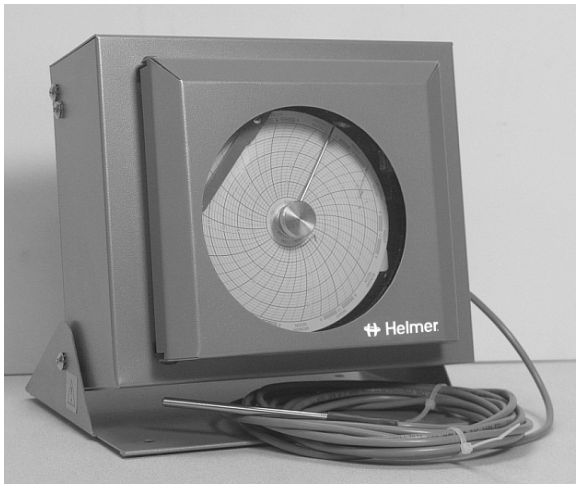
Temperature Chart Recorder

Operation and Service Manual



Factory-Installed on Select Helmer Products	
TCR	Version A

Standalone	
TCR1 (0°C to 35°C)	Version A
TCR2 (-5°C to 20°C)	Version A
TCR3 (-50°C to 0°C)	Version A

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Document History

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K	16 JUL 2013*	5428	Supersedes A, B, C, D, E, F, G, H, I, J	► Revised layout for ease of navigation and locating information. ► Updated Helmer logo and address. ► Corrected metric dimensions.

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About this manual

Welcome to the Helmer Temperature Chart Recorder Operation and Service Manual.

This section explains the symbols and conventions used in this manual, as well as trademark and copyright information about this product.

Symbols and conventions

Several symbols and conventions are used in this manual.

Cautions

A Caution is used to call attention to a condition or possible situation that could damage or destroy the equipment or the operator's work.

Cautions are identified as follows:

CAUTION This is a sample of a CAUTION: Before you calibrate the chart recorder, be sure the temperature has stabilized. An unstable temperature during calibration will result in incorrect temperature readings.

Notes

Notes contain additional information about a topic. Notes are used to provide information about how a topic relates to another topic, or background information about a design characteristic.

Notes are identified as follows:

NOTE This is a sample of a NOTE: Individual parts on the chart recorder are not available for replacement unless noted.

Copyright information

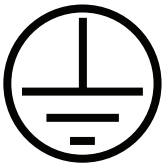
1 Working safely

This section describes general safety information for installing, using, and maintaining the chart recorder. Your organization may provide additional safety information.

1.1 Understanding safety-related labels

The following safety-related labels may appear on your chart recorder.

Caution, risk of danger



Protective earth ground terminal

1.2 General safety

To avoid injury to yourself and the chart recorder, follow these safety instructions:

- ► Use the chart recorder for the purpose for which it was designed. Protection provided by the chart recorder may be impaired if the chart recorder is used improperly.
- ► Do not use the chart recorder if its components are damaged. Notify the appropriate personnel in your organization for guidance regarding usage and maintenance.
- ► Never attempt to physically restrict any of the moving components.
- ► Do not move or bump the chart recorder during operation.
- ► Before performing the procedures in this manual, review the specific safety instructions for them.
- ► Perform only the maintenance and service described in this manual. Maintenance other than that specified in this manual should only be performed by technical service representatives authorized by Helmer.

1.3 Electrical safety

CAUTION The product on which the chart recorder is installed has the potential of being a shock hazard. Review all safety instructions for the product prior to removing or installing the chart recorder.

Review the following safety instructions before installing, using, or maintaining the chart recorder:

- ► Inspect all electrical equipment and address and problems prior to installation.
- ► To adjust, maintain, or troubleshoot the chart recorder, you may need to either remove it from the product, or remove covers to access certain parts. Follow all safety instructions, including disconnecting the power as applicable.
- ► Use only the power cords supplied with the chart recorder (if applicable).

1.4 Chemical and biological safety

Review the following safety instructions before installing, using, or maintaining the chart recorder:

CAUTION

- ► Decontaminate parts prior to sending for service or repair. Contact Helmer or your distributor for decontamination instructions and a Return Authorization Number.

2 Touring the chart recorder

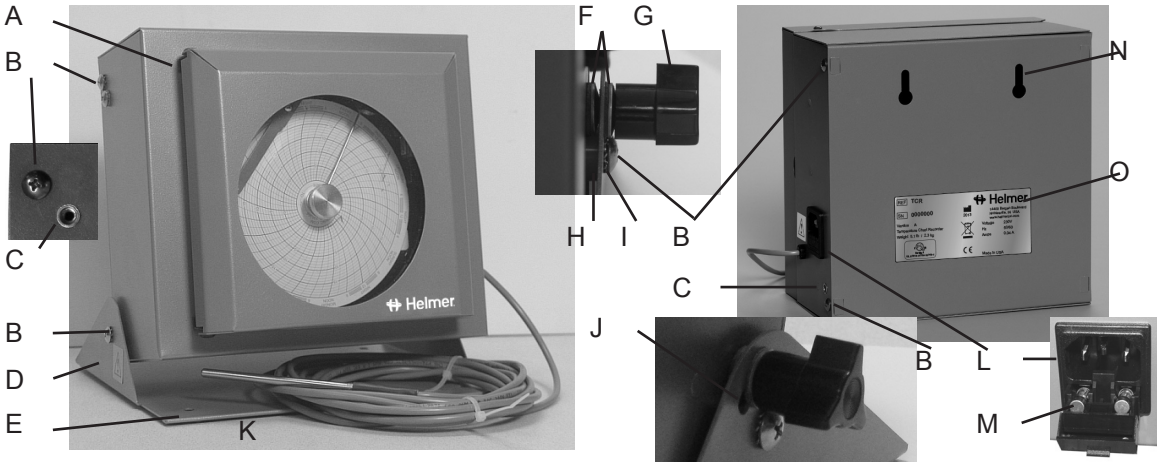
Congratulations on your purchase of a Helmer Temperature Chart Recorder (TCR). The TCR is inkless and continually records seven days' worth of temperature information.

The chart recorder is available in the following configurations:

- ► Chart recorder assembly installed on select Helmer products
- ► Standalone accessory with cover and stand for any temperature monitoring application

This section gives a brief overview of the components of the chart recorder.

2.1 Touring the cover and stand (standalone units only)



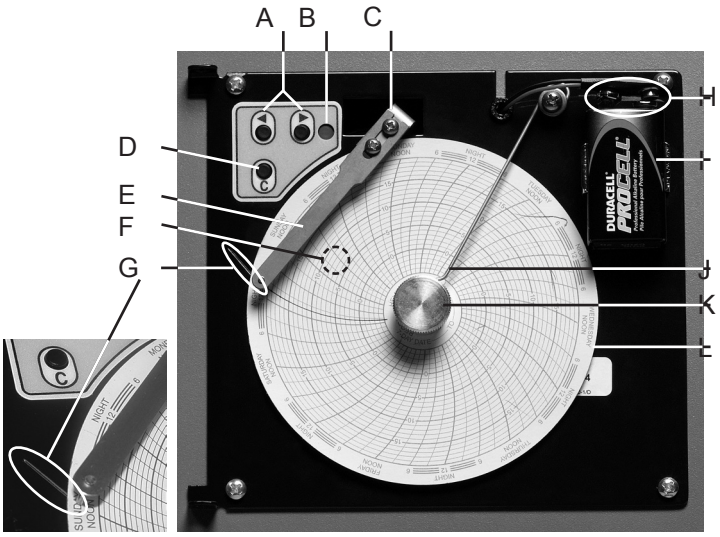
Standalone chart recorder with detail

Label	Description	Function
A	Chart recorder door and cover	Used to protect and access the chart recorder
B	Pivot screw	Used to adjust the position of the chart recorder and fasten the cover
C	Adjustment hole	Used to adjust the position of the chart recorder
D	Stand	Used to adjust the position of the chart recorder, and to mount the chart recorder under a cabinet
E	Mounting hole on stand	Used to mount the chart recorder under a cabinet
F	Compression washer	Used with the adjustment know to adjust the position of the chart recorder
G	Adjustment knob	Used to adjust the position of the chart recorder
H	Nylon washer	Used with the pivot screws to adjust the position of the chart recorder
I	Lock washer	Used with the pivot screws to adjust the position of the chart recorder
J	Adjustment slot	Used to adjust the position of the chart recorder
K	Temperature probe	Used to collect temperature data
L	Power connector	Interface for the power cord
M	Fuse	Prevents current overload
N	Wall mounting hole	Used to mount the chart recorder on a wall
O	Product Specification label	Provides the model number, serial number, and electrical requirements for the chart recorder

2.2 Touring the chart recorder assembly

This section describes parts common to both installed and standalone configurations.

2.2.1 Touring the front

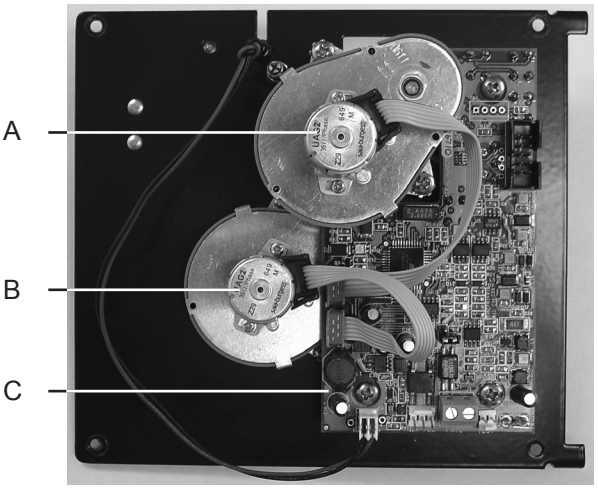


Front of chart recorder with chart paper and battery installed

Label	Description	Function
A	Left and Right Arrow buttons	Used to adjust settings and the stylus position
B	LED (light-emitting diode)	Indicates the status of the chart recorder while in operating mode, or the selected temperature range value in paper change mode
C	Mounting bracket	Maintains the angle of the stylus
D	C (Chart Change) button	Used to adjust the position of the stylus when changing the chart paper, or to run a test pattern
E	Stylus	Marks the temperature line on the paper
F	Reset button	Used to restart the chart recorder
G	Time line groove	Used to calibrate the chart paper to the correct time
H	Battery leads	Connects the backup battery to the chart recorder
I	Backup battery	Provides power if AC power fails
J	Chart knob holder	Prevents loss of the chart knob
K	Chart knob	Holds the chart paper in place
L	Chart paper	Used to record temperature information

2.2.2 Touring the rear

NOTE For more information about connectors on the circuit board, see Section 8.2, “Schematics.”



Rear of chart recorder

Label	Description	Function
A	Stylus (pin) motor	Moves the stylus
B	Paper motor	Rotates the paper
C	Circuit board	Controls chart recorder operation

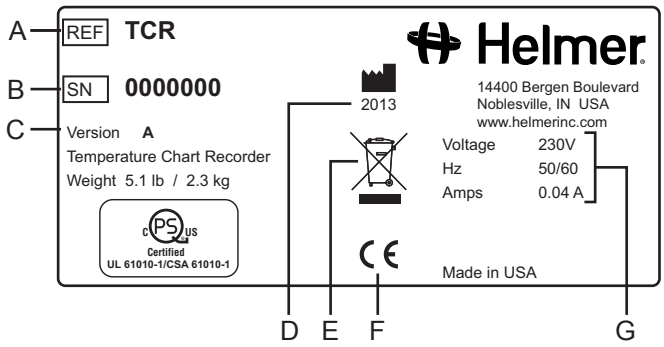
3 Installing the chart recorder

3.1 Recording identification information

For easy reference, write the serial number on the front of this manual. The serial number is needed to provide efficient service.

For chart recorders are installed on Helmer products, the serial number can be found on the product's Product Specification label.

For standalone chart recorders, the serial number can be found on the Product Specification label located on the rear panel.



Product Specification label

Label	Description
A	Model
B	Serial number (S/N)
C	Version
D	Date of manufacture
E	WEEE symbol. For more information, see Section 8.1.5.1, "WEEE compliance."
F	CE symbol. For more information, see Section 8.1.5.2, "CE Conformity for European Countries."
G	Power requirements

3.2 Selecting an appropriate location

If the chart recorder is not installed on a Helmer product, the location for your chart recorder must meet the following requirements, as well as any additional requirements specified for your organization:

- ► Stable, flat horizontal surface (such as a desktop), vertical surface (such as a wall), or under a cabinet.
- ► Access to a grounded outlet meeting the electrical requirements as listed in Section 8.1.1.1, "Input voltage and frequency."
- ► Access to the power cord so it can easily be disconnected from the chart recorder.

3.3 Placing the chart recorder (standalone units only)

Standalone chart recorders include a stand and mounting holes, which allow you to either place it on a horizontal surface or mount it according to your needs.

3.3.1 Placing the chart recorder on a horizontal surface

The rubber feet on the stand prevent the surface from being scratched, and the adjustment knob allows you to adjust the viewing angle.

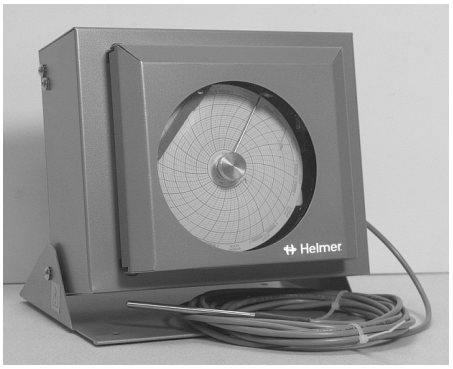


Chart record~~er~~ with stand, tilted for viewing

3.3.1.1 Adjusting the viewing angle

You may adjust the viewing angle.

To adjust the viewing angle

1. Loosen the pivot screw next to the adjustment knob and the one on the opposite side.
2. Loosen the adjustment knob, pivot the chart recorder to the appropriate angle, then tighten the knob.

3.3.2 Mounting the chart recorder on a wall or under a cabinet

You may mount the chart recorder on a wall or under a cabinet. To do so, first remove the stand.

You will need the following:

- Mounting kit (wall anchor with screw). Two kits are needed to mount the chart recorder directly onto a surface. Four kits are needed to mount the chart recorder with the stand onto a surface.
- #2 Phillips head Screwdriver

3.3.2.1 Removing the stand

The chart recorder attaches to the stand with two pivot screws, two lock washers, and two nylon washers. Two compression washers and the adjustment knob hold the chart recorder in position.

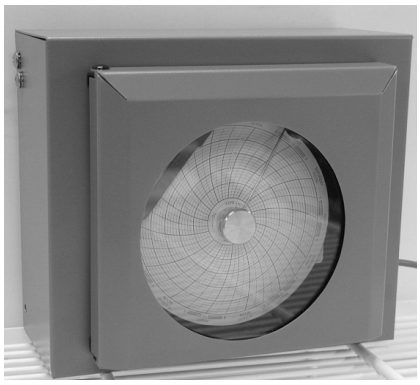
CAUTION Before removing the stand, disconnect the power cord.

To remove the stand

1. Disconnect the power cord.
2. Unscrew and remove the adjustment knob and the outer compression washer.
3. While holding the chart recorder in place, unscrew and remove the two lock washers and screws on which the chart recorder pivots.
4. Gently lift the chart recorder away from the stand. As you lift it, the two nylon washers and the inner compression washer will fall.
5. Reinstall the two screws, lock washers, and nylon washers you removed. Keep the stand, adjustment knob, and two compression washers for future use.

3.3.2.2 Mounting the chart recorder on a wall

The chart recorder has two rear apertures that allow it to be mounted on a wall.



Left: Mounting holes on the chart recorder. Right: Chart recorder mounted on a wall.

To mount the chart recorder on a wall

1. Remove the stand from the chart recorder. For instructions, see Section 3.3.2.1, “Removing the stand.”
2. Mark the wall with the location for the two anchors.
3. Install the anchors in the wall.
4. Install the mounting screws into the anchors, leaving a gap between the screw head and the anchor.
5. Place the chart recorder on the wall so the screw heads protrude into the lower part of the mounting holes.
6. Slide the chart recorder downward until the top of the mounting holes rest on the screws.

3.3.2.3 Mounting the chart recorder under a cabinet

The chart recorder can be mounted under a cabinet.

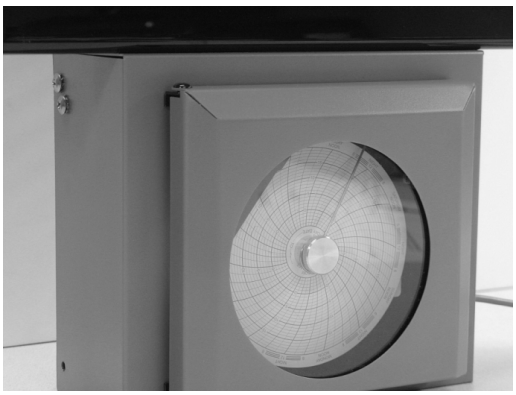


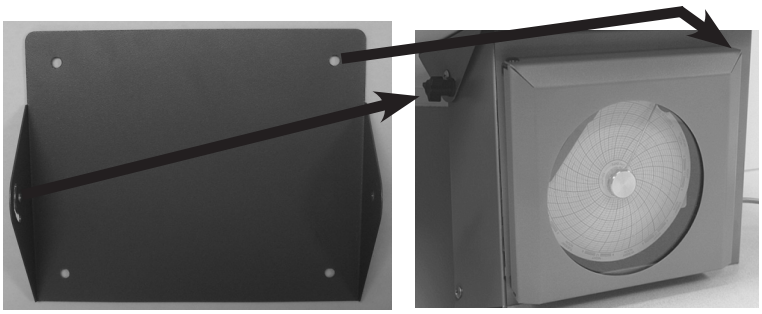
Chart recorder mounted under a cabinet

To mount the chart recorder under a cabinet

1 Remove the stand from the chart recorder. For instructions, see Section 3.3.2.1, “Removing the stand.”

2 Attach the stand to the bottom of the cabinet

a With the bottom of the stand facing up, and the adjustment slot on the left side, mark the underside of the cabinet with the location for the four mounting screws.

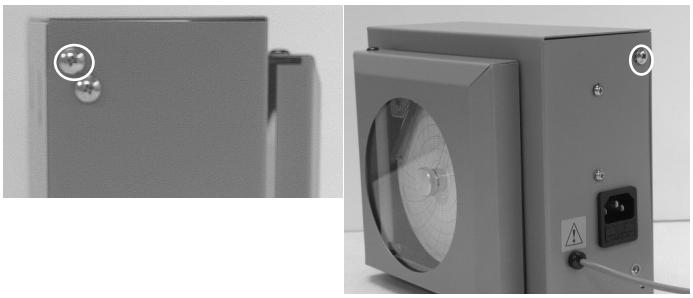


b While holding the stand in place, install the mounting screws through the stand into the underside of the cabinet. The wall anchors are not needed.

4 On the chart recorder, remove the two bottom pivot screws, remove the two lock washers and nylon washers, and reinstall the screws.

5 Attach the chart recorder to the stand

a On the chart recorder, remove the two top pivot screws (circled).

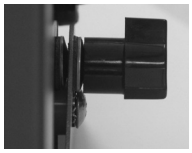


b Slide the chart recorder between the sides of the stand, aligning the pivot holes in the stand with the pivot screw holes on the chart recorder.

c Insert the two nylon washers between the chart recorder and the stand. Insert one washer on the left side of the chart recorder and one on the right.

d Reinstall both of the top pivot screws through the lock washer, through the pivot hole on the stand, through the nylon washer, and into the chart recorder. Do not tighten the screws all the way.

6 Install the adjustment knob by inserting it through the outer compression washer (black side toward the chart recorder), through the adjustment slot on the stand, and through the inner compression washer, then into the adjustment hole on the chart recorder.



7 Tilt the chart recorder to the desired angle, then tighten the knob to hold it in place.
8 Tighten the two top pivot screws to secure the chart recorder at the desired angle.

3.4 Connecting to and disconnecting from power

Chart recorders installed on Helmer products obtain main (AC) power through the product. Standalone chart recorders are shipped with a modular power cord.

To connect to main (AC) power

CAUTION As with any electronic device, before connecting to power, make sure the chart recorder is at room temperature.

- ► Do one of the following:
  - ► Chart recorders installed in a Helmer product:
    - ► Connect the product to main power.
  - ► Standalone chart recorders:
    1. Connect one end of the power cord to the power connector on the chart recorder.
    2. Plug the power cord into a grounded outlet that meets the power requirements found on the Product Specification label on the chart recorder.

To disconnect from power

- ► Do one of the following:
  - ► Chart recorders installed in a Helmer product: Disconnect the power to the product.
  - ► Standalone chart recorders: Unplug the power cord from the outlet or power connector.

3.5 Connecting the backup battery

The backup battery provides power to the chart recorder if AC power fails. The chart recorder is shipped from the factory with the battery installed but not connected to the leads.

You must connect the leads to the battery to provide backup power to the chart recorder.

4 Configuring the chart recorder

This section includes procedures to configure the chart recorder prior to operation.

4.1 Setting the temperature range for your application

The chart recorder has three settings, each of which corresponds to a certain temperature range. For valid temperature information, the correct chart paper must be installed, and the temperature range must be set to the correct value. The options are as follows:

Temperature range	Helmer product	Range value
0 ºC to 35 ºC	Platelet Incubators	1 (LED single flash)
-5 ºC to 20 ºC	Refrigerators	2 (LED double flash)
-50 ºC to 0 ºC	Freezers	3 (LED triple flash)

For chart recorders installed on Helmer products, the temperature range is set correctly for use with the product.

For standalone chart recorders, the temperature range is set to match the model ordered:

- ► TCR1: Range value 1
- ► TCR2: Range value 2
- ► TCR3: Range value 3

If you do not know what range is programmed, or need to monitor a different temperature range, use the following procedures to check and change the range value.

To determine the temperature range setting

1. On the chart recorder, enter paper change mode by pressing and holding the C (Chart Change) button until the stylus starts to move to the left, then releasing the button. The LED flashes green to indicate the current temperature range value.
2. Exit paper change mode by pressing and holding the C (Chart Change) button until the stylus starts to move to the right, then releasing the button. The LED returns to a constant pattern.

To change the temperature range setting

1. On the chart recorder, enter paper change mode by pressing and holding the C (Chart Change) button until the stylus starts to move to the left, then releasing the button. The LED flashes green to indicate the current temperature range value.
2. Enter range change mode by pressing and holding the left arrow button. After about five seconds, the LED flashes red to indicate the selected temperature range value.
3. While continuing to press the left arrow button, press and release the right arrow button to cycle through and select the new range value.
4. Save the selected value by releasing the left arrow button. The chart recorder returns to paper change mode. The LED flashes green to indicate the current temperature range value.
5. Repeat steps 2-4 as necessary until the LED pattern indicates the correct range.
6. Exit paper change mode by pressing and holding the C (Chart Change) button until the stylus starts to move to the right, then releasing the button. The LED returns to a constant pattern.

4.2 Installing and changing the chart paper

You must install paper to use the chart recorder. Products with the chart recorder already installed are shipped from the factory with chart paper packaged separately.

Each temperature range value requires a different chart paper. The temperature grid pre-printed on the

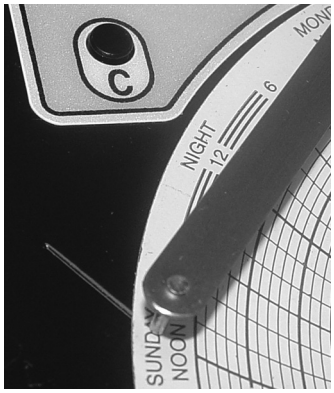
paper corresponds with the temperature range. Be sure to use the correct paper for your product or application. For part number information, see Section 7.2, “Parts.”

After seven days of continuous recording, the paper must be changed. If the paper is not changed, the paper will continue to rotate, resulting in multiple temperature markings.

The chart recorder itself does not have an alarm to change the paper; however, an alarm can be set on select models of the products in which the chart recorder is installed. For more information and instructions to set the alarm, refer to the Operation Manual for your product.

To change the chart paper

1. On the chart recorder, enter paper change mode by pressing and holding the C (Chart Change) button until the stylus starts to move to the left, then releasing the button. The LED flashes to indicate the current temperature range value.
2. After the stylus has stopped, remove the chart knob by turning it counter-clockwise, then swing it toward the top of the chart recorder.
3. If chart paper is already installed, remove it by gently lifting the stylus and removing the paper.
4. Press the new chart paper onto the chart recorder.
5. Gently lift the stylus and turn the paper so the correct time line coincides with the time line groove.



Paper positioned so SUNDAY NOON coincides with the time line groove

6. While holding the chart paper to prevent it from turning, re-install the chart knob by turning it clockwise until it is snug.

CAUTION

- ► After the chart knob has been tightened, do not turn the knob counter-clockwise to adjust the position of paper. If the time line does not coincide with the groove, repeat Steps 5-6 to adjust it.
- ► The paper motor has some “play,” or looseness, designed into it. If the chart knob is not turned fully clockwise prior to operation, the “play” could cause the temperature to be marked on the paper up to two hours later than when the probe actually read the temperature.

7. Confirm the temperature range is set to the correct value for your product. For more information, see Section 4.1, “Setting the temperature range for your application.”
8. Exit paper change mode by pressing and holding the C (Chart Change) button until the stylus starts to move to the right, then releasing the button.
9. Confirm the stylus is marking the temperature correctly. If it is not, see Section 7.1.3, “Troubleshooting stylus and marking problems,” for information on how to proceed.

4.3 Calibrating the chart recorder

Calibrate to ensure the temperature being marked matches that read by the chart recorder probe. The frequency for calibration and the acceptable tolerance may be determined by your organization. The chart recorder should be calibrated whenever the temperature range is changed.

Verify the probe is reading correctly by comparing the reading to that of an independent thermometer. After determining the appropriate temperature, you may change the position of the stylus on the chart recorder so the temperature is marked in the correct location.

The chart recorder is calibrated at the factory prior to shipment.

To calibrate the settings for the chart recorder temperature probe

1. After the chamber temperature has stabilized, measure the temperature where the probe for the chart recorder is located. If the probe is inserted into liquid, measure the temperature of the liquid. For more information and instructions, refer to the Operation Manual for the product in which the chart recorder is installed (if applicable).
2. Change the position of the stylus arm if necessary. The arrow buttons on the chart recorder indicate which direction the stylus will move. Press and hold the appropriate arrow button until the stylus has moved to the desired location, then release the button to save the setting. While the stylus is moving to the new location, the LED is off. After the button is released, the LED lights green (constant pattern) to indicate a return to normal operating mode.

5 Understanding normal operation

This section describes how the chart recorder normally operates, and explains the meaning of the LED patterns for each mode.

5.1 Understanding initialization

When the chart recorder starts receiving power, it goes through an initialization sequence.

First, the stylus travels outward until the stylus tip reaches near the outer edge of the chart paper. Next, the stylus travels to the inner temperature ring of the chart paper. Finally, the stylus swings out again and stops at the location corresponding to the temperature reading from the probe.

The LED flashes during initialization, then returns to a constant green upon reaching normal operation mode.

5.2 Understanding temperature markings

The temperature marking will fluctuate as the temperature read by the probe fluctuates. A typical temperature marking fluctuates within a range of about 1 ºC.

5.3 Understanding visual indicators

The chart recorder has an LED that visually indicates the status of the chart recorder. The meaning of the LED pattern varies depending on what mode the chart recorder is in.

LED color/pattern	Mode	Meaning
Off	Test pattern	A test pattern is in progress. For more information, see Section 7.1.4, “Running a test pattern.”
	Normal operation	The chart recorder is not receiving power.
Green/Constant	Normal operation	The chart recorder is receiving AC power; and the backup battery for the chart recorder is installed and has sufficient power.
Red/Constant	Normal operation	The chart recorder is receiving AC power; and the backup battery for the chart recorder is either not installed or does not have sufficient power.
Red/Single flash (fast)	Normal operation	The chart recorder is receiving power only from the backup battery for the chart recorder.
Green/Single flash	Initialization	The chart recorder is initializing upon start-up or restoration of power.
	Normal	There is a problem with the probe circuit.
	Paper change	Temperature Range Value 1 (0 ºC to 35 ºC / incubator) is selected.
Red/Single flash (slow)	Range change	Temperature Range Value 1 (0 ºC to 35 ºC / incubator) is selected and can be changed.
Green/Double flash	Paper change	Temperature Range Value 2 (-5 ºC to 20 ºC / refrigerator) is selected.
Red/Double flash	Range change	Temperature Range Value 2 (-5 ºC to 20 ºC / refrigerator) is selected and can be changed.
Green/Triple flash	Paper change	Temperature Range Value 3 (-50 ºC to 0 ºC / freezer) is selected.
Red/Triple flash	Range change	Temperature Range Value 3 (-50 ºC to 0 ºC / freezer) is selected and can be changed.

6 Maintaining the chart recorder

6.1 Reviewing the preventive maintenance schedule

Maintenance tasks must be completed according to the following schedule.

NOTE These are minimum requirements. Regulations for your organization or physical conditions at your organization may require maintenance items to be performed more frequently. Follow the guidelines for your organization.

	Frequency		
Task	**Quarterly**	**Annually**	**As Needed**
Calibrate the chart recorder. ► For more information and instructions, see Section 4.3, “Calibrating the chart recorder.”			✓
Check the backup battery and replace it if necessary. ► For more information and instructions, see Section 6.2, “Replacing the backup battery.”	✓		
Clean the cover (standalone units only). ► For more information and instructions, see Section 6.3, “Cleaning the chart recorder (standalone units only).”			✓

6.2 Replacing the backup battery

The chart recorder has a visual alarm to notify you if the remaining charge on the installed battery is too low: the LED color changes from green to red (constant pattern). This alarm remains active until a battery with sufficient charge is installed.

When the low battery alarm appears, the chart recorder can continue to operate on battery power for about 14 hours. While the chart recorder is operating on battery power only, the LED flashes red (fast).

You must have the following to replace the backup battery:

► 9 V non-rechargeable alkaline (or equivalent) battery.

To replace the backup battery

1. On the chart recorder, disconnect the leads to the old battery and remove the old battery from the holder.
2. Press the new battery into the holder and connect the leads to the new battery. The LED color changes from constant red to constant green.

6.3 Cleaning the chart recorder (standalone units only)

CAUTION Follow all chemical handling and disposal requirements and procedures specified by your organization. For more information, see Section 1, “Working safely.”

For standalone chart recorders, clean the cover with a dry cloth.

7 Troubleshooting and servicing the chart recorder

This section explains issues you may experience while using the chart recorder, and provides actions you may take to correct them. This section also includes information about certain replacement parts.

7.1 Troubleshooting

CAUTION You may need to either remove the chart recorder from another product or remove covers to access the rear of the chart recorder. Follow all safety instructions, including disconnecting the chart recorder from power as applicable. If you do not have the technical expertise or authority to troubleshoot and address the problem, you may need to contact a qualified service technician for assistance.

7.1.1 Troubleshooting general operation problems

Problem	Possible cause	Action
The chart recorder paper is not rotating.	The chart knob is not fully tightened.	► Tighten the chart knob.
	The connection between the paper rotation motor and the circuit board is loose or incorrect.	► Confirm the ribbon cable from the paper rotation motor is securely connected to the P2 (PAPER) connector
	The chart recorder is not receiving power (units installed on Helmer products only).	Verify the following and correct issues as necessary. ► Verify the product on which the chart recorder is installed is receiving AC power. ► Verify the correct voltage is being supplied from the chart recorder power source, and the connections from the power source to the J2 connector on the circuit board are secure. ► Verify the leads are securely connected to the battery and the J3 connector on the circuit board.

Problem	Possible cause	Action
The chart recorder paper is not rotating.	The chart recorder is not receiving power (standalone units only).	Verify the following and correct issues as necessary. ► Verify the power cord is connected securely to the chart recorder and the outlet. Tighten the connections if necessary. ► Verify one or both fuses has not blown. Replace the fuse or fuses if necessary. For part number information, see Section 7.2, “Parts.” ► Verify power at the outlet. Repair the original outlet or connect to a different outlet if necessary. ► Confirm voltage running through the power connector is appropriate, and that the connections from the power connector through the transformer to the J2 connector on the circuit board are secure. If it is not, secure the connections or replace the power cord, power connector, or transformer as appropriate. ► Verify the leads are securely connected to the battery and the J3 connector on the circuit board.
	The chart recorder electronics have locked up.	► Run a test pattern to verify the mechanics of the chart recorder are working correctly. For more information and instructions, see Section 7.1.4, “Running a test pattern.” If the mechanics are working correctly, but the problem is not solved, restart the chart recorder. For instructions, see Section 7.1.6, “Restarting the chart recorder.”
The chart recorder is hard to read (standalone units only).	The viewing angle is set wrong or has changed.	► Adjust the viewing angle and tighten it in place. For more information and instructions, see Section 3.3.1.1, “Adjusting the viewing angle (standalone units only).”

7.1.2 Troubleshooting visual indicators

For more information, see Section 5.3, “Understanding visual indicators.”

Problem	Possible cause	Action
The LED is constant red.	The backup battery is missing or not connected.	► Verify a battery is installed and connected. ► Verify the leads are connected to the backup battery, and the connections from the lead wires to the J3 connector on the circuit board are secure.
	The backup battery power is low.	► Replace the backup battery. For more information and instructions, see Section 6.2, “Replacing the backup battery.”
The LED is flashing red.	The chart recorder is in range change mode.	► Verify the temperature range is set correctly for your application, then return to normal operation. For more information and instructions, see Section 4.1, “Setting the temperature range for your application.”
	The chart recorder is only receiving power from the backup battery. (units installed on Helmer products only)	► Verify the product on which the chart recorder is installed is receiving AC power. ► Verify the correct voltage is being supplied from the chart recorder power source on the product, and that the connections from the power source to the J2 connector on the circuit board are secure.
	The chart recorder is only receiving power from the backup battery. (standalone units only)	► Verify the power cord is connected securely to the chart recorder and the outlet. Tighten the connections if necessary. ► Verify one or both fuses has not blown. Replace the fuse or fuses if necessary. For part number information, see Section 7.2, “Parts.” ► Verify power at the outlet. Repair the original outlet or connect to a different outlet if necessary. ► Check the voltage flowing through the power connector is appropriate, and the connections from the power connector through the transformer to the J2 connector on the circuit board are secure. If not, secure the connections or replace the power cord, power connector, or transformer as appropriate.

Problem	Possible cause	Action
The LED is flashing green.	The chart recorder is initializing after start-up or restoration of power.	► Wait for the initialization process to end. For more information, see Section 5.1, “Understanding initialization.”
	The chart recorder is in paper change mode.	► Verify the temperature range is set correctly for your application, then return to normal operation. For more information and instructions, see Section 4.1, “Setting the temperature range for your application.”
	There is a problem with the probe circuit.	► Verify the probe connections are secure. ► Test the probe circuit to determine if the probe is faulty. For more information and instructions, see Section 7.1.7, “Testing the probe circuit.”

7.1.3 Troubleshooting stylus and marking problems

Problem	Possible cause	Action
The stylus is not marking the paper or is marking too lightly.	The stylus tip is not touching the paper.	► Gently bend the stylus to move the tip closer to the paper. ► Adjust the mounting bracket angle. **a** Remove the stylus. **b** Gently bend the mounting bracket. **c** Install the stylus, making sure the tip is aligned with the time line groove.
The stylus is at the edge of the paper and will not move.	There is a problem with the probe circuit.	► Verify the probe connections are secure. ► Test the probe circuit to determine if the probe is faulty. For more information and instructions, see Section 7.1.7, “Testing the probe circuit.”
	The chart recorder is in paper change mode.	► Verify the temperature range is set correctly for your application, then exit paper change mode. For more information and instructions, see Section 4.1, “Setting the temperature range for your application.”
	The chart recorder electronics have locked up.	► Run a test pattern to verify the mechanics of the chart recorder are working correctly. For more information and instructions, see Section 7.1.4, “Running a test pattern.” If the mechanics are working correctly, but the problem is not solved, restart the chart recorder. For instructions, see Section 7.1.6, “Restarting the chart recorder.”

Problem	Possible cause	Action
The stylus moves beyond the outer edge of the paper.	The temperature range is set to the wrong range.	► Verify the temperature range is set correctly for your application. For more information and instructions, see Section 4.1, “Setting the temperature range for your application.”
	There is a problem with the probe circuit.	► Verify the probe connections are secure. ► Test the probe circuit to determine if the probe is faulty. For more information and instructions, see Section 7.1.7, “Testing the probe circuit.”
	The chart recorder is in probe simulation mode.	► Verify the jumper is set correctly for normal operation. For more information, see Section 7.1.7, “Testing the probe circuit.”
The stylus moves beyond the inner edge of the paper.	The temperature range is set to the wrong range.	► Verify the temperature range is set correctly for your application. For more information and instructions, see Section 4.1, “Setting the temperature range for your application.”
	The chart recorder is in probe simulation mode.	► Verify the jumper is set correctly for normal operation. For more information, see Section 7.1.7, “Testing the probe circuit.”
The stylus is marking at the wrong time.	The chart recorder electronics have locked up.	► Run a test pattern to verify the mechanics of the chart recorder are working correctly. For more information and instructions, see Section 7.1.4, “Running a test pattern.” If the mechanics are working correctly, but the problem is not solved, restart the chart recorder. For instructions, see Section 7.1.6, “Restarting the chart recorder.”
	After the paper was changed, the chart knob was not turned fully clockwise, causing the paper rotation motor to lag.	► After changing the paper, verify the chart knob is turned fully clockwise. For more information and instructions, see Section 4.2, “Installing and changing the chart paper.”
The stylus is marking at the wrong temperature.	The temperature range is set to the wrong range.	► Verify the temperature range is set correctly for your application. For more information and instructions, see Section 4.1, “Setting the temperature range for your application.”
	The chart recorder is in probe simulation mode.	► Verify the jumper is set correctly for normal operation. For more information, see Section 7.1.7, “Testing the probe circuit.”
	The chart recorder is not calibrated.	► Calibrate the chart recorder. For instructions, see Section 4.3, “Calibrating the chart recorder.”
	There is a problem with the probe circuit.	► Verify the probe connections are secure. ► Test the probe circuit to determine if the probe is faulty. For more information and instructions, see Section 7.1.7, “Testing the probe circuit.”

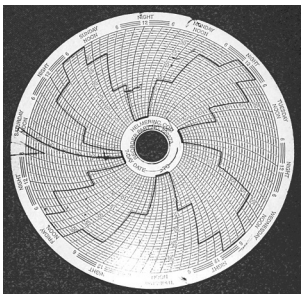
Problem	Possible cause	Action
The temperature line being marked is more erratic, fuzzy, or saw-toothed than normal (applies to chart recorders used with Helmer refrigerators and freezers only).	The chart recorder probe is not immersed in the probe bottle.	In the product where the chart recorder is installed, do the following: ► Verify the chart recorder probe is immersed correctly in the probe bottle. ► Verify the probe bottle has an adequate amount of product simulation solution. For more information, refer to the Operation Manual for your product.
Multiple markings appear for a time period.	The paper was not changed.	► Change the paper. For instructions, see Section 4.2, “Installing and changing the chart paper.”

7.1.4 Running a test pattern

Verify the mechanics of the chart recorder are working correctly by running a test pattern.

When you run a test pattern, the full range of the chart recorder is tested. The test prints a step pattern across the temperature range, regardless of the temperature range setting. During the test, the paper makes one complete revolution, then the chart recorder returns to normal operating mode.

The pattern is used to check if the marking is being recorded at the wrong time (“losing time”) due to a faulty paper motor. The pattern is also used to check if the chart recorder is capable of marking across the temperature range, or if a faulty stylus (pin) motor is preventing the temperature from being marked correctly.



Sample test pattern (shown for an incubator / 0 ºC to 35 ºC)

To run a test pattern

► On the chart recorder, press and hold the C (Chart Change) button and the right arrow button together until the LED turns off. The chart recorder marks the test pattern. When the pattern is completed, the LED lights green (constant pattern) to indicate a return to normal operating mode.

To stop a test pattern in progress

► Press and hold the C (Chart Change) button for one second. The stylus returns to the starting point, and the LED lights green (constant pattern).

7.1.5 Removing the rear panel (standalone units only)

Some tasks require you access the inside of the chart recorder. Use the following procedures to remove and replace the rear panel.

You will need a screwdriver to remove the rear panel from the base.

CAUTION Before removing the rear panel, disconnect the power to the chart recorder to eliminate the potential of electric shock.

To remove the rear panel

1. Disconnect the power to the chart recorder. For instructions, see Section 3.4, “Connecting to and disconnecting from power.”
2. Remove the chart recorder from the stand. For instructions, see Section 3.3.2.1, “Removing the chart recorder from the stand.”
3. Using a screwdriver, loosen and remove all four pivot screws, then pull the rear panel away from the base.

7.1.6 Restarting the chart recorder

Some troubleshooting actions require you restart the chart recorder. Restarting is typically done to address software or electronics issues when other actions have not effectively solved the problem.

To restart the chart recorder using the reset button

1. Move the chart paper to expose the access hole for the reset button. The access hole is located below the LED.
2. Using a paper clip or other narrow tool, press and release the reset button. The chart recorder initializes and the LED flashes.

To restart the chart recorder by disconnecting AC power to the product

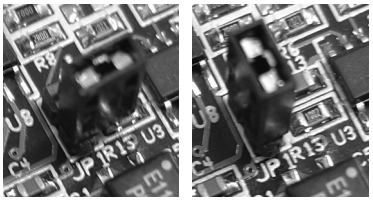
1. On the chart recorder, disconnect the leads from the backup battery. The LED changes to constant red.
2. Disconnect the AC power to the chart recorder or the product in which the chart recorder is installed. The LED turns off.
3. Connect AC power to the chart recorder or the product in which the chart recorder is installed. The chart recorder initializes and the LED flashes. When initialization is complete, the LED changes to constant red.
4. On the chart recorder, connect the leads to the backup battery. The LED changes to constant green to indicate normal operating mode.

7.1.7 Testing the probe circuit

If you notice the LED is slowly flashing green, or temperature markings are slowly and repeatedly deviating from the calibrated temperature, then there may be a problem with the probe circuit. You may test the probe circuit to determine where the problem lies.

When the chart recorder is put into probe simulation mode, a jumper is added to the probe circuit in place of the chart recorder probe. The jumper causes the circuit board to provide a fixed resistance that simulates a temperature reading. The stylus should move to a fixed temperature on the paper.

While in probe simulation mode, the LED pattern indicates where the problem lies. If the LED changes to a constant pattern, then the problem is with the probe or its connectors or wiring. If the LED continues to flash slowly, then the problem is with the chart recorder.



JP1 jumper positions. Left: Normal mode. Right: Probe simulation mode (pins connected).

To test the probe circuit

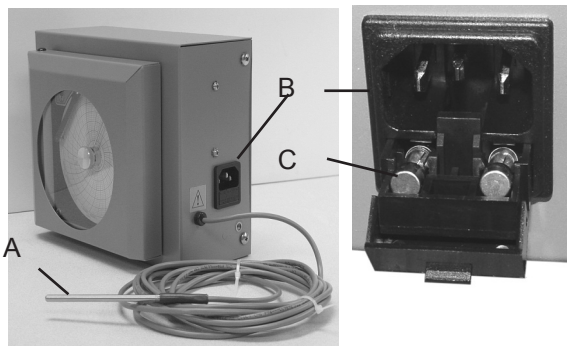
1. Put the chart recorder in probe simulation mode.
   - **a** Access the rear of the chart recorder.
   - **b** Disconnect the chart recorder probe from the circuit board.
   - **c** On the circuit board, locate the JP1 connector and move the jumper so it connects both pins. The chart recorder is now in probe simulation mode.
2. On the front of the chart recorder, check whether the LED pattern is flashing or constant.
   - ► If the LED pattern is constant, the problem is with the probe or its connectors or wiring. Verify all connections are tight. Replace the probe if necessary.
   - ► If the LED pattern is flashing, the chart recorder is faulty. Replace the chart recorder.
3. Return the chart recorder to normal operating mode.
   - **a** On the JP1 connector, verify the jumper is in normal mode. Move the jumper if necessary.
   - **b** Secure the chart recorder to the product. If the chart recorder was replaced, make sure the connections are correct and secure.

7.2 Parts

The Troubleshooting section recommends replacing parts in certain situations. This section shows where to find replaceable parts and lists part numbers for them. It also includes references to the parts on the electrical schematic, as appropriate. See Section 8.2, “Schematics” for more information.

NOTE The chart recorder assembly, which includes the stylus and motors, is not serviceable at the part level.

7.2.1 Cover and main power parts (standalone units only)



Standalone chart recorder with various parts shown

Label	Description	Replacement part numbers	Label on schematic
A	Probe	400799-1	E
B	Power connector with fuse holder	Fuses are not included 115 V models: 120152 230 V models: 120379	F
C	Fuse, 0.063 A	115 V models (one required): 120572	G
	Fuse, 0.05 A	230 V models (two required): 120571	
Not shown	Chart recorder assembly	400498-1	-
Not shown	Power cord	115 V models: 120155 230 V models: 120156	-
Not shown	Mounting kit	Includes one screw and one wall anchor. Two kits are needed for wall mounting; Four kits are needed for under cabinet mounting. 230350	-

7.2.2 Accessories and supplies

Description	Replacement part numbers	Label on schematic
Chart paper, 0 ºC to 35 ºC (incubator range)	220273 (package of 52 sheets)	-
Chart paper, -5 ºC to 20 ºC (refrigerator range)	220366 (package of 52 sheets)	-
Chart paper, -50 ºC to 0 ºC (freezer range)	220419 (package of 52 sheets)	-
Backup battery (9 V alkaline, non-rechargeable)	120218	C

8 Reference information

NOTE Information in this section is for the chart recorder. For information about the product in which the chart recorder is installed, refer to the Operation Manual for the product.

8.1 Technical specifications

8.1.1 Power

8.1.1.1 Input voltage and frequency

For chart recorders installed in a Helmer product, the main power varies depending on the product in which the chart recorder is installed. Power is received from the chart recorder power source on the product.

- ► Platelet Incubators: 12 V dc to 16 V dc
- ► Refrigerators and Freezers: 12 V ac to 16 V ac

For standalone chart recorders, the requirements are specified on the Product Specification label. The voltage tolerance is ± 10% of the nominal voltage:

- ► 115 V, 50/60 Hz
- ► 230 V, 50/60 Hz

8.1.1.2 Power consumption

The power consumption for a standalone chart recorder is specified on the Product Specification label.

- ► 115 V models: 0.06 A
- ► 230 V models: 0.04 A

8.1.1.3 Fuses

Standalone models require one or more fuses. Fuses are 5 mm x 20 mm, Time Lag (Type T), High Breaking Capacity (H).

- ► 115 V models: one fuse rated 0.063 A / 250 V
- ► 230 V models: two fuses, each rated 0.05 A / 250 V

8.1.2 Weight (standalone units only)

Weight: 5.1 lb (2.3 kg)

8.1.3 Size (standalone units only)

Exterior dimensions for the chart recorder without the stand (does not include items protruding from the main unit):

- ► Width: 8 in (204 mm)
- ► Height: 7 in (178 mm)
- ► Depth: 4.5 in (115 mm)

Overall exterior dimensions for the chart recorder with the stand, adjusted so chart recorder is tilted about 30° and including items that protrude from the main unit.

- ► Width: 9.5 in (242 mm)
- ► Height: 8.25 in (210 mm)
- ► Depth: 6.75 in (172 mm)

8.1.4 Operating conditions

This chart recorder is designed for indoor use only.

This monitoring system is designed for indoor use only.

Altitude (maximum): 2000 m

Ambient temperature range: 5 ºC to 40 ºC (41 ºF to 104 ºF)

Relative humidity (maximum for ambient temperature): 80%

8.1.5 Energy conservation and regulatory compliance

This product is certified to applicable UL and CSA standards by a NRTL.

Pollution Degree: 2 (for use in USA and Canada only)

8.1.5.1 WEEE compliance

The WEEE (waste electrical and electronic equipment) symbol indicates compliance with European Union Directive WEEE 2002/96/EC and applicable provisions. The directive sets requirements for the labeling and disposal of certain products in affected countries.

WEEE symbol

When disposing of this product in countries affected by this directive, ensure the following:

- ► Do not dispose of this product as unsorted municipal waste.
- ► Collect this product separately.
- ► Use the collection and return systems available to you.

For more information on the return, recovery, or recycling of this product, contact your local distributor.

8.1.5.2 CE Conformity for European Countries

CE

This device complies with the requirements of directive 89/336/EEC Electromagnetic Compatibility, and 73/23/EEC Low Voltage Directive.

8.2 Schematics

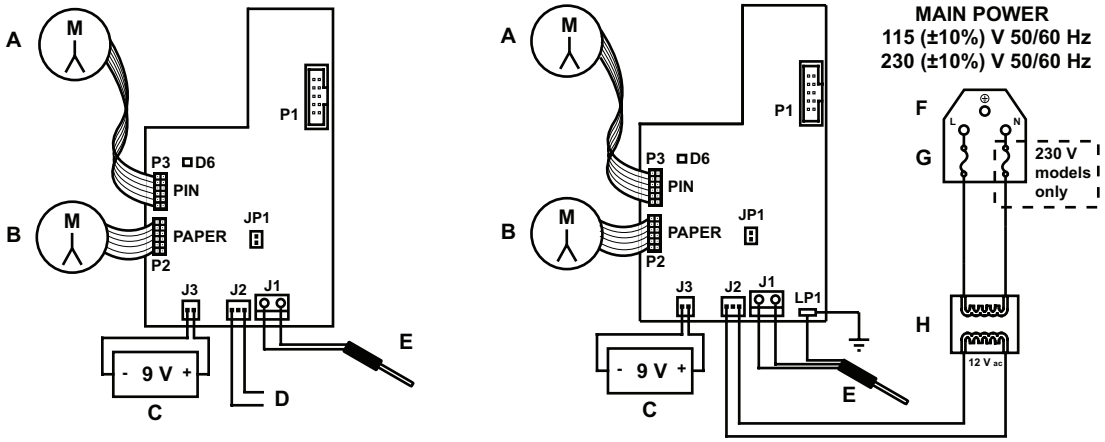


Chart recorder schematics. Left: As installed in a Helmer product. Right: Standalone unit

Label	Description
A	Stylus (pin) motor
B	Paper (timer) motor
C	Backup battery
D	Chart recorder power source in Helmer product
E	Temperature probe
JP1	Jumper for probe simulation mode
P1	Programming port (factory use only)
D6	Heartbeat LED (alternately flashes red and green)
LP1	Ground for probe on standalone unit
F	Power connector for standalone unit
G	Fuses for standalone unit
H	Transformer for standalone unit

Warranty

USA and Canada

For technical service needs, please contact Helmer at 800-743-5637 or www.helmerinc.com. Be sure to have the model and serial number available.

Rapid Resolution

When a warranty issue arises it is our desire to respond quickly and appropriately. The service department at Helmer is there for you. Helmer will oversee the handling of your warranty service from start to finish. Therefore, Helmer must give advance authorization for all service calls and/or parts needs relating to a warranty issue. Any repeat service calls must also be authorized as well. This allows for proper diagnosis and action. Helmer will not be responsible for charges incurred for service calls made by third parties prior to authorization from Helmer. Helmer retains the right to replace any product in lieu of servicing it in the field.

Parts

For a period of two (2) years, Helmer will supply at no charge, including freight, any part that fails due to defects in material or workmanship under normal use, with the exception of expendable items. Batteries and chart paper are expendable items. Inspection of defective parts by Helmer will be final in determining warranty status. Warranty procedures must be followed in all events.

Labor

For a period of one (1) year, Helmer will cover repair labor costs, provided that the product is returned to Helmer for warranty service. Alternatively, your facility's staff may work with a Helmer technician to make repairs on site. Labor costs for repairs performed at a location other than Helmer, or for repairs made without the assistance of a Helmer technician, will be the responsibility of the end user.

Additional warranty information

The time periods set forth above begin two weeks after the original date of shipment from Helmer. Warranty procedures set forth above must be followed in all events.

THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE SHALL APPLY.

THE LIABILITY, IF ANY, OF HELMER FOR DIRECT DAMAGES WHETHER ARISING FROM A BREACH OF ANY SALES AGREEMENT, BREACH OF WARRANTY, NEGLIGENCE, OR INDEMNITY, STRICT LIABILITY OR OTHER TORT, OR OTHERWISE WITH RESPECT TO THE GOODS OR ANY SERVICES IS LIMITED TO AN AMOUNT NOT TO EXCEED THE PRICE OF THE PARTICULAR GOODS OR SERVICES GIVING RISE TO THE LIABILITY. IN NO EVENT SHALL HELMER BE LIABLE FOR ANY INDIRECT, INCIDENTAL, CONSEQUENTIAL, OR SPECIAL DAMAGES, INCLUDING WITHOUT LIMITATION DAMAGES RELATED TO LOST REVENUES OR PROFITS, OR LOSS OF PRODUCTS.

This warranty does not cover damages caused in transit, during installation by accident, misuse, fire, flood, or acts of God. Further, this warranty will not be valid if Helmer determines that the failure was caused by a lack of performing recommended equipment maintenance (per Helmer manual) or by using the product in a manner other than for its intended use. Installation and calibration are not covered under this warranty agreement.

Outside of USA and Canada

Consult your local distributor for warranty information.

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