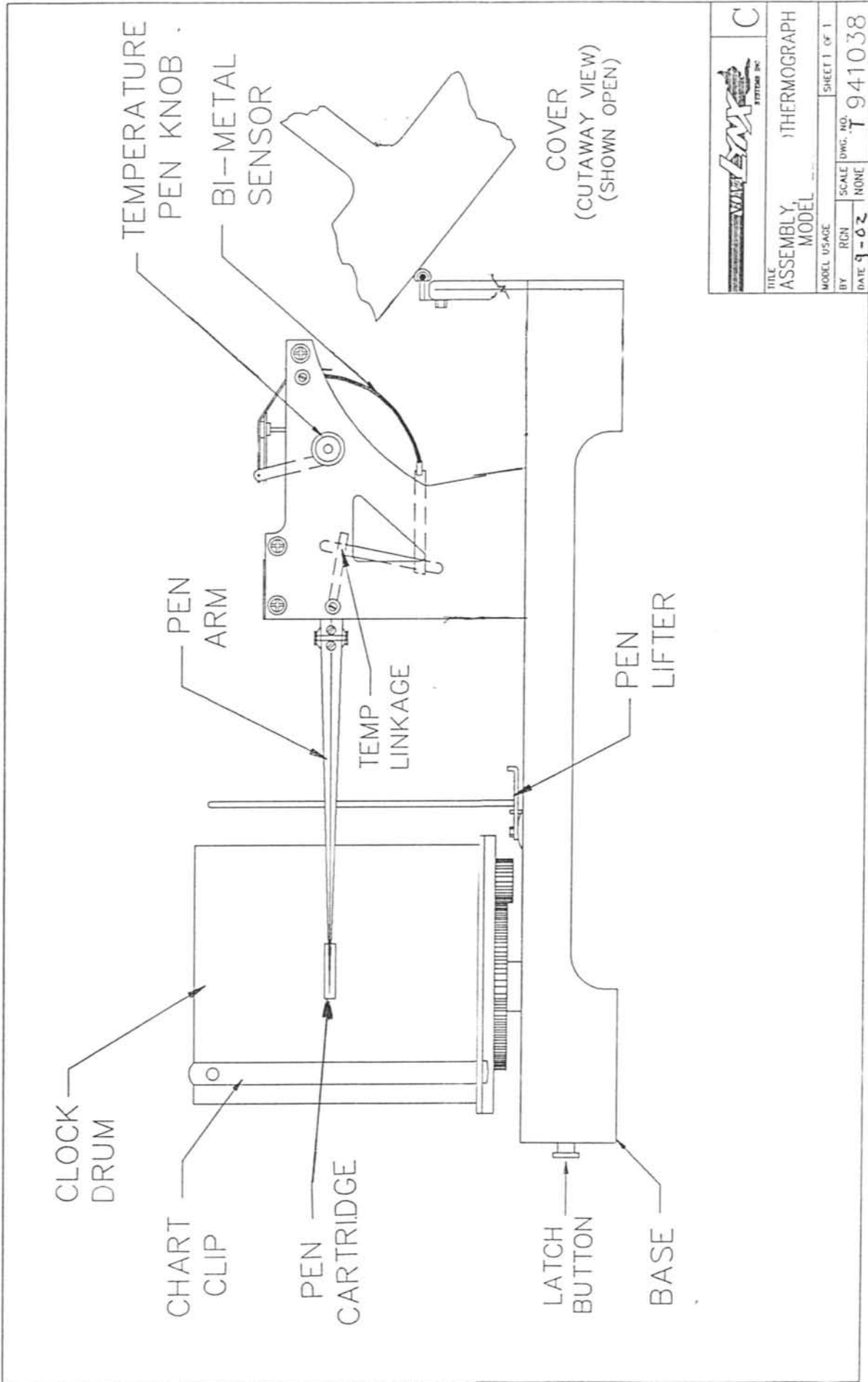
## 7.0 LIST OF CHART PAPER

<b>Model #</b>	<b>Range</b>	<b>Period</b>	<b># of Sheets</b>
210-41101	-20 to + 40 C	7 days	55
210-41102	+10 to +120 F	7 days	55
210-41103	-30 to + 80 F	7 days	55
210-41105	-10 to + 50 C	7 days	55
210-41107	+10 to +120 F	31 days	25

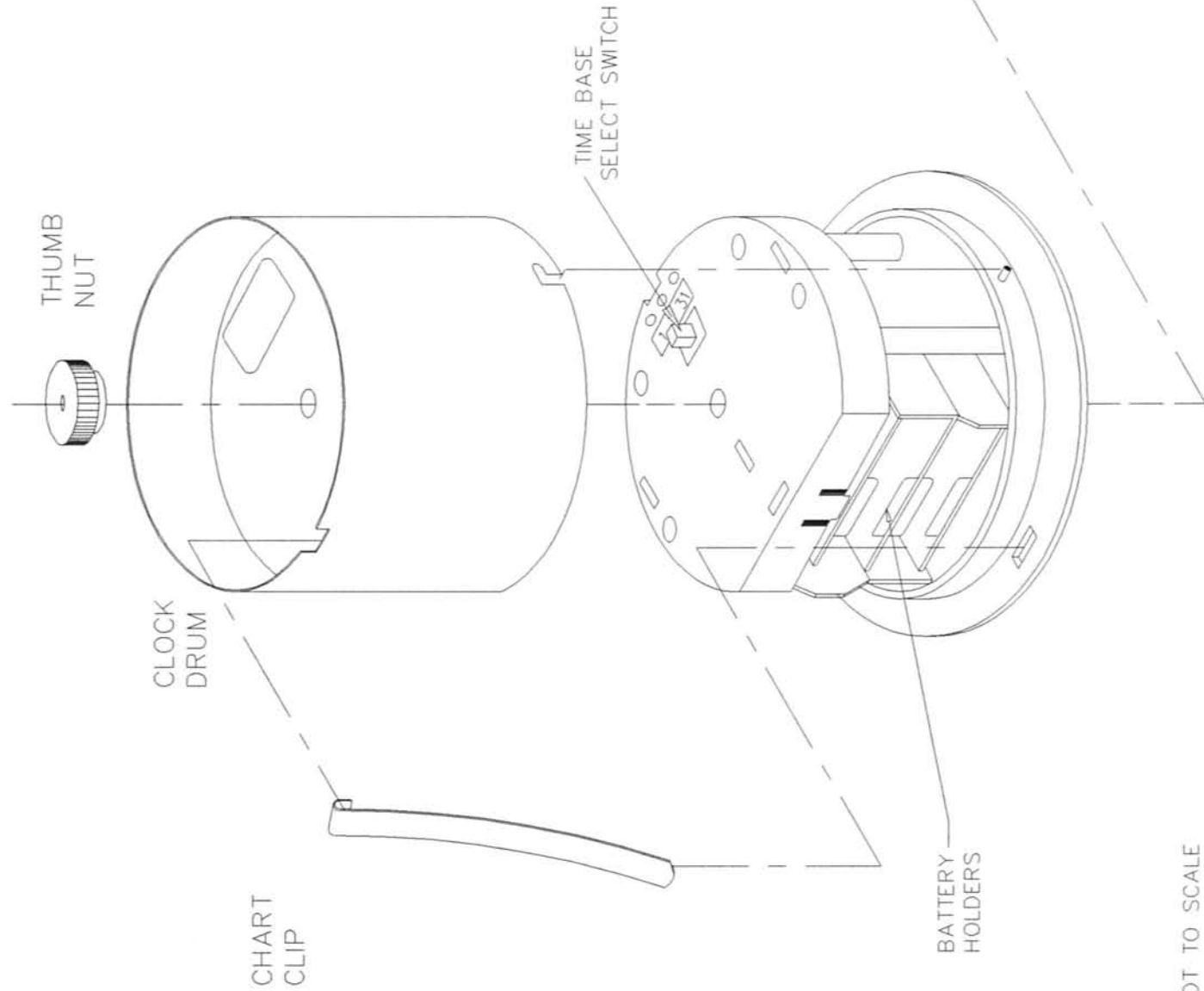


TITLE: OUTLINE, THERMOGRAPH MODEL 210-4110-A  
MODEL USAGE 210-4110-A  
BY: RGN  
DATE 11-25-97  
SCALE: FULL  
DWG. NO.: 971105  
SHEET 1 OF 1





TITLE ASSEMBLY, THERMOGRAPH MODEL			
MODEL USAGE	SCALE	DWG. NO.	SHEET 1 OF 1
BY RCN	DATE 9-02	NONE	T 941038



MAIN  
SHAFT  
(INSTALL ON BASE OF  
HYGROTHERMOGRAPH)

SPACER  
LOCK  
WASHER  
HEX NUTS

SPACER IS INSTALLED  
BETWEEN MAIN SHAFT  
& INSTRUMENT CASE.

THUMB  
NUT

CLOCK  
DRUM

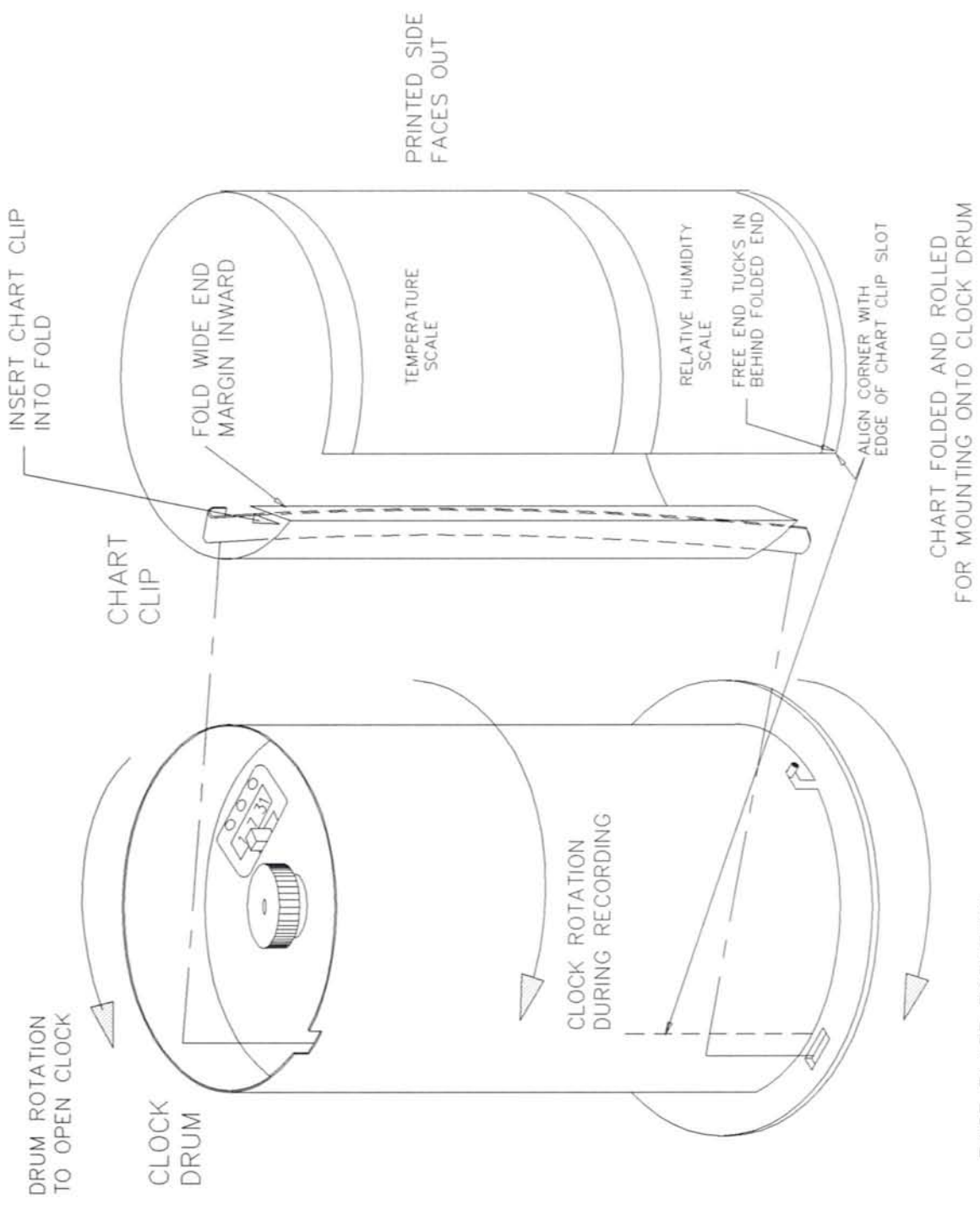
CHART  
CLIP

TIME BASE  
SELECT SWITCH

BATTERY  
HOLDERS

		SHEET 1 OF 1	
		DATE 10-27-94	SCALE NONE
TITLE <b>ASSEMBLY, ELECTRONIC CLOCK</b>		DWG NO.	941039
MODEL USAGE	BY RGN	SCALE	NONE

DRAWING NOT TO SCALE



DRAWING NOT TO SCALE