

USER GUIDE
UGD046-0713

Model DM3-e Drying Monitor

Included as part of the DC-T TouchView Dryer Control



Please record your equipment's model and serial number(s) and the date you received it in the spaces provided.

It's a good idea to record the model and serial number(s) of your equipment and the date you received it in the User Guide. Our service department uses this information, along with the manual number, to provide help for the specific equipment you installed.

Please keep this User Guide and all manuals, engineering prints and parts lists together for documentation of your equipment.

Date: _____

Manual Number: UGD046-0713 _____

Serial Number(s): _____

Model Number(s): _____

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Table of Contents

1-1 Introduction

Purpose of the User Guide	1-2
How the Guide Is Organized	1-2
Your Responsibility as a User	1-2
ATTENTION: Read this so no one gets hurt	1-3
Zero Mechanical State	1-4

2-1 Description

What is the DM3-e?	2-2
Typical Applications	2-2
How the DM3-e Works	2-3
DM3-e Drying Monitor System	
Components	2-4
RTD Sensor Positions in the Hopper	2-5
Specifications	2-6

3-1 Installation

Unpacking the Boxes	3-2
Preparing for Installation	3-3
Installing the Probe	3-4
Mounting Method 1	3-5
Mounting Method 2	3-6
Mounting Method 3	3-7
Preparing for Electrical Installation	3-9
Installing the ModBus Cable Sets	3-10
Creating ModBus Addresses for	
Each RTD Junction Box	3-11
Terminating the Final RTD Junction Box	3-13
Connecting the Main Power	3-14

4-1 Operation

Navigating the DM3-e Monitor (on the DC-T control):	
System Overview	4-2
Configuring the DC-T for DM3-e Operation	4-4
Individual Hopper Screens	4-6
Setting up Your DM3-e: The Basics	
Alarm Location (Simple)	4-10
Alarm Location (Advanced)	4-11
Alarm Setpoint	4-13
Drying Hopper Material Change	4-14
Drying Hopper Volume by Model Number	4-16
Understanding Bulk Density	4-20
Interpreting DM3-e Trend Curves	4-21

5-1 Maintenance

Preventative Maintenance Schedule	5-2
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6-1 Troubleshooting

Before Beginning	6-2
A Few Words of Caution	6-2
What Can The DM3-e Tell You	6-3
Understanding Alarms	6-4
DM3-e Problems	6-5

A Appendix

Service and Warranty Information	A-1
Before You Call	A-1
Equipment Guarantee	A-2
Performance Warranty	A-2
Warranty Limitations	A-2

Note: Manufacturers instructions for DM3-e Drying Monitor components can be found in the Appendix or within the instruction packet that was shipped with this machine.



Introduction

Purpose of the User Guide 1-2

How the Guide Is Organized 1-2

Your Responsibility as a User 1-2

ATTENTION: Read This So No One Gets Hurt 1-3

Zero Mechanical State 1-4

Purpose of the User Guide

This user guide describes the DM3-e (embedded) and explains step-by-step how to install, operate, and maintain this equipment. The DM3-e software is embedded into the Conair DC-T Dryer control.

Before installing this product, please take a few moments to read the user guide and review the diagrams and safety information in the instruction packet. You should also review manuals covering associated equipment in your system. This review won't take long, and it could save you valuable installation and operating time later.

How the Guide is Organized

Symbols have been used to help organize the User Guide and call your attention to important information regarding safe installation and operation.



Symbols within triangles warn of conditions that could be hazardous to users or could damage equipment. Read and take precautions before proceeding.



Numbers indicate tasks or steps to be performed by the user.



A diamond indicates the equipment's response to an action performed by the user.



An open box marks items in a checklist.



A circle marks items in a list.



Indicates a tip. A tip is used to provide you with a suggestion that will help you with the maintenance and the operation of this equipment.



Indicates a note. A note is used to provide additional information about the steps you are following throughout the manual.

Your Responsibility as a User

You must be familiar with all safety procedures concerning installation, operation, and maintenance of this equipment. Responsible safety procedures include:

- Thorough review of this User Guide, paying particular attention to hazard warnings, appendices, and related diagrams.
- Thorough review of the equipment itself, with careful attention to voltage sources, intended use and warning labels.
- Thorough review of instruction manuals for associated equipment.
- Step-by-step adherence to instructions outlined in this User Guide.

ATTENTION:

Read This So No One Gets Hurt

We design equipment with the user's safety in mind. You can avoid the potential hazards identified on this machine by following the procedures outlined below and elsewhere in the User Guide.



WARNING: Improper installation, operation, or servicing may result in equipment damage or personal injury.

This equipment should be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type of machine.

All wiring, disconnects, and fuses should be installed by qualified electrical technicians in accordance with electrical codes in your region. Always maintain a safe ground. Do not operate the equipment at power levels other than what is specified on the machine serial tag and data plate.



WARNING: Voltage hazard




This equipment is powered by single-phase current, as specified on the machine serial tag.

A properly sized conductive ground wire from the incoming power supply must be connected to the chassis ground terminal inside the electrical enclosure. This ground connection is supplied with the DM3-e panel and must not be removed or must be replaced if damaged. Improper grounding can result in severe personal injury and erratic device operation.

Always disconnect and lock out the incoming main power source before opening the electrical enclosure or performing non-standard operating procedures, such as routine maintenance. Only qualified personnel should perform troubleshooting procedures that require access to the electrical enclosure while power is on.

Zero Mechanical State (ZMS)

 **CAUTION:** Before performing maintenance or repairs on this product, you should disconnect and lockout electrical power sources to prevent injury from unexpected energizing or start-up.


During maintenance, it is essential that the system be put into a state which eliminates the possibility of components making an unexpected and dangerous movement. This procedure is typically referred to as lockout. After all energy sources have been neutralized, the system is in the zero mechanical state (ZMS). This provides maximum protection against unexpected mechanical movement.

The lockout procedure must include all energy sources:

- Electrical power supply
- Compressed air supply
- Hydraulic fluids under pressure
- Potential energy from suspended parts
- Energy in springs
- Any other source that might cause unexpected mechanical movement

The following is a recommended Zero Mechanical State procedure which must be followed prior to any inspection, or maintenance of the DM3-e drying hopper probe(s).

- 1 Turn off the loading device installed to the top of the drying hopper to assure that it does not attempt to load the hopper with material.**
- 2 Perform the proper shutdown sequence to the connected dryer or drying system and allow all hopper components (internally and externally) to adequately cool.**
- 3 Disconnect and lock out the primary electrical supply feeding the dryer.**
- 4 Drain the drying hopper, at least to a level that fully exposes the probe; typically just below the air spreader cone in the hopper, as observed through a sight glass or viewing window.**
- 5 Carefully open the drying hopper door and clarify that material level is below the probe and that the temperature of all hopper surfaces and the probe are adequately reduced to make touching and handling safe.**
- 6 Use caution working in elevated areas and use approved fall prevention measures and carefully disconnect the drying monitor probe from its junction box on the top of the hopper.**
- 7 The probe is now accessible for maintenance, replacement, adjustment or repairs.**

 **WARNING:** Before removing lockout devices and returning switches to the ON position, make sure that all personnel are clear of the machine, tools have been removed, and all safety guards reinstalled.

Description



What is the Drying Monitor DM3-e? 2-2

Typical Applications 2-2

How the DM3-e Works 2-3

DM3-e Drying Monitor System

 Components 2-4

RTD Sensor Positions in the Hopper 2-5

Specifications 2-6


What is the Drying Monitor DM3-e?

The DM3-e is the latest generation of technology created for analyzing drying performance from a multi-zone, resistance temperature detector (RTD) probe installed in the drying hopper. Embedded into the DC-T dryer control software, the DM3-e is designed to provide early detection of poor drying conditions and provide alarms for correcting problems. Up to 15 hoppers can be monitored.

DM3-e probes are supplied for any size or brand of drying hopper and are installed through the lid of the hopper (or from the bottom of the hopper up) and extend to the base of the air diffuser. Probe signals are then continuously fed back to the DC-T control where each hopper's temperature profile can be viewed, trended and used to determine if proper drying is taking place according to required drying parameters.


Typical Applications

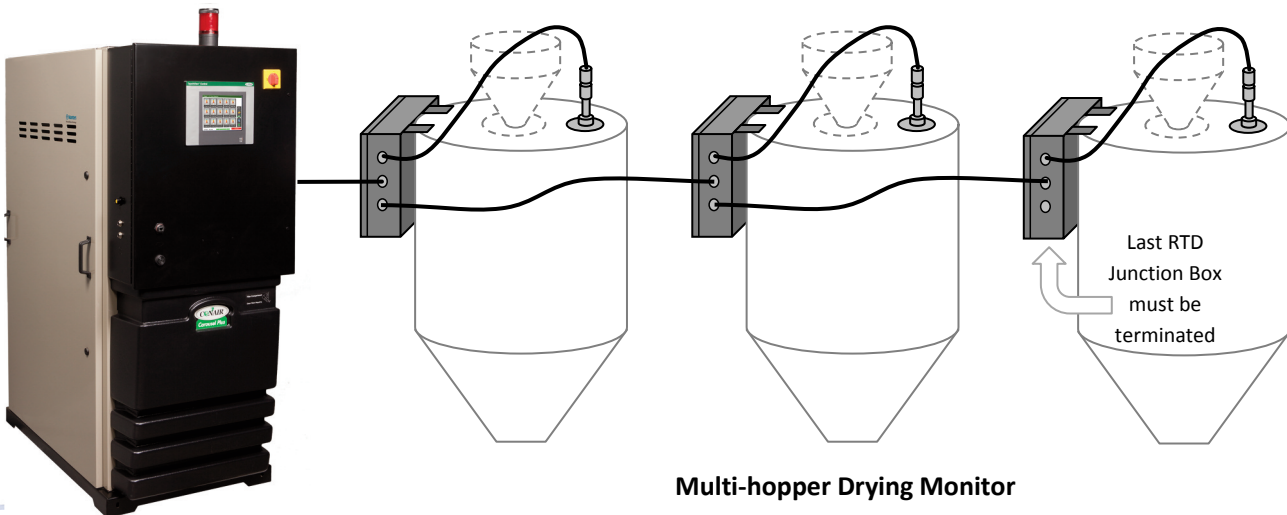
The DM3-e is ideal for applications that require strict monitoring of the drying process to meet product quality specifications. The DM3-e can also aid in the prevention of product rejects through early identification of potential drying problems.

 **Note:** The DM3-e is also web enabled. Upon initial startup, the user will have the option to chose to utilize the web enable functionality.

The DM3-e will alert the operator, through a passive alarm shown on the DC-T monitor that one of these common drying problems may exist:

- A change in the temperature profile within the drying hopper.
- Loss of air flow through the drying hopper.
- A reduction or loss of drying time at the selected and programmed drying temperature.

 **Note:** Drying Monitor is also provided as an independent control and probe set for dryers not equipped with DC-T. This independent version is called the DM3-i. The DM3-i operation is similar to the DM3-e and the probe(s) are identical. On the DM3-i version of Drying Monitor, an independent TouchView control provides the operator interface. For more information on the DM3-i version of the Drying Monitor, contact Conair.



How the DM3-e Works

The DM3-e Drying Monitor consists of stainless steel, 6-zone, temperature probes installed in drying hoppers that sense the specific temperature profile of the hoppers and compares their profiles to the requirements needed for proper drying in a specific hopper for a specific material.

Interpretation of that temperature profile by the DM3-e leads directly to predicting under or over dried material, inadequate air flow, clogged filters, heater failure, excess throughput for that hopper size, unresponsive loading, over capacity drying and many other conditions that are likely to produce scrap and waste time, energy and material.

The DM3-e will store all temperature readings and organize the data into logical groups for review or downloading to a spreadsheet program for analysis. The DM3-e has memory capacity to store seven days of data for each hopper in the system.

Alarms are displayed on the DC-T and also stored for future reference. Pressing the Alarms button will take you to the alarm list. This list displays Active alarms, Accepted alarms, and Cleared alarms.





No Active Alarms

Previous
Next
Accept

- Active Alarm
- Accepted Active Alarm
- Cleared Alarm

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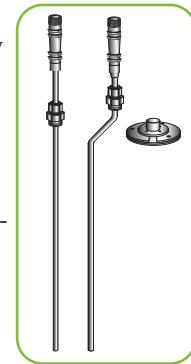
DM3-e Drying Monitor System Components

The DM3-e system consists of:

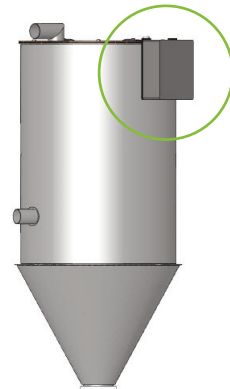
A Conair Carousel Plus dryer with DC-T control that connects to up to 15 probes via RTD junction boxes at each hopper. The DC-T control provides all operator interface functions for all hoppers included in the monitoring system and is the only power connection required for the DM3-e system.



Stainless steel, 6-zone, temperature probes are installed in each of the drying hoppers. These probes are sized specifically for the hoppers they will be installed into and hang from the lid of the hopper approximately halfway between the centerline and the inside wall of the hopper. Some hoppers (especially those fitted with loading equipment) often require probes with an offset to allow location in one position on the lid and another vertical position in the hopper. Conair hoppers are typically out-fitted to readily receive a DM3 probe. Non-Conair or older Conair hoppers will require adaptation for probe installation according to instructions supplied in this manual.



RTD junction boxes link the cable from the hopper probe into the ModBus communications interface, and back to the DC-T control. All junction boxes (up to 15) are wired together in a series string (daisy-chain) with ModBus cables. The final junction box terminates the ModBus string.




To order a cable set:

Contact Conair Parts
1 800 458 1960
From outside of the United States, call:
814 437 6861

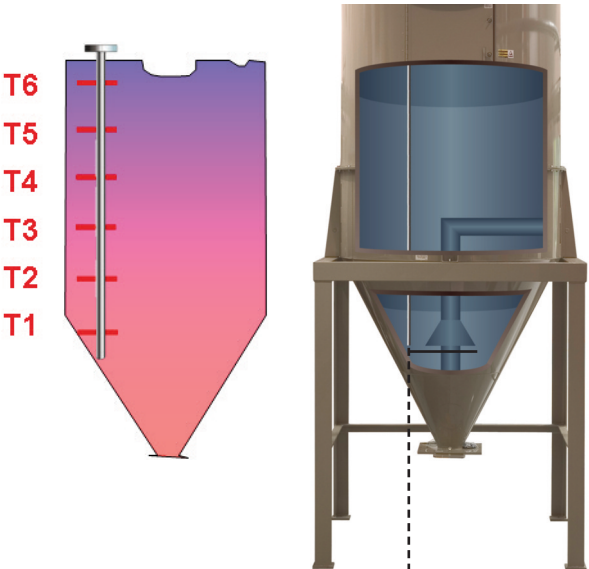
5 ft {1.5 m}- 1886780405
10 ft {3.0 m}- 18886780410
15 ft {4.6 m}- 18886780415
20 ft {6.1 m}- 18886780420
50 ft {15.2 m}- 18886780450
75 ft {22.9 m}- 18886780475
100 ft {30.5 m}- 188867804100

Cable sets are custom ordered in lengths of 5 feet {1.5 meters}, 10 feet {3.0 meters}, 15 feet {4.6 meters}, 20 feet {6.1 meters}, 50 feet {15.2 meters}, 75 feet {22.9 meters} and 100 feet {30.5 meters} long.

 **Note:** Cables can be shortened in the field by a qualified technician. It is better to order a cable length that is too long and shorten it in the field than to have a cable that is too short.



RTD Sensor Positions in the Hopper

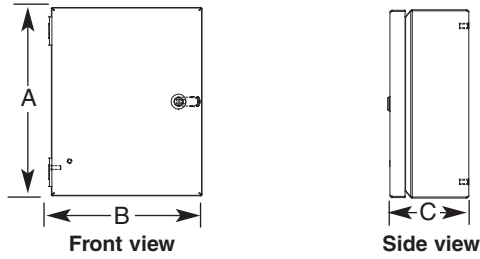


Probe lines up with the bottom of the diffuser cone section

RTD's will be referred to in this user guide and on your DM3-e display as T1, T2, T3, T4, T5, and T6. T1 is the lower most temperature sensor within the DM3-e temperature probe and is positioned at the bottom of the diffuser cone section. T6 is the upper most temperature sensor in the DM3-e temperature probe and is located near the top of the hopper when installed. Position T6 is always located in the air void above the bed of material in the hopper.

Specifications

Probe junction box



MODEL	DM3-e
Control box type	DM3-e probe junction box
Dimensions inches {mm}	
A- Height	10.0 {254}
B- Width	8.0 {203}
C- Depth	4.0 {101}
Weight lb {kg}	
Installed	29 {13}
Shipping	36 {16}

SPECIFICATION NOTES
Specifications may change without notice. Check with a Conair representative for the most current information.
The DM3 is also available as a independent option, with its own TouchView control panel, to monitor up to 30 hoppers. Contact Conair for more information on the DM3-i.

Installation

Unpacking the Boxes	3-2
Preparing for Installation	3-3
Installing the Probe	3-4
Mounting Method 1	3-5
Mounting Method 2	3-6
Mounting Method 3	3-7
Preparing for Electrical Installation	3-9
Installing ModBus Cable Sets	3-10
Creating ModBus Addresses for	
Each RTD Junction Box	3-11
Terminating the Final RTD	
Junction Box	3-13
Connecting the Main Power	3-14

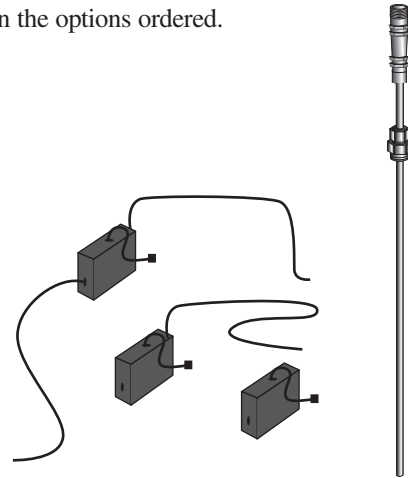
Unpacking the Boxes

The DM3-e software is included as part of your DC-T control. The necessary hardware (not included as part of the dryer - must be ordered separately) comes in two or more shipping containers, depending on the options ordered.

The DM3-e consists of:

- One or more stainless steel probes
- An RTD junction box for each probe, including associated mounting hardware
- ModBus connecting cables and
- If ordered, installation hardware for each probe.

Packaging for the DM3-e system can be varied depending upon what has been ordered, so carefully inventory all items.



To order a hopper mount adapter kit, part #18169902:

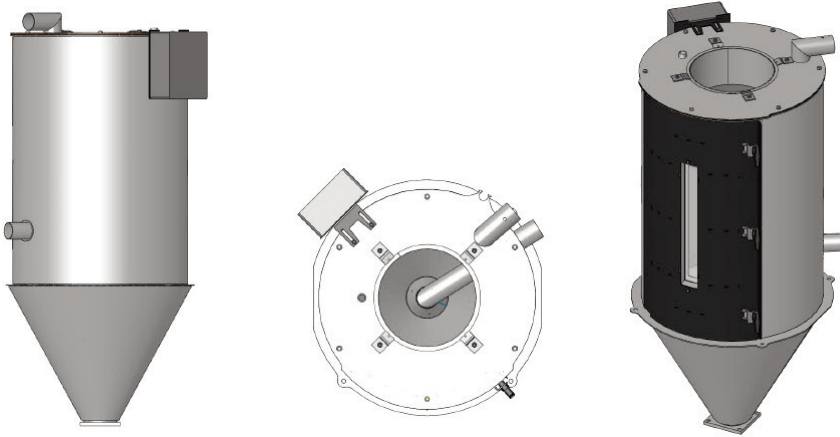
Contact Conair Parts
1 800 458 1960
From outside of the
United States, call:
814 437 6861

- 1 Carefully remove all components** from their shipping containers.
- 2 Remove all packing material, protective paper, tape, and plastic.** Do not discard installation notice tags.
- 3 Carefully inspect all components** to make sure no damage occurred during shipping, and that you have all the necessary hardware.
 - **TIP:** Inspect all of the equipment in the presence of the freight carrier's representative for damage during shipment. Note any damage on the delivery receipt before signing it. If damage is evident, file a claim immediately against the carrier as it is their responsibility to pay for any damage incurred during shipping. Make sure to include a detailed report of the damage along with photos. Note that RTD probes are delicate and may not operate properly if bent or otherwise damaged.
- 4 Take a moment to record serial numbers.** Also record the drying hopper's model number and specifications. This information will be helpful if you ever need service or parts.

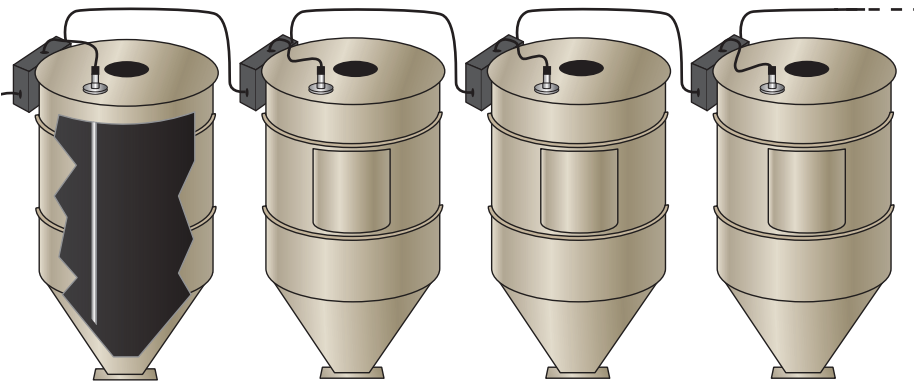
Preparing for Installation

In addition to mounting the probe into the hopper, each hopper will be equipped with an RTD Junction Box. This box provides the link from the probe to the ModBus interconnection cables that will connect each hopper to the monitor panel.

IMPORTANT: The DC-T controlled dryer, and any junction boxes should not be installed in extreme temperature locations. Ambient air temperatures below 41°F {5°C} and above 104°F {40°C} should be avoided.



The RTD Junction Box should be mounted in a safe location, at the top of the hopper as near as possible to the hopper probe and if possible, not directly above the hopper, to minimize transmitted heat from the hopper to the junction box. Stay clear of loading equipment that may require service access and be sure to mount the box so that it is not likely to be used as step or hand-hold during service procedures.



Installing the Probe



CAUTION: Hopper surfaces may be hot. Make sure the drying hopper is empty and has cooled to room temperature before installing the probe assembly. Failure to do so can lead to serious injury.

The DM3-e probe is inserted through a hole in the top of the drying hopper and secured to a threaded coupling with a compression fitting. Mounting adapter plates may be necessary.



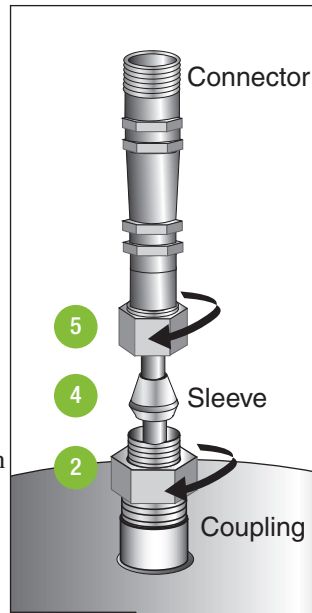
CAUTION: Always disconnect and lock out the main power supply before beginning the installation process.

There are three mounting methods for the probe:

- **Select Mounting Method 1** if you purchased a new Conair CH series drying hopper equipped with a factory-installed coupling for the probe.
- **Select Mounting Method 2** if you are installing the probe and coupling in a drying hopper that has enough overhead clearance to insert the probe from the top of the hopper.
- **Select Mounting Method 3** if you are installing the probe and adapter kit on a drying hopper that does not have enough overhead clearance to insert the probe from the top.

Mounting Method 1 (New Conair hopper with Factory Installed coupling)

- 1** Insert the probe through the coupling in the top of the drying hopper.
- 2** Screw the fitting into the coupling. Tighten with a wrench.
- 3** Make sure the probe is the correct size. The probe should extend from just above the top of the hopper into the hopper, with the tip approximately in-line with the bottom edge of the diffuser cone.
- 4** Push the compression sleeve into the fitting.
- 5** Tighten the nut over the sleeve. The compression sleeve will crimp the tube to hold the probe in place. Be sure to position the connector in such a way as to avoid interference of the cable with the loader, etc. Use a wrench to tighten the nut so that it covers the threads.



CAUTION: Always disconnect and lock out the main power supply before beginning the installation process.

CAUTION: Hopper surfaces may be hot. Make sure the drying hopper is empty and has cooled to room temperature before installing the probe assembly. Failure to do so can lead to serious injury.

Tools for Installation:

- 7/8-in. wrench

NOTE: The mounting adapter kit will only be included if the DM3-e was ordered as a retrofit kit.



NOTE: If the angled probe is used, the bend (dog leg) in the probe must be oriented so that it is angled in toward the center of the hopper.



CAUTION: Always disconnect and lock out the main power supply before beginning the installation process.

CAUTION: Hopper surfaces may be hot. Make sure the drying hopper is empty and has cooled to room temperature before installing the probe assembly. Failure to do so can lead to serious injury.

IMPORTANT: Stretch cloth or plastic across the inside of the hopper to catch metal shavings from the hole you will drill in the top of the hopper.

NOTE: The mounting adapter kit will only be included if the DM3-e was ordered as a retrofit kit. Remove the mounting adapter plates from the probe assembly, you will not need them. You will need the gasket.

Tools for Installation:

- Drill and 10-32 tap
- Knife
- Flathead screwdriver
- 7/8-in. wrench

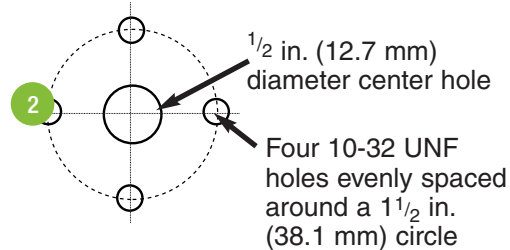
NOTE: If the angled probe is used, the bend (dog leg) in the probe must be oriented so that it is angled in toward the center of the hopper.



Mounting Method 2 (Drying hopper with enough overhead clearance to insert probe from the top of the hopper)

1 Reference the drawings at the end of this user guide and select the drawing that reflects your installation. Drill the appropriate hole in the top of the hopper.

2 Drill and tap four 10-32 UNF holes to match the hole pattern in the coupling.



3 Secure the gasket and coupling to the hopper with the four 10-32 screws. Remove any excess gasket with a knife.

4 Insert the probe through the coupling in the top of the hopper.

5 Screw the fitting into the coupling. Tighten with a wrench.

6 Make sure the probe is the correct size. The probe should extend from just above the top of the hopper into the hopper, with the tip approximately in-line with the bottom edge of the diffuser cone.

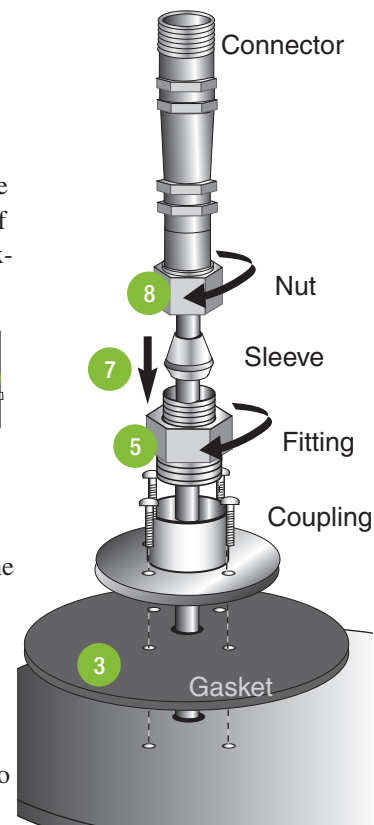


7 Push the compression sleeve into the fitting.

8 Tighten the nut over the sleeve.

The compression sleeve will crimp the tube to hold the probe in place. Be sure to position the connector in such a way as to avoid interference of the cable with the loader, etc. Use a wrench to tighten the nut so that it covers the threads.

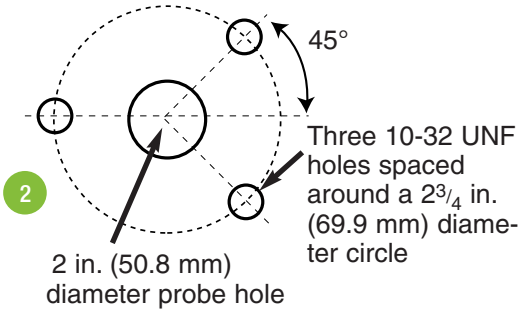
9 Thoroughly clean the inside of the hopper to remove any debris left from installation of the probe.



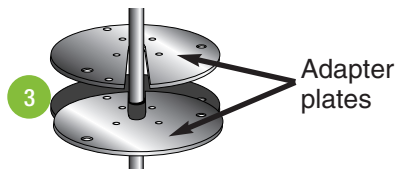
Mounting Method 3 (Not enough overhead clearance to insert the probe from the top of the hopper)

1 Reference the drawings at the end of this user guide and select the drawing that reflects your installation. Drill the appropriate hole in the top of the hopper.

2 Drill and tap three 10-32 UNF holes to match the screw pattern in the adapter plates and gasket. You can use the template in the appendix.

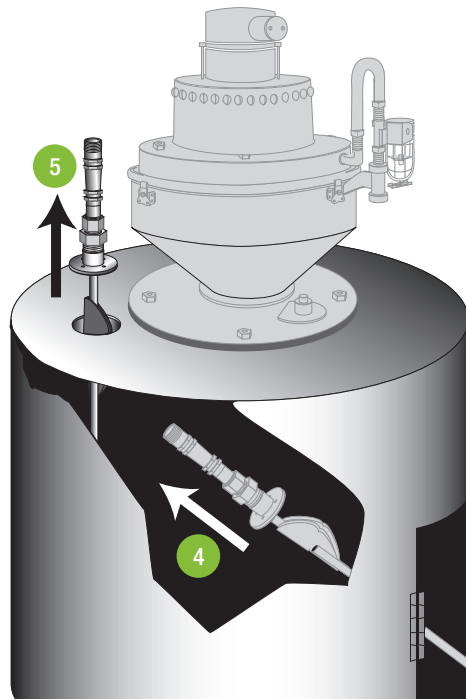


3 Remove the two adapter plates from the probe mounting assembly. Set the adapter plates aside for use in Step 7.



4 Insert the probe and mounting assembly through the door of the hopper.

5 Pull the probe and mounting assembly through the hole in the top of the hopper. Fold the gasket around the probe so that it will fit through the hole.



Tools for Installation:

- Drill and 10-32 tap
- Flathead screwdriver
- 7/8-in. wrench
- 2-in. hole saw

CAUTION: Always disconnect and lock out the main power supply before beginning the installation process.

CAUTION: Hopper surfaces may be hot. Make sure the drying hopper is empty and has cooled to room temperature before installing the probe assembly. Failure to do so can lead to serious injury.

IMPORTANT: Stretch cloth or plastic across the inside of the hopper to catch metal shavings from the hole you will drill in the top of the hopper.

NOTE: If the angled probe is used, the bend (dog leg) in the probe must be oriented so that it is angled in toward the center of the hopper.



(continued)

Mounting Method 3 (continued)

6 Place the gasket over the probe hole.

7 Place the adapter plates over the gasket and secure them to the hopper with three 10-32 UNF screws. Make sure the adapter plate with the threaded holes is on the bottom, and that the slots in the adapter plates are oriented in the opposite direction as shown. See drawing to right, #7.

8 Secure the coupling to the adapter plates with the four 10-32 UNF screws.

9 Screw the fitting into the coupling. Tighten with a wrench.

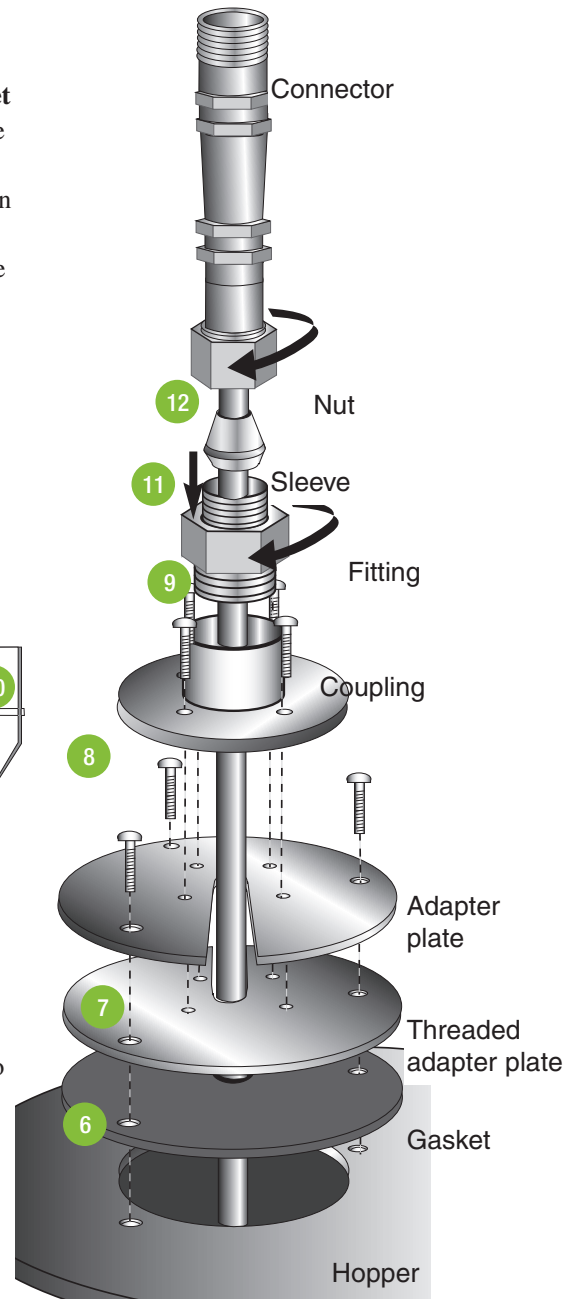
10 Make sure the probe is the correct size. The probe should extend from just above the top of the hopper into the hopper, with the tip approximately in-line with the bottom edge of the diffuser cone.



11 Push the compression sleeve into the fitting.

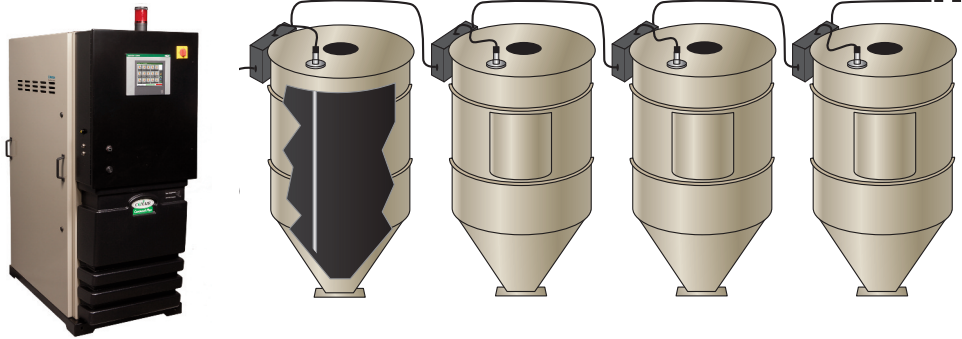
12 Tighten the nut over the sleeve. The compression sleeve will crimp the tube to hold the probe in place. Be sure to position the connector in such a way as to avoid interference of the cable with the loader, etc. Use a wrench to tighten the nut so that it covers the threads.


13 Thoroughly clean the inside of the hopper to remove any debris left from installation of the probe.




Preparing for Electrical Installation

1 Using the ModBus cables provided, connect the DC-T control to the closest drying hopper being monitored. From there, additional cables will connect to the next hopper and so on (up to 15) in a series fashion. Prepare for appropriate cable routing of the ModBus cable from the monitor to the first hopper, avoiding parallel runs with your factory's power cables, and material conveying lines.



 **CAUTION:** Always disconnect and lock out the main power supply before making electrical connections. Electrical connections should be made only by qualified personnel.

 **IMPORTANT:** Always refer to the wiring diagrams that came with your dryer to locate specific electrical components. Illustrations in the User Guide are intended to be representative only.

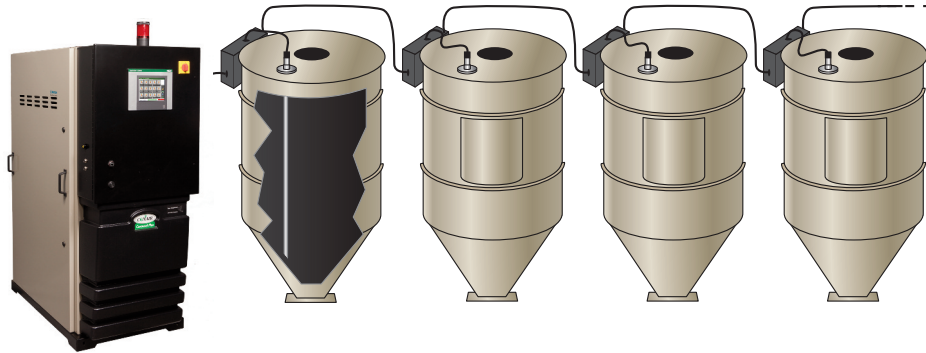
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IMPORTANT: Always refer to the wiring diagrams that came with your dryer to locate specific electrical components. Illustrations in the User Guide are intended to be representative only.

Installing ModBus Cable Sets

ModBus cables, with multi-pin connectors on each end must be connected from the DM3-e monitor panel to the first hopper in the system. From there, another cable will be connected to the second hopper and so on, in a series fashion, for up to 30 hoppers. Note that the last hopper in the system will require jumpers to be installed, indicating the end of the series string of hoppers. *See Installation section - Terminating the Final RTD Junction Box.*

Cables are available in a wide variety of lengths and a cable assembly should be supplied with each probe/junction box set in the system. Plan your installation appropriately, determining which cable length has been selected for each hopper/junction box with consideration to neat cable routing. Cables should be routed away from heated surfaces, material conveying lines, or moving equipment and not run in parallel to three-phase power lines. Support each cable as needed to prevent strain on the connectors.



Carefully install each cable set from the DC-T control to the first hopper, firmly screwing the connectors into place on each panel. Wiring starts at the DC-T panel and stops at the hopper farthest from the DC-T panel.

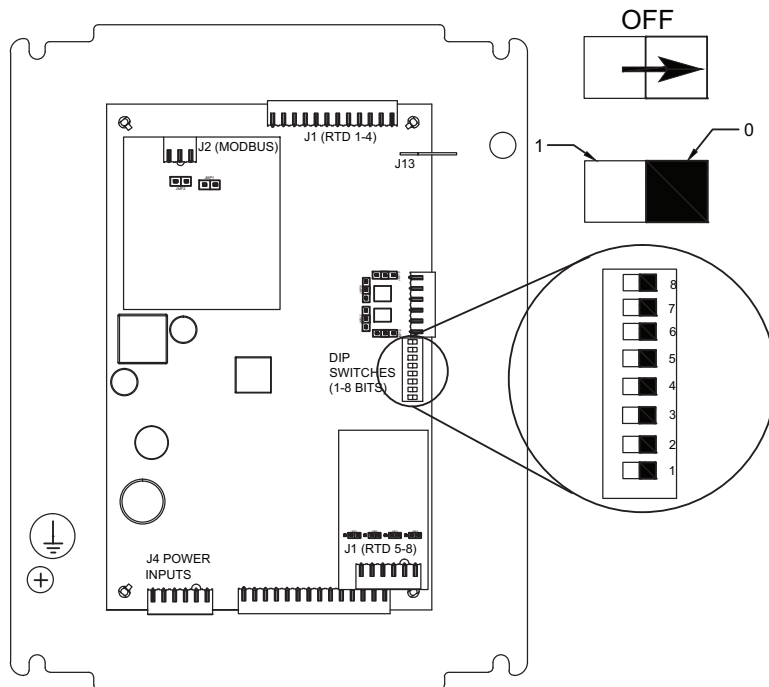
Creating ModBus Addresses for Each RTD Junction Box

Each junction box in the Drying Monitor system must be uniquely coded so that the DC-T can recognize it from all the others.

- **TIP:** A convenient time to set these switches is before the box is placed on the hopper, or while connecting the ModBus cables to each junction box. It must be done before applying power to the system.

ModBus coding is done with miniature DIP switches inside each RTD junction Box, as follows:

- 1** Locate the row of 8 DIP switches on the main PC board inside the RTD junction box. The ModBus addressing process only uses the first 5 DIP switches, numbered 1 through 5. Do not touch switches 6, 7, and 8.
- 2** Start by setting all 5 switches to “Off” or “0” by pushing the DIP switch toward its identifying number.
- 3** Addressing each box is done by moving the proper switches from Off (“0”) to On (“1”) in a specific arrangement that will identify it as a unique number, from 1 to 15.



- 4** Make sure that no two hoppers have the same number or arrangement of switches. In operation, these assigned hopper numbers will appear as 1 through (up to) 15 on the DC-T control.


NOTE: Even though the hopper identities can be changed on the monitor to your own chosen names or numbers of up to 16 characters later, it is helpful to number them sequentially, from closest to the monitor panel (1) to furthest away (15, or highest numbered hopper).




(continued)

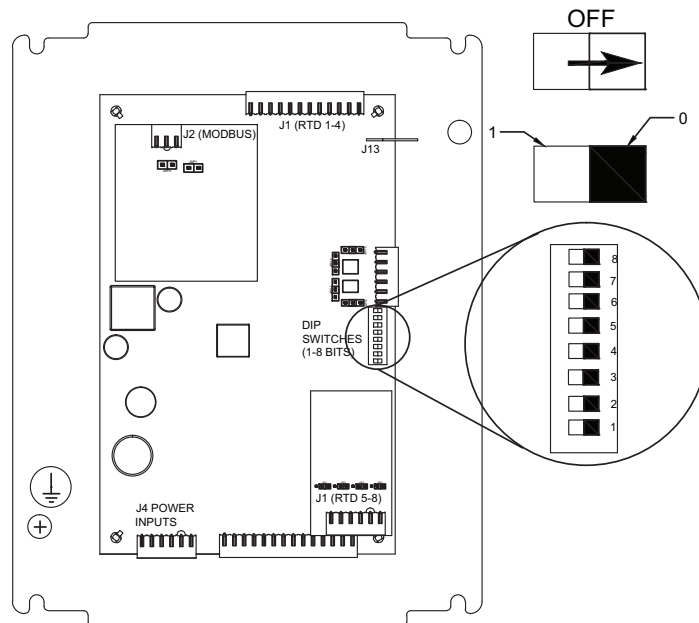
Creating ModBus Addresses for Each RTD Junction Box (continued)

5 By moving switches to the “1” position according the following chart, unique ModBus Identities for each hopper, 1 through 15, may be set:

 **NOTE:** Note that in your drying system with the DC-T control, hopper 1 will be ModBus ID 17, and so on.

ModBus Hopper ID	Dip #1 (1)	Dip #2 (2)	Dip #3 (4)	Dip #4 (8)	Dip #5 (16)
17	1	0	0	0	1
18	0	1	0	0	1
19	1	1	0	0	1
20	0	0	1	0	1
21	1	0	1	0	1
22	0	1	1	0	1
23	1	1	1	0	1
24	0	0	0	1	1
25	1	0	0	1	1
26	0	1	0	1	1
27	1	1	0	1	1
28	0	0	1	1	1
29	1	0	1	1	1
30	0	1	1	1	1
31	1	1	1	1	1

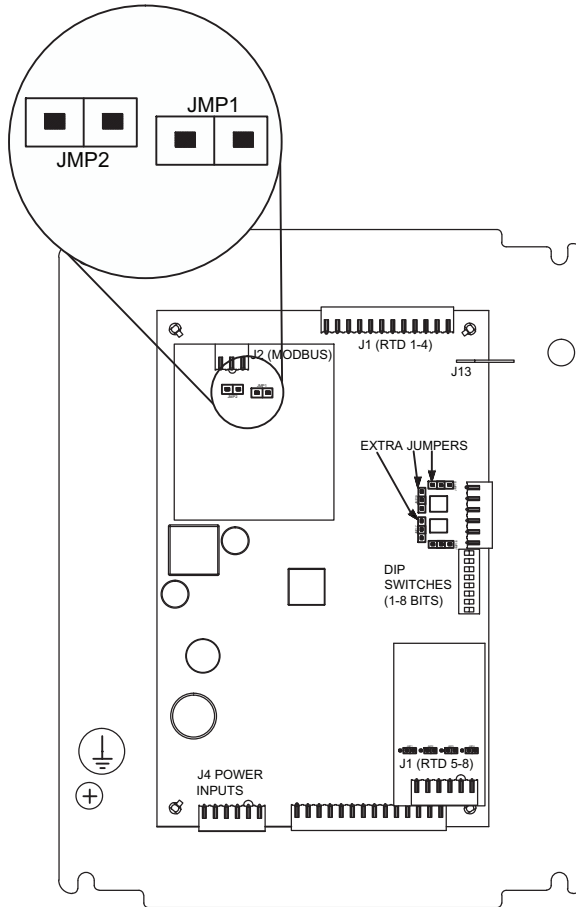
 **NOTE:** When looking at the dip switches, the unshaded area will be the area the switch is set to.



Terminating the Final RTD Junction Box

Cables from the DM3-e monitor panel to the last hopper in the system form a series string that must be terminated at the last junction box in the string, indicating the end of the line. To terminate the last hopper, two jumpers must be installed on the small PC board mounted above and located on the upper left corner of the main PC board in the junction box. This small PC board is labeled “RS 485 Termination”.

- 1** Locate the PC board “RS 485 Termination” in the last RTD junction box in the Drying Monitor system.
- 2** On this PC board, locate the upright pairs of pins labeled as JMP1 and JMP2.
- 3** Install a jumper block onto each of these pairs of pins and press down until the jumpers touch the PC board surface.
- 4** Only one RTD junction box will be the last in the system, so assure that **ONLY** the last junction box contains jumpers in the JMP 1 and JMP 2 positions. Jumpers may have been left in place from Conair quality control and/or testing procedures, and must be removed on all junction boxes, except the last.



NOTE: If not supplied otherwise, jumpers for the JMP1 and JMP2 terminations can be found on the right side of the main PC board (the board the RS 485 Termination board is mounted to) in positions labeled JMP16 through JMP19, approximately midway on the right side of the board. Any of these jumpers may be removed and installed in positions JMP1 and JMP 2. Do NOT remove any other jumper(s) or the DM3-e operation could be effected.



IMPORTANT:

- If only one hopper is connected to the monitor, it would be the last in the string and must be terminated as detailed above.
- If hoppers are added to the Drying Monitor string later, the termination jumpers must be moved from the former last hopper to the new last hopper of the system.
- Hoppers added within the string (not at the end) need not be terminated and the termination jumpers do not need to be moved from the last hopper. Remember to set a unique ModBus hopper ID properly to give the new hopper(s) their individualized ModBus identification.

Operation

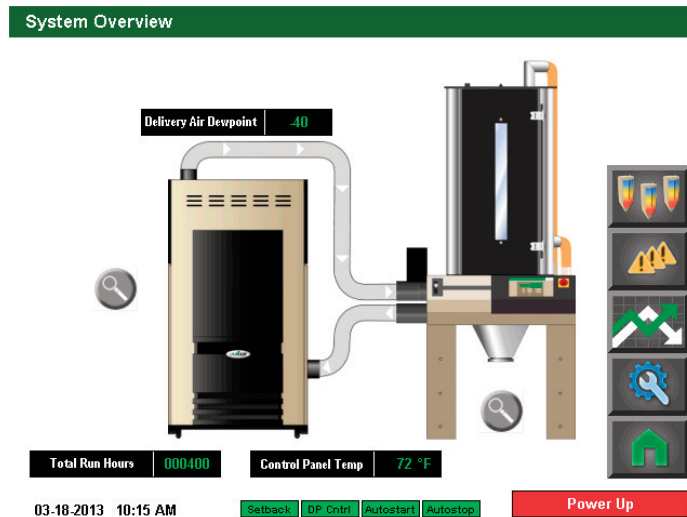
Navigating the DM3-e Monitor	4-2
Configuring the DC-T for DM3-e Operation	4-4
Individual Hopper Screens	4-6
Alarm Location (Simple)	4-10
Alarm Location (Advanced)	4-11
Alarm Setpoint	4-13
Drying Hopper Material Change	4-14
Drying Hopper Volume by Model Number	4-16
Understanding Bulk Density	4-20
Interpreting DM3-e Trend Curves	4-21



NOTE: The functionality of your DC-T control is explained in detail in the User Guide that came with your dryer. This section covers screens and operation procedures specific to the DM3-e Drying Monitor.

Navigating the DC-T with DM3-e Enabled (ResinWorks Configuration)

The System Overview screen



Navigation buttons for all DC-T functions are located on the right side of the screen and will appear in this location on all screens. The selection of buttons will change based on the specific screen. From the Overview page the buttons include:



A **Hopper Selector Button** for viewing of all hoppers included in the system (up to 15).



An **Alarm Log Button** for viewing of not only active alarms, but also alarms that have appeared in the past.



A **Trend Selection Button** for viewing hoppers to show trends for each hopper.



A **Setup Button** for establishing operating parameters for the system.



The Home Button

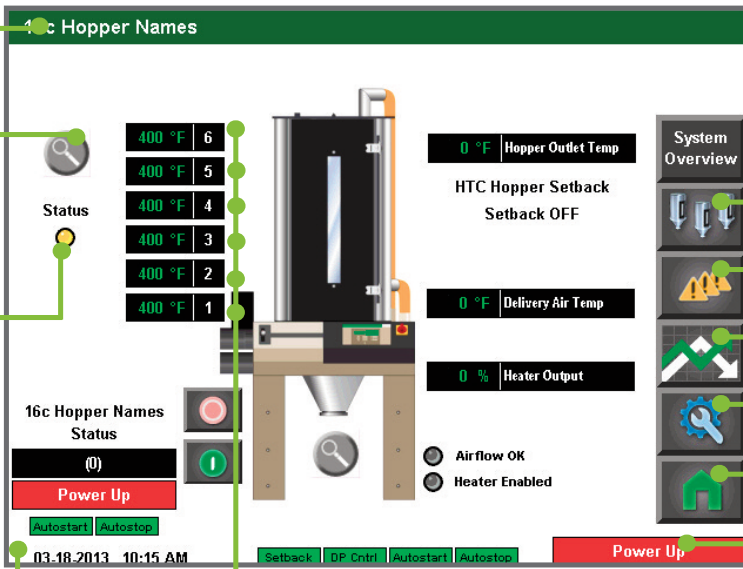
On pages other than the Home page, a “Home” button will appear in the lower right corner, allowing the user to return to the home screen at any time.

The Drying Monitor Screens of the DC-T (RW Configuration)

Screen name
Indicates what screen you are currently looking at.

DM3-e Settings Zoom
Used to change the DM3-e settings. Including enabling the DM3-e for this hopper, and setting alarm location.

Status LED
Reflects current alarm status. Gray: temperature not yet within band. Green: enabled. Yellow: temperature has fallen out of range for a period less than the delay setting. Red: temperature has been out of range beyond the delay time setting.

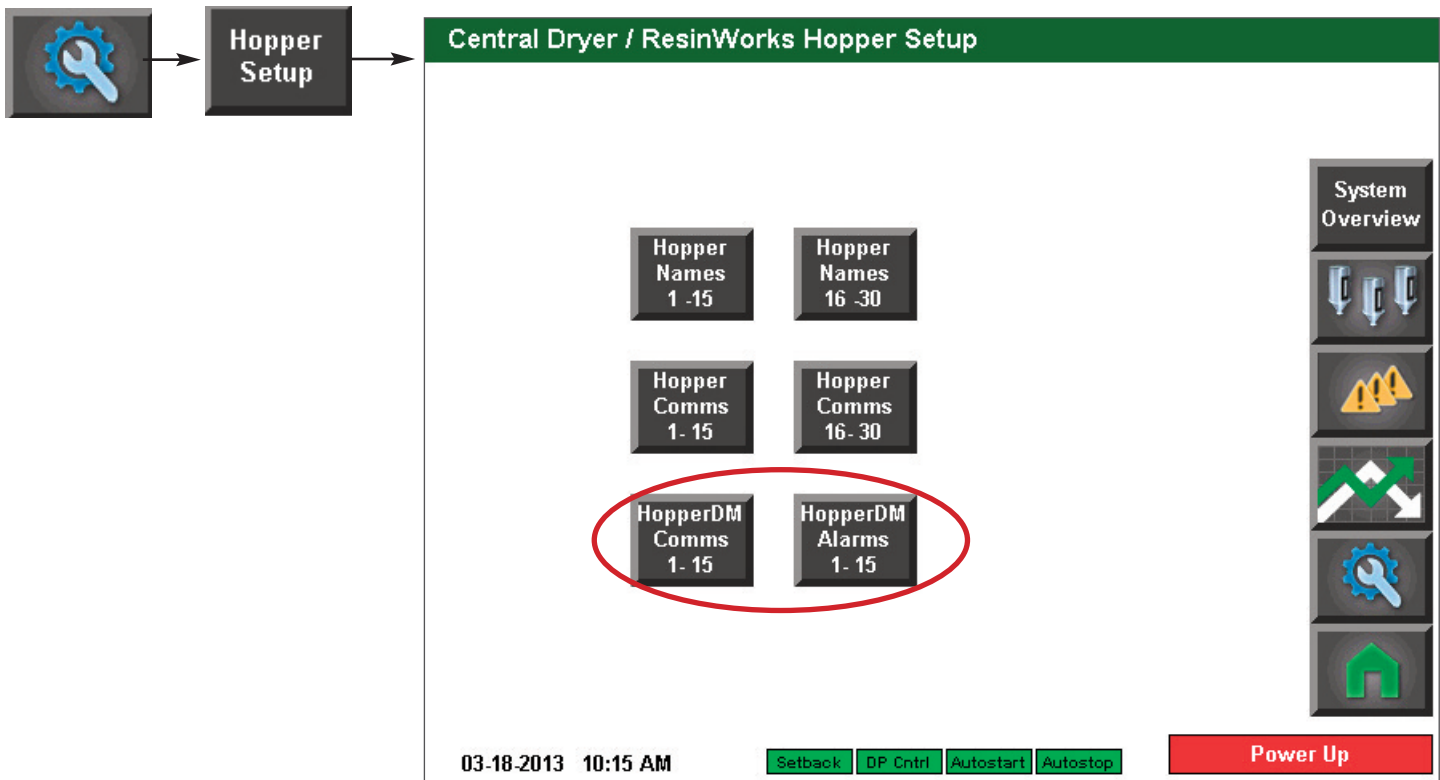


Date and Time
Displays the current date and time.

RTD probe temperature sensor zones
Displays the current temperature in each zone.

- Hopper selection button**
Go to the Hopper Selection area.
- Alarm log button**
Go to the Alarm log.
- Trending button**
Go to the Trending area.
- Setup button**
Go to the Setup area.
- Home button**
Return to the Home screen.
- Dryer Status**
Shows current dryer status.

Configuring the DC-T for DM3-e Operation



Before using the DM3-e functionality of your DC-T dryer control, the DC-T must be set to communicate to your installed Drying Monitor hardware.

To set up the DC-T to use the DM3-e:

- 1 Press the Settings button.** The ResinWorks System Settings screen will open.
- 2 Press the Hopper Setup button.** The ResinWorks Hopper Setup screen will open.
- 3 Press the Hopper DM Comms 1-15 button.** The Hopper Drying Monitor Comms screen will open.



Configuring the DC-T for DM3-e Operation (continued)

4 Press the **Enable** button for each hopper to enable communications to the DM3-e hardware at each hopper. The DC-T will communicate with the junction box at each hopper. The LED light should turn green, showing that communication has been enabled and is active. Make sure you enable communications to each hopper in your system.

Hopper Drying Monitor Comms			
ID #	Status	ID #	Status
17	16c Hopper Names	25	16c Hopper Names
18	16c Hopper Names	26	16c Hopper Names
19	16c Hopper Names	27	16c Hopper Names
20	16c Hopper Names	28	16c Hopper Names
21	16c Hopper Names	29	16c Hopper Names

5 Return to the ResinWorks Hopper Setup Screen.

6 Press the **Hopper DM Alarms 1-15** button. The Hopper Drying Monitor Alarms screen will open.

7 Enter the **Offset, Band, and Delay** for each hopper. Pressing on the set-point you would like to change will open a pop up number pad. Enter the setting using the number pad, pressing the green enter arrow when completed.

NOTE: Your screen may appear different than what is shown here depending on your dryer configuration. For example, if you have changed the name of each hopper in your system, those names will appear here, which will help to recognize which hopper is which.

Drying Monitor Alarm Setup

16c Hopper Names	16c Hopper Names	16c Hopper Names	16c Hopper Names	16c Hopper Names	<div style="background-color: #333; color: white; padding: 5px; margin-bottom: 5px;">System Overview</div>
Offset: <input style="width: 40px;" type="text" value="10°"/>	Offset: <input style="width: 40px;" type="text" value="10°"/>	Offset: <input style="width: 40px;" type="text" value="10°"/>	Offset: <input style="width: 40px;" type="text" value="10°"/>	Offset: <input style="width: 40px;" type="text" value="10°"/>	
Band: <input style="width: 40px;" type="text" value="40°"/>	Band: <input style="width: 40px;" type="text" value="40°"/>	Band: <input style="width: 40px;" type="text" value="40°"/>	Band: <input style="width: 40px;" type="text" value="40°"/>	Band: <input style="width: 40px;" type="text" value="40°"/>	
Delay: <input style="width: 40px;" type="text" value="5 min."/>	Delay: <input style="width: 40px;" type="text" value="5 min."/>	Delay: <input style="width: 40px;" type="text" value="5 min."/>	Delay: <input style="width: 40px;" type="text" value="5 min."/>	Delay: <input style="width: 40px;" type="text" value="5 min."/>	
16c Hopper Names	16c Hopper Names	16c Hopper Names	16c Hopper Names	16c Hopper Names	
Offset: <input style="width: 40px;" type="text" value="10°"/>	Offset: <input style="width: 40px;" type="text" value="10°"/>	Offset: <input style="width: 40px;" type="text" value="10°"/>	Offset: <input style="width: 40px;" type="text" value="10°"/>	Offset: <input style="width: 40px;" type="text" value="10°"/>	
Band: <input style="width: 40px;" type="text" value="40°"/>	Band: <input style="width: 40px;" type="text" value="40°"/>	Band: <input style="width: 40px;" type="text" value="40°"/>	Band: <input style="width: 40px;" type="text" value="40°"/>	Band: <input style="width: 40px;" type="text" value="40°"/>	
Delay: <input style="width: 40px;" type="text" value="5 min."/>	Delay: <input style="width: 40px;" type="text" value="5 min."/>	Delay: <input style="width: 40px;" type="text" value="5 min."/>	Delay: <input style="width: 40px;" type="text" value="5 min."/>	Delay: <input style="width: 40px;" type="text" value="5 min."/>	
16c Hopper Names	16c Hopper Names	16c Hopper Names	16c Hopper Names	16c Hopper Names	
Offset: <input style="width: 40px;" type="text" value="10°"/>	Offset: <input style="width: 40px;" type="text" value="10°"/>	Offset: <input style="width: 40px;" type="text" value="10°"/>	Offset: <input style="width: 40px;" type="text" value="10°"/>	Offset: <input style="width: 40px;" type="text" value="10°"/>	
Band: <input style="width: 40px;" type="text" value="40°"/>	Band: <input style="width: 40px;" type="text" value="40°"/>	Band: <input style="width: 40px;" type="text" value="40°"/>	Band: <input style="width: 40px;" type="text" value="40°"/>	Band: <input style="width: 40px;" type="text" value="40°"/>	
Delay: <input style="width: 40px;" type="text" value="5 min."/>	Delay: <input style="width: 40px;" type="text" value="5 min."/>	Delay: <input style="width: 40px;" type="text" value="5 min."/>	Delay: <input style="width: 40px;" type="text" value="5 min."/>	Delay: <input style="width: 40px;" type="text" value="5 min."/>	

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Setback
DP Cntrl
Autostart
Autostop

Power Up

Navigating the DM3-e Individual Hopper Screens

NOTE: Each hopper in your system will be displayed individually. The DM3-e information is found on the left top area of the screen, and includes the DM3-e Zoom button, the Status LED, and the RTD probe zones 1-6.

Detailed Hopper View

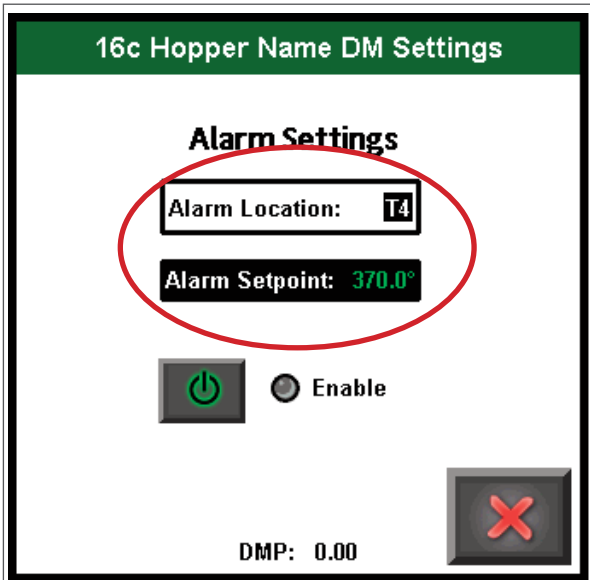
From the **Hopper Selection** screen, any hopper can be spotlighted by pressing its icon and a detailed view of that hopper will appear and its name will be shown in the green stripe.

From the detailed hopper view, you will see all the information about that hopper. The DM3-e information is on the top left of the screen, and includes the zoom button, the status LED, and the live temperature information for each of the RTZ zones. Pressing the zoom button takes you to the DM3-e settings screen for this hopper where you can set the alarm zone. See *Operation: Setting Up Your DM3-e: The Basics: Alarm Location* for more information on establishing the alarm location probe.

In addition to the DM3-e information, this screen also shows the current Hopper Outlet Temperature, the hopper heater start/stop and status, the Delivery Air Temperature of the dryer, and the Heater Output. See the User Guide for your DC-T controlled dryer for more information about the DC-T control.

(continued)

Navigating the DM3-e Individual Hopper Screens (continued)



DM Settings



Alarm Location: Set this specific probe location as the highest probe point in the drying hopper where the Process Temp is within 10 degrees of the process temperature. This probe position will be used to determine that the temperature profile in the hopper is correct at any given time. See [Operation: Setting Up Your DM3-e: The Basics: Alarm Location](#) for more information on establishing the alarm location probe.



Alarm Setpoint: This setting appears automatically, relative to the process temperature and user established settings and indicates the lowest temperature allowable during operation before the Drying Monitor provides an alarm alert.



There is also a simple on/off button, accompanied by an “Enable” light to turn the alarm functions of this particular hopper on or off. This button is helpful to prevent nuisance alarms during set-up or changeover procedures for each hopper.

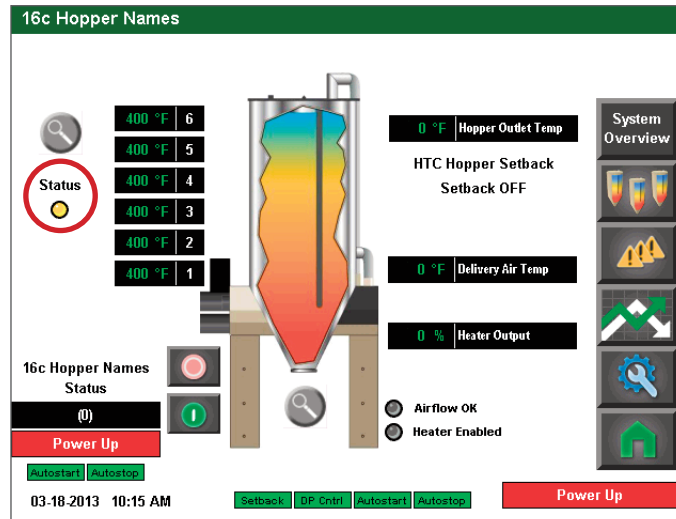


When the button is off and the status light is gray, the alarm functions of the drying monitor will not trigger an alarm condition, but the temperatures of that hopper are still being read and are visible on this screen for your observation. In addition, data continues to be logged for this hopper. With the hopper alarm system turned on, the alarm system is engaged and the drying monitor will alert to under-temperature alarm conditions as described.

NOTE: The Alarm Location can be set to T2, T3, T4, or T5.

(continued)

Navigating the DM3-e Individual Hopper Screens (continued)



In addition, the Status light for this hopper will now reflect the current alarm status by the color of the status light:

Gray- Temperature has not yet achieved the setpoint band. This is typical during warmup during startup.

Green- Enabled, alarm location is in the normal range and the drying process is likely to produce quality product via proper drying.

Yellow- The temperature sensor in the alarm location has fallen to the alarm setpoint value, but has not been out of range for a period of time beyond the “Delay” setting set on the Alarm Settings screen for that hopper.

Red- The hopper out of temp condition has extended beyond the Delay time setting and the drying process is in jeopardy of not producing properly dried resin.

The illustration on the Detailed Hopper View depicts the hopper being monitored, with the six temperature probe locations shown. In operation, these areas will display the actual temperatures within the drying hopper at six critical locations.

NOTE: For more information about the Alarm Location and Alarm Setpoint, see [Operation: Setting Up Your DM3-e: The Basics: Alarm Settings](#).

Setting Up Your DM3-e: The Basics- Delivery Air Temperature

Select a drying hopper for set up from the drying hopper selection screen. The following process can be followed for each hopper in the system and whenever a drying application changes.

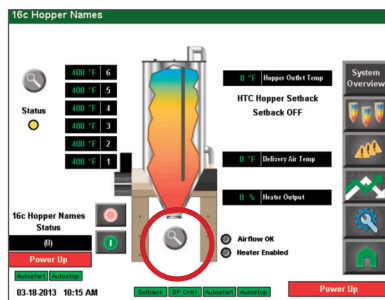
Delivery Air Temperature:

Each drying application uses the set point temperature recommended by the material manufacturer for proper drying. This is the temperature typically set on the dryer's temperature controller and on most dryers, is the delivery temperature to your drying hopper.

NOTE: On some drying systems the set point temperature of the dryer may be somewhat higher than the actual temperature delivered to the drying hopper, due to heat losses between the dryer and the hopper. This might be the result of the location of the temperature sensor, poor or no insulation on the dry air delivery line, dry air delivery line length or other issues. The first task in setting up the drying monitor will be to set the temperature the drying hopper should be getting for adequate drying performance according to drying specifications. In some cases, the set point temperature setting at the dryer control may have to be set higher in order to achieve the proper drying temperature at the hopper.

1 Navigate to the individual hopper screen for the hopper you would like to view.

2 Press the Zoom button located under the hopper to go to the hopper settings for that hopper.



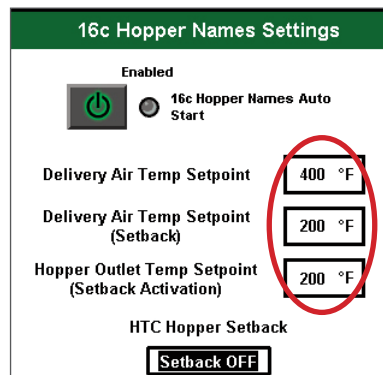
3 Determine your setpoints for the Delivery Air Temperature. The DM3-e will use the active setpoint of the dryer to determine if material is drying properly. If the dryer is operating in Setback, the Setback temperature will be used as the basis for DM3-e alarms. Make sure that your setback temperature is appropriate for the material you are using.

4 Press the box labeled "Delivery Air Temp Setpoint" to enter the temperature setpoint.

5 Enter the setpoint drying temperature on the keypad.

6 Press the green enter arrow to lock in the value of the setpoint.

7 Repeat steps 4 through 6 for each setpoint that needs changed.

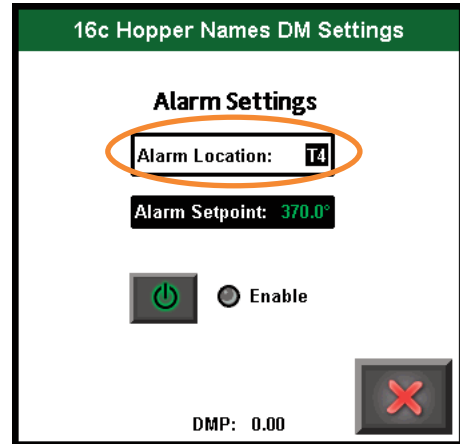


TIP: The allowable setpoint range is displayed at the bottom of the pop-up keypad.

Setting Up Your DM3-e: The Basics- Alarm Location (Simple)

The **Alarm Location** establishes the location in the drying hopper where the actual drying temperature is within a certain range of the process temperature. The user sets the point on the RTD probe to assure good drying with proper temperature delivery.

In drying, the material must be exposed to the process temperature for a set period of time (refer to your dryer manual for more information) to assure good drying. The DM3-e's multiple temperature sensors allow you to select the specific point where the material will see that process temperature for 4 hours, or the remainder of its travel through the hopper on its way to processing. The 'drying zone' is between sensor T1 (the bottom sensor, located at the hot air entry point of the hopper) and the selected "Alarm Location" sensor T4.




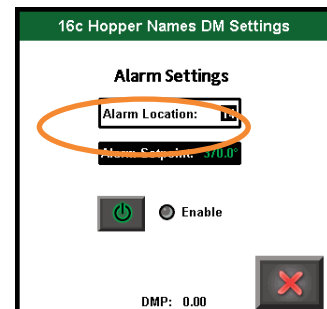
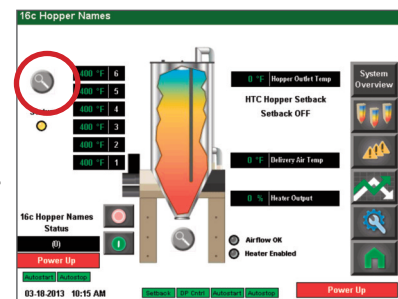
This critical position in the hopper, called the "Alarm Location" will monitor the temperature reading to assure that material will be within a certain range of the process temperature for the determined time, assuring good drying. Default value of the temperature range is within 10°F of the process temperature. This default value can be changed on the set-up screen in case tighter or looser tolerances are required by your application.

Determining the Alarm Location

The easiest method for selecting this drying monitor probe position is to allow the DM3-e to operate on a normal drying process and observe the active temperatures on the individual hopper screen. The highest probe that consistently reports to be within the established range of the Process Temperature can be used as the Alarm Location probe and be set on the hopper settings screen. To set the Alarm Location:

- 1 Navigate to the individual hopper screen for the hopper you would like to view.**
- 2 Press the Zoom button located beside the temperature zones of the hopper to go to the DM-3e settings for that hopper.**
- 4 Press the box labeled Alarm Location.** A drop-down window will appear.
- 5 Select the location you will be using as your alarm location.** You can choose between T2- and T-5. T1 and T6 are not selectable because they would not be accurate as an alarm location.
- 6 Press Enter.**
- 7 Press the Enable button to enable DM3-e on this hopper.**

 **NOTE:** This setting may change based on the extremes for your drying applications, IE; switching from a 180°F drying application to a 300°F.



Setting Up Your DM3-e: The Basics- Alarm Location (Advanced)

Why would an operator want to use the Advanced method for selecting an RTD to use as the **Alarm Location**? The advanced Alarm Location selection may be desirable for processes where the operator wants to pick an RTD at a specific material residence time level at a given throughput. To select an RTD as a monitoring position for the alarm setpoint (advanced) the operator will need to consider the following drying parameters:

- hopper capacity (ft³)
- throughput rate
- bulk density
- drying (residence) time

EXAMPLE calculation

- | | |
|---|------------------------------|
| 1. lbs per hour throughput | 100 |
| 2. drying time (residence time) | 4 hours |
| 3. material's bulk density (lbs/ft ³) | 35 lbs/ft³ |
| 4. drying hopper capacity (ft ³) | 15 lbs/ft³ |

A 15 ft³ hopper holds 525 lbs of material at 35 lbs/ft³ (35 ft³ x 15).

Use the chart in *Operation: Drying Hopper Volume by Model Number*.

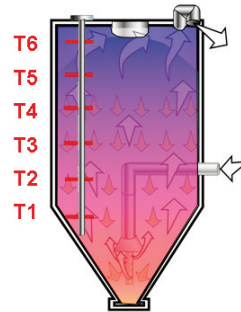
- RTD T5 is likely at a 440 lb fill level (35 ft³ x 12.6).
- RTD T4 is at the 320 lbs level (35 ft³ x 9.15)

This position is at the 3/4 point of the material load.

RTD T5 is closest to the desired monitoring point of 400 lbs (100 lbs/hr x 4 hrs).

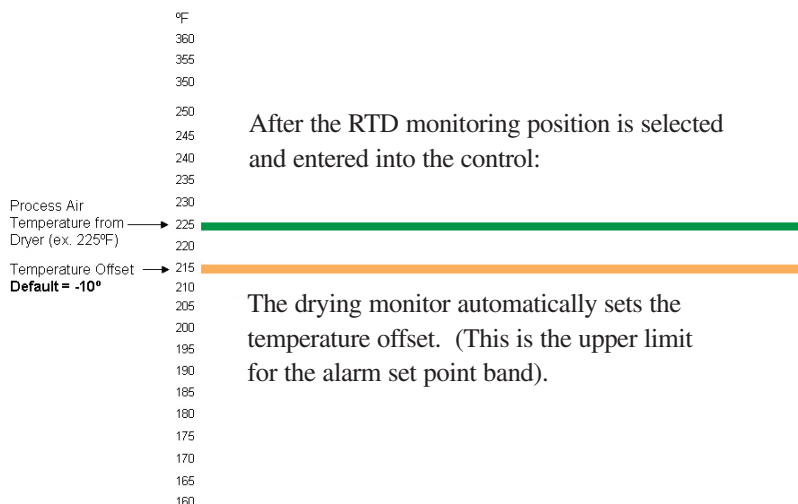
Since T5 is closest to the desired monitoring point, select T5.

Check the temperature reading at T5 to confirm that the temperature is not at or below the alarm set point (default is 30 deg. below process). If necessary, adjust the alarm set point.



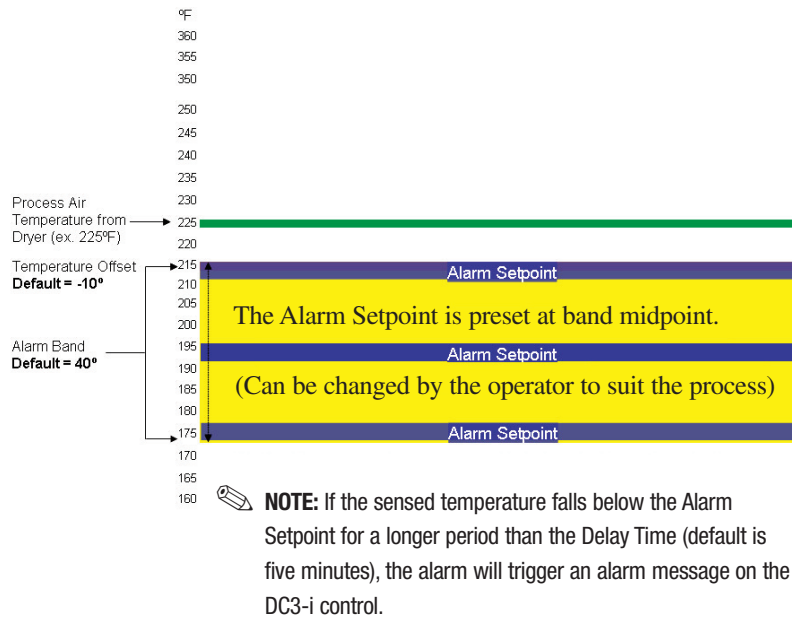
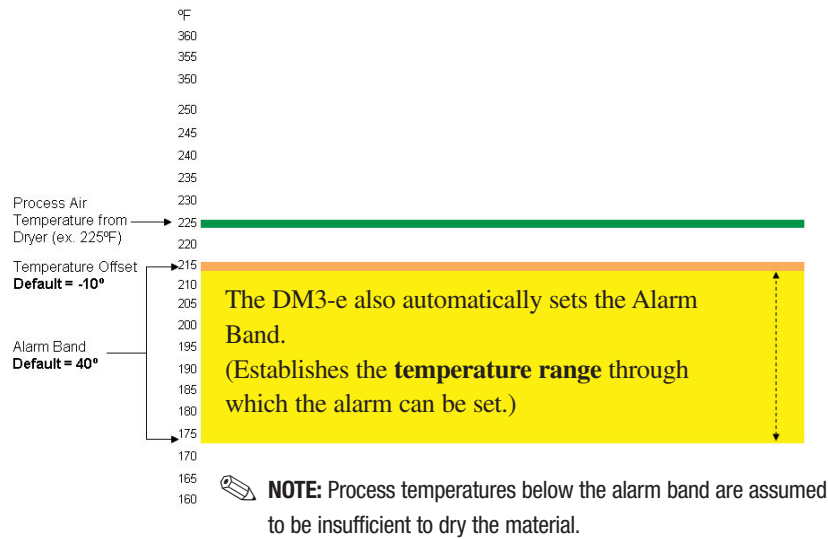
NOTE: You will need to know the bulk density of your material to calculate your drying hopper volume in cubic feet (ft³). See *Operation: Understanding Bulk Density*.

NOTE: Nuisance alarms may trigger if the selected RTD position is too close to the alarm set point. In this case, the operator would either simply select a lower RTD or adjust the alarm set point lower within the alarm band.



(continued)

Setting Up Your DM3-e: The Basics- Alarm Location (Advanced) (continued)

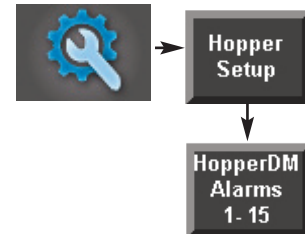


NOTE: From a cold start: If, after a preset time period, the temperature read at the selected alarm RTD does not reach the Alarm Setpoint, DM3-e triggers "Temperature Not Met" alarm.

Setting Up Your DM3-e: The Basics- Alarm Setpoint

Alarm Setpoint

The alarm setpoint is automatically established on the “Hopper Settings” screen but can be adjusted on the set-up screen. This value acts as a default level of temperature performance. If the temperature reported on the alarm location falls below this level for longer than an adjustable time range (default, 5 minutes), the DM3-e will alarm that the material is not being properly dried. The alarm setpoint relationship with the process setpoint (referred to as “band”) as well as the time range before alarm notification can be adjusted on the Set up screen.



Drying Monitor Alarm Setup

16c Hopper Names	16c Hopper Names	16c Hopper Names	16c Hopper Names	16c Hopper Names
Offset: 10°	Offset: 10°	Offset: 10°	Offset: 10°	Offset: 10°
Band: 40°	Band: 40°	Band: 40°	Band: 40°	Band: 40°
Delay: 5 min.	Delay: 5 min.	Delay: 5 min.	Delay: 5 min.	Delay: 5 min.

16c Hopper Names	16c Hopper Names	16c Hopper Names	16c Hopper Names	16c Hopper Names
Offset: 10°	Offset: 10°	Offset: 10°	Offset: 10°	Offset: 10°
Band: 40°	Band: 40°	Band: 40°	Band: 40°	Band: 40°
Delay: 5 min.	Delay: 5 min.	Delay: 5 min.	Delay: 5 min.	Delay: 5 min.

16c Hopper Names	16c Hopper Names	16c Hopper Names	16c Hopper Names	16c Hopper Names
Offset: 10°	Offset: 10°	Offset: 10°	Offset: 10°	Offset: 10°
Band: 40°	Band: 40°	Band: 40°	Band: 40°	Band: 40°
Delay: 5 min.	Delay: 5 min.	Delay: 5 min.	Delay: 5 min.	Delay: 5 min.

System Overview

03-18-2013 10:15 AM

Setback
DP Cntrl
Autostart
Autostop

Power Up

Once the process temperature and alarm location are established for the first hopper, the remaining hoppers in the system may be set up in an identical fashion.

Once hopper settings are made, only setting the Process Temp is required to align the DM3-e functions with a particular drying application. But if necessary, further fine tuning of the process conditions can be made on the DM3-e Set-up screen.

NOTE: Remember to enable the alarm on each individual hopper screen that you are using. See [Operation: Navigating the DM3-e Monitor - Individual Hopper Screens](#).

Drying Hopper Material Change

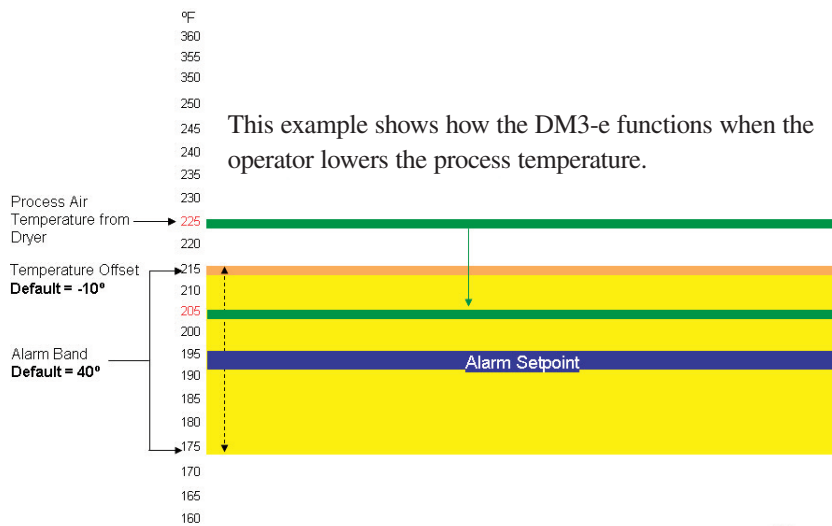
What happens when there is a drying hopper material change?

1 Change the process temperature. For example, let's say the process temperature is changed to 205°F from 225°F. If the DM3-e is being used on a central drying with an HTC or Heater Pack, the process temperature on that hopper must be changed.

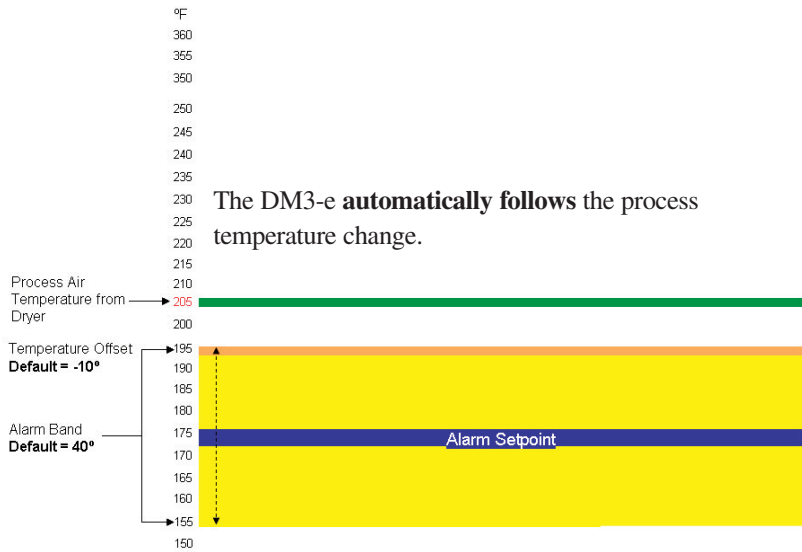
The DM3-e automatically follows and adjusts:

- Temperature offset
- Alarm Band
- Alarm Setpoint

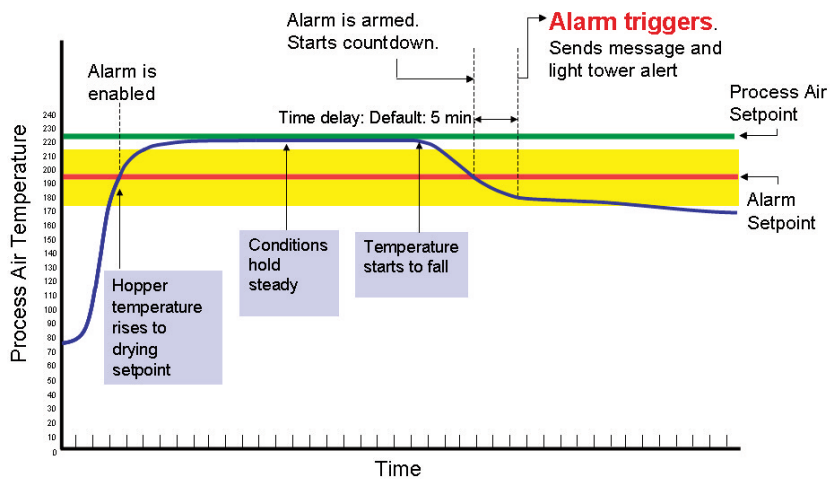
2 If material characteristics require a parameter adjustment, adjust that now. Otherwise, no further operator action is required.



Drying Hopper Material Change (continued)



This graph shows the time sequence of a DM3-e alarm indicating low hopper air temperature, that could result in improperly dried material.



Drying Hopper Volume by Model Number

Drying Hopper	Hopper Diameter	Volume (ft. ³)	RTD Position	RTD Distance from the top	Volume up to RTD position (ft. ³)
CH/RW 10-1	10	1	5	8.38	0.85
		1	4	12.88	0.65
		1	3	17.38	0.45
		1	2	21.88	0.28
		1	1	26.612	0.09
CH/RW 10-1.5	10	1.5	5	8.88	1.37
		1.5	4	16.13	1.04
		1.5	3	23.38	0.72
		1.5	2	30.63	0.46
		1.5	1	37.88	0.15
CH/RW 14-2	14	2	5	8.75221183	1.62
		2	4	13.75221183	1.18
		2	3	18.75221183	0.78
		2	2	23.75221183	0.35
		2	1	28.75221183	0.14
CH/RW 14-3	14	3	5	9.25	2.87
		3	4	17.25	2.17
		3	3	25.25	1.47
		3	2	33.25	0.80
		3	1	41.25	0.16
CH/RW 14-4	14	4	5	8.87	3.62
		4	4	19.12	2.72
		4	3	29.37	1.82
		4	2	39.62	0.95
		4	1	49.87	0.14
CH18-4	18	4	5	12.725	3.19
		4	4	18.225	2.38
		4	3	23.725	1.64
		4	2	29.225	0.84
		4	1	34.725	0.25
RW 18-5	18	5	5	10.41	4.36
		5	4	18.66	3.17
		5	3	26.91	1.97
		5	2	35.16	0.85
		5	1	43.41	0.25
CH/RW 18-6	18	6	5	10.12	5.87
		6	4	20.66	4.39
		6	3	30.91	2.92
		6	2	41.16	1.52
		6	1	51.41	0.25

(continued)

Drying Hopper Volume by Model Number

(continued)

Drying Hopper	Hopper Diameter	Volume (ft. ³)	RTD Position	RTD Distance from the top	Volume up to RTD position (ft. ³)
CH 24-8	24	8	5	13.23	7.38
	24	8	4	20.73	5.50
		8	3	28.23	3.56
		8	2	35.73	1.58
		8	1	43.23	0.39
RW 24-9	24	9	5	10.79	8.73
	24	9	4	19.54	6.48
		9	3	28.35	4.22
		9	2	37.04	2.09
		9	1	45.79	0.47
CH/RW 24-12	24	12	5	53.33	10.89
	24	12	4	42.58	8.14
		12	3	31.83	5.39
		12	2	21.08	2.72
		12	1	10.33	0.52
CH/RW 24-15	24	15	5	11.13	12.60
	24	15	4	24.63	9.14
		15	3	38.13	5.69
		15	2	51.63	2.32
		15	1	65.13	0.57
CH/RW 24-18	24	18	5	10.88	15.56
	24	18	4	27.38	11.35
		18	3	43.88	7.15
		18	2	60.38	2.94
		18	1	76.88	0.55
CH/RW 33-21	33	21	5	18.30	19.66
	33	21	4	29.80	13.96
		21	3	41.30	8.27
		21	2	52.80	2.95
		21	1	64.05	1.63
CH/RW 33-28	33	28	5	20.30	25.68
	33	28	4	34.80	18.52
		28	3	49.30	11.36
		28	2	63.80	4.19
		28	1	78.30	1.68
CH/RW 39-35	39	35	5	25.25	35.32
	39	35	4	38.75	25.98
		35	3	52.25	16.65
		35	2	65.75	7.83
		35	1	79.25	1.83

(continued)

Drying Hopper Volume by Model Number

(continued)

Drying Hopper	Hopper Diameter	Volume (ft. ³)	RTD Position	RTD Distance from the top	Volume up to RTD position (ft. ³)
CH/RW 39-42	39	42	5	25.25	42.38
		42	4	41.25	31.32
		42	3	57.25	20.26
		42	2	73.25	9.72
		42	1	89.25	1.90
CH/RW 44-58	44	58	5	27.00	59.24
		58	4	44.50	43.84
		58	3	62.00	28.45
		58	2	79.50	13.55
		58	1	97.00	2.73
CH 54-70	54	70	5	22.98	66.76
		70	4	33.48	52.85
		70	3	43.98	38.93
		70	2	54.48	25.01
		70	1	64.98	15.68
CH 54-85	54	85	5	23.98	80.12
		85	4	36.98	62.89
		85	3	49.98	45.67
		85	2	62.98	28.52
		85	1	75.98	15.17
CH 54-99	54	99	5	26.98	92.93
		99	4	42.73	73.05
		99	3	56.98	53.17
		99	2	71.98	33.40
		99	1	86.98	15.61
CH54-114	54	114	5	28.98	92.36
		114	4	47.23	69.17
		114	3	63.98	45.98
		114	2	81.48	22.78
		114	1	98.98	16.15
CH 54-129	54	129	5	29.98	116.87
		129	4	49.98	90.36
		129	3	69.98	63.85
		129	2	89.98	37.36
		129	1	109.98	16.15
CH 64-158	64	158	5	28.98	145.06
		158	4	46.98	111.55
		158	3	64.98	78.04
		158	2	82.98	44.98
		158	1	100.98	20.21

(continued)

Drying Hopper Volume by Model Number

(continued)

Drying Hopper	Hopper Diameter	Volume (ft. ³)	RTD Position	RTD Distance from the top	Volume up to RTD position (ft. ³)
CH 64-187	64	187	5	30.98	176.67
		187	4	52.23	137.11
		187	3	73.48	97.55
		187	2	94.73	58.15
		187	1	115.98	20.73
CH 64-215	64	215	5	33.98	198.55
		215	4	58.23	153.40
		215	3	82.48	108.25
		215	2	106.73	63.16
		215	1	130.98	20.73
CH 64-248	64	248	5	34.48	229.24
		248	4	62.48	177.12
		248	3	90.48	124.99
		248	2	118.48	72.86
		248	1	146.48	23.49
CH 74-245	74	245	5	30.98	180.95
		245	4	50.48	132.42
		245	3	69.98	40.15
		245	2	89.48	22.59
		245	1	108.98	5.62
CH 74-366	74	366	5	38.98	304.39
		366	4	68.48	230.97
		366	3	97.98	157.55
		366	2	127.48	29.68
		366	1	156.98	5.90
CH 74-487	74	487	5	47.98	369.86
		487	4	86.98	272.79
		487	3	125.98	175.72
		487	2	164.98	42.10
		487	1	203.98	6.78

(continued)

Understanding Bulk Density

Bulk density is the weight of material in pellet form, where the material has a lot of free space between pellets. It is not a specification that material suppliers typically provide. You may need to calculate the bulk density. It is important not to confuse bulk density with material density, which is the weight of the plastic in solid form without any air gaps between pellets.

How to calculate the bulk density-

- 1 You will need a container or bucket that you know the volume of to calculate the bulk density of your material.**
- 2 Weigh the empty container and record the weight.**
- 3 Fill the container with your material, level it off at the top with a straight edge.**
- 4 Weigh the container with material in it. Record this weight.**
- 5 Subtract the weight of the empty container from the weight of the container with the material present. The result will be the weight of the material for the volume of the container.**
- 6 Convert the number you calculated in step 4, to lbs. per cubic foot. (lbs/ft³)**
For example, if your container had a volume of 0.5 ft³ and the material weight was 20 lbs., divide 20 lbs by 0.5 ft³. The result: The bulk density of the material is 40 lbs/ft³.

Interpreting DM3-e Trend Curves

⚠ IMPORTANT: The descriptions and curve examples shown in this user guide are for general reference only and may not relate to the characteristics of your specific drying process. These guidelines are intended to make the user aware of common temperature patterns of common drying applications to allow correct identification of proper or improper drying through observation of the temperature patterns within the drying hopper as displayed by the DM3-e.

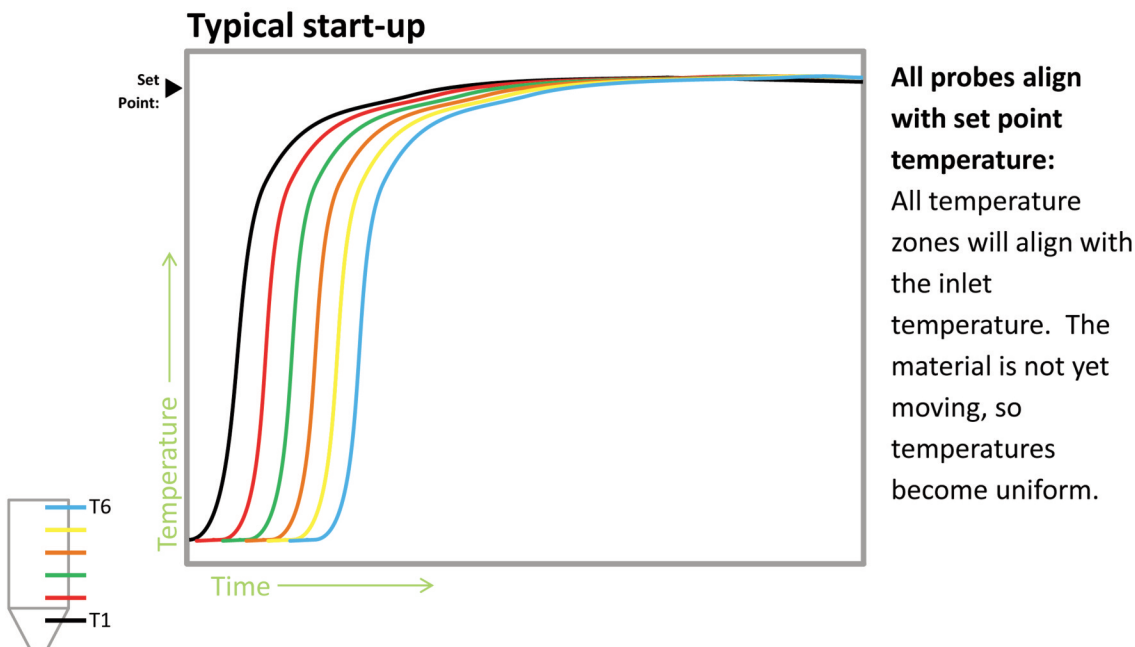
Any of these variables can effect how your drying system’s particular trending curves and data will be displayed:

- hopper size and length/diameter relationship
- drying system and heat/air delivery capability
- bulk density of material being dried
- drying temperature
- condition of the drying equipment’s heaters, filters and blowers and heat/air delivery system
- proper installation, condition and connection of the DM3-e hopper probe
- type and regularity of the automated loading system being employed
- level of the material in the hopper
- temperature of incoming, new material
- specific location of probe sensors, once installed

📝 NOTE: Conair recommends that users familiarize themselves with these guidelines to develop an understanding of typical drying parameters and then apply those principles to monitor their own particular drying system.

Interpreting DM3-e Trend Curves- Typical Startup

Upon start-up with a full hopper of material, temperatures read by all DM3-e probes will rise towards the drying set point temperature, starting with T1. If processing does not start (no material taken away from the hopper) eventually all the probes (with the possible exception of T6 if it is above the material level) will come very close to the process temperature.



Interpreting DM3-e Trend Curves- Normal Operation

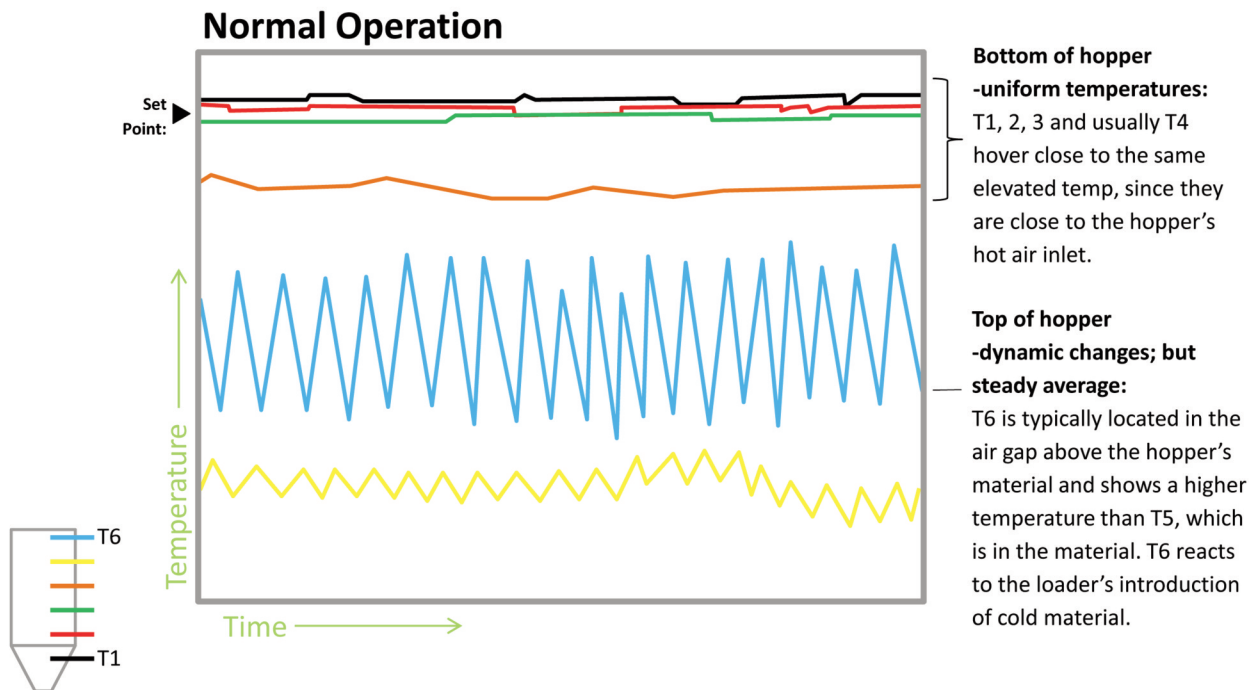
The DM3-e can be used to determine when successful drying is underway and processing of material can begin, using the following guidelines:

NOTE: If the alarm location sensor never reaches the drying temperature setpoint, there is a problem with the drying system and it should be examined for proper operation. Refer to the user guide for your dryer.

- See *Operation: Setting Up Your DM3-e: The Basics-Alarm Location* for establishing the “alarm location” sensor for your drying system (this is typically T3 or T4).
- The alarm location sensor can be used to determine when the hopper’s material has been sufficiently exposed to proper drying temperature for the proper length of time (residence time) and processing of the material in the hopper can begin.
- Processing can begin when the alarm location sensor (typically T3 or T4) has stabilized at the drying temperature setpoint for approximately 50% of the required residence time.

Example: If the material drying temperature is 250°F and the required residence time is 4 hours, once the alarm location sensor has displayed 250°F for 2 hours (50% of 4 hours), processing can begin.

In normal operation, T1 will read closest to the process air temperature.



(continued)

Interpreting DM3-e Trend Curves-

Normal Operation (continued)

In normal operation with material flowing through to the process, readings from T1, T2 and T3 will typically be very close to the process air temperature. T4 and T5 (and T6 if it is located in material) will display temperatures descending in value from the process temperature.

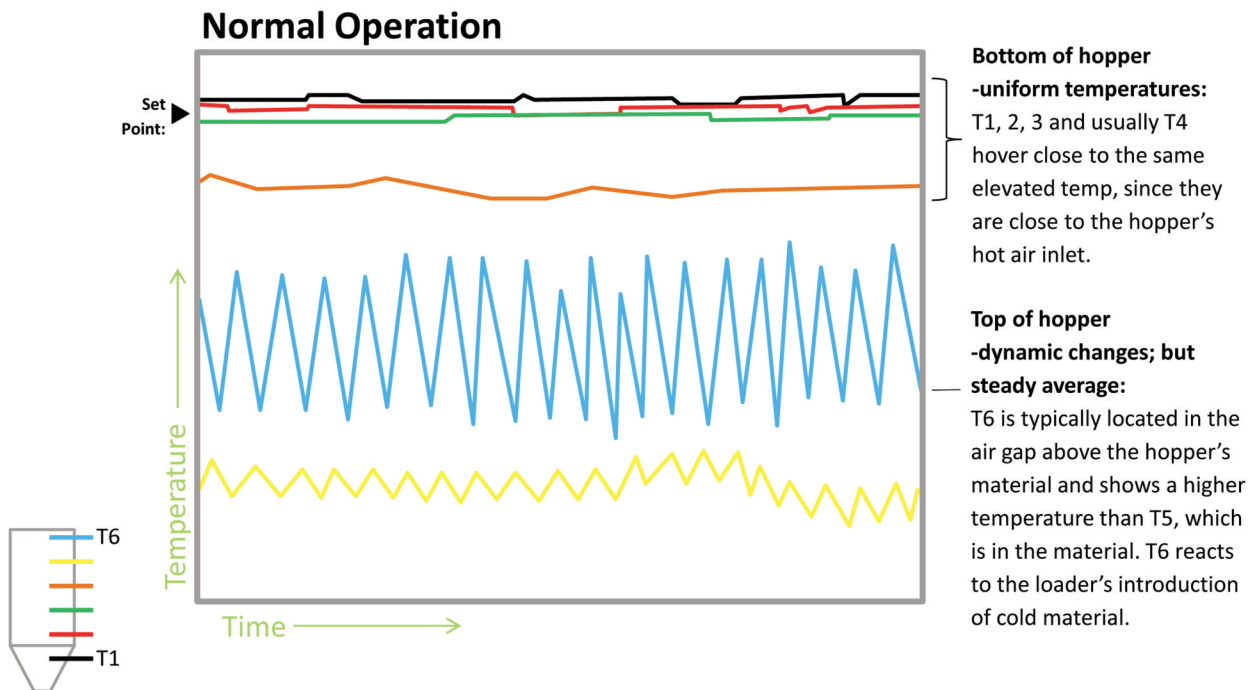
In normal operation with material flowing through to the process, if T6 is located in the air space at the top of the hopper (where there is no material), it will display a higher temperature than T5, which is typically located within the material. This is because a sensor in the open air is not in contact with heat-consuming resin. This is especially true at higher (275+°F) drying temperatures.

The hopper design, and how the material comes to rest in the hopper (the “angle of repose”) and the loading system being used typically dictate the size of the “no-material” area at the top of the hopper depending upon:

- where the demand switch for loading more material is located
- how far into the hopper the discharge of the loader/receiver extends

The DM3-e can show a reaction to successful automated material loading as a drop in the T5 temperature (from the loading of new, cold material), alternating with a rise of T5 (as the new material absorbs drying heat). This reaction can be seen as a saw-tooth up/down temperature pattern.

NOTE: Hoppers being used at less than full capacity (hoppers using demand sensors on their viewing windows for loading, small drying jobs, hoppers that are larger than necessary for the drying task, etc) are likely to have more than one sensor exposed to air and not material, and this should be taken into consideration when analyzing DM3-e data. This consideration is also important when selecting the “alarm location” sensor. (See [Operation: Setting Up Your DM3-e: The Basics-Alarm Location.](#))



Interpreting DM3-e Trend Curves- Material Flow problems

If material flow through the drying hopper is slowed down (a decrease in material throughput), the difference in temperature readings between T1 and T5 will steadily decrease. T4 and T5 will gradually align towards the T1 temperature since the slower moving material will absorb more of the drying heat.

If material flow is stopped (no material is leaving the hopper) and prior to any energy saving functions in the dryer being engaged, the temperature readings from T4, T5 and T6 will begin to increase and align with the process temperature. The stopped material now has time to more fully absorb drying heat.


If material flow increases (an increase in throughput), the difference in temperature readings between T1 through T5 will steadily increase. The faster moving material now spends less time being heated so the difference in temperatures read at the bottom of the hopper compared to the top, will display a greater spread.

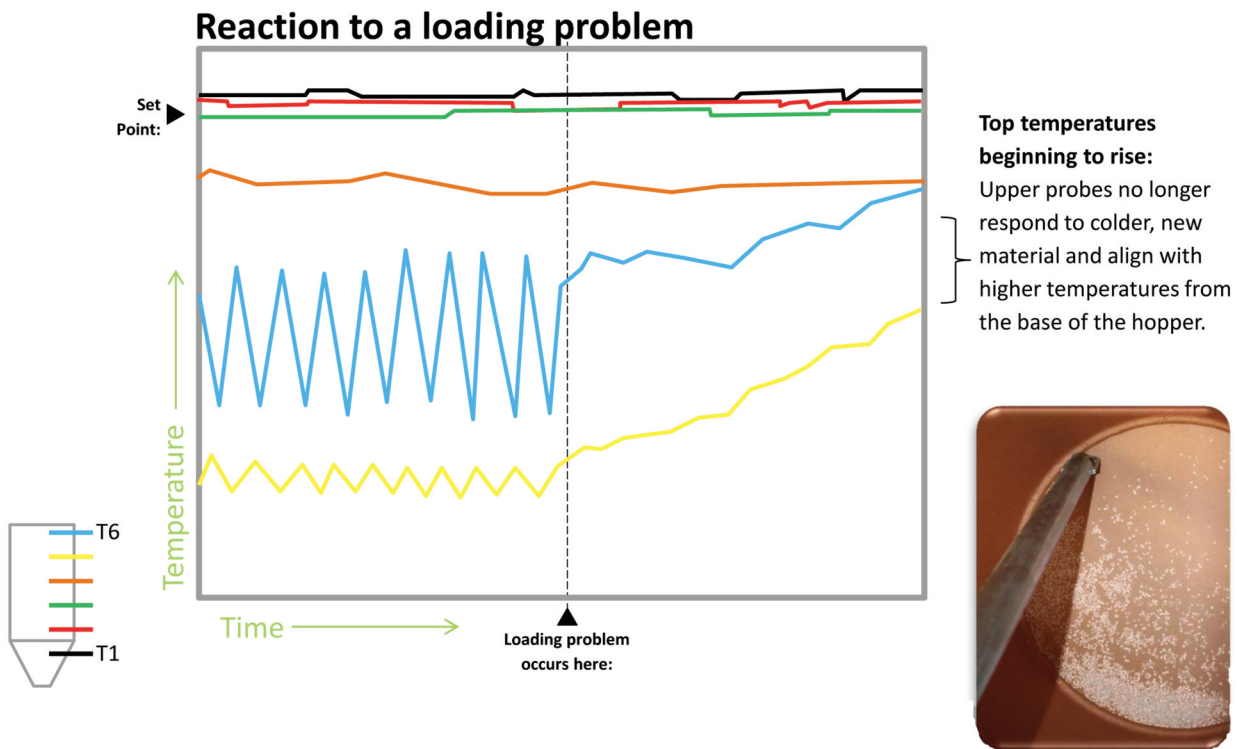


NOTE: An increase in the difference between T1 through T5 (as described above) can also be the result of an increase in the quantity of reground material being dried in the hopper. Increasing the quantity of regrind decreases the bulk density of the material being dried and increases the flow of material.

Interpreting DM3-e Trend Curves- Loading problems

If the loading function stops (no new material being supplied to the hopper) while normal operation is underway, T5 and T6 will increase in temperature as the heat-consuming material level in the hopper decreases. T4 will eventually follow, especially if it also becomes exposed to air and not material.


 **NOTE:** Successful drying is in jeopardy if the material supply to the hopper is interrupted. Even if the problem is corrected and the hopper is refilled, the incoming material will not be exposed to the proper length of residence time for successful drying.



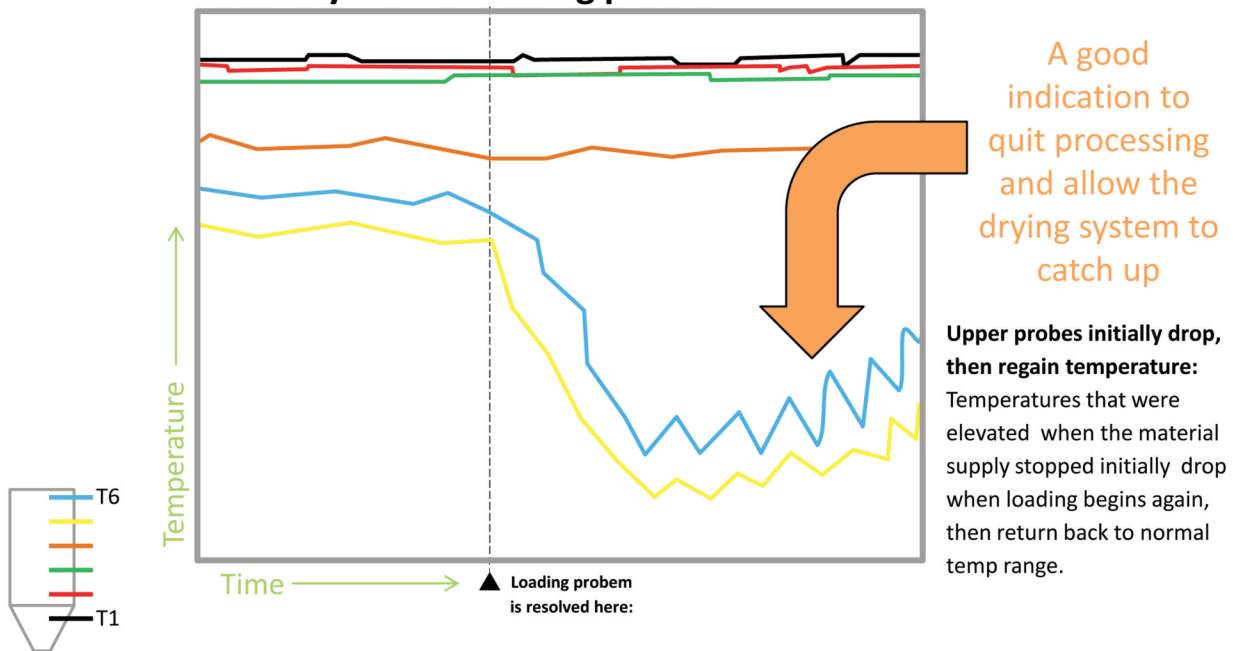
(continued)

Interpreting DM3-e Trend Curves- Loading problems (continued)

When automatic loading is restored, (new material is once again supplied to the hopper), T3 through T5 will initially drop in temperature from exposure to the new, colder material coming into the hopper, and then begin to rise and realign into a normal temperature profile for the hopper.

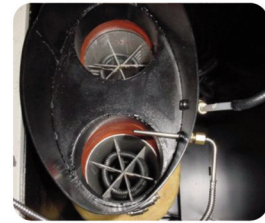
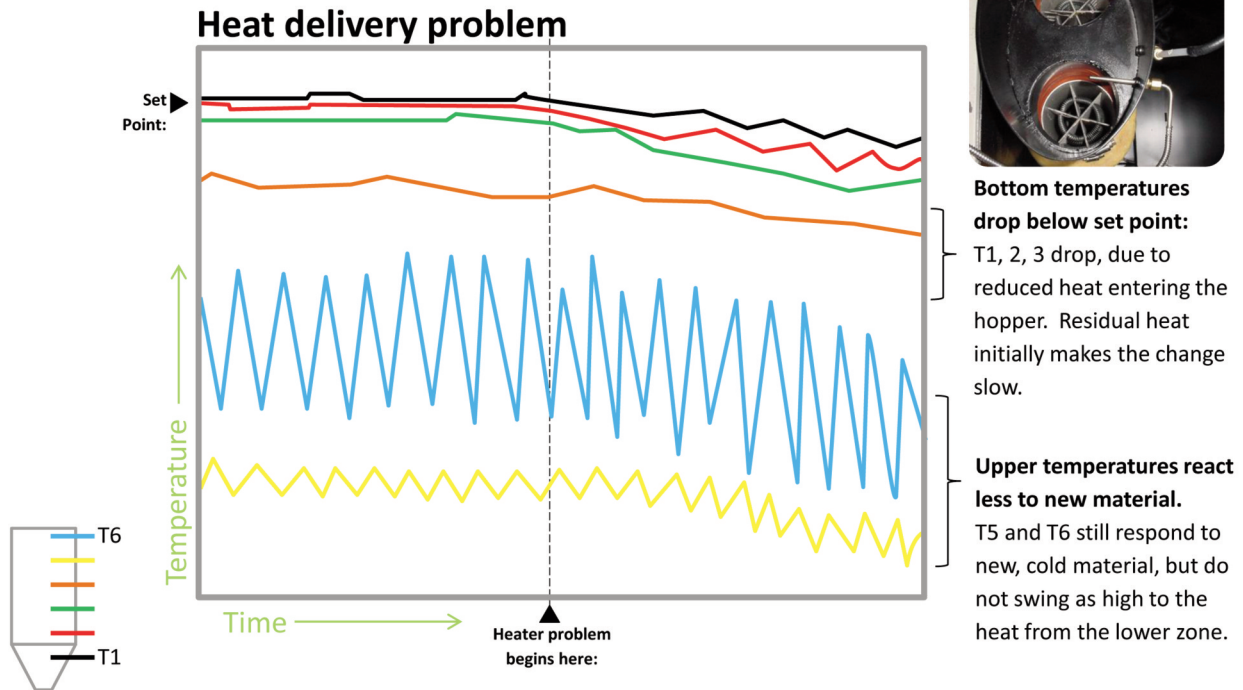
 **NOTE:** The drop in temperature displayed by T3 through T5 is a reaction to a quantity of cold material being introduced into the hopper following a lapse of automatic loading. This drop can be compared to a 'cold front' of material moving down through the hopper that has not been exposed to drying in the hopper for a long enough residence time. Temporary halting of the process should be considered to allow the drying system to catch up and deliver proper residence time to this new material, to prevent production of insufficiently dried product. If the process is not stopped, this 'cold front' will eventually be seen to a lesser degree, on T2, then T1.

Recovery from a loading problem



Interpreting DM3-e Trend Curves- Problems with Heat Supply

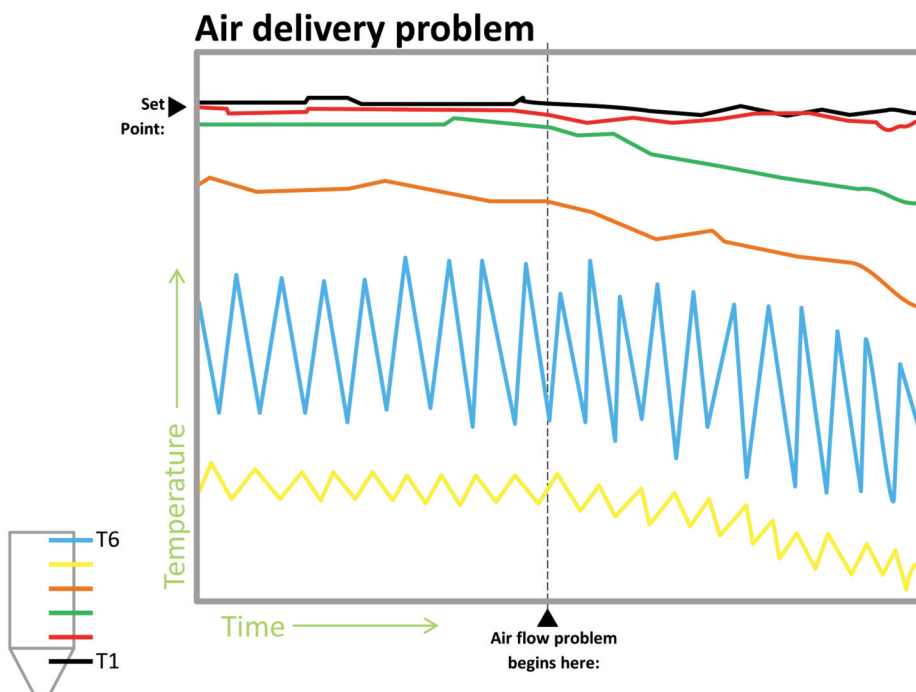
Problems with the heat supply (reduced temperature) to the drying hopper initially show up as a reduction in T1 and T2 temperature readings. Frequently, this reduction does not display immediately due to the residual heat of the material. The remaining probes will also sequentially decrease in temperature as the problem continues.



Interpreting DM3-e Trend Curves- Air Supply Problems

Problems with the air supply to the drying hopper (I.E: clogged filters or blocked drying air supply line) initially show up as a reduction in the T5, T4, and eventually T3 temperature readings since the air flow is no longer strong enough to carry the drying heat up through the hopper. The remaining probes will also decrease in temperature as the problem continues, even though T1 and T2 continue to display levels close to the process temperature. This can be a very gradual reaction to filters gradually becoming clogged.

NOTE: A decrease of T3 (as described above) can also be the result of an increase in throughput or an increase in the quantity of regrind material being dried in the hopper. Increasing the quantity of regrind decreases the bulk density of the material being dried.

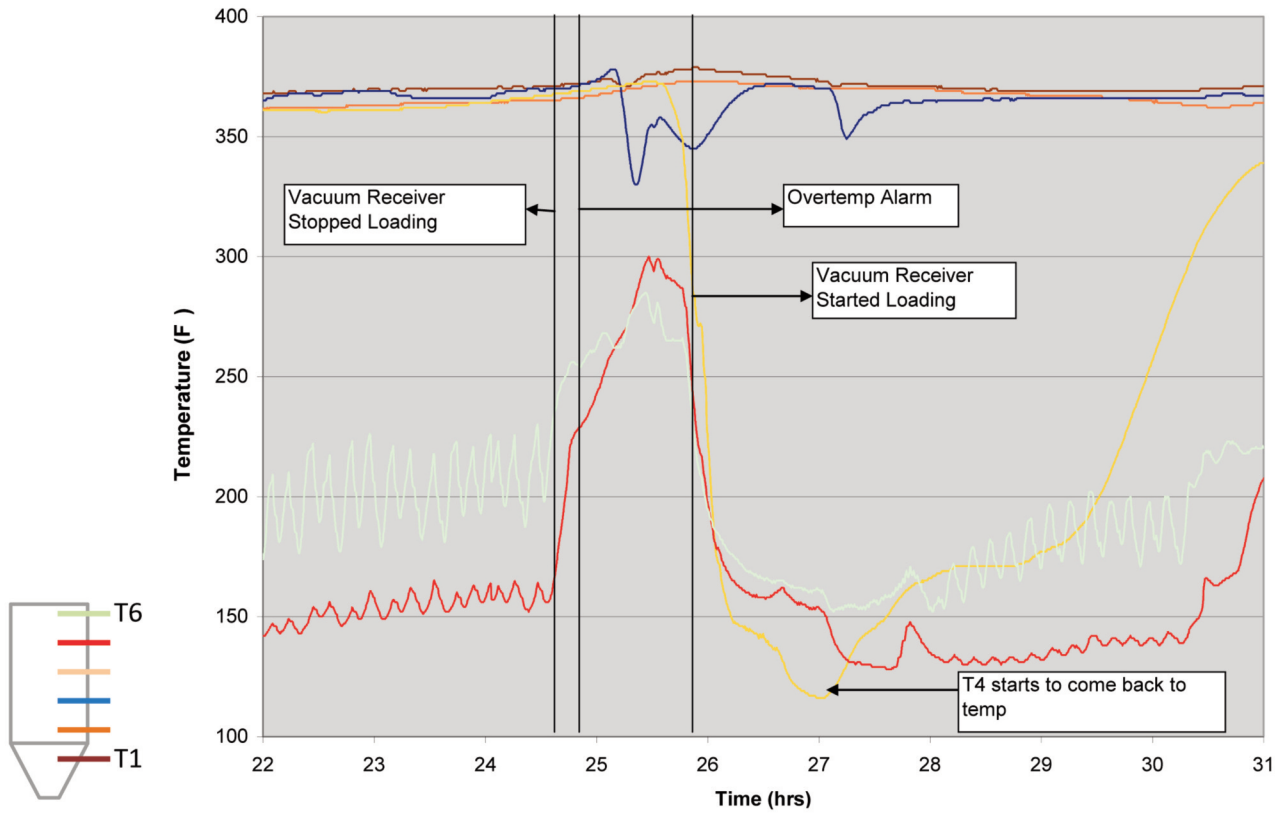


Mid temperatures react to reduced air flow.

T4 and T5 begin to drop since air flow is not strong enough to drive heat to them. T3 will eventually follow. But T1 and T2 often stay strong since they are still receiving the proper heat, in spite of reduced air flow.

Interpreting DM3-e Trend Curves- Actual DM3-e Trend Analysis

Below is an actual trend analysis used by a PET bottle processor to find the cause of overnight process variations.



Maintenance

Preventative Maintenance Schedule 5-2



Preventative maintenance schedule

No specific maintenance schedule is required for the DM3-e since there are no moving parts. All components of the system are electrical in nature, but like any component in a factory, can be prone to unforeseen breakage.

In the event of breakage, replace the component(s). Do not attempt repair.

- **When material is changed.** Since a key component of the DM3-e is the temperature probe(s) and they are exposed to your material and elevated temperatures, they should be checked whenever their host drying hopper is drained, cleaned, etc. No specific preventative maintenance is required beyond wiping down and examining for damage whenever the hopper is empty, cool and available for inspection. In the event of visible damage or non-operation, replace the probe. Do not attempt repair.

In addition, the coupling assembly that holds the probe in place should be closely examined from the top of the hopper and inside the hopper to be sure it is intact and has not been damaged or become loose as a result of use in the hopper.

- **Monthly, or as often as needed**

- Check that the cables and junction boxes associated with the DM3-e.**
Make sure all cables are intact, undamaged, out of harm's way, etc.
- Correct the mounting integrity of junction boxes as required and re-route the ModBus cables to avoid high amperage electrical lines and/or moving, hot or sharp objects.**

Troubleshooting

Before Beginning	6-2
A Few Words of Caution	6-2
What Can the DM3-e Tell You	6-3
Understanding Alarms	6-4
DM3-e Problems	6-5

Before Beginning

You can avoid most problems by following the recommended installation, operation and maintenance procedures outlined in this User Guide. If you have a problem, this section will help you determine the cause and tell you how to fix it.

Before you begin troubleshooting:

- ❑ Find any wiring, parts, and assembly diagrams that were shipped with your equipment. These are the best reference for correcting a problem. The diagrams will note any custom features or options not covered in this User Guide.
- ❑ Verify that you have all instructional materials related to the DM3-e. Additional details about troubleshooting and repairing specific components are found in these materials.
- ❑ Check that you have manual for other equipment connected in the system. Troubleshooting may require investigating other equipment attached to, or connected with the DM3-e.

A Few Words of Caution



WARNING: Improper installation, operation or servicing may result in equipment damage or personal injury.

This equipment should only be installed, adjusted, and serviced by qualified technical personnel who are familiar with the construction, operation, and potential hazards of this type of machine.

All wiring, disconnects, and fuses should be installed and adjusted by qualified electrical technicians in accordance with electrical codes in your region. Always maintain a safe ground. Do not operate the equipment at power levels other than what is specified on the machine serial tag and data plate.



WARNING: Electrical hazard



Before performing maintenance or repairs on this product, disconnect and lock out electrical power sources to prevent injury from unexpected energization or start-up. A lockable device has been provided to isolate this product from potentially hazardous electricity.

What the DM3-e Can Tell You

The DM3-e monitors the temperature profile of the material in the hopper using six Resistance Temperature Device (RTD) sensors. These RTD sensors are located at evenly spaced positions in the drying hopper. Monitoring the six sensors creates an accurate profile of the hopper's temperature gradient. This simple gradient measuring system informs the user that major characteristics of good drying are present (or not).

Heat: Each probe precisely measures the heat being created by the dryers heating system and more importantly, the changes that heat goes through as it is combined with the flow of material through the hopper. Heated air is going up in the hopper and is constantly facing a refreshed supply of material while that material is flowing down and into the process, which creates a predictable heat profile for good drying inside the hopper. The DM3-e keeps precise track of that profile and alerts you if something is not as it should be for good drying.

Air flow: Air is the medium that carries heat to the drying hopper and carries moisture away from the material. By keeping track of different heat zones in the drying hopper, the DM3-e is also passively keeping track of the air flow through the hopper.

Time: The DM3-e interprets the temperature findings from the drying hopper and knows how long material needs to be kept at the correct temperature for good drying. Once again, by measuring each of the six zones the DM3-e can tell you if you are getting good drying performance or if something is not correct for success.

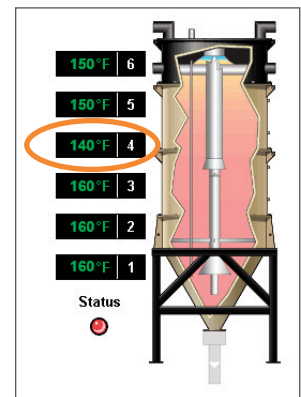
Understanding Alarms

The DM3-e monitors each hopper and will give you an alarm if the temperature falls below your established alarm setpoint. See [Operation: Setting Up Your DM3-e: The Basics- Alarm Setpoint](#) for more information about setting the alarm setpoint.

The DM3-e uses the DC-T's alarm system to alert the user to an alarm condition. Refer to the User Guide that came with your dryer for more information on understanding alarms.

The information in the alarm notification box on your DC-T screen tells you which hopper has triggered the alarm, and at what time the alarm delay was met. For example, after being at temperature, Hopper 1 fell below the alarm setpoint for a period of time longer than the alarm delay. The DM3-e triggered an alarm so that you can determine the problem and avoid downtime due to material not being properly dried.

If you select the hopper that is causing the alarm, you will see that the temperature in the alarm location selected is below the alarm setpoint.



DM3-e Problems

Symptom

Hopper data does not display

Hopper alarm message appears on touch screen.

Possible cause

Connection to RTD(s) in hopper(s) is incorrect or disconnected.

The last hopper in the ModBus string is not terminated.

Loose or damaged connectors in the ModBus cables.

Damaged connectors on the hopper probe.

Defective temp sensor(s) within the probe.

A low temperature condition has been sensed by the drying monitor in the hopper listed in the alarm message

Solution

Check integrity of cable connections from drying monitor panel to RTD junction boxes to RTD.

See section **Terminating the final RTD Junction Box** for properly terminating the last hopper

Check all connections and replace cable set(s) that are damaged

Replace the hopper probe.

Replace the hopper probe.

Press trend button on Drying Monitor, and select the alarm hopper to view the specific time the temperature dropped, to pinpoint possible problem.

Review settings in the hopper set-up screen to assure the drying monitor settings are correct for the current drying task.

Check drying system for insufficient air flow caused by blower malfunction or damaged or plugged air connection to hopper from dryer.

Check if drying system material throughput has elevated due to process change or sharing of material with another process, beyond the capabilities of the drying system.

We're Here to Help


Conair has made the largest investment in customer support in the plastics industry. Our service experts are available to help with any problem you might have installing and operating your equipment. Your Conair sales representative also can help analyze the nature of your problem, assuring that it did not result from misapplication or improper use.

Additional manuals and prints for your Conair equipment may be ordered through the Customer Service or Parts Department for a nominal fee. Most manuals can be downloaded free of charge from the product section of the Conair website.
www.conairgroup.com

How to Contact Customer Service

To contact Customer Service personnel, call:



 **NOTE:** Normal operating hours are 8:00 am - 5:00 pm (EST). After hours emergency service is available at the same phone number.

You can commission Conair service personnel to provide on-site service by contacting the Customer Service Department.

Before You Call...

If you do have a problem, please complete the following checklist before calling Conair:

- Make sure you have all model, control type and serial numbers from the serial tag, and parts list numbers for your particular equipment. Service personnel will need this information to assist you.
- Make sure power is supplied to the equipment.
- Make sure that all connectors and wires within and between control systems and related components have been installed correctly.
- Check the troubleshooting guide of this manual for a solution.
- Thoroughly examine the instruction manual(s) for associated equipment, especially controls. Each manual may have its own troubleshooting guide to help you.
- Check that the equipment has been operated as described in this manual.
- Check accompanying schematic drawings for information on special considerations.

Equipment Guarantee

Conair guarantees the machinery and equipment on this order, for a period as defined in the quotation from date of shipment, against defects in material and workmanship under the normal use and service for which it was recommended (except for parts that are typically replaced after normal usage, such as filters, liner plates, etc.). Conair's guarantee is limited to replacing, at our option, the part or parts determined by us to be defective after examination. The customer assumes the cost of transportation of the part or parts to and from the factory.

Performance Warranty

Conair warrants that this equipment will perform at or above the ratings stated in specific quotations covering the equipment or as detailed in engineering specifications, provided the equipment is applied, installed, operated and maintained in the recommended manner as outlined in our quotation or specifications.

Should performance not meet warranted levels, Conair at its discretion will exercise one of the following options:

- Inspect the equipment and perform alterations or adjustments to satisfy performance claims. (Charges for such inspections and corrections will be waived unless failure to meet warranty is due to misapplication, improper installation, poor maintenance practices or improper operation.)
- Replace the original equipment with other Conair equipment that will meet original performance claims at no extra cost to the customer.
- Refund the invoiced cost to the customer. Credit is subject to prior notice by the customer at which time a Return Goods Authorization Number (RGA) will be issued by Conair's Service Department. Returned equipment must be well crated and in proper operating condition, including all parts. Returns must be prepaid.

Purchaser must notify Conair in writing of any claim and provide a customer receipt and other evidence that a claim is being made.

Warranty Limitations

Except for the Equipment Guarantee and Performance Warranty stated above, Conair disclaims all other warranties with respect to the equipment, express or implied, arising by operation of law, course of dealing, usage of trade or otherwise, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.