TOWER DRYER

with
QuadraTouch Pro™
Dryer Control System

OWNER'S OPERATION MANUAL

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Manual L13892
01/23/2018

Thank you for purchasing Sukup equipment. At Sukup Manufacturing Co., we strive to provide our customers with the best products available. It's important to us that you get the best value for your money. That means producing top-quality products that will provide you with many years of satisfied ownership.

We back our products with experienced staff and the best customer service in the industry. Our dedicated employees have done their best to ensure that your Sukup equipment will meet your needs. With proper installation and use, it will serve you for many years.

If for some reason you experience difficulties with your Sukup equipment, your authorized Sukup dealer can provide you with the help you need. If you need assistance beyond what your dealer can provide, you can always contact your regional Sukup Distribution Center or our headquarters in Sheffield, Iowa, USA.

Thank you again for your purchase. We wish you many years of profitable, safe use of your Sukup equipment.

Eugene, Charles, Steve and
The Entire Sukup Family

Sukup Manufacturing Co.
Sheffield, Iowa, USA

Tower Dryer Owner's Operation Manual

This manual is comprised of several tabbed sections. The first provides warranty and safety information and identifies components of dryer. Others provide instructions for operation, troubleshooting and maintenance of dryer. Please read entire manual thoroughly before installation or operation. Check with dealer before each drying season for important updates.

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Preliminary Information

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TOWER DRYER LIMITED WARRANTY

SUKUP MANUFACTURING CO. (Sukup) warrants to original retail purchaser that within time limits set forth, new equipment shall be free from defects in material and workmanship. A part will not be considered defective if it substantially fulfills performance specifications. Should any part prove defective within warranty period, part will be replaced or repaired without charge F.O.B. Sukup Manufacturing Co., Sheffield, Iowa USA or Distribution Centers - Arcola, Illinois; Aurora, Nebraska; Cameron, Missouri; Defiance, Ohio; Jonesboro, Arkansas; Watertown, South Dakota. To claim warranty, a copy of original invoice is required.

THE FOREGOING LIMITED WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES OF MERCHANTABILITY, FITNESS OR PURPOSE AND OF ANY OTHER TYPE, WHETHER EXPRESS OR IMPLIED. Sukup neither assumes nor authorizes anyone to assume for it any other obligation or liability in connection with said part, and will not be liable for incidental or consequential damages. THE REMEDIES STATED HEREIN SHALL BE THE EXCLUSIVE REMEDIES AVAILABLE UNDER THIS LIMITED WARRANTY.

Sukup reserves the right to change specifications, add improvements or discontinue manufacture of any of its equipment without notice or obligation to purchasers of its equipment. This warranty gives you specific legal rights. You may also have other rights which vary according to state or province.

WARRANTY EXCLUSIONS - Labor, transportation, or any cost related to a service call is not provided by Sukup. This Limited Warranty does not apply to damage resulting from misuse, neglect, normal wear, accident or improper installation or maintenance. ITEMS NOT MANUFACTURED BY SUKUP (e.g., belts, motors) ARE COVERED UNDER WARRANTIES OF THEIR RESPECTIVE MANUFACTURERS AND ARE EXCLUDED FROM COVERAGE UNDER THE SUKUP WARRANTY. SUKUP MANUFACTURING CO. MAKES NO WARRANTY, EXPRESS OR IMPLIED, OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Upon taking delivery of product, purchaser (dealer and/or end user) assumes responsibility for proper storage of all materials. Proper storage includes dry, temperature and humidity controlled facilities that eliminate the potential of moisture, including condensation, from causing white rust and/or corrosion of any sort. Warranty does not extend to defects, damage or cosmetic (appearance) issues caused by improper storage or handling.

TOWER DRYER WARRANTY - Sukup warrants stick-built tower dryers for one year from date of purchase and modular tower dryers for two years from date of purchase.

An optional **FOUR-YEAR** (stick-built) or **THREE-YEAR** (modular) **LIMITED WARRANTY EXTENSION** may be purchased **only** at time of dryer purchase. Period of extended warranty begins on 13th month (stick-built) or 25th month (modular) after date of purchase and continues through 60th month from date of purchase. Dryer parts found to be defective during this period will be replaced or repaired, with the exception of motors (as excluded herein) or "wear parts" (any parts worn by high usage, such as rotors, bearings, burner components, moving parts, sensors, etc.). Extended limited warranty does not apply to labor, transportation, shipping or any cost related to a service call.

ELECTRIC MOTOR WARRANTY - The manufacturers of electric motors warranty their motors through authorized service centers for a 2-year period from motor date code. Contact motor manufacturer for nearest location. If motor warranty is refused by a service center based upon date of manufacture, use the following procedure: Have motor repair shop fill out the warranty report form as if they were providing warranty service. State on report reason for refusal. Send report, motor nameplate, and proof of purchase date (invoice from Sukup and invoice for your customer) to Sukup. If electric motor warranty is not satisfactorily handled by motor service center, contact Sukup for assistance. Sukup will attempt to obtain warranty from motor manufacturer. Any credit obtained will be passed on. Warranty may also be obtained by returning motor to Sukup Manufacturing Co. or Distribution Centers with prior authorization. **NOTE**: Sukup will not be responsible for unauthorized motor replacement or repair. Labor for removal of motor from fan not included.

WARRANTY CERTIFICATION - Warranty registration card should be mailed within one month of product delivery to certify warranty coverage.

UNAPPROVED PARTS OR MODIFICATION - All obligations of Sukup under this warranty are terminated if unapproved parts are used or if equipment is modified or altered in any way not approved by Sukup.

Purchaser must adhere to applicable safety regulations and federal, state and local codes in the location, installation, and use of this product. Sukup assumes no responsibility for property damages or personal injuries.

On safety decals and throughout this manual, this symbol and the signal words Danger, Warning, Caution and Notice draw your attention to important instructions regarding safety. They indicate potential hazards and levels of intensity.

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

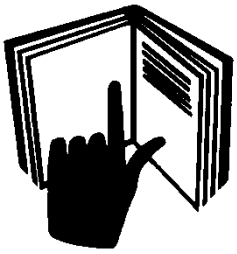
WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE alerts you to practices unrelated to personal injury, such as messages related to property damage.

IMPORTANT: To prevent death or serious injury to you or your family, it is essential that safety decals are clearly visible, in good condition, and applied to the appropriate equipment.

FOLLOW MANUAL & SAFETY DECAL MESSAGES



Observe safe operating practices. Carefully read this manual and all safety decals on your equipment. Safety decals must be kept in good condition. Replace missing or damaged safety decals free of charge by contacting Sukup Manufacturing Co. by mail at PO Box 677, Sheffield, Iowa USA 50475; by phone at 641-892-4222; or on our website, www.sukup.com.

Learn how to use controls and operate machine. Do not operate without safety shields in place. Worn or missing shields can be replaced free of charge by contacting Sukup Manufacturing Co.

Do not let anyone operate unit without thorough training of basic operating and safety procedures. Owners/operators need to know what specific requirements, precautions, and work hazards exist. It is their responsibility to inform anyone near equipment of hazards and safety precautions that need to be taken to avoid personal injury. Always keep children away from bins and vehicles with flowing grain.

Make no unauthorized modifications to machine. Modifications may endanger function and/or safety of unit. Keep unit well-maintained according to procedures in Maintenance section of this manual.

NOTICE: Do not dump polluting liquids, worn parts and maintenance waste into the environment. Dispose of all such materials as specified by applicable standards.

WARNING: PREVENT EXPLOSION OR FIRE

- Carefully review operator's manual
- Keep dryer clean inside and out, as fines may cause a fire
- Check for gas leaks by spraying soapy solution on piping and joints
- Run fan at least half a minute before starting heater
- NEVER start heater if you smell gas or hear a hissing sound
- NEVER run heater with inspection door open

Failure to heed these warnings could cause death or serious injury.

ANALYZE ARC FLASH/SHOCK HAZARD. Installations of equipment containing switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers are subject to National Electrical Code (NEC) and National Fire Protection Association (NFPA), and enforced under Occupational Safety and Health Administration (OSHA) regulations. These installations must be analyzed for arc flash and shock hazard. Additional requirements under these standards include:

- Facility needs to have written electrical safety program.*
- Equipment shall be FIELD MARKED with a label containing available incident energy and/or required Personal Protective Equipment (PPE) level.
  This labeling requirement is employer's responsibility and not that of equipment manufacturer or installer.
- All persons working on or near affected equipment must be properly trained.
- Proper tools and equipment must be provided by installation operator or employer.

*NFPA 70E has numerous significant changes in 2012 edition. Be sure to update your facility's safety program.

USE PROPER LOCKOUT PROCEDURES. Facility management needs to proactively train employees to ensure use of proper lockout procedures while working on dryer. Management also needs to inspect this unit for any covers or guards not in proper place. It is everyone's responsibility to report any missing grates, guards, equipment failures or failures to lock out. Make certain that no cover is removed unless power is locked out.

NOTE: Refer to OSHA's typical minimal lockout procedures (29CFR 1910.147 App A).

Basic Safety Rules

1. Learn how to use controls and operate equipment.
2. Do not let anyone operate unit without thorough training of basic operating and safety procedures. **Always follow a proper lockout procedure.**
3. Periodically check all mechanical and electrical components. Keep unit in good working condition.
4. Handle equipment and parts with care. **Wear protective clothing** to avoid injury from sharp metal edges.
5. Wear Personal Protective Equipment (PPE) such as safety glasses, gloves, hardhat, steel-toe boots, ear protection and dust mask as required by local, state and national regulations.

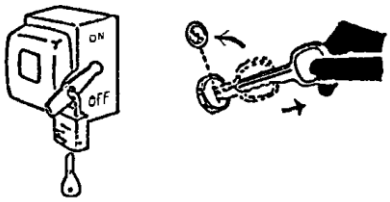
Good housekeeping practices and correct safety procedures will help protect lives, jobs, property and profits.

Please contact Sukup Manufacturing Co. with any specific safety questions about dryer or its use!

To avoid electric shock or electrocution, all equipment must be properly wired and grounded according to electrical codes. Have unit wired by qualified electrician.

Have an electrician install a main power disconnect switch capable of being locked only in OFF position. Mark disconnect clearly as to equipment it operates. Always lock out main power disconnect switch whenever equipment is not in use.

Service Disconnect



WARNING: When servicing equipment, never enter bin unless all power is locked out and another person is present. Always LOCK OUT all power and always check with voltage meter before servicing.

Failure to do so could result in death or serious injury.

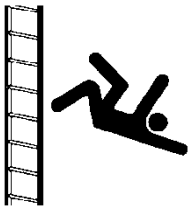
NOTE: Refer to OSHA's typical minimal lockout procedures (29CFR 1910.147 App A) at www.osha.gov to establish a written plan for your work site.

WARNING: KEEP CLEAR OF ALL MOVING PARTS.
Keep people (ESPECIALLY YOUTH) away from equipment, particularly during operation.

Keep away from all moving parts. Keep all shields and screen guards in place. **SHUT OFF AND LOCK OUT** all power before servicing.

Failure to follow precautions above could result in death or serious injury.

WARNING: METAL IS SLIPPERY WHEN WET
Inspect ladder carefully before use. Never climb deteriorated, damaged or improperly assembled ladder components. Maintain secure hand and foothold when climbing. Never carry items while climbing. Use safety harness and safety line as required by safety regulations.



Failure to heed these precautions could result in death or serious injury.

CAUTION: Metal edges are sharp. To avoid injury, wear protective clothing and handle equipment and parts with care. Failure to do so may result in minor or moderate injury.

Refer to OSHA 1910.132 (Personal Prot. Equip.)

PERSONAL PROTECTIVE EQUIPMENT

Owners/Operators are responsible for developing site-specific personal protective equipment standards.

These include, but are not limited to personal protective equipment for eyes, face, head, and extremities, as well as protective clothing and respiratory devices.

For a complete listing of OSHA's personal protective equipment standards go to www.osha.gov (29CFR 1910.132).

Grain Bin Safety

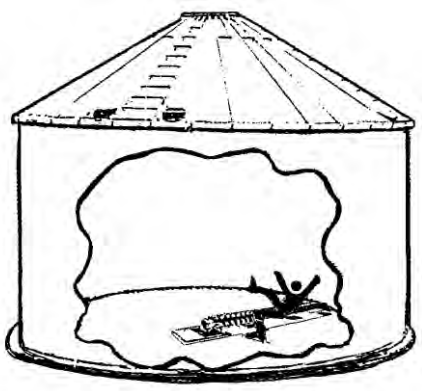
When entering a bin, owners/operators are responsible for following site-specific confined space entry procedures. OSHA's confined space entry procedures (29CFR 1910.146) can be found at www.osha.gov.

If you must enter bin for repair or maintenance:

- Use a safety harness, safety line and respirator
- Station another person outside of bin
- Avoid the center of the bin
- Wear appropriate personal protective equipment
- Keep clear of all augers and moving parts

DANGER: Never enter bin unless all power is locked out and another person is present.

Rotating augers can kill or dismember!



NEVER enter bin when augers are running!
When bin is nearly empty, sweep auger will travel at an increasingly fast speed. Keep away from sweep and sump augers to avoid entanglement.

Failure to follow these precautions will result in death or serious injury.

DANGER: Flowing grain may trap and suffocate. If you enter a bin of flowing grain you can be completely submerged in grain in about 8 seconds.

Failure to heed this warning will result in death or serious injury.

EMERGENCIES - KNOW WHAT TO DO

Have emergency numbers and written directions to work site readily available in case of emergency. An area to record emergency information is provided below.

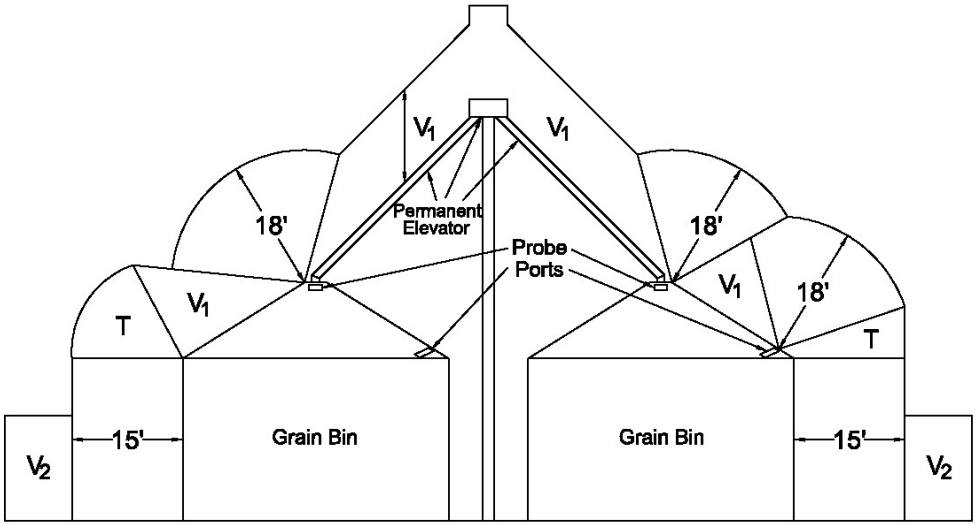
Ambulance • Fire • Police: 9-1-1
Farm rescue team: _____
Local EMS team: _____
Address of work site:_____
Directions to work site:_____

Electrical Wire Clearances

Your local electric utility may be able to provide assistance in planning a safe environment for working around tower dryers and associated structures. State codes may vary regarding specific clearances for electrical lines around structures. Be certain your local electric utility is in accordance with your state's regulations. **To prevent overhead safety issues, bury electrical lines.**

The American National Standards Institute (ANSI) provides clearance envelopes for Grain Bins filled by permanently installed augers, conveyors or elevators in (ANSI) C2 2007 "National Electrical Safety Code," Rule 234, page 120.

NOTE: An electric utility company may refuse to provide electrical service to any tower dryer or grain bin built near an existing electric line that does not provide clearance required by ANSI and the National Electrical Safety Code.



V_1 = Vertical clearance above a building required by Rule 234C (Table 234-1)

V_2 = Vertical clearance above land required by Rule 232

T = Transition clearance

Fig. 1 – Electrical wire clearances

To prevent death or serious injury to people involved in operation of this equipment, it is essential that these safety decals be mounted on dryer. Check that all are in place according to the decal placement drawing and are legible when dryer is installed.

IMPORTANT: If suggested locations are not clearly visible, place safety decals in a more suitable area. Never cover up existing safety decals.

Make sure location for decal is free from grease, oil and dirt. Remove backing from decal and place in proper position. Replace missing or damaged safety decals or shields free of charge by contacting Sukup Manufacturing Co. by mail at Box 677, Sheffield, Iowa 50475 USA; by phone at 641-892-4222; or by e-mail at info@sukup.com. Please specify number when ordering.

1. **Decal L0164 – WARNING:** Ladder safety – falling from heights hazard. Overall precautions for ladder safety.

2. **Decal L0258A – DANGER:** Do not enter this bin! Keep clear of all augers.

3. **Decal L0520 – CAUTION:** Failure to keep unit clean may cause fire and serious injury or death.

4. **Decal L0237 – WARNING:** To prevent serious injury or death.

5. **Decal L0165 – WARNING:** Disconnect Electricity; Bleed gas; etc.

6. **Decal L0284 – WARNING:** Keep away from all moving parts.

7. **Decal L0281 – WARNING:** To avoid serious injury or death.

TOWER DRYER SAFETY (DECAL PACKET- U99999)

Safety decals should be mounted on dryer as shown on this page.

L0164

L0165

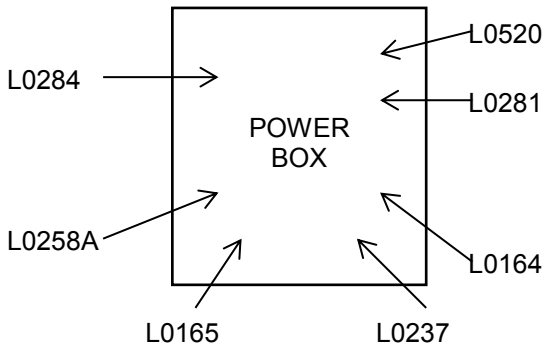
L0237

L0520

L0281

L0258A

L0284



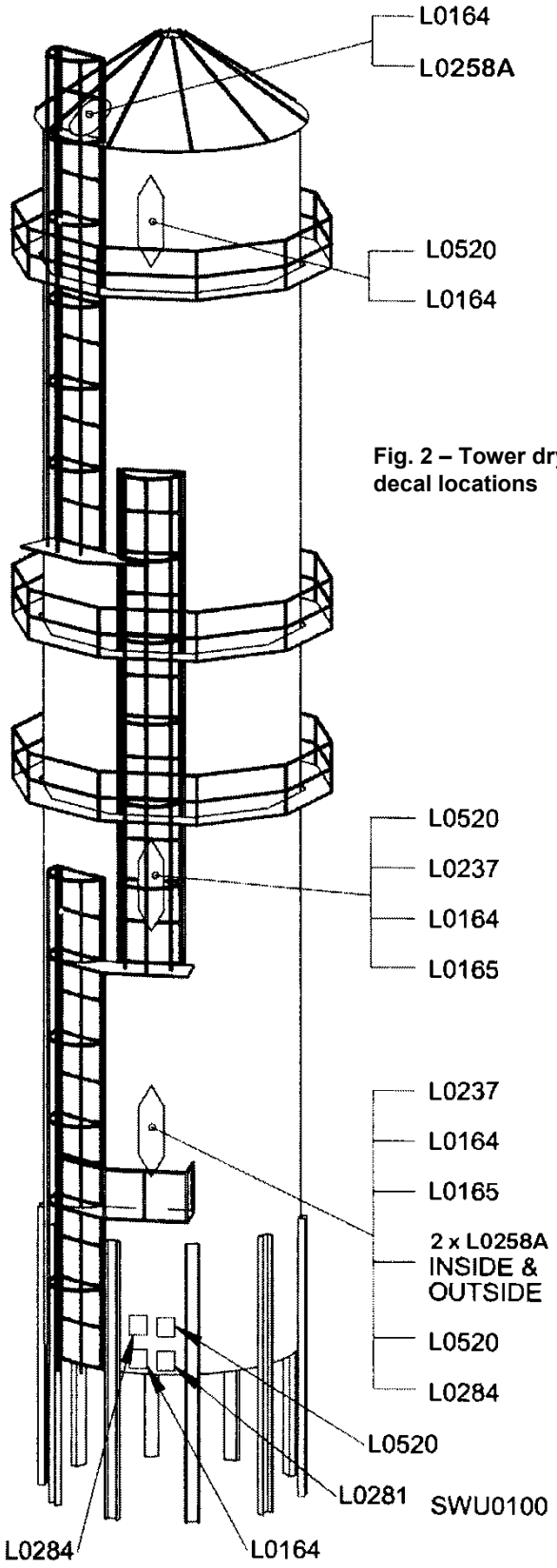


Fig. 2 – Tower dryer decal locations

Emergency Shutdown Switch Locations

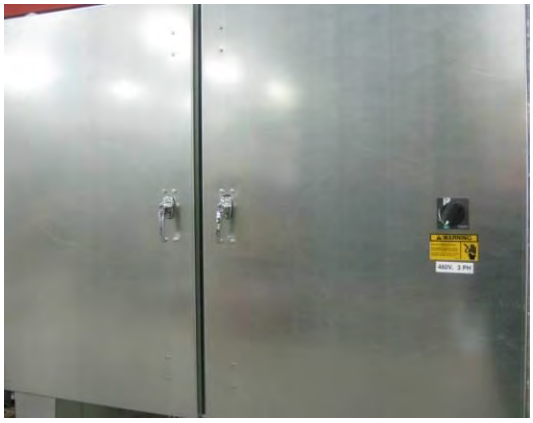


Image 1 – Power distribution box

Power distribution box is located at front of dryer. It contains all main power distribution components. Door latches secure door and can be locked. Main Disconnect switch prevents opening of power box while power is present in system.

Image 1 shows power box on a one-fan dryer. Box for three-fan dryer is different, with gray exterior and larger black handles. Main Disconnect switch is at right on front of box.

WARNING: High voltage is still present on bottom terminals of main switch in power distribution box even if Main Disconnect switch is in "Off" position. To remove voltage from power box, shut off main breaker ahead of dryer. Failure to follow this procedure could cause electrocution or shock, resulting in death or serious injury.

Image 2 – Main Disconnect switch

Image 2 shows Main Disconnect switch of single-fan dryer in "Off" position. Power is not present in system except as noted in warning above.

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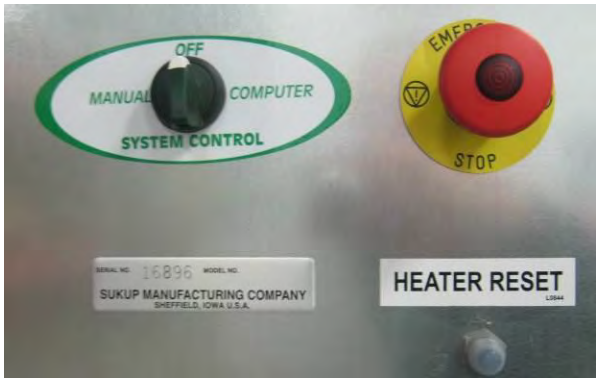

Image 3 – System Control and Emergency Stop switches

Emergency Stop switch is located on side of power distribution box for single-fan and three-fan dryers. During operation, switch is pulled out and red knob is illuminated.

Pressing Emergency Stop button or turning Main Disconnect switch to "Off" position will shut down power to PLC and backup control system. Main power is still present inside box as noted in warning above.

Sensor/Switch Locations

See Fig. 3 and Table 1 to identify tower dryer sensor/switch locations

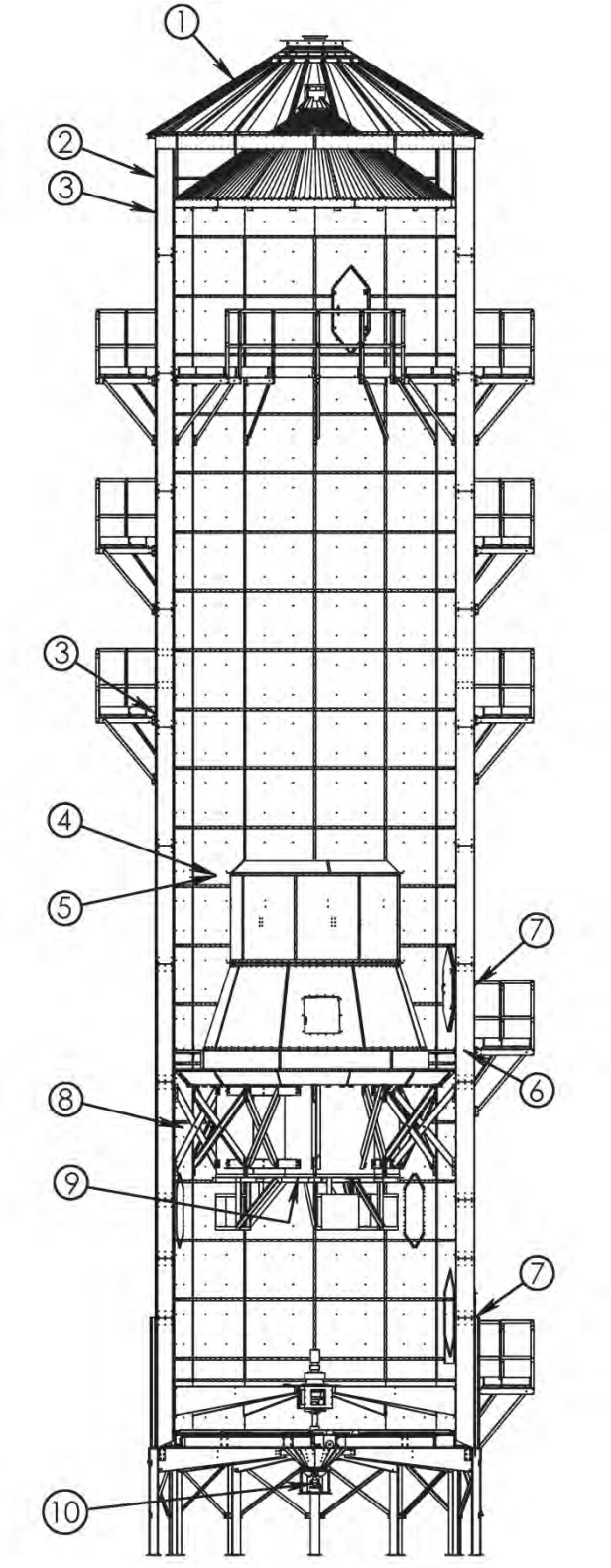

Fig. 3 – Tower dryer sensor/switch locations

ITEM #	COMP. #	DESCRIPTION	QTY.	LOCATION
1	U10601	Rotary Fill Switch	1	On roof, approximately 48" up from eave. (Mounting near stairs simplifies future maintenance.)
2	T6035	Incoming Moisture Sensor	1	Mounting near ladder simplifies future maintenance
3*	**Dryer Dia.** 10': J4532 (16') 12': J4533 (24') 18': J4534 (28') 24': J17287 (40')	Upper Column Over-Temp Sensor All trip at 240°F --- Middle Column Over-Temp Sensor (Not used on Modular Tower Dryer). All trip at 240°F	4	Top of first perforated sheet (below first two solid sheets) --- On first perforated sheet below grain exchangers. If platform is in same location, mount sensor above toe-kick plate.
4*	**Dryer Dia.** 10': J67961 (28') 12': J6796 (24') 18': J6796 (24') 24: J67961 (28')	Plenum Over-Temp Switch. All trip at 325°F	1 2 2 2	Inside plenum/heat chamber, 1 ft. below top of burner cylinder. It can share holding clip with plenum RTD (Resistance Temperature Detector). To prevent large bends in copper tube, route it around top of door. This aids in future switch replacement.
5	J5648 (28')	Plenum RTD Sensor	1	Inside plenum/heat chamber, 1 ft. below top of burner cylinder (can share holding clip with Plenum Over-Temp Sensor).
6	J5660	Single-Point Grain Column RTD Sensor	1	Two feet above plenum heat/cool divider in grain column
7	J4487	Access Door Switches	2	1 – In door leading into cooling chamber 1 – In door for heating chamber
8*	**Dryer Dia.** 10': J4534 (28') 12': J4532 (16') 18: J4533 (24') 24: J17287 (40')	Lower Column Over-Temp Sensor All trip at 240°F	1 2 2 2	Inside dryer in cool chamber, 2-3 ft. below divide
9	J5860	Blower Air Switch	1 or 3	Tube is at inlet of blower. Switch is in power box.
10	T6035	Discharge Moisture Sensor	1	At discharge of dryer

* Sensors come in two sections, with length depending on diameter of dryer

Table 1 – Sensor/switch locations

Power Box Component Identification

Image 4 identifies major components of power box for a one-fan tower dryer.

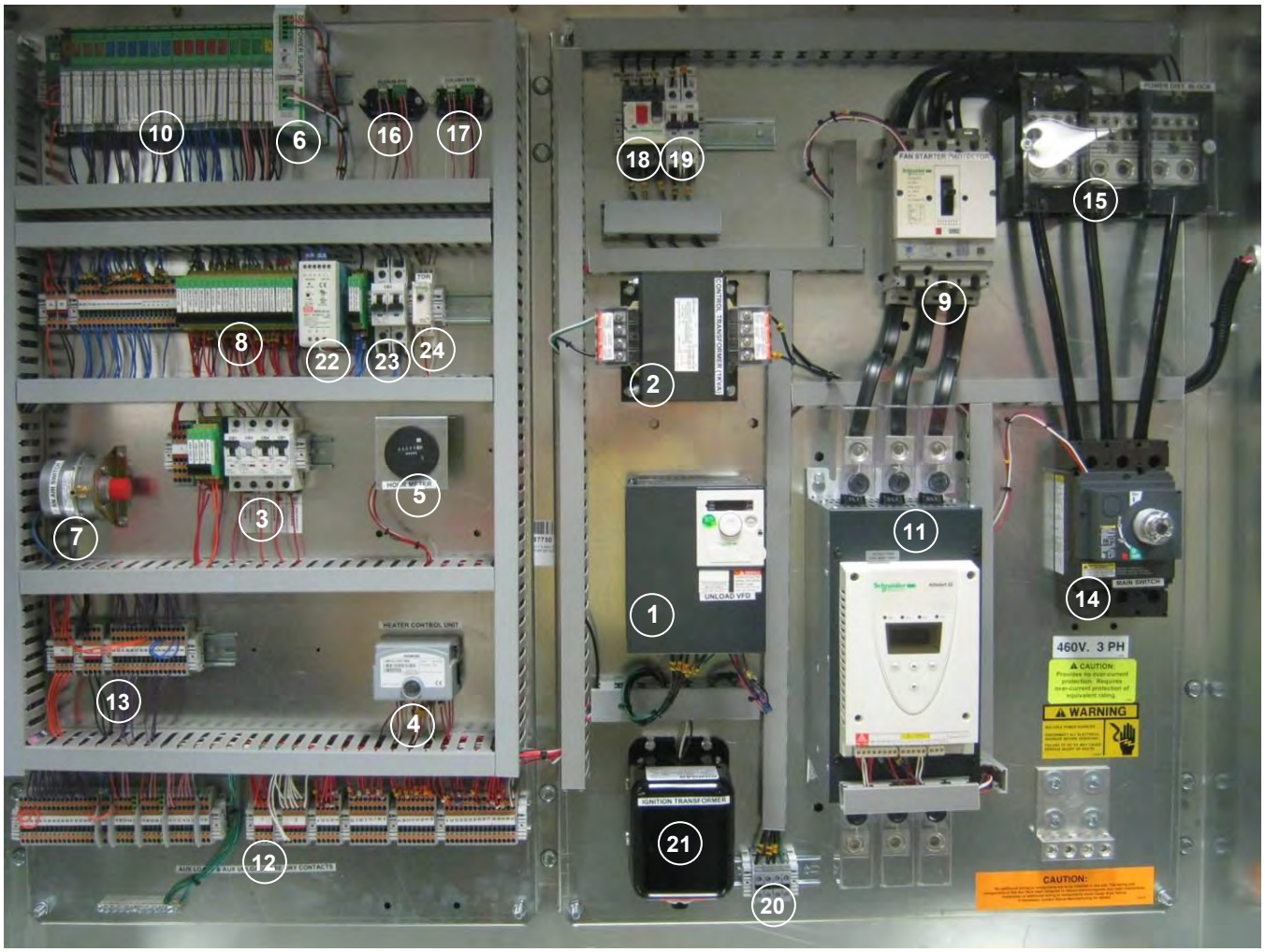

Image 4 – Power box components for single-fan tower dryer (Locations of some components may be different)

1. Variable frequency drive
2. Control transformer
3. Control/heater circuit breakers
4. Burner control unit
5. Hour meter
6. 28V power supply
7. Blower air switch
8. 28VDC/110VAC relays
9. Blower starter protector
10. Programmable logic control (PLC)
11. Soft start w/ built-in bypass contactor
12. AC feed-through terminals
13. DC feed-through terminals
14. Main switch
15. Power distribution block
16. Column RTD transmitter
17. Plenum RTD transmitter
18. Unload rotor starter protector
19. Control transformer circuit breaker
20. Unload rotor connections
21. Ignition transmitter
22. Discharge gate actuator power supply
23. Discharge gate actuator circuit breaker
24. Burner control time delay relay

***IMPORTANT:** During initial setup or after relocation of dryer, it is highly recommended that ALL main power wiring connections be inspected for security and tight connections. Wires are tightened at factory; but connections should be checked after transport.

NOTICE All power boxes use 24VDC control voltage to minimize EM noise inside of box. AC/DC separation is key to reducing EMI inside of panel. When installing, make sure to practice good wire maintenance to ensure quality operation.

Table 2 shows part numbers of components in main power box for a single-fan tower dryer.

		SUKUP COMP. #	
ITEM #	**DESCRIPTION**	**208/230V**	**460V**
1	Variable frequency drive	J6848	J6851
2	Control transformer	J6485	
3	Control/heater circuit breakers	J48189, J48190, J48191, J48194 all used in each unit.	
4	Burner control unit	J5713	
5	Hour meter	J4766	
6	28V power supply	J8729	
7	Blower air switch	J5860	
8	28VDC/110VAC relays	J8727/28VDC J8728/110VAC	
9	Blower starter protector	See Table 3	
10	Programmable logic control (PLC)	J8700	
11	Soft start w/ built-in bypass contactor	See Table 3	
12	AC and DC feed-through terminals	J6915	
13			
14	Main switch	See Table 3	
15	Power distribution block	J6697	
16	Column RTD transmitter	U17018	
17	Plenum RTD transmitter	U17028	
18	Unload rotor starter protector	J5236	J5233
19	Control transformer circuit breaker	J48189	
20	Unload rotor connections	J6907	
21	Ignition transmitter	J5710	
22	Discharge gate actuator power supply	J8729	
23	Discharge gate actuator circuit breaker	J48191	
24	Burner control time delay relay	J5614	

Table 2 – Component numbers, single-fan dryer power box

Table 3 shows part numbers of soft start, blower starter protector and main switch, depending on fan motor HP and voltage.

DRYER MODEL	FAN MOTOR HP	MOTOR COMP. #	SOFT START			BLOWER STARTER PROTECTOR			MAIN SWITCH		
			208/230V	460V	575V	208/230V	460V	575V	208/230V	460V	575V
U1010	50	H7210	J6870	J6866	J5235	J5241	J5235	J5235	J52121	J52121	J52121
U1510	75	H7505	J6872	J6868	J6867	J52411	J5241	J5235	J5214	J52121	J52121
U1812	75	H7505	J6872	J6868	J6867	J52411	J5241	J5235	J5214	J52121	J52121
U2012	100	H7510	J6873	J6870	J6869	J48153	J5241	J5241	J5214	J52121	J52121
U2412	100	H7510	J6873	J6870	J6869	J48153	J5241	J5241	J5214	J52121	J52121

Table 3 – Soft start, blower starter protector and main switch part numbers, single-fan dryer power box

Illustration below shows part numbers of “slices” in PLC. Slices are same for one-fan and three-fan dryers. There are six blue slices, five red, three green and one yellow. All are individual slices except for J8702 and J87031, each of which are four-slice units.

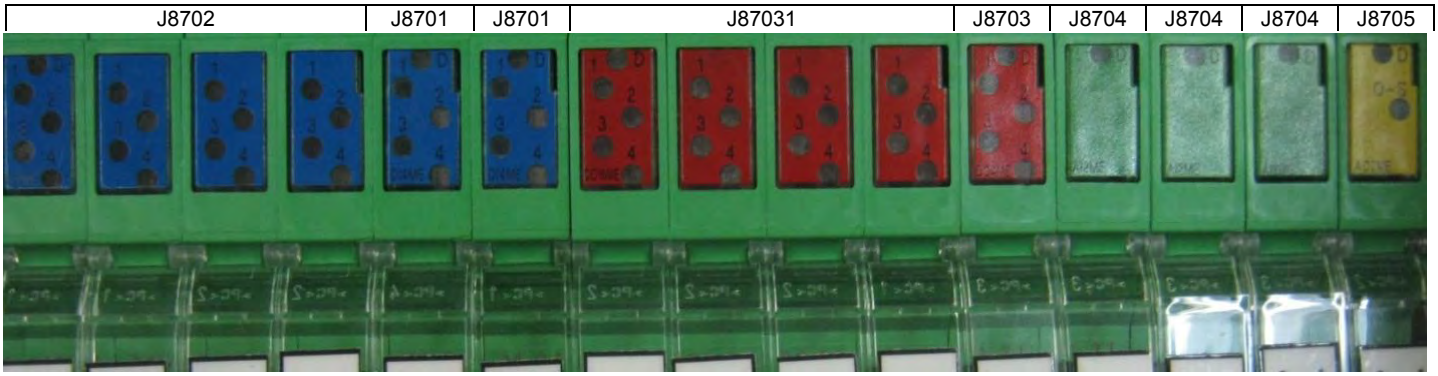

Image 5 identifies major components of power box for a three-fan tower dryer.

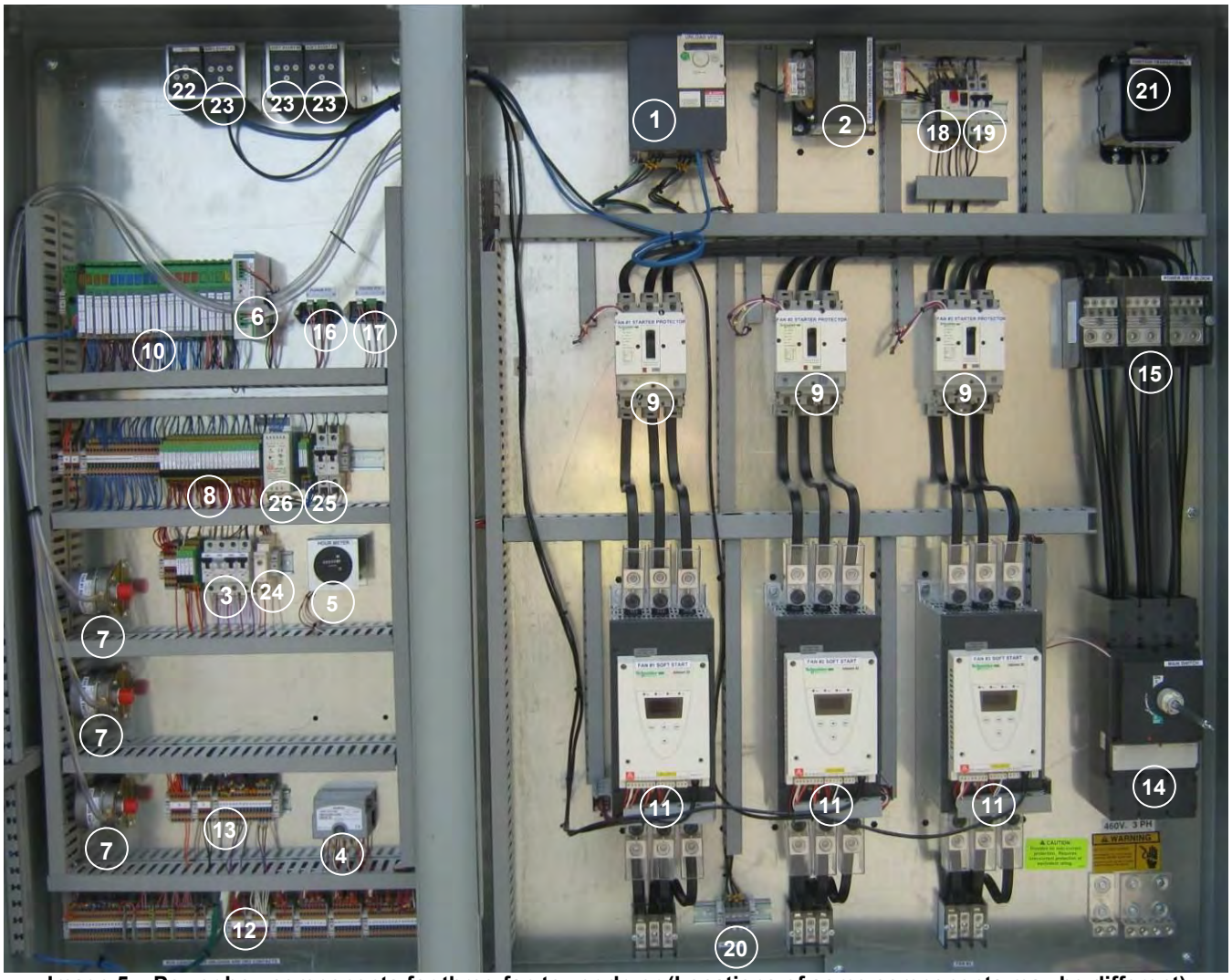

Image 5 – Power box components for three-fan tower dryer (Locations of some components may be different)

1. Variable frequency drive
2. Control transformer
3. Control/heater circuit breakers
4. Burner control unit
5. Hour meter
6. 28V power supply
7. Blower air switch
8. 28VDC/110VAC relays
9. Blower starter protector
10. Programmable logic control (PLC)
11. Soft start w/ built-in bypass contactor
12. AC feed-through terminals
13. DC feed-through terminals
14. Main switch
15. Power distribution block
16. Column RTD transmitter
17. Plenum RTD transmitter
18. Unload rotor starter protector
19. Control transformer circuit breaker
20. Unload rotor connections
21. Ignition transmitter
22. Variable frequency drive remote display
23. Soft start remote display
24. Burner control time delay relay
25. Discharge gate actuator circuit breaker
26. Discharge gate actuator power supply

Table 4 shows part numbers of components in main power box for a three-fan tower dryer.

		SUKUP COMP. #	
ITEM #	**DESCRIPTION**	**208/230V**	**460V**
1	Variable frequency drive	J6848	J6851
2	Control transformer	J6485	
3	Control/heater circuit breakers	J48189, J48190, J48191, J48194 all used in each unit.	
4	Burner control unit	J5713	
5	Hour meter	J4766	
6	28V power supply	J8729	
7	Blower air switch	J5860	
8	28VDC/110VAC relays	J8727/28VDC J8728/110VAC	
9	Blower starter protector	See Table 5	
10	Programmable logic control (PLC)	J8700	
11	Soft start w/ built-in bypass contactor	See Table 5	
12	AC and DC feed-through terminals	J6915	
13			
14	Main switch	See Table 5.	
15	Power distribution block	J6690	
16	Column RTD transmitter	U17018	
17	Plenum RTD transmitter	U17028	
18	Unload rotor starter protector	J5236 for 18’	J5234 for 18’; J5236 for 24’
19	Control transformer circuit breaker	J48189	
20	Unload rotor connections	J6907	
21	Ignition transmitter	J5710	
22	Variable frequency drive remote display	J67801	
23	Soft start remote display	J67803	
24	Burner control time delay relay	J5614	
25	Discharge gate actuator circuit breaker	J48191	
26	Discharge gate actuator power supply	J8729	

Table 4 – Component numbers, three-fan dryer power box

Table 5 shows part numbers of soft start, blower starter protector and main switch, depending on fan motor HP and voltage.

DRYER MODEL	FAN MOTOR HP	MOTOR COMP. #	SOFT START			BLOWER STARTER PROTECTOR			MAIN SWITCH		
			208/230V	460V	575V	208/230V	460V	575V	208/230V	460V	575V
U3018	50	H7210	J6870	J6866	---	J5241	J5235	---	J52121	J52121	J52121
U3518	60	H7260	J6871	J6868	J6866	J52411	J5235	J5233	J52143	J5214	J5214
U4018	75	H7505	J6872	J6868	J6867	J52411	J5241	J5235	J5214	J52121	J52121
U4718	75	H7505	J6872	J6868	J6867	J52411	J5241	J5235	J5214	J52121	J52121
U5024	100	H7510	J6873	J6870	J6869	J48153	J5241	J5241	J5214	J52121	J52121
U6024	100	H7510	J6873	J6870	J6869	J48153	J5241	J5241	J5214	J52121	J52121
U7024	125	H7511	---	J6871	---	---	J52411	---	---	J52143	---

Table 5 – Soft start, blower starter protector and main switch part numbers, three-fan dryer power box

See illustration on Page 1-15 for identification of “slices” in PLC.

Tower Dryer Pipe Train Component Identification

Image 6 identifies pipe train components for a propane-fueled stick-built tower dryer. Pipe train for modular tower dryer is shown in Image 7.

WARNING: Check pipe train before each use to ensure components are properly connected and in good working order. Fuel leak could result in fire or explosion causing death or serious injury.

See Tables 6-9 for identification of pipe train part numbers for domestic stick-built tower dryers.

See Tables 10-12 for identification of pipe train part numbers for modular tower dryers.

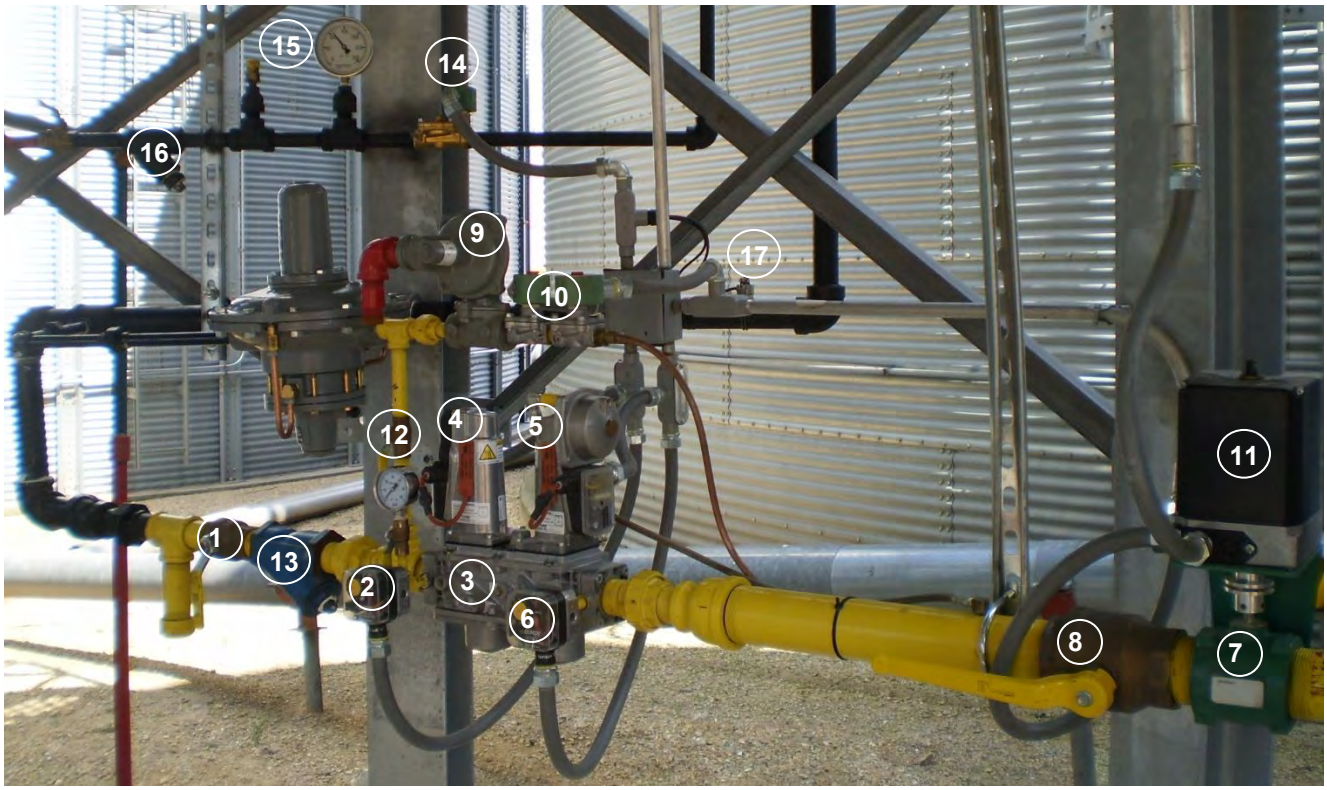

Image 6 – Stick-built tower dryer pipe train components

Siemens Pipe Train Part Numbers for Domestic Stick-Built Tower Dryers

NATURAL GAS

	ITEM #	1		2	3		4	5	6	7		8		9
DRYER MODEL	SIEMENS PIPE TRAIN	BALL VLV.	BALL SIZE	LOW PRESS. SWITCH	GAS VLV.	VLV. SIZE	ACTU-ATOR	ACT. & REG.	HIGH PRESS. SWITCH	BUTTER-FLY VLV.	VLV. SIZE	BALL VLV.	BALL SIZE	1/2" PILOT REG.
U1812	J6337	J6088	2"	J4428	J6238	2"	J62407	J62403	J4428	J61321	3"	J6093	3"	J6164
U2012	J6337	J6088	2"	J4428	J6238	2"	J62407	J62403	J4428	J61321	3"	J6093	3"	J6164
U2412	J6337	J6088	2"	J4428	J6238	2"	J62407	J62403	J4428	J61321	3"	J6093	3"	J6164
U2518	J6338	J6045	2-1/2"	J4428	J6131	2-1/2"	J62407	J62403	J4428	J61321	3"	J6093	3"	J6164
U3018	J6339	J6045	2-1/2"	J4428	J6131	2-1/2"	J62407	J62403	J4428	J61651	4"	J6096	4"	J6164
U3518	J6339	J6045	2-1/2"	J4428	J6131	2-1/2"	J62407	J62403	J4428	J61651	4"	J6096	4"	J6164
U4018	J6340	J6045	3"	J4428	J62383	3"	J62407	J62403	J4428	J61651	4"	J6096	4"	J6164
U4718	J6340	J6045	3"	J4428	J62383	3"	J62407	J62403	J4428	J61651	4"	J6096	4"	J6164
U5024	J6342	J6096	4"	J4428	Contact Sukup Mfg. Co.	4"	J62407	J62403	J4428	Contact Sukup Mfg. Co.	6"	J6096	4"	J6164
U6024	J6342	J6096	4"	J4428		4"	J62407	J62403	J4428		6"	J6096	4"	J6164
U7024	J6342	J6096	4"	J4428		4"	J62407	J62403	J4428		6"	J6096	4"	J6164

Table 6 – Siemens pipe train part numbers for natural gas-fueled dryers

LIQUID PETROLEUM

	ITEM #	1		2	3		4	5	6	7		8		9
DRYER MODEL	SIEMENS PIPE TRAIN	BALL VLV.	BALL SIZE	LOW PRESS. SWITCH	GAS VLV.	VLV. SIZE	ACTU-ATOR	ACT. & REG.	HIGH PRESS. SWITCH	BUTTER-FLY VLV.	VLV. SIZE	BALL VLV.	BALL SIZE	1/2" PILOT REG.
U1812	J6363	J6087	1-1/2"	J4428	J6237	1-1/2"	J62407	J62403	J4428	J61311	2-1/2"	J6045	2-1/2"	J6164
U2012	J6363	J6087	1-1/2"	J4428	J6237	1-1/2"	J62407	J62403	J4428	J61311	2-1/2"	J6045	2-1/2"	J6164
U2412	J6363	J6087	1-1/2"	J4428	J6237	1-1/2"	J62407	J62403	J4428	J61311	2-1/2"	J6045	2-1/2"	J6164
U2518	J6365	J6088	2"	J4428	J6237	1-1/2"	J62407	J62403	J4428	J61321	3"	J6093	3"	J6164
U3018	J6365	J6088	2"	J4428	J6238	2"	J62407	J62403	J4428	J61321	3"	J6093	3"	J6164
U3518	J6365	J6088	2"	J4428	J6238	2"	J62407	J62403	J4428	J61321	3"	J6093	3"	J6164
U4018	J6366	J6045	2-1/2"	J4428	J6131	2-1/2"	J62407	J62403	J4428	J61651	4"	J6096	4"	J6164
U4718	J6366	J6045	2-1/2"	J4428	J6131	2-1/2"	J62407	J62403	J4428	J61651	4"	J6096	4"	J6164
U5024	J6366	J6045	2-1/2"	J4428	J6131	2-1/2"	J62407	J62403	J4428	J61651	4"	J6096	4"	J6164
U6024	J6367	J6045	3"	J4428	J62383	3"	J62407	J62403	J4428	J61651	4"	J6096	4"	J6164
U7024	J6367	J6045	3"	J4428	J62383	3"	J62407	J62403	J4428	J61651	4"	J6096	4"	J6164

Table 7 – Siemens pipe train part numbers for liquid petroleum-fueled dryers

See next page for identification of other pipe train part numbers.

LIQUID PETROLEUM

ITEM #	10	11	12	13	14	15	16	17
DRYER MODEL	PILOT SOLENOID VALVES	BUTTERFLY VALVE ACTUATOR	HIGH PRESSURE GAUGE	VAPOR GAS WYE STRAINER	LP SOLENOID VALVE	LP PRESSURE GAUGE	LP WYE STRAINER	VAPOR OT SWITCH
U1812	J6244	J62281	J5960	J6232	J6259	J5968	J6230	J5900
U2012	J6244	J62281	J5960	J6232	J6259	J5968	J6230	J5900
U2412	J6244	J62281	J5960	J6232	J6259	J5968	J6230	J5900
U2518	--	J62281	--	**Contact Sukup Mfg. Co.**	--	--	--	
U3018	--	J62281	--		--	--	--	
U3518	--	J62281	--		--	--	--	
U4018	--	J62281	--		--	--	--	
U4718	--	J62281	--		--	--	--	
U5024	--	J62281	--		--	--	--	
U6024	--	J62281	--		--	--	--	
U7024	--	J62281	--		--	--	--	

Table 8 – Pipe train part numbers for liquid-petroleum-fueled dryers
NOTE: Internal vaporizer used only on 12' dia. dryers

NATURAL GAS

ITEM #	10	11	12	13
DRYER MODEL	PILOT SOLENOID VALVES	BUTTERFLY VALVE ACTUATOR	HIGH PRESSURE GAUGE	VAPOR GAS WYE STRAINER
U1812	J6244	J62281	J5960	**Contact Sukup Mfg. Co.**
U2012	J6244	J62281	J5960	
U2412	J6244	J62281	J5960	
U2518	--	J62281	J5960	
U3018	--	J62281	J5960	
U3518	--	J62281	J5960	
U4018	--	J62281	J5960	
U4718	--	J62281	J5960	
U5024	--	J62281	J5960	
U6024	--	J62281	J5960	
U7024	--	J62281	J5960	

Table 9 – Pipe train part numbers for natural gas-fueled dryers

Modular Tower Dryer Pipe Train Component Identification

Image 7 & Tables 10-12 identify components of pipe trains for modular tower dryers.

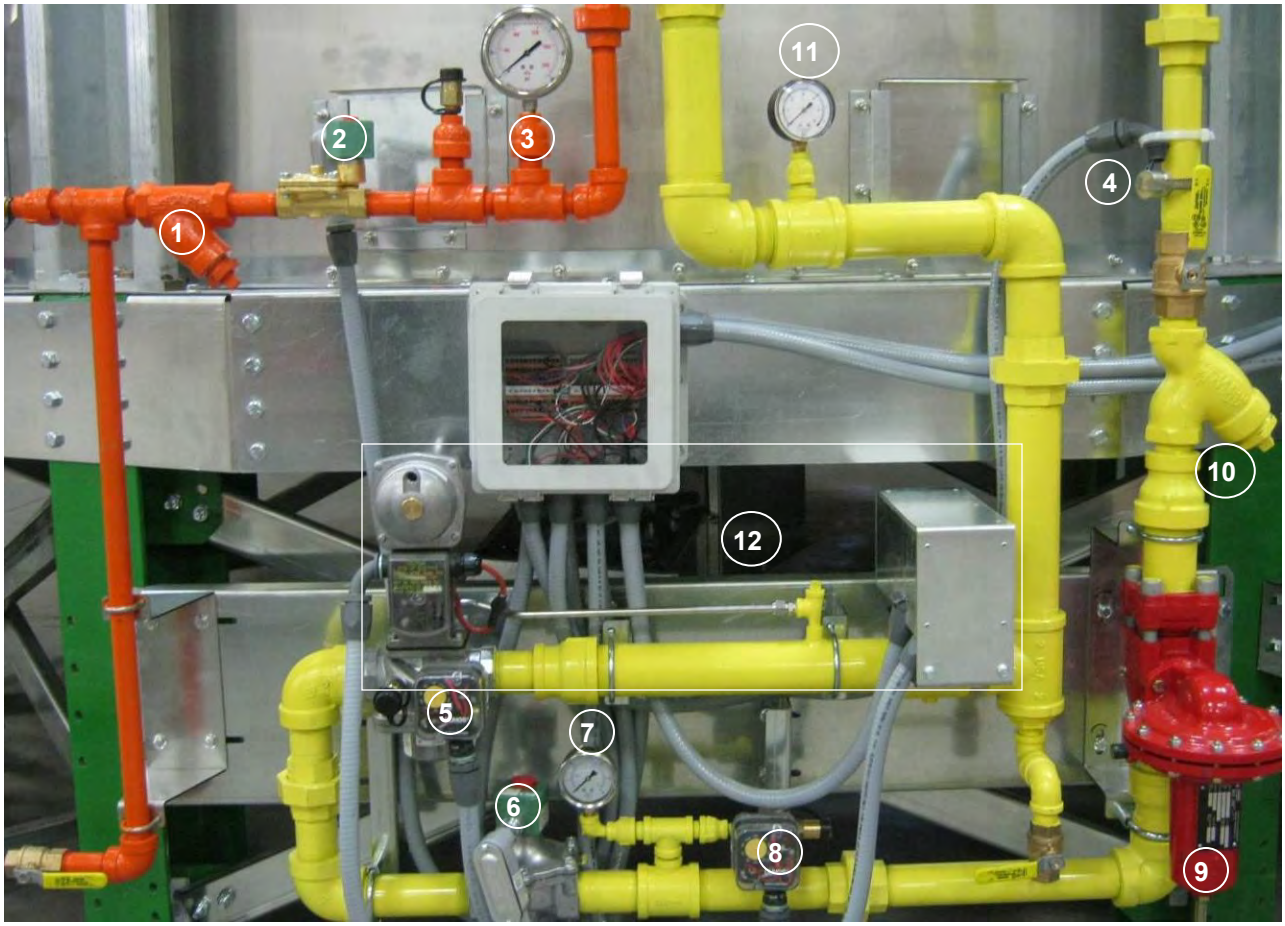

Image 7 – LP-fueled modular tower dryer pipe train components

ITEM #	1	2	3	4	5	6	7	8	9	10	11	12
DRYER MODEL	WYE STRAIN-ER	SOLEN-OID VLV.	LIQUID PRESS. GAUGE	VAPOR OT SWITCH	HIGH PRESS. SWITCH	SOLEN-OID VLV.	VAPOR HIGH PRESS. GAUGE	LOW PRESS. SWITCH	REGU-LATOR	WYE STRAIN-ER	GAS PRESS. GAUGE	SIEM-ENS PIPE TRAIN
U1010	J6230	J6259	J5968	J5900	J4428	J6259	J5960	J4428	J6114	J6233	J5972	J6390
U1510	J6230	J6259	J5968	J5900	J4428	J6259	J5960	J4428	J6114	J6233	J5972	J6392

Table 10 – Liquid petroleum-fueled pipe train components

ITEM #	5	6	7	8	9	10	11	12
DRYER MODEL	HIGH PRESS. SWITCH	SOLENOID VLV.	VAPOR HIGH PRESS. GAUGE	LOW PRESS. SWITCH	REGU-LATOR	WYE STRAIN-ER	GAS PRESS. GAUGE	SIEMENS PIPE TRAIN
U1010	J4428	J6259	J5960	J4428	J6114	J6232	J5972	J6391
U1510	J4428	J6259	J5960	J4428	J6114	J6232	J5972	J6393

Table 11 – Natural gas-fueled pipe train components

SIEMENS PIPE TRAIN	ACTUATOR & REGULATOR	SPRING	GASKET	THERMO-STAT	BUTTER-FLY VALVE	VALVE SIZE	GAS VALVE	VALVE SIZE
J6390	J62405	J62411	J6241	J62409	J61265	2’	J62372	1”
J6391	J62405	J62411	J6241	J62409	J61265	2’	J62371	1-1/2”
J6392	J62405	J62411	J6241	J62409	J61265	2’	J62371	1-1/2”
J6393	J62405	J62411	J6241	J62409	J61266	2-1/2’	J62371	1-1/2”

Table 12 – Siemens pipe train components

Switches

Images 8 and 9 – Rotary fill switch and fill sensor

Images 8 and 9 show rotary fill switch and sensor. Switch is located on roof of dryer and indicates when wet holding bin is full. **NOTE:** Appearance of switch may be different.

Image 10 – Single-point grain temperature sensor RTD

Image 10 shows single-point RTD (Resistance Temperature Detector). It is located two feet above plenum heat-cool divider in grain column.

Image 11 – Key switch

Image 12 – Key switch with key inserted

Image 11 shows key switch for access door. Image 12 shows switch with key inserted.

Grain Exchangers, Rotor Arm and Scrapers

Image 13 shows grain exchangers, viewed from top.

Image 13 – Grain exchangers

Image 14 shows rotor arm and scraper (curved) of unload.

Image 14 – Rotor arm and scrapers

Image 15 shows work light, alarm light and alarm buzzer.

Image 15 – Work light, alarm light, alarm buzzer

Rotor, Blower Drive Shaft, Motor

Image 16 – Unload motor, gearbox

Image 16 shows AC motor and gearbox for unload rotor on a modular tower dryer. See Maintenance section for pictures of gearboxes for larger tower dryers.

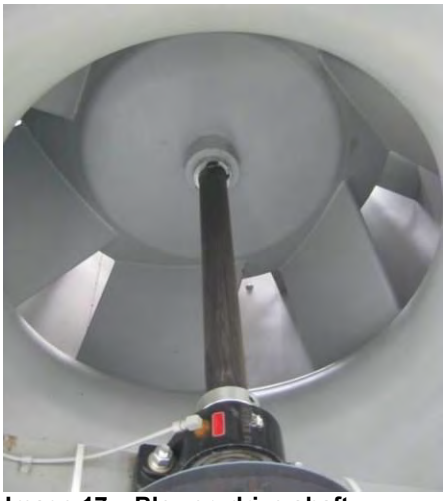

Image 17 – Blower, drive shaft

Image 17 shows blower and drive shaft. ***NOTICE:*** Blowers for three- and four-fan dryers have backspin preventers that must be installed before operation and must remain on blowers. See Assembly Instruction L2491 and Maintenance section of this manual.

Image 18 – Blower motor

Image 18 shows blower motor and fan belts.

Louvers, Cleanouts, Roof Door

Image 19 – Louvers on door

Image 19 shows louvers on door. Louvered air vents help control amount of air pulled through grain for cooling.

Image 20 – Cleanout panel

Image 20 shows a cleanout panel at base of dryer. Cleanout panels are around base and near grain exchangers.

Image 21 – Roof door

Image 21 shows roof door.

Moisture, Temperature Sensors

Image 22 – Incoming moisture sensor

Image 22 shows incoming moisture sensor. Twist-clip latch allows for easy removal for cleaning sensor.

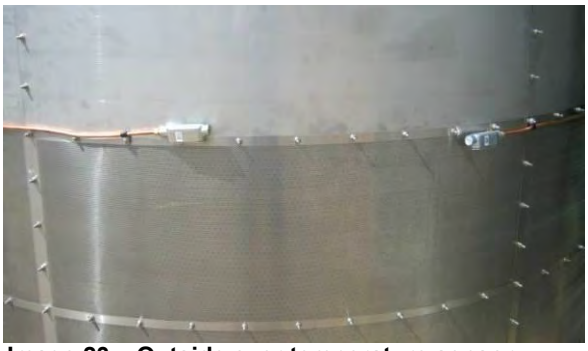

Image 23 – Outside over temperature sensor

Image 23 shows outside over temperature sensors.

Image 24 – Plenum RTD, capillary box

Image 24 shows plenum RTD and plenum over-temp capillary and junction box (lower).

Discharge Moisture Sensor, Grain Flow Tube

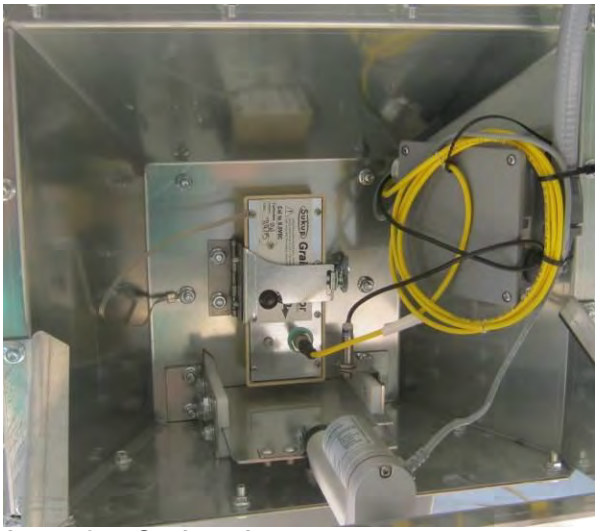

Image 25 – Static moisture sensor

Image 25 shows discharge moisture sensor in static sample box.

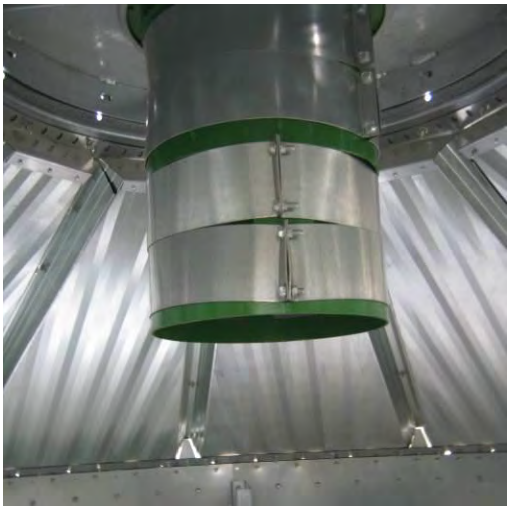

Image 26 – Grain flow tube

Image 26 shows grain flow tube. Sleeve clamps can be removed or added as needed to ensure grain does not press against roof of dryer. See installation instructions in appendices.

Touch Screen Controller

QuadraTouch Pro Controller

Image 27 – QuadraTouch Pro control screen

Control box (Image 27) should be mounted away from dryer and connected by shielded, direct-bury Ethernet cable. Cable is available in 50', 100', 150', and 200' lengths (J8720, J8721, J8722, J8723). Panel needs its own, independent 100VAC – 240VAC power supply.

Main power switch is on bottom, right-hand portion of box. See Image 27. When turned on, switch will illuminate to a green color. Panel will boot up shortly and connect with PLC inside power box.

To communicate with dryer, dryer must be powered up and system control switch should be in "COMPUTER" position.

Back of QuadraTouch Pro panel is accessible by removing screws on bottom left and right corners of swing panel. See Image 27.

Although QuadraTouch Pro controller is contained in a sealed enclosure, it's a good idea to mount controller in a shed or other shelter.

QuadraTouch Pro controller has an operating temperature of 10°F to 135°F and a storage temperature of -4°F to 150°F. Outdoor placement is acceptable in most locations, but controller must not be left where temperature may be outside of storage range above. Cover of controller must be closed when unit is not in use.

QuadraTouch Pro controller comes with molded mounting brackets. These allow controller to be mounted directly onto wall or bench using four (4) screws.

NOTICE: If location where controller is mounted is not heated, unit must be taken into a temperature-controlled environment when not in use.

Operation

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DATE	REVISIONS	PAGES
01/23/2018	Added moisture sensor calibration instructions	3

Introduction

Sukup Tower Dryers use two variables to dry grain to desired moisture: plenum (drying) temperature and time of exposure to heat (unload speed). The higher the temperature, the faster the grain will dry. However, drying at too high a temperature can damage grain or, in worst case, burn it. Moving grain through dryer at a slower speed allows greater exposure to heat than running it through quickly. Speed of grain moving through columns of tower dryer is determined by speed of unload rotor, which is set by operator.

There are two modes of operation: manual and automatic. Manual operation should be used first in order to determine heat and speed levels that will dry grain to desired moisture level at discharge of dryer.

Before starting dryer, ensure that tarp has been removed from burner (Tarp is used to protect burner from moisture when not in use). As well, operator must close drain valve(s) on fuel line; remove and blow out copper tube for pilot light (if applicable) to ensure it is clear; and open valves to allow fuel into dryer's pipe train.

Sukup's QuadraTouch Pro control system provides for easy operation of dryer. Press Start button to begin, and then follow prompts that appear on screen. Software section elsewhere in this manual provides detailed instructions for QuadraTouch Pro system.

Before filling dryer with grain, turn blowers on to remove any dust and/or debris from burner and plenum areas.

NOTE: When initially starting dryer, it is best to fill it with dry grain before loading it with wet grain. This will help avoid/limit the need to transfer wet grain to a temporary holding bin. Since most drying occurs in upper half of dryer, grain at bottom during initial start-up will not heat up much (lose moisture) before discharge. So unless dryer is equipped with a way to recycle wet grain back through dryer, it is advisable to start with dry grain.

Setting Drying Temperature and Unload Speed

Optimum drying temperature and unload speed will depend on moisture of grain coming into dryer. Drying (plenum) temperature setpoints are typically between 140 and 180 degrees Farenheit.

Plenum temperature sensor is located in heat chamber near burner. Since heat rises, readings from sensor are typically 20 to 50 degrees lower than air temperature near top of heat chamber (plenum). For instance, a reading of 180 degrees could mean that air near top of dryer is 220 degrees and average temperature is 200 degrees. Keep this in mind when setting desired drying temperature. Also keep in mind that wetter grain at top of dryer needs more heat than dryer grain near bottom of dryer.

Use QuadraTouch Pro control screen and follow directions in QuadraTouch Pro software manual to set temperature and drying (unload) speed.

Use tables in Appendix D (and prior experience) for guidance in setting drying (unload) speed. Be sure to read introduction to tables.

Run dryer long enough to cycle one batch of grain completely through, then check moisture of grain discharged from dryer. If moisture is too high, reset drying (unloading) speed lower so grain stays in dryer longer. Changing speed in increments of 5 percent (unless moisture level is drastically higher than desired) will help in zeroing in on optimum drying speed.

Repeat process every 20 to 30 minutes until desired output moisture is achieved consistently and grain is not becoming overstressed (cracked kernels). If overheated (cracked or burnt) grain is coming out of dryer, reduce drying plenum temperature and unload speed accordingly until dryer is not damaging grain.

NOTE: It takes 45 to 60 minutes for grain to move through a Sukup Tower Dryer running at maximum (100 percent) of drying (unload) speed, regardless of size of dryer. Capacities range from about 1,200 bushels in a U1010 Modular Tower Dryer to about 7,500 bushels in a U7024 dryer.

After dryer is consistently producing grain at desired moisture level and quality, decide whether to run it in Automatic or Manual mode. Use QuadraTouch Pro control panel to choose which mode. In Automatic mode, user will have option of basing drying on grain temperature (at its hottest point) or moisture of grain exiting dryer.

Moisture is more difficult to measure consistently than temperature of grain in dryer. However, different varieties of grain may require different temperatures to dry to the same moisture level. Drying to a particular moisture content, such as 15 percent, generally produces more consistently dried grain.

Whether using plenum temperature or grain moisture as primary factor in drying grain, it is important to keep an eye on both factors, especially in commercial dryers where there is likely to be a variety of grain hybrids and moisture levels entering dryer.

In Automatic mode, to help dryer accommodate fluctuating levels of moisture of incoming grain, operator can set maximum and minimum drying (unload) speeds. Program both at 10 percentage points off of rate that would produce desired moisture level. For example, on a tower dryer that will be run at drying rate of 38 percent, set drying (unload) rate maximum at 48 percent and minimum at 28 percent. This lets dryer adjust unload rate some, but prevents it from getting too far off. Range can be set to be smaller if needed/desired.

Calibrating Discharge Moisture Sensor

IMPORTANT: Calibrating discharge moisture sensor to desired output moisture will help ensure proper drying of grain. It works best to calibrate sensor when actual grain moisture is as close to desired target moisture as possible. For instance, if 16% corn is desired, sensor should be calibrated when actual grain moisture is 16%.

It may be necessary to do an initial calibration when actual grain moisture is wetter or dryer than desired target, then another calibration when grain is at or near target moisture. Do this by running dryer in Continuous Flow for 30 minutes (or after Stabilization period) and then taking a sample from spout and checking it with an external moisture sensor known to be accurate. If readout is more than half a percentage point different than what dryer is showing (for instance, 17.5% moisture vs. 16.5%), dryer's sensor must be recalibrated. See recalibration steps under Tools Menu heading in Software Manual.

Take samples and check dryer's moisture sensor a few times a day. If it's off by .5% or more, put unload on pause, remove sensor from dryer and check for any dust or debris buildup on sensor or metal tube around sensor. Replace sensor and resume unloading. Check moisture again. If it's still off by .5% or more, calibrate sensor again.

NOTE: Grain variety, maturity level, cleanliness, weather conditions and operation can all affect performance of dryer. To the extent possible, be aware of different varieties of grain being fed into dryer, as no two varieties dry identically.

IMPORTANT: Unload rotor, fan(s), and heater(s), along with auxiliary fill and take-away equipment, will start without warning during dryer operation. Use extreme caution around grain handling system.

NOTE: Please refer to Software Manual for a detailed description of each operation mode. Software is frequently updated, so content may differ slightly from descriptions in this manual.

Make sure to go through steps in Maintenance section before initial, daily or seasonal operation of dryer.

Before Loading or Starting Dryer

Dryer Start-up Preliminary Steps

Image 2-1 – System Control switch, Emergency Stop button

Prior to starting dryer, pull out red Emergency Stop button. See Image 2-1. It will illuminate when pulled out. Turn System Control switch to "Computer," then engage Main Disconnect (shown in Image 2-2) by turning clockwise to "On" position.

Image 2-2 – Main Disconnect switch

Operation

Before starting dryer, ensure that the latest operating software has been downloaded. Go to http://www.sukup.com/Products/QuadraTouch to download the latest version.

Sukup's QuadraTouch Pro control system provides for easy operation of dryer. Press Start button to begin, and then follow prompts that appear on screen.

For detailed information, refer to Software Manual.

IMPORTANT: Temperatures inside of plenum will vary widely from bottom to top. For example, a plenum temp setting of 180°F may produce a temperature of 220°F at top of plenum. Wetter grain at top of dryer can withstand higher temperatures than drier grain at bottom. For this reason, temperature sensor is located at bottom of plenum. If there are signs of burned kernels or other heat damage to grain, reduce plenum temperature.

Dryer Shut-down

Pressing "Reset" button on QuadraTouch Pro controller will shut down dryer in proper sequence. To allow fan to continue running, use Fan Start Delay option from Settings Menu. **NOTE:** Never leave grain in dryer for extended periods of time.

Maintenance

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DATE	REVISION	PAGE
01/23/2018	Added emphasis on keeping divider between cooling & heating sections clean	3
01/23/2018	Updated instructions for greasing blower bearings	6
01/23/2018	Updated blower belt specifications table	9

Periodic Maintenance

Good maintenance practices can make start-up easier and will help to ensure good performance each drying season. The following guidelines are **minimum** recommended procedures to be carried out.

NOTICE: Do not leave grain in dryer without dryer running for longer than 24 hrs. Grain can absorb moisture and expand, putting unnecessary stress on screens and on dryer itself.

WARNING: When using ladder attached to dryer, make sure ladder is dry before climbing. Ladder may be slippery when wet. Falling from ladder could cause death or serious injury.

IMPORTANT: All bolts used to enclose access points after maintenance MUST be securely retightened to prevent undesired access.

PRIOR TO OPERATION

Burner	• Inspect closely to make sure no gas ports or holes are blocked.
Fan(s)/Heater	• Check wiring for loose connections, bare wires, or rodent damage. • Check heater ignition wires for damage or shorting.
Motor(s)	• Check openings for blockage. • Inspect belts for tension, cracks or excessive wear.
Moisture Sensor	• Remove moisture sensors. Make sure they are clean and inside of tube is clear of buildup. • Check condition of wire and ground wire.
Pipe Train	• Inspect pipe train components for physical integrity and tightness. • Open drain valve on pipe train. Make sure no water is in it or in pilot gas line. (Close drain valve before turning on gas supply.)
Unload	• Inspect rotor for obstructions. • Make certain rotor turns freely.

Whenever maintenance is performed, check all fasteners and retighten as needed.

The most important maintenance on any grain dryer is keeping it clean. Clean dryers run more efficiently, have higher capacity, are safer and have a significantly lower risk of fire.

Items listed below should be checked daily and cleaning operations performed as needed. **Differences in each season's grain will affect amount of cleaning needed.** For example, in a season when grain is unusually dirty, some parts of dryer may require attention daily or every few days, while in another season they will need weekly care.

CLEANING DURING DRYING SEASON

Burner	• Clean off all fines and debris, especially after cleaning interior screens. If not removed, debris could ignite.
Catwalk	• Clean catwalk walking surface; it can become slippery with buildup of fines.
Cooling Chamber	• Remove fines and debris on floor (where unload rotor gearbox and motor are located). • **Keep divider between cooling chamber and heating section clean.** Build-up could damage dryer.
Grain Discharge	• Clean out to ensure uniform flow of grain and prevent clogs.
Screens (Exterior)	• Inspect and clean with broom, pressure washer or shop vacuum to remove dust, fines and bees wings. (Can be reached from service catwalks.)
Screens (Interior)	• Inspect and clean with broom.

PRE-WINTER/END-OF-SEASON MAINTENANCE

Burner	• Clean with shop vacuum. • Install tarp or cover over burner or entire burner can. (Prevents debris from collecting; prevents water from entering pipe train.)
Dryer	• Empty dryer. **Do not** use it to store grain.
Grain Table	• Clean, especially around columns on outside. (Floor and sweep are stainless steel, but columns are galvanized, thus susceptible to deterioration and corrosion.)
Oil Drain Cap*	• Remove cap on bottom of oil drain. Remove any buildup. Drain any waste oil into container for responsible disposal.
Pilot Gas Line*	• Disconnect and plug to prevent water/moisture freeze during cold weather
Pipe Train Drain Valve*	• Shut off gas. • Open drain valve on bottom of vertical gas line (it is a quarter-turn ball valve) to allow drainage of moisture. Water allowed into pipe train could freeze and break expensive components.
Y-Strainer*	• Remove screen, clean it and reinstall it.

* See photos and identifiers on next page.

NOTICE: When tower dryer is not in regular use, burner should be tarped. Also, gas supply to dryer should be shut off and pipe train drain valve should be opened to prevent water from getting into pipe train valves.

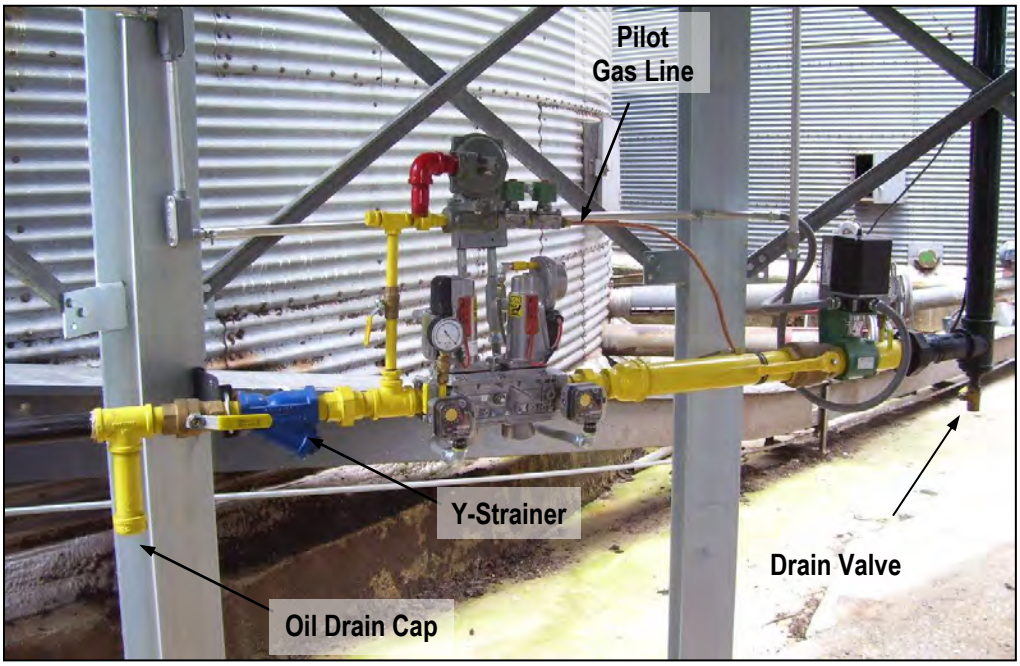


Image 3-1 – Pipe train components

Component Maintenance

Blower, Unload Motors

See Table 3-1 to identify blower motor and Table 3-2 to identify unload motor used on each model of tower dryer, as well as electrical loads.

Model #	Blower Motor HP	Motor Pt. #	Service Factor	FLA 460V (w/SF)	FLA 230V (w/SF)	FLA 208V (w/SF)
U1010	50	H7210	1.15	67	135	144
U1510	75	H7505	1.15	98	197	217
U1812	75	H7505	1.15	98	197	217
U2012	100	H7510	1.15	129	259	286
U2412	100	H7510	1.15	129	259	286
U3018	50 (3)	H7210	1.15	67	135	144
U3518	60 (3)	H7260	1.15	80	160	170
U4018	75 (3)	H7505	1.15	98	197	217
U4718	75 (3)	H7505	1.15	98	197	217
U5024	100 (3)	H7510	1.15	129	259	286
U6024	100 (3)	H7510	1.15	129	259	286
U7024	125 (3)	H7511	1.25	172	N/A	N/A

Table 3-1 – Blower motor specifications

Model #	Unload Motor HP	Motor Pt. #	Service Factor	FLA 460V (w/SF)	FLA 230V (w/SF)	FLA 208V (w/SF)
U1010	1.5	H1445	1	2.3	4.6	5.1
U1510	1.5	H1445	1	2.3	4.6	5.1
U1812	1.5	H1445	1	2.3	4.6	5.1
U2012	1.5	H1445	1	2.3	4.6	5.1
U2412	1.5	H1445	1	2.3	4.6	5.1
U3018	2	H2040	1	3	6	6.6
U3518	2	H2040	1	3	6	6.6
U4018	2	H2040	1	3	6	6.6
U4718	2	H2040	1	3	6	6.6
U5024	3	H2980	1	4	8	8.8
U6024	3	H2980	1	4	8	8.8
U7024	3	H2980	1	4	8	8.8

Table 3-2 – Unload motor specifications

Greasing Blower, Unload Motors

Motor bearings are greased at factory. Lubricate at start of each season. Use Shell Dolium R or Chevron SR1 No. 2 grease – 1 to 2 strokes for 1.5 HP to 3 HP motors; 2 to 3 strokes for 50 HP to 70 HP motors; 3 to 4 strokes for 100 HP and 125 HP.

Greasing Blower Bearings

See Table 3-3 for blower bearing greasing frequency and type of grease to use.

NOTICE: Bearings are not sealed. Pump grease until it begins coming out of bearings.

NOTICE: Shaft should be turned at least monthly. See lubrication sticker on blower for additional information. See Image 3-2.

Model #	Blower Model	Part #	Shaft Dia.	RPM	Bearing Greasing Interval
U1010	QSL402	J7719	2-3/16"	1200	30 days
U1510	QSL445	J7718	2-7/16"	1200	15 days
U1812	QSL542	J7716T	2-5/16"	900	45 days
U2012	QSL542	J7716T	2-5/16"	964	45 days
U2412	QSL600	J7709T	3-7/16"	800	45 days
U3018	QSL402 (3)	J7702T	2-3/16"	1270	45 days
U3518	QSL445 (3)	J7704T	2-7/16"	1110	45 days
U4018	QSL490 (3)	J7701T	2-11/16"	990	45 days
U4718	QSL490 (3)	J7701T	2-11/16"	1040	45 days
U5024	QSL542 (3)	J7703T	2-15/16"	940	45 days
U6024	QSL600 (3)	J7705T	3-7/16"	815	45 days
U7024	QSL600 (3)	J7705T	3-7/16"	890	45 days

Table 3-3 – Blower models, greasing specifications

Lubricate with high-quality NLGI No. 2 lithium-based R&O grease w/ minimum oil viscosity of 500 SUS at 100 ° F. Examples: Shell Alvania RL, Mobil Mobilith SHC100 or SHC220, Exxon Ronex MP.

Image 3-2 – Twin City Fan & Blower lubrication sticker

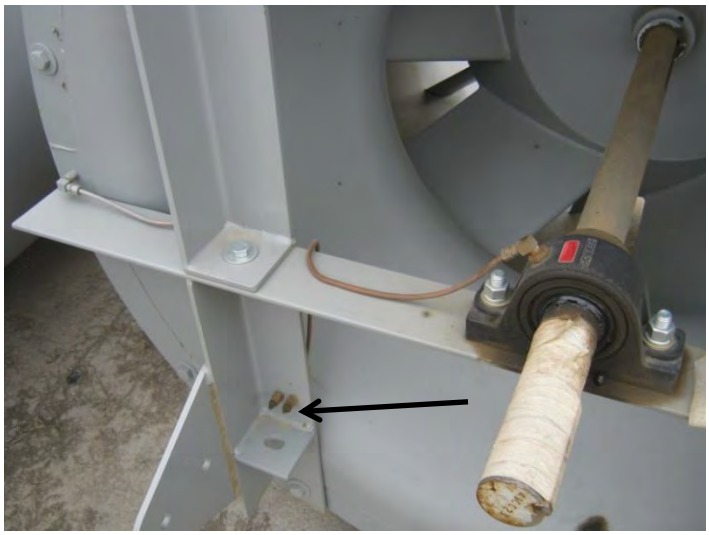


Image 3- 3 – Model U1010 blower

Images 3-3 and 3-5 show grease zerks for shaft bearings. Blowers are shown prior to installation. When placed upright on base, zerks will be connected to grease feeding tubes shown in Image 3-4. Bearings are packed with grease at factory, but must be re-lubricated periodically. See table on previous page for frequency. Make sure tubes are full of grease if not filled at factory. Use zerks at front of blower base to apply grease.

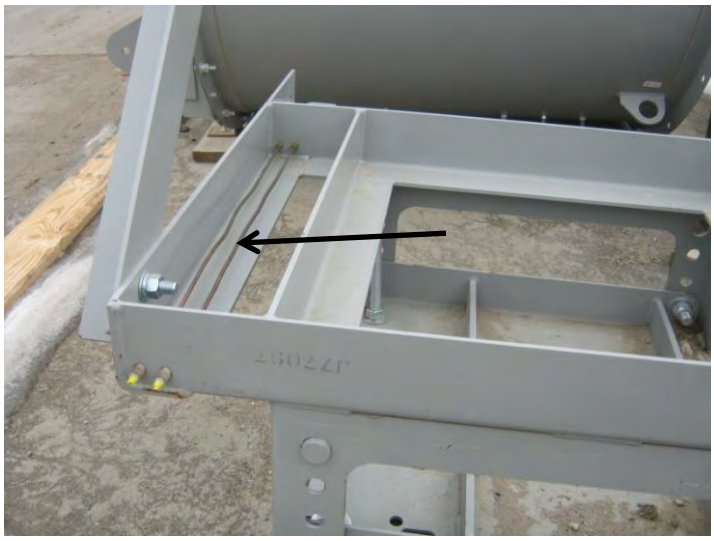


Image 3-4 – Base for Model U1010 blower

Image 3-6 shows blower installed in U1510 modular tower dryer.

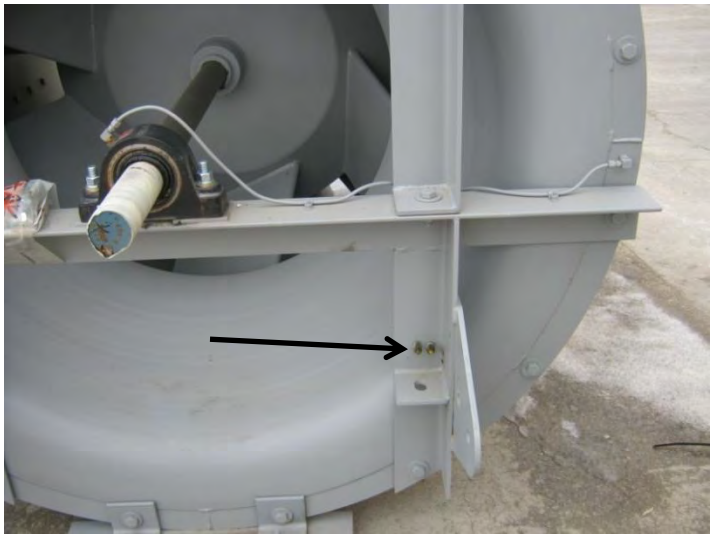


Image 3-5 – Model U1510 blower

Image 3-6 – Model U1510

Checking Backspin Preventer

A backspin preventer is used on each blower of a multi-fan tower dryer to prevent improper fan rotation. Image 3-7 shows proper installation. Each device should be checked annually and is accessible by removing lid from top of blower. See Image 3-8. Ensure clutch housing is firmly in place on drive shaft. If loose, tighten using socket-head screw (see Image 3-9) to a maximum of 38 to 40 ft. lbs. Ensure arms are securely bolted to unit as shown in Image 3-9. Check and retighten cable hardware as needed.
NOTICE: Cable deflection should be between 3/4" and 1-1/2" per side, with maximum total deflection of 3". Failure to properly adjust could result in product damage.

If clutch housing needs to be removed, loosen socket-head screw. When reinstalling backspin preventer, ensure shaft goes completely into clutch housing. Tighten socket-head screw to a maximum of 38 to 40 ft. lbs.

NOTICE: Verify that each blower's drive shaft rotates clockwise as seen from above before bolting arms to clutch housing shaft. Failure to do so could result in damage to motor, belts and/or blower when started.

Image 3-7 – Backspin preventer installed

Image 3-8 – Shaft cover plate on top of blower

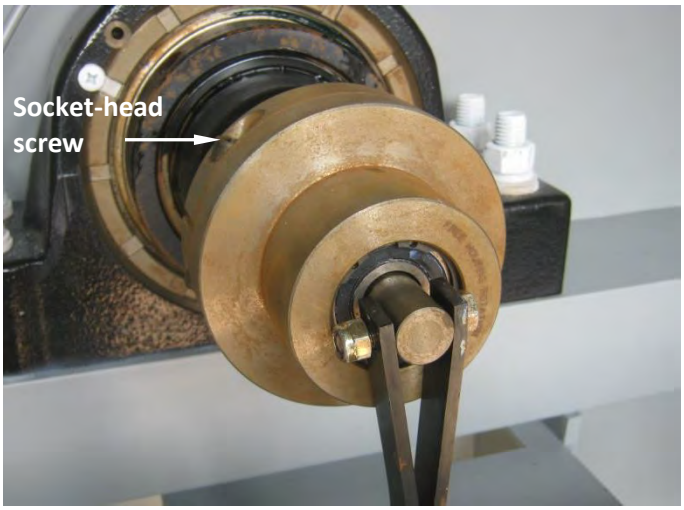


Image 3-9 – Socket-head screw on clutch housing

Tensioning Belts

See Table 3-4 and Fig. 3-1 to properly tension belts.

Model #	Belt Part #	# of Belts	Belt Profile / Length	Small (motor) pulley dia. (inches)	Large (driven) pulley dia. (inches)	Deflection (inches)	Pounds of force for new belt	Pounds of force for used belt
U1010	J0263	2	CX / 96	9.5	14	0.46	23.5	15.9
U1510	J02483	4	5VX / 106	7.9	11.7	0.59	22.1	14.8
U1812	J02751	3	CX / 124	9	18	0.64	21.8	14.7
U2012	J0276	4	CX / 144	13	24	0.67	23.5	15.9
U2412	J02761	4	CX / 136	11	24	0.63	23.5	15.9
U3018	J0263	6	CX / 96	10	14	0.46	23.5	15.9
U3518	J02803	6	CX / 109	10	16	0.5	23.5	15.9
U4018	J0277	9	CX / 112	10	18	0.51	23.5	15.9
U4718	J0277	9	CX / 112	10-1/2	18	0.53	23.5	15.9
U5024	J0275	12	CX / 128	9-1/2	18	0.67	21.8	14.7
U6024	J02761	12	CX / 136	11	24	0.7	23.5	15.9
U7024	J02761	12	CX / 136	12	24	0.7	23.5	15.9

Table 3-4 – Blower belt specifications

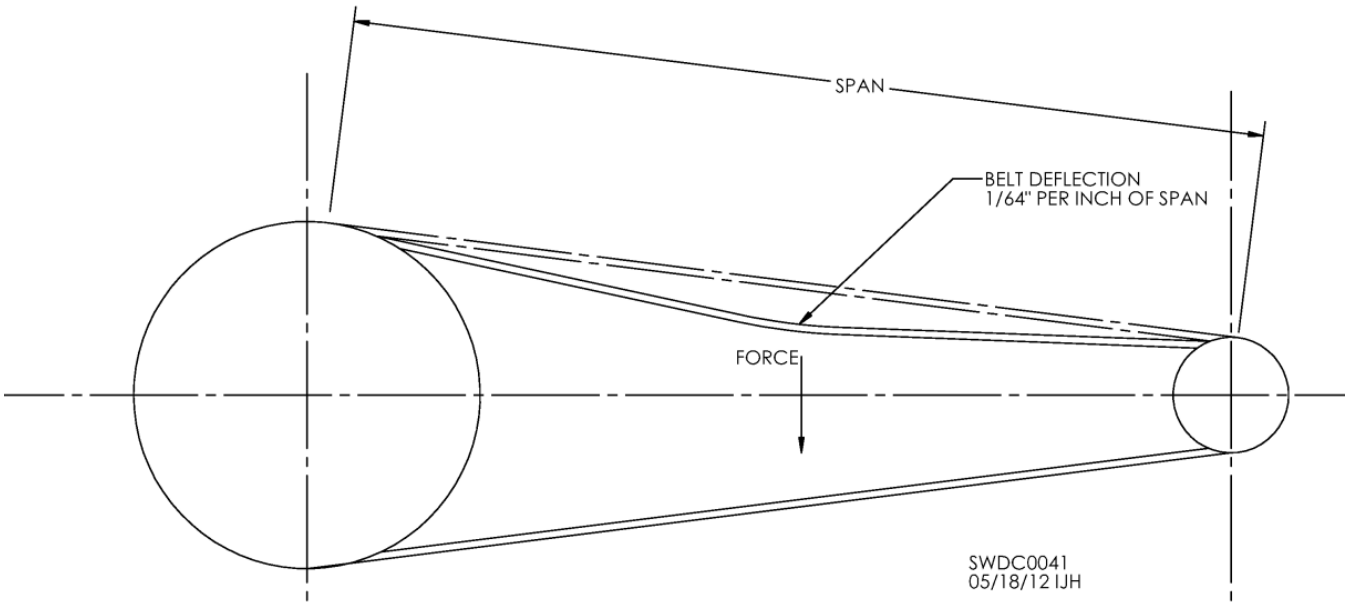


Fig. 3-1 – Adjusting belt tension

Follow these steps to tension belt.

1. Measure span length. See Fig. 3-1.
2. At center of span, apply enough force to deflect belt 1/64” for every 1” of belt span. If span is 32”, deflection amount should be 32/64”, or 1/2”.
3. Use Table 3-4 to determine pounds of force to apply to gauge proper deflection per belt.

Gearbox Lubrication

See Table 3-5 and Images 3-10 through 3-12 for gearbox lubrication specifications and locations.

Model #	Gearbox	Part #	Oil Change Interval	Amount of Oil	Type/Weight of Oil
U1010	Rossi	J36873	2 to 4 yrs.	3.38 qts.	ISO VG 320
U1510					
U1812					
U2012					
U2412					
U3018	Shimpo	J3685	Gearbox is packed with grease at factory. No re-lubrication is required.		
U3518					
U4018					
U4718					
U5024	Sumitomo	J3686	Gearbox is packed with grease at factory. Add 8 oz. Shell Alvania No. 2 grease each year.		
U6024					
U7024					

Table 3-5 – Gearbox lubrication specifications

Image 3-10 – Rossi gear reducer

Image 3-11 – Shimpo gear reducer

Image 3-12 – Sumitomo gear reducer

Image 3-10 shows Rossi gear reducer used on models U1010 through U2412, including oil fill (F), level (L) and drain (D) plugs. See Table 3-5 for oil change frequency, amount and type.

Image 3-11 shows Shimpo gear reducer used on models U3018 through U4718. Reducer is grease-packed at factory and does not require periodic re-greasing.

Image 3-12 shows Sumitomo gear reducer used on models U5024 through U7024, including location of grease zerk (G). Reducer is grease-packed at factory. See Table 3-5 for information on maintaining grease level.

NOTE: All reducers are shown in factory packaging.

Unload Rotor Bearing Lubrication

Image 3-13 shows typical unload rotor bearing used in Sukup tower dryers. Models U1010 and U1510 use bearing J00669 (for 2-7/16” dia. shaft) and all others use bearing J0064 (for 3-1/2” dia. shaft). All bearings are grease-packed at factory with lithium-based grease. On dryers running 8 to 16 hours a day, bearings should be re-greased every 12 weeks. On dryers running 24 hours a day, bearings should be re-greased every 10 weeks. Use lithium-based grease. ***NOTICE:*** Do not over-grease bearing. It can break bearing seal. Image 3-13 shows location of grease zerk.

Image 3-13 – Bearing used on unload rotor

Burner Maintenance

Maxon Corporation provides the following information

Periodic maintenance will ensure continued trouble-free operation of Series NP-LE AIRFLO® Burner system.

Inspect burner at least once a year. Previous experience is the best guide in determining frequency of inspection. As a minimum, the following procedure should be followed:

1. Shut system down totally. Disconnect or lock out power supply so there can be no accidental start-up during inspection.
2. Inspect burners carefully, including upstream and downstream sides of mixing plates as well as burner body face. Any accumulation of scale or foreign material of either side of mixing plates should be removed with a wire brush. Check visually that no holes in mixing plates are blocked.

***NOTICE*:** Do not enlarge burner ports or performance may be drastically affected!

3. If any mixing plates are loose or are missing fasteners, tighten/replace as necessary. Always use zinc plated or stainless metric fasteners.

Inspection and Maintenance of Gas Ports

- Conduct initial inspection within first month after commissioning. Visually check gas ports of new burner assemblies for any piping scale or debris. Use pin vise with drill bit to remove.
- Annual inspections are normally adequate once initial piping debris is removed. Operating conditions of burner will determine how frequently maintenance is required.
- Use of an electric drill is not suggested unless both pin vise and drill can be chucked up in a variable-speed drill unit. **CAUTION:** It is easy to snap bits off in a port when using a drill motor, and removal of broken bits from gas ports is difficult.

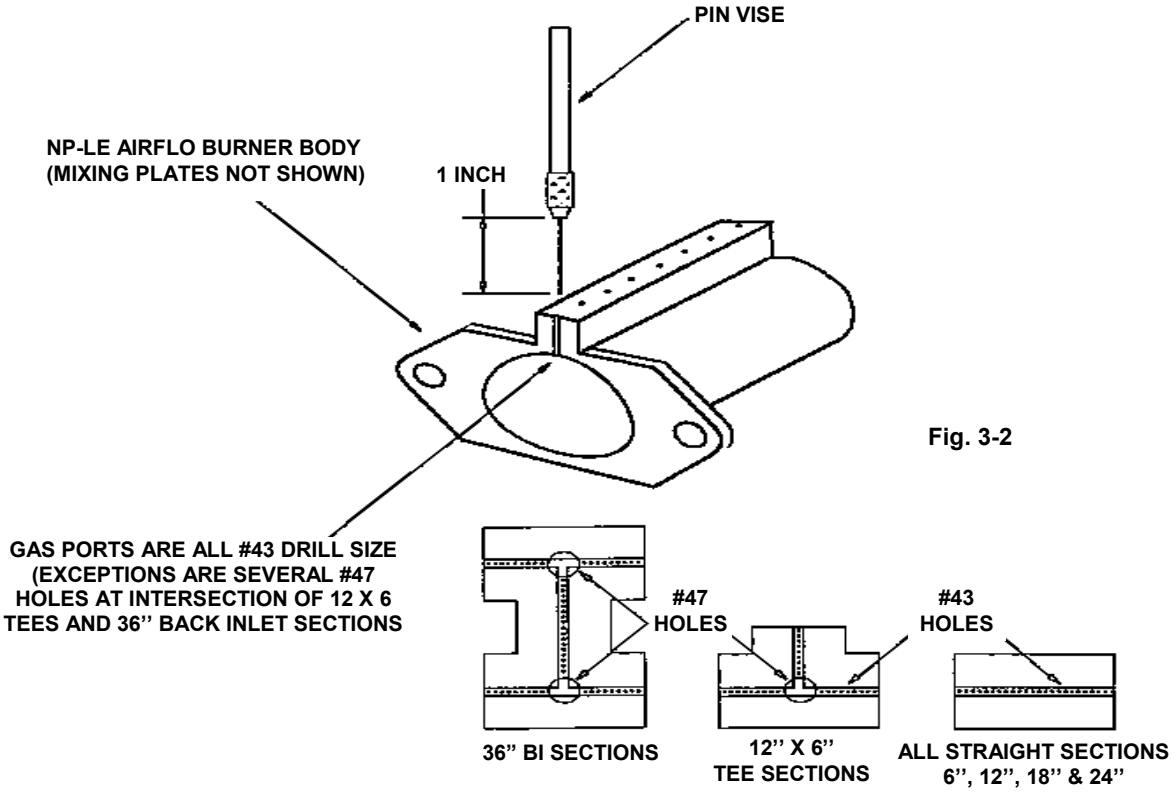


Fig. 3-2

Troubleshooting Guide

Table of Contents

DATE	REVISIONS	PAGE
01/23/2018	Corrected moisture sensor wire label references	9
01/23/2018	Updated instructions for fixing a QuadraTouch Pro communication error	10
01/23/2018	Updated instructions for troubleshooting plenum & grain column RTD's & transmitters	11

See table below for quick-reference guide to troubleshooting.

See following pages for help in troubleshooting problems with specific components of dryer.

See Tower Dryer Sensor Locations pages in Component Identification Section of this manual.

Problem/Fault	Possible Cause or Solution
Pilot flame does not light	• Make sure low-fire position switch by valve is closed. • Make sure both pilot solenoid valves are opening. • Make sure spark transformer is receiving power. • Make sure spark plug is clean. • Check for blockages in the pilot gas line.
Pilot flame of flame is not sensed	• Visually inspect to make sure pilot flame is lighting. If not, see above problem. • At burner, check that flame rod is clean and not touching something. • Check connection of flame rod at burner and back to control box terminal. • Make sure ground wire is attached to burner and to ground terminal in control box. Also make sure there is a ground wire between power box and control box.
Burner is not reaching setpoint	• Ensure there is no obstruction of fuel to burner. • Gas pressure may need to be increased to reach high temperatures. • If not reaching in the lower set points, the lower fire positions of the valve may need to be decreased.
No grain unloading out of dryer	• Check unload motor wires in power box and at motor on dryer. • Ensure 24VDC run signal is going to frequency drive. • Ensure that reference voltage is going to drive unit. • If drive is receiving run signal and reference voltage, display on unit should be showing a number. This is the frequency sent to unload motor. Ensure unload rotor is turning and rotor arms are not hitting on floor or on side of dryer. Drive unit will cut voltage to motor if it starts drawing higher amps than motor will allow (current limiting).
Upper column high limit fault	• The 240-degree switch is located in a copper tube on top of first perforated sheet on outside of dryer. • Dryer plenum temperature may be set too high. • If grain level dropped below sensor, hot air will start blowing on sensor, causing it to trip. • Wet grain level in storage bin may be getting too low. • Dryer is unloading faster than fill system can fill dryer, causing grain to drop below sensor.
No grain column temperature	• Take a voltage reading between DC COM (#95) and signal wire (#70). This should be between 1 – 5 VDC. Take reading to control box. • If voltage is not present between #95 and #70, voltages and resistance need to be checked on sensor. • At transmitter, disconnect wires coming from sensor and take a resistance reading from yellow wire to each white wire. If a resistance is present, sensor is OK. • At transmitter, check voltage between +24VDC terminal and COM. This should read 24VDC. If 24VDC is present, reconnect sensor wires and check output signal at transmitter. This should be the same as before (1-5VDC). • If still no voltage on output, transmitter needs to be replaced.
Moisture sensor not working	• Take sensor out of tube and visually inspect it for damage to copper tube or flag. Also make sure that it is clean and free of debris. Any kind of buildup on sensor will cause inaccurate moisture readings. • Check that ground strap is attached from sensor to sample tube. • Take a voltage reading on moisture sensor wire and terminals in power box and control box: White = ground, Brown = 28VDC supply to sensor, Blue = 0-3V (return voltage for temperature), Black = 0-10VDC (return voltage for moisture). • On moisture sensor 0V = 50%, 10V = 0%.

Rotary Fill Switch

Image 4-1 – Rotary fill switch

Rotary fill switch is located on roof of dryer. Its sensor is used to indicate when wet bin of dryer is full of grain. A fault will be displayed when this occurs.

Fault Condition
10-Minute Load Attempt Timeout

All dryer models use wire #44

1. Is wet bin out of grain?
   If this is last load of season, press Reset and Start →Final Dry.
2. Has an auxiliary load malfunctioned?
   Repair cause of load failure and press Reset.
3. If wet grain is available and load auxiliaries are functioning, is fill switch bound up?
   If so, free the fill switch and repair cause.
4. Are both PLC input lights off? (Both lights should be off when dryer is calling for grain.)
   Are both PLC input lights on? (Both lights should be on when dryer is full.)
   If not, remove cover from fill switch and visually check sensors for proper placement in their respective holders. See Image 4-1.
5. Check PLC input lights (# 44-Lower; # 53-Upper) while someone stops fill switch. If either PLC input light does not turn on, check for 24VDC on wire # 18 to ground. (Touch black probe from meter to dryer frame.)
6. If 24VDC is detected on wire # 18, check for 24VDC on other wire going to sensor.
   a. With fill switch not spinning, 24VDC should be detected on wire # 44 or # 53.
   b. If not, replace respective sensor and recheck for voltage.
7. If 24VDC is detected at power box terminal strip and PLC input lights are not on, PLC may be malfunctioning.

Images 4-2 & 4-3 – Rotary fill switch, fill sensor

NOTE: Appearance of switch may be different.

Vapor Over-Temperature Switch

Image 4-4 – Vapor over-temp switch

On an LP dryer, vapor over-temp switch is located on pipe train. Its purpose is to detect gas that is overheating and prevent damage to heater components. See Image 4-4.

Fault Condition
Vapor Over-Temp

All dryer models use wire #37

1. This fault indicates when output of vaporizer coil has become too hot (above 140 F).
   a. Tubing near fault device should be fairly warm to touch, but not hot.
   b. Check fuel supply. Is tank low on fuel?
   c. Check for air inlet obstruction. Clear any debris.
2. Has vaporizer coil had sufficient time to cool down?
   Device will automatically reset when it has cooled down.
3. Is PLC input light on?
   a. After device has cooled down and reset, PLC input light should be ON.
   b. If not, follow wiring from coil to heater box and check for 24VDC on wire # 18.
4. If 24VDC is not found on wire # 18, go to power box and check for 24VDC on terminal strip.
   If 24VDC is found on wire # 18 on power box terminal strip, check wiring connections from heater box to power box.
5. With 24VDC being found on wire # 18 on one wire of vaporizer O/T switch, and after device has cooled down to ambient temperature, check for 24VDC on other wire (not # 18) coming from O/T switch.
   a. If 24VDC is NOT found on other wire, O/T switch must be replaced.
   b. If 24VDC is found on other wire coming from O/T switch, take note of wire number and go to power box and check for 24VDC on terminal strip.
   c. If 24VDC is NOT found on power box terminal strip, check wiring connections between power box and heater box.
   d. If 24VDC is found on input terminal, and input light is NOT on and fault message is still being displayed (after pressing RESET), then PLC is malfunctioning.

Access Door Switches

Image 4-5 – Access door switch

Access door switches, also called key switches, are located on each door on dryer. The switches are used to keep dryer from running when a door is open and a person may be inside of tower dryer.

Fault Condition
Door is Open

All dryer models use wire #36.

1. Check doors to be sure no one is inside and doors are closed.
2. If both doors are closed, check that PLC input light is ON. If light is **not** ON, go to junction box that contains wire from switches. Remove cover and check for 24VDC on input wire.

NOTE: On ALL dryers, wire # 18 feeds into door switches. Switches are connected in series and route back to PLC input.

3. If 24VDC is not present on input wire, check that 24VDC is present on wire #18.
   a. If 24VDC is present on input wire, but PLC input light is not ON, check for 24VDC returning from both switches. Generally, each additional door switch adds a letter to wire number after coming out each successive key switch: 36, 36A.
   b. If 24VDC is not returned from door switches, a voltage check on wire coming from each switch may be required.
4. If 24VDC is being returned from last switch, check for 24VDC on appropriate wire on power box terminal strip.
   a. If 24VDC is not found on power box terminal strip, check wiring connections between junction box and power box.
   b. If 24VDC is found on power box terminal strip, check #36 on PLC for 24VDC
5. If 24VDC is present on PLC input terminal but input light is not on and there is a door fault, PLC is malfunctioning.

Grain Column Over-Temperature Switch

Image 4-6 – Grain column over-temp switch

There are two or three grain column over-temperature switches on dryer (two on modular, three on regular). See locations in Fig. 3 and Table 1. These sensors monitor temperature in grain. Switch will turn dryer off if temperature reaches 240°F.

Fault Condition
Column Over-Temp

Upper switch uses wires 84 & 85
Middle switch uses wires 82 & 83
Lower switch uses wires 80 & 81

Check all grain columns for obstructions that would prevent grain from flowing through. If an obstruction is found, do not restart dryer until it has been cleared.

NOTE: To check for an obstruction, go to Manual operation and turn unload to ON. Run unload long enough for grain level in columns to drop at least 1 foot. Stand back from dryer and look through screens to observe grain level in each column. Any column with an obstruction will be readily visible.

1. If no obstructions are found and grain is flowing freely through each column, plenum temperature may need to be reduced.
2. If column temperature has cooled down and RESET button has been pressed on touch screen and fault message is still being displayed, remove junction box cover and check for 24VDC on wire # 18.
3. Allow time for columns to cool down.
4. At this point, 24VDC should be present on wire # 18 at O/T sensor.
   Check for 24VDC on other wire (not # 18) coming from sensor.

a. If 24VDC is NOT detected, O/T sensor is defective.
b. If 24VDC is found on wire coming from O/T sensor but PLC input light is NOT on, note number of wire and go to power box and check for 24VDC on terminal strip.
c. If 24VDC is NOT found on terminal strip in power box, check wiring connections between junction box and power box.
d. If 24VDC is detected on terminal strip in power box, go to PLC and check for 24VDC on input terminal.
e. If 24VDC is detected on PLC input terminal, and input light is not on and fault message is still displayed (after pressing RESET), then PLC is malfunctioning.

Blower Air Switch

Image 4-7 – Blower air switch

Air switch sensor monitors air flow at inlet of blower. Single-blower dryers have one air switch; three-blower dryers have three. They are located in main power box. Device will shut down dryer if there is not enough air flow. See Fig. 3 and Table 1 for location of sensor(s) on dryer.

Fault Condition
No Static Air Pressure

Blower 1 uses wire # 143
Blower # 2 uses wire # 243
Blower # 3 uses wire # 343

1. For monitoring adequate air flow, blower(s) must be turned on.
2. Using Tools → Manual Operation, turn blower(s) ON. Check for proper operation and airflow.
3. If a fault message is displayed, switch may not be adjusted correctly.
   a. Open power box.
   b. With blower switch turned to ON, check PLC input light. It should be ON.
   c. If input light is NOT on, check tubing for kinking and to ensure it is positioned to sense air flow into blower. Also check fittings on switch in power box to ensure tight connection. If fan is on and input light is still not on, use a straight screwdriver to turn adjustment screw counterclockwise until screw is up against c-ring.
   d. Once input light is on, turn blower(s) off and observe PLC input light. Light should turn OFF as blower(s) slows down.
   e. If light remains ON after blower(s) slow or stop, switch should be replaced and checked again.
   f. While watching PLC input, turn blower(s) ON and then OFF, ensuring input light is turning on and off with fan.
4. If, after going through above procedure, PLC input light remains in either ON or OFF position without changing, voltage measurements will be necessary.
   a. Locate wire # 18 in junction box and check for 24VDC.
   b. If 24VDC is NOT found, go to power box and check for 24VDC on terminal strip.
   c. If 24VDC is found on terminal strip, go to PLC and check for 24VDC.
   d. If 24VDC is found on this wire, use a small screwdriver and turn screw clockwise until 24VDC is not present.
   e. If turning adjustment screw clockwise fails to turn air switch OFF, then switch is defective.
   f. If 24VDC is NOT found on wire coming from switch, use a small screwdriver to turn screw counterclockwise until 24VDC is detected.
   g. If turning adjustment screw counterclockwise fails to turn air switch ON, then switch is defective.
5. After replacing blower switch, follow previous instructions on switch adjustment for proper operation.
   a. If PLC input light is not turning on when switch is on, check voltage.
   b. Adjust switch to ON position. Check for 24VDC on wire coming from switch.
   c. Take note of wire number and go to power box. Check for 24VDC on terminal strip.
   d. If 24VDC is NOT found on terminal strip, check wiring connections between junction box and power box terminal strip.
   e. If 24VDC is found on terminal strip, go to PLC input terminal and check for 24VDC.
   f. If 24VDC is NOT found on input terminal, check wiring connections between terminal strip and PLC.
   g. If 24VDC is found on PLC input terminal but input light is not on and fault message is still being displayed after pressing RESET, PLC is malfunctioning.

Plenum Over-Temperature Switch

Image 4-8 – Plenum over-temp switch.

Plenum over-temp switch is located inside plenum of dryer. See Fig. 3 and Table 1 for location(s). It is provided to protect plenum from overheating.

Fault Condition
Plenum Over-Temp

Switch uses wire # 39

1. With dryer shut down, open door and inspect plenum for any problems.
2. After plenum has cooled down, press RESET and fault should be cleared. **NOTE:** Switch will reset automatically when temperature drops below 325°.
3. If fault has not cleared, remove cover from junction box containing plenum O/T switch and check for 24VDC on wire # 18.
4. If 24VDC is NOT detected, check connection with terminal 18 in power box.
5. Check for 24VDC on other side of switch.
   a. If O/T switch has cooled down below 325° and 24VDC is NOT found on other wire, then switch is defective.
   b. If 24VDC is found on other wire coming from switch, go to PLC and check input light. If input light is ON, press RESET and fault should clear.
   c. If input light is not ON, take note of number of wire coming out of O/T switch. Go to power box and check for 24VDC on terminal strip.
   d. If 24VDC is NOT found on power box terminal strip, check wiring connections between junction box and power box.
   e. If 24VDC is found on power box terminal strip, check for 24VDC on PLC input terminal.
   f. If 24VDC is found on PLC terminal and input light is OFF and fault message is still displayed, PLC is malfunctioning.

Incoming/Discharge Moisture Sensors

Image 4-9 – Incoming moisture sensor

See Fig. 3 and Table 1 for locations of incoming and discharge moisture sensors. They monitor moisture and temperature of grain as it enters and is discharged from dryer.

Input Sensor Not Found

If red “Input Sensor Not Found” screen appears, it means that at least one analog input sensor is missing from PLC. Follow steps below.

1. Using a screwdriver, remove cover on junction box.
2. Find the four (4) wires used by moisture sensor. They are red, blue, black, green + shield.
3. Using a voltage meter, check for 24VDC voltage between red and green + shield. If 0VDC is found, check connection between power box and junction box.
4. Assuming red wire has 24VDC, check for DC voltage between black and green + shield wires. Something between 1 and 10VDC should be detected. If so, check connection between junction box and power box. Black wire is labeled D4/D5 (D5 for incoming moisture, D4 for discharge moisture) on power box terminal strip. If 0VDC is found, sensor is malfunctioning and must be replaced.
5. If same voltage is found on D4/D5 terminal in power box as back in junction box, check between D4/D5 terminal on PLC and 95. If 0VDC is found, there is a connection problem between power box terminal strip and PLC. If same voltage (1-10VDC) is present on PLC D4/D5 input as junction box, the green analog input PLC card may be malfunctioning.
6. Blue wire is labeled D3 on power box terminal strip. If voltage between 0VDC to 3.0VDC is not found, sensor is malfunctioning and must be replaced (0.70 = 70° F.)

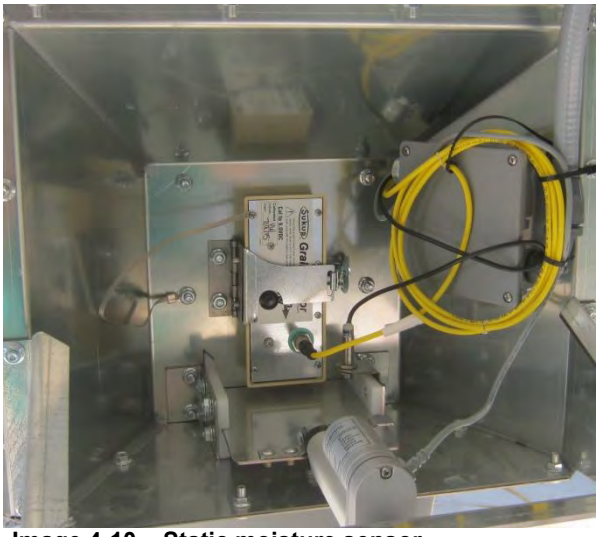


Image 4-10 – Static moisture sensor

QuadraTouch Pro Controller

If connection between QuadraTouch Pro panel and PLC is lost, Communication Error screen will appear.

Fixing a Communication Error

NOTE: Requires software version 1.19 or later.

Make sure touch-screen and PLC are both ON.

- On Power Box, make sure E-Stop is pulled out and illuminated RED, and that System Control Switch is on COMPUTER and is illuminated GREEN. Make sure PLC lights are on.
- Check link lights on Ethernet ports of both QuadraTouch Pro console and PLC. To check on console, loosen knurled thumb screws below touch-screen and lift screen. Ethernet cable should be plugged into the “X2 ETH” port.
- If one link light is illuminated on either the X2 ETH port or PLC, Ethernet cable should be good.
- If one of the Ethernet couplers is bad, both link lights will be off.
- If link light is lit on one device (PLC or console) but not the other, use a cable known to be good and connect the device with no link light into another device such as a laptop computer. If no light illuminates, Ethernet port on device (PLC or console) is likely bad.

Checking Communications Settings on QuadraTouch Pro

- Ensure that Ethernet cable connecting dryer to QuadraTouch Pro console is plugged into port “X2 ETH” and that link lights are ON in both the PLC and touch-screen console.
- If another cable is plugged into “X3 ETH,” unplug it and reconnect after the communication error has been resolved.
- Go to Tools → System Tools → Maintenance Tools → Network Configuration → Network Repair Utility → Start Network Repair. This will reset the touch-screen console’s Ethernet ports to factory settings.
- After process is complete, press Reset to return to main page.

Plenum/Grain Column Temperature Sensor RTD and Transmitter

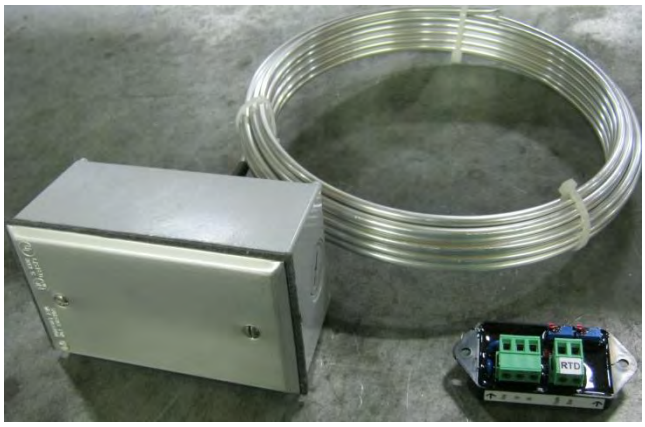


Image 4-11 – Plenum temperature sensor RTD and transmitter

Plenum and grain column temperature sensors consist of RTD (Resistance Temperature Detector) and transmitter. See Fig. 3 and Table 1 for locations of plenum and column temperature sensors.

RTD measures average resistance over length of tube. Dryers use 24' or 28' tube lengths, and one single-point RTD.

RTD is used with a transmitter that converts resistance into a 1 to 5 VDC signal. This voltage is then fed into PLC and displayed on QuadraTouch Pro screen.

If RTD is in question, a voltage and resistance comparison can be made to determine if unit is defective.

1. Begin by locating transmitter in main power box. See Images 4 and 5 in Component Identification section of this manual. Plenum RTD transmitter is black and column RTD transmitter is gray. A white label should be attached to each transmitter. Also, two terminal strips are located on each transmitter. Above each RTD (two-pin) terminal strip are two small adjustment screws. NEVER adjust either of these screws. They are calibration adjustments and once moved, transmitter will not work correctly until a factory calibration is performed.
2. On three-pin terminal strip, check for 24VDC on terminals 18 and 95.
3. With 24VDC present at plenum transmitter, check output voltage (71 and 95). Voltage between 1.0VDC and 5.0VDC should be found. **NOTE:** Respective terminals on column transmitter are 70 and 95. Use same testing process as for plenum transmitter.

Image 4-12 – Single-point grain column temperature sensor

4. With 24VDC on terminals 18 and 95 but no voltage between terminals 71 and 95, transmitter is defective.
5. If voltage is detected, use table on next page to determine if equivalent temperature is reasonable.
6. If voltage is detected between terminals 71 and 95, go to other terminal strip and remove two wires coming from RTD (both pink).
7. Take a resistance reading with meter. Resistance of RTD is directly related to temperature of RTD.

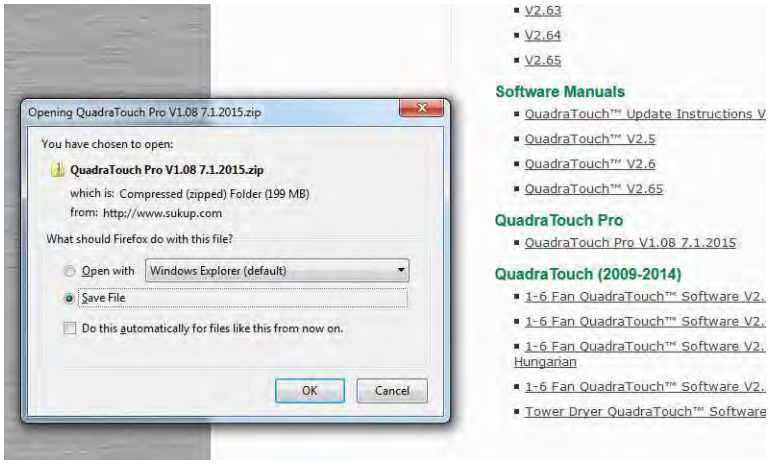
NOTE: This reading should be taken with dryer cooled down and at ambient temperature.

8. If reading shows infinite (open) resistance, RTD is defective. Compare resistance reading to table on next page to determine if resistance is reasonable.
9. If resistance compares to ambient temperature around dryer, and voltage on output wire is close to ambient temperature, then transmitter and RTD are functioning correctly.

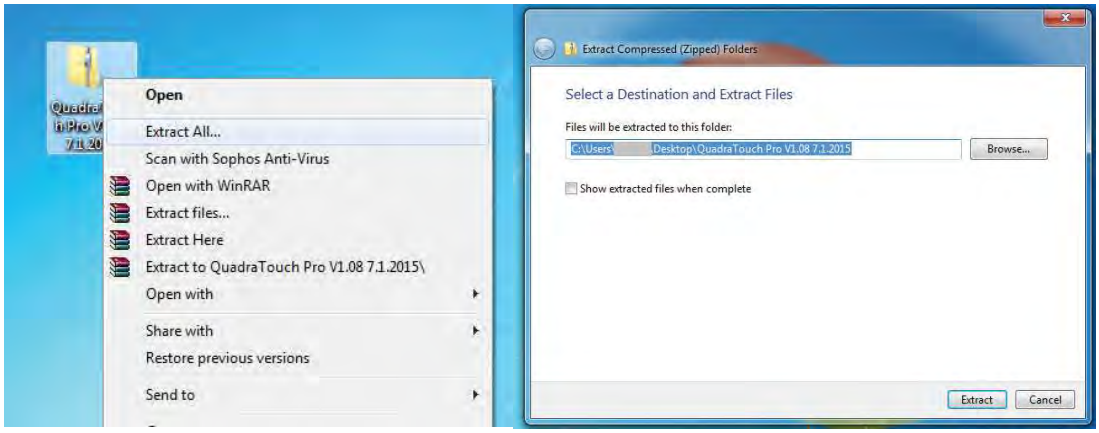
Temperature (°F)	Resistance (1,000 ohm) of Plenum RTD	Resistance (100 ohm) of Single-point Column RTD	Voltage
10	952	95.2	1.16
15	963	96.3	1.24
20	974	97.4	1.32
25	984	98.4	1.40
30	995	99.5	1.48
35	1006	100.6	1.56
40	1017	101.7	1.64
45	1028	102.8	1.72
50	1039	103.9	1.80
55	1049	104.9	1.88
60	1060	106.0	1.96
65	1071	107.1	2.04
70	1082	108.2	2.12
75	1093	109.3	2.20
80	1103	110.3	2.28
85	1114	111.4	2.36
90	1125	112.5	2.44
95	1136	113.6	2.52
100	1146	114.6	2.60
105	1157	115.7	2.68
110	1168	116.8	2.76
115	1178	117.8	2.84
120	1189	118.9	2.92
125	1200	120.0	3.00
130	1211	121.1	3.08
135	1221	122.1	3.16
140	1232	123.2	3.24
145	1243	124.3	3.32
150	1253	125.3	3.40
155	1264	126.4	3.48
160	1275	127.5	3.56
165	1285	128.5	3.64
170	1296	129.6	3.72
175	1306	130.6	3.80
180	1317	131.7	3.88
185	1328	132.8	3.96
190	1338	133.8	4.04
195	1349	134.9	4.12
200	1359	135.9	4.20
205	1370	137.0	4.28
210	1380	138.0	4.36
215	1391	139.1	4.44
220	1402	140.2	4.52
225	1412	141.2	4.60
230	1422	142.2	4.68
235	1433	143.3	4.76
240	1443	144.3	4.84
245	1454	145.4	4.92
250	1464	146.4	5.00

QuadraTouch Pro™ Update Instructions:

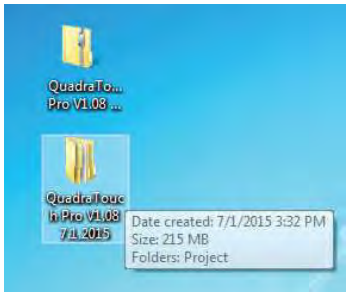
Download the newest QuadraTouch Pro™ software from
http://www.sukup.com/Products/QuadraTouch



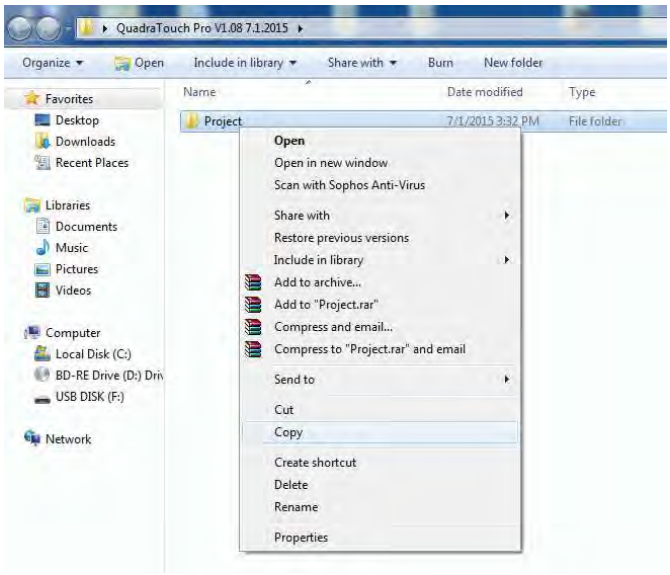
After downloading the .zip file, extract the contents.



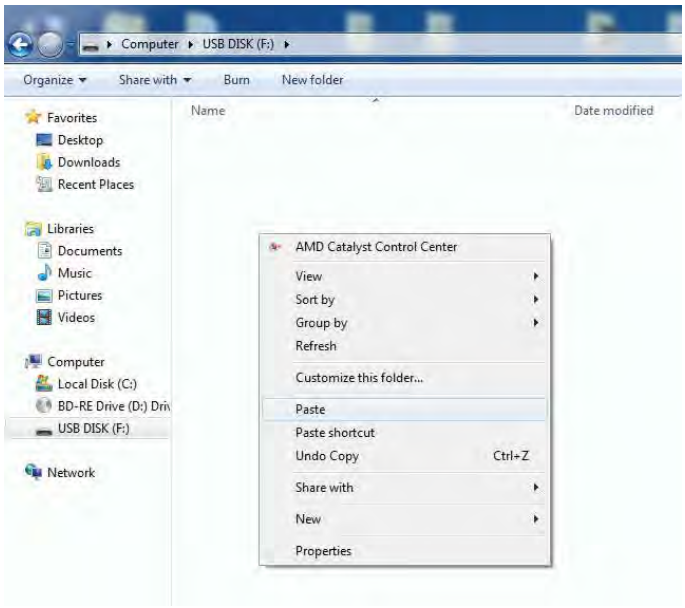
A new folder will appear, double click it.



Right-Click and Copy the folder called “Project”



Paste the “Project” folder onto the root directory of a USB stick.



After the file transfer is complete to the USB stick, you are ready to take the USB stick to the QuadraTouch Pro™ display.

To perform the update:

Insert the USB stick into the external USB service port on the bottom of the box.

Navigate to Tools → System Tools → QuadraTouch Update → and choose STEP 1. The transfer will begin automatically (original versions 1.06 and 1.07 of QuadraTouch Pro software will ask you to continue)

After the panel automatically updates itself, it will prompt you for the PLC update after it reboots. Then perform step 2.

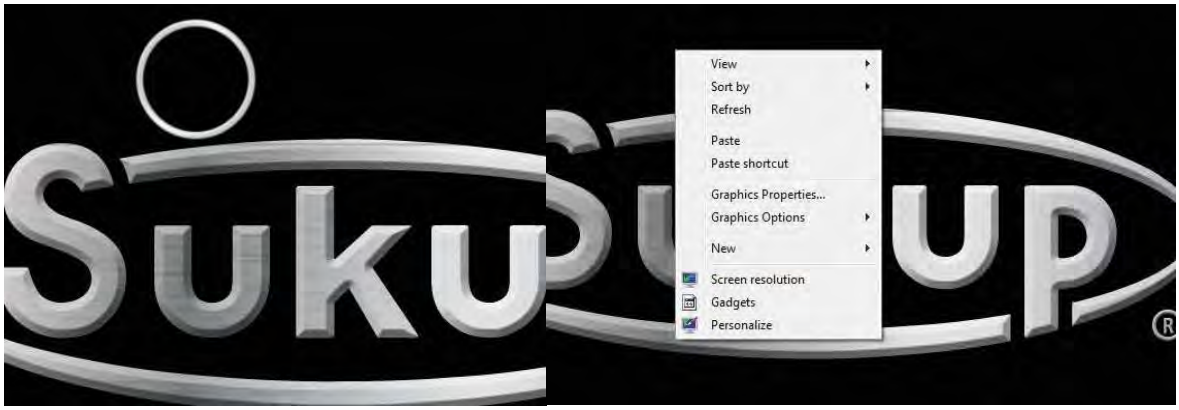
Manually Updating QuadraTouch Pro™

In the event an automatic update will not work, Insert the programmed USB stick

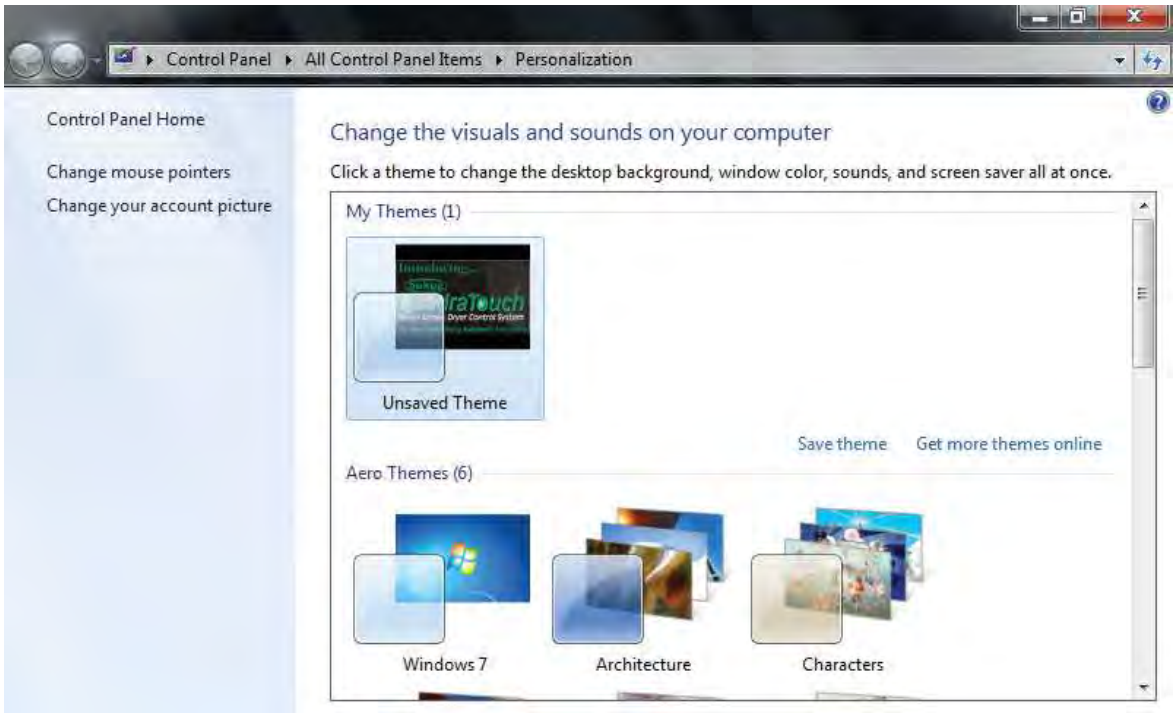
Go to Tools → System Tools → Maintenance Tools → Stop HMI

This will close the program and take you back to the HMI's Desktop.

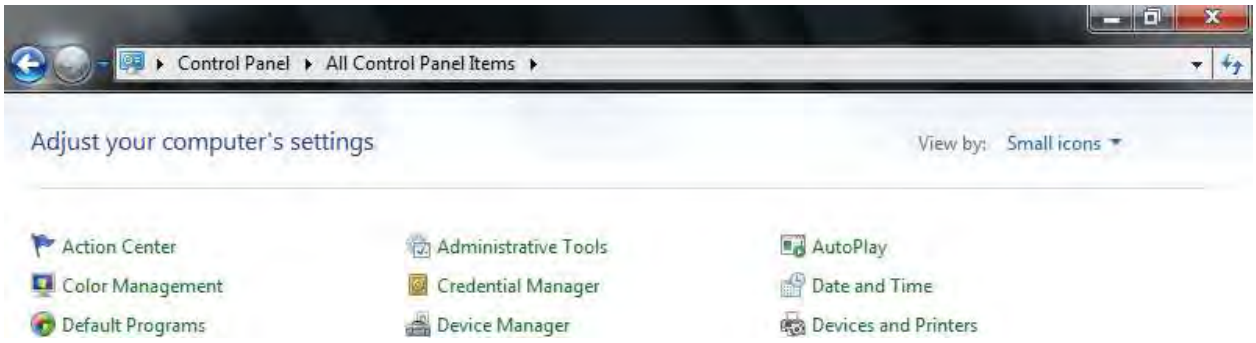
Press and Hold the screen until a circle appears – release the screen.



The Right-Click menu will appear, choose "Personalize"

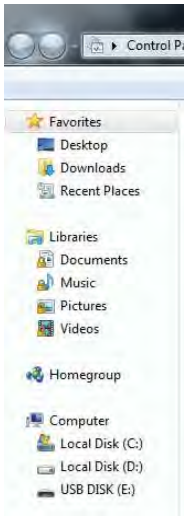


On the top of the screen, choose "All Control Panel Items"

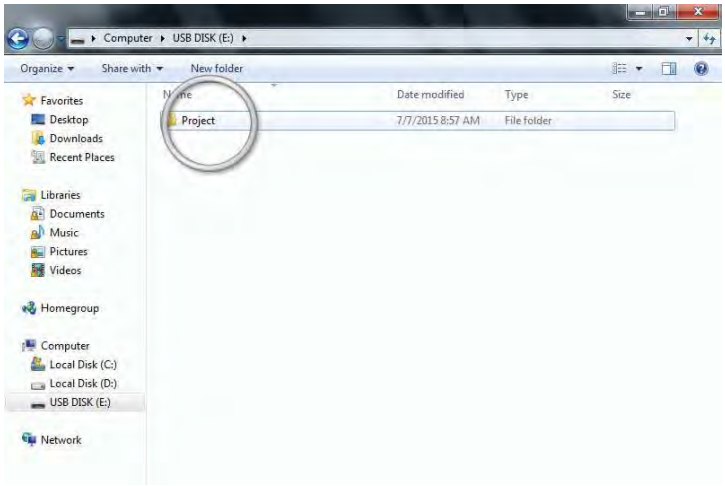


Choose “Administrative Tools”

In the left navigation pane, choose the USB DISK (Probably (E:), but not always)



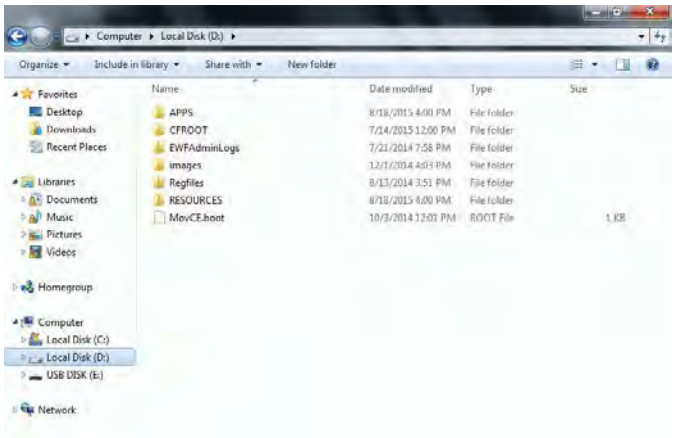
Press and hold the folder called “Project” until a circle appears.



When the Right-Click Menu appears, choose “Copy.”

In the left navigation pane, choose “Local Disk (D:)”

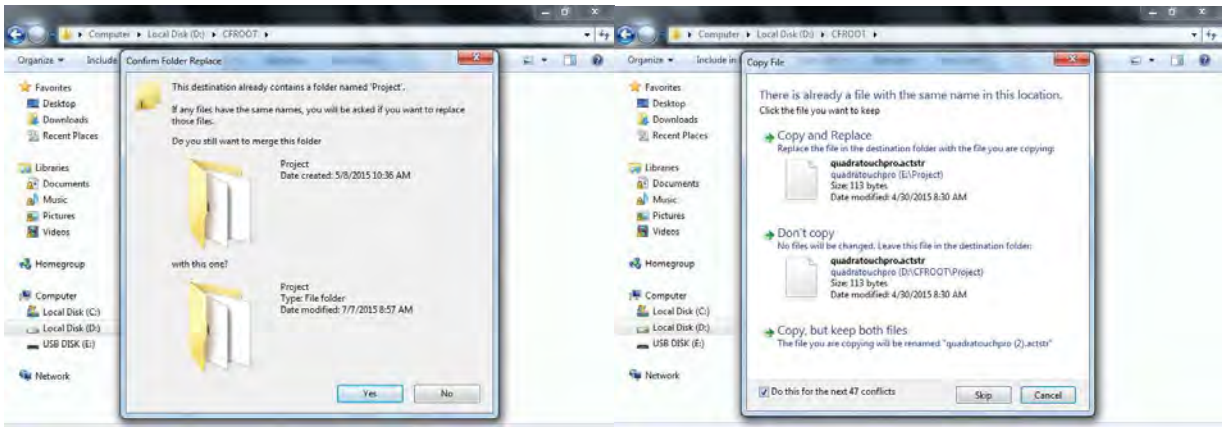
Double-Click on the folder called CFROOT



You will see the folder called Project, DO NOT go into the folder.

Press and hold the screen somewhere in the white area.

Choose “Paste”



Select “Yes” and merge the folders. Overwrite all existing files and folders by checking the “Do this for the next # conflicts” and choose “Copy and Replace”

QuadraTouch Pro™ Software Manual

Dryer Control System

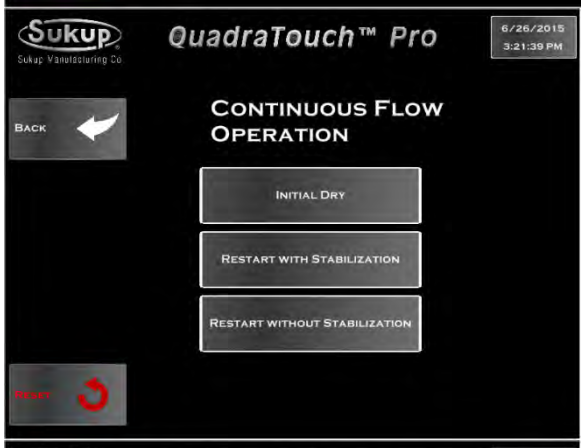
Software is constantly changing. Make sure you are up to date with Sukup's newest software. New software and manuals are available for download at:

http://www.sukup.com/Products/QuadraTouch

TABLE OF CONTENTS

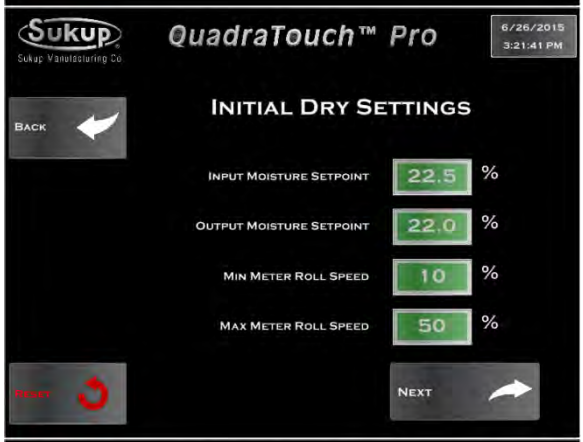
Operation Screens Unique to Tower Dryer

Pressing the "Start" button on the main screen will bring up the start menu. From here, the dryer can be used in many different drying modes, the most common of which will be continuous flow. This section will describe each mode and how it's accessed.

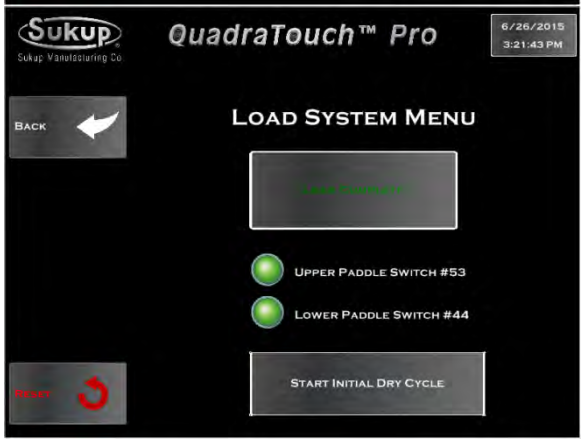


Start → Continuous Flow

Continuous Flow is divided into 3 smaller processes when grain is loaded into the dryer for the first time. Initial dry essentially warms up the grain for a set period of time depending on the user input. The fans and heaters will turn on, and a timer will appear on the screen. This is essential for creating a steady flow of grain through the next step of stabilization.



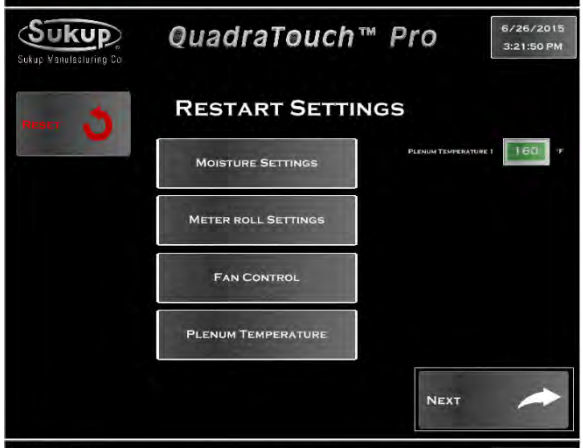
To begin initial dry, the dryer needs some information to get started for the first time. To give it an idea of how long to heat the first batch of grain, enter in the values of the incoming and desired output moisture. Press "Next" to continue on to the loading phase.



Now that the dryer has been programmed with a few basic settings, we are ready to load the dryer with grain and start initial dry. After the dryer has been loaded with grain, a button will appear to start initial dry cycle.

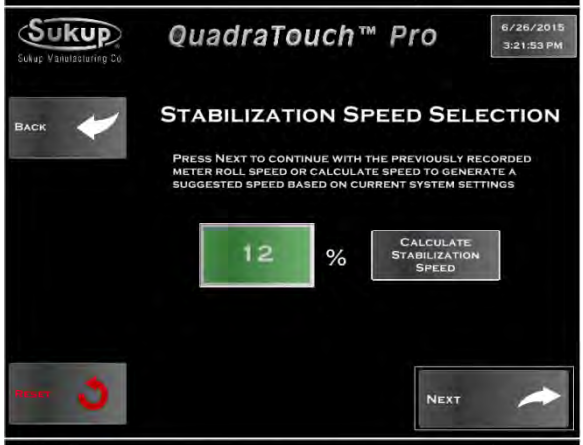
Start → Stabilization

After Initial Dry is finished, Stabilization is the next phase of Continuous Flow Mode. Stabilization is designed to go through 1 full cycle of grain, discharging at a calculated roll speed. The first step of stabilization is to select which fans and heaters should be utilized. Heaters will not be enabled unless its corresponding fan is used.

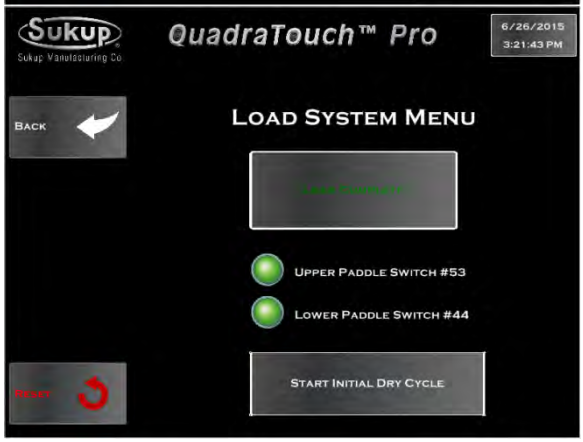


Stabilization/Restart

All previous settings will be stored from the last time the dryer was running, so make any changes necessary on this page before calculating the stabilization speed.



The stabilization speed in the green box is the last recorded speed when the dryer was running in continuous flow mode. If the dryer was running well the last time it was used, using this value for Stabilization is recommended.



If you are currently coming out of Initial Dry, the screen will automatically switch to Stabilization mode. If you have not performed Initial Dry, the load menu will appear. After the dryer has been loaded with grain, a button will appear to start Stabilization.

Start → Dry Fire

Dry Fire mode allows the dryer to turn its fan(s) and heater(s) on when the dryer is empty. This mode should be run every year before operation to test for functionality. Be sure to inspect each heater and pipe train for component integrity and functionality.

Start → Dry Fire

Dry Fire mode lasts for 10 minutes and that status of the signals will be displayed. When the dryer is empty, the air switch will most likely not be closed.

Start → Final Dry

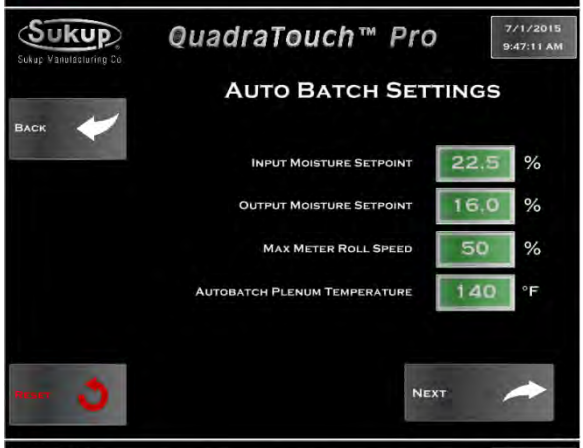
Final Dry mode is used to finish off the last "batch" when there is no more grain to dry in continuous flow. The dryer will batch dry the last grain in the dryer, then turn its fan(s) and heater(s) off and unload the dryer for a set period of time.

Start → Final Dry

Final Dry mode will automatically exit when the timers have expired.

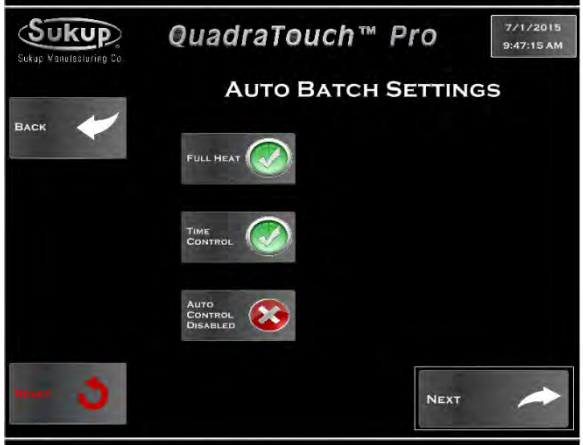
Start → Auto Batch

Due to very high moisture content, Auto Batch mode may be required. After selecting Auto Batch, the system will prompt you about restarting from the last batch. If no previous batch has been recorded, it will start you from the new batch settings.



Start → Auto Batch

Input the settings for Auto Batch.

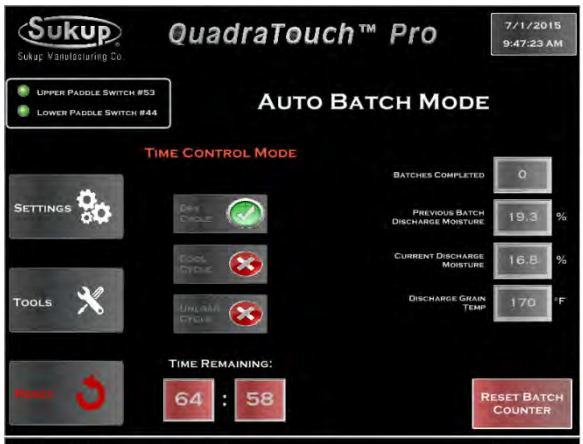


Start → Auto Batch

Choose the heat or heat/cool operation and control method.

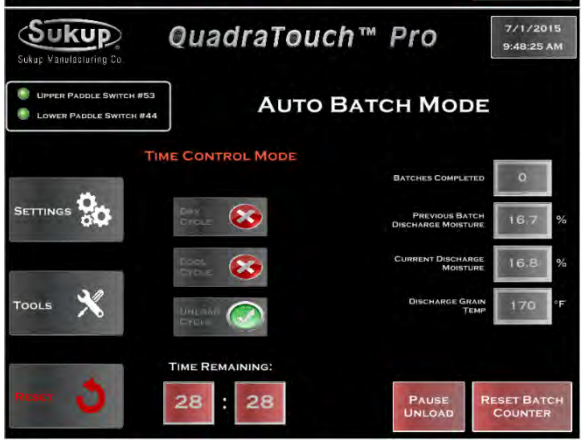
Start → Auto Batch

Based on your settings, the dryer will calculate a base point to start from.



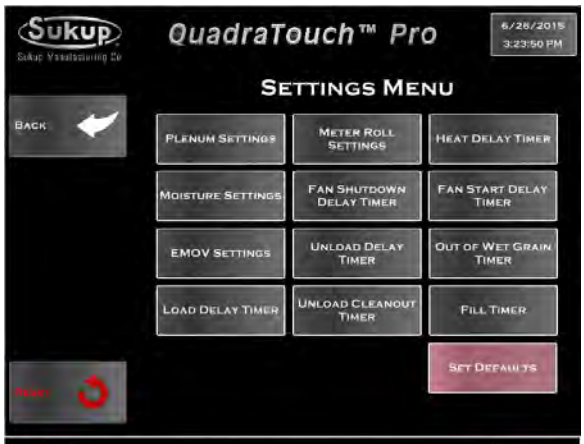
Start → Auto Batch

Auto Batch will start with the Dry Cycle. After the timer expires, the Cool Cycle will be used (if heat/cool operation was selected), then the dryer will start unloading the batch.



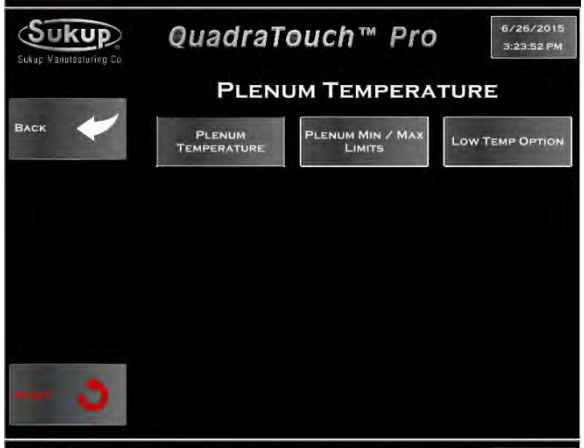
Start → Auto Batch

The Unload Cycle can be paused during operation, but needs to be resumed before the next cycle starts. Each of the mode times can be changed using the settings menu.



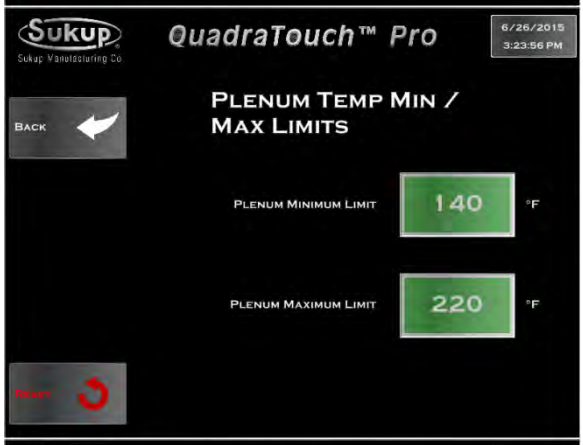
Settings Menu

The Settings menu houses most of the drying settings that are commonly used during operation.



Settings → Plenum Temperature

The Plenum Temperature menu contains settings for each individual plenum/heater.

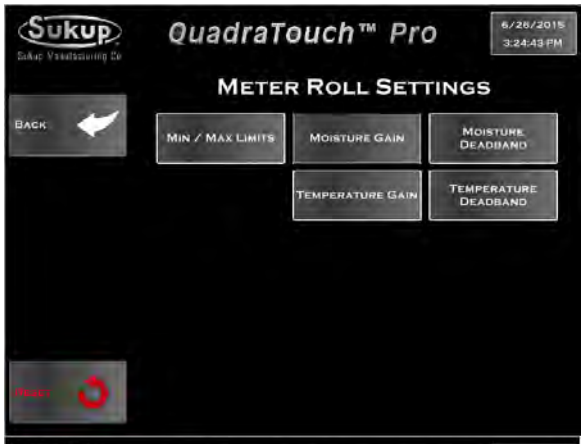


Settings → Plenum Temperature → Min/Max

The minimum and maximum plenum temperatures can be found here. When choosing the low temp option, the values can be adjusted even further.

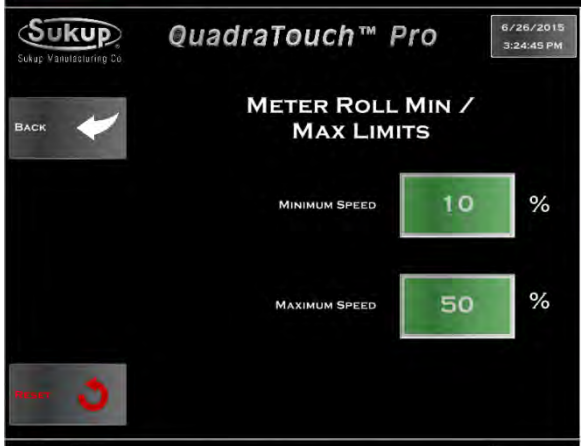
Settings → Plenum Temperature → Low Temp Option

If enabled, the low temp option allows the plenum to be set as low as 100℉. It may result in permanent damage if a low temp kit is not installed in the dryer. The port cup and orifice may need to be changed out on axial fan heaters.



Settings → Meter Roll Settings

The Meter Roll Settings (Unload Settings for Tower Dryers) contain the minimum and maximum speed settings as well as loop control settings

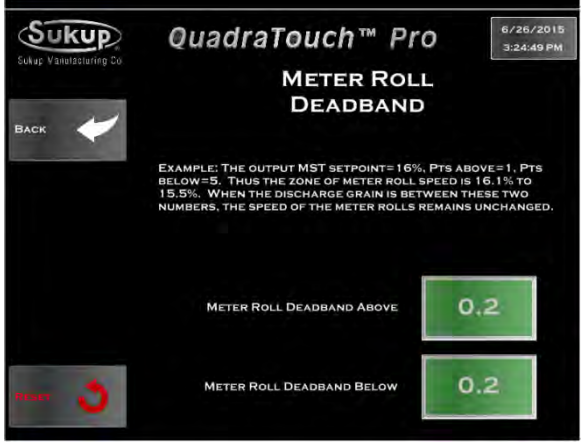


Settings → Meter Roll Settings→ Min/Max

The minimum and maximum settings dictate how fast or slow the system is capable of running. Make sure to never unload faster than your takeaway system is capable of running.

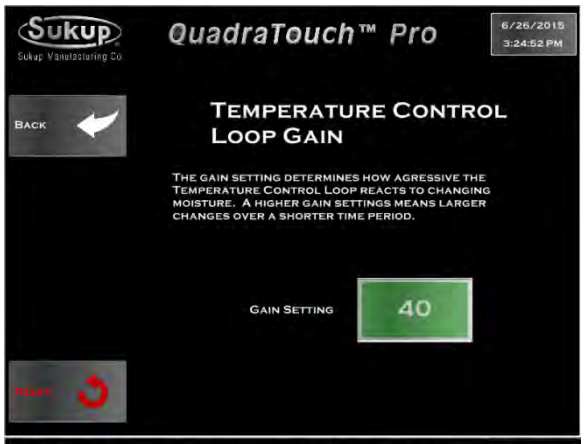
Settings → Meter Roll Settings→ Moisture Gain

The Moisture Loop Gain settings are important for optimum operation when discharging, based on moisture. Choosing a higher setting will mean more aggressive changes in a shorter amount of time. When the dryer is running at slower speeds, this number should stay around 40 or so. Conversely, at higher speeds, it may yield better control to boost this setting up higher.



Settings → Meter Roll Settings→ Meter Roll Deadband

For some systems, it may be preferable to lock in the unload speed when grain is discharging very near the target setpoint. This is referred to as the loop deadband.

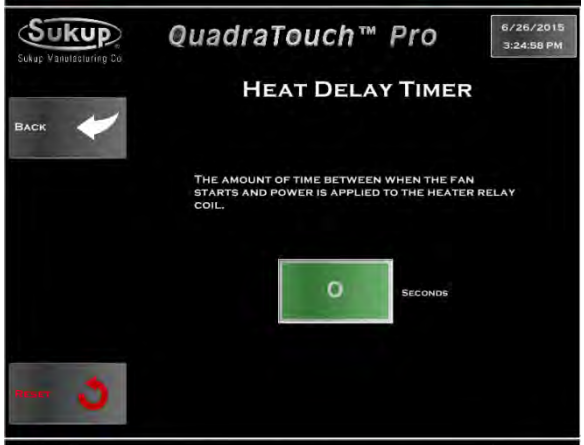


Settings → Meter Roll Settings→ Temperature Gain

The Temperature Gain settings are important for optimum operation when discharging based on temperature. Choosing a higher setting will mean more aggressive changes in a shorter amount of time. When the dryer is running at slower speeds, this number should stay around 40 or so. Conversely, at higher speeds, it may yield better control to boost this setting up higher.

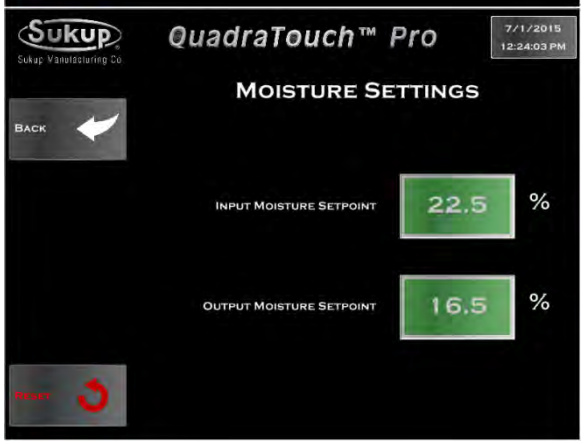
Settings → Meter Roll Settings→ Temperature Deadband

For some systems, it may be preferable to lock in the unload speed when grain is discharging very near the target setpoint. This is referred to as the loop deadband.



Settings → Heat Delay Timer

Sometimes, it may be necessary to put a delay between when the fan starts, and when power is applied to the heater box.



Settings → Moisture Settings

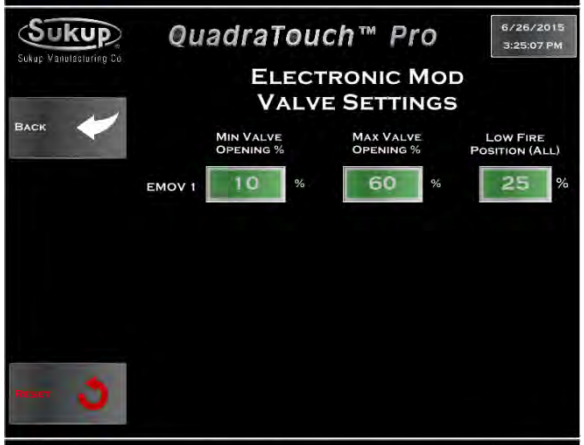
The moisture settings are important for internal calculations as well as the target moisture for grain discharge. These can be accessed almost anytime the dryer is running.

Settings → Fan Shutdown Delay

In addition to the standard 3-second fan shutdown delay, additional time can be added to cool off the grain when stopping operation or fault shutdowns that aren't related to temperature or direct safety.

Settings → Fan Start Delay

This setting dictates the amount of time between fan starts. Stretching this time out may be a good idea if power is limited or motor current draws are very high.



Settings → EMOV Settings

The electronic mod valve settings generally never need to be touched, however, if needed, they are here. The Low Fire Position is the percentage the valve stem will be open when heater ignition takes place.

Settings → Unload Delay

During operation, it sometimes becomes necessary to shut the unload system down to change takeaways, air system distributors, or like situations. This timer will begin counting when the unload is paused, and will cause a fault condition if the unload isn't resumed in time.

Settings → Out of Wet Grain Timer

Defaulted to 10 minutes, this timer begins counting when both paddle switches are down (calling for more grain) and will trigger a fault condition if they aren't satisfied within that period of time.

Settings → Fill Timer

Defaulted to 15 minutes, this timer begins counting when the paddles switches are satisfied and haven't dropped back down. This timer will trigger a fault condition if it expires before the switches drop down again.

Settings → Load Delay

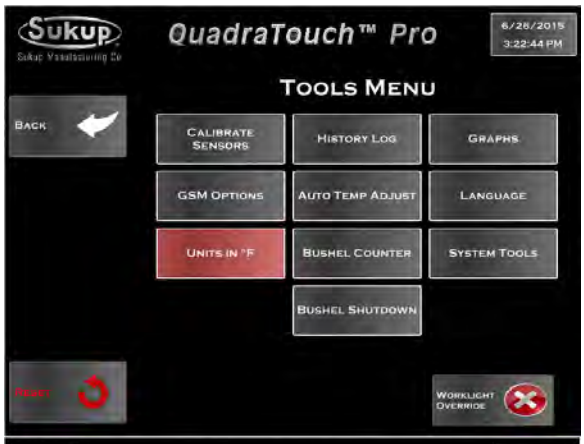
The Load Delay timer is an additional period of time put between when the load auger starts and when the auxiliary devices are energized.

Settings → Unload Cleanout

Additional time for the unload auger to run after a standard shutdown. It provides an opportunity for the unload to clean itself out before shutting down.

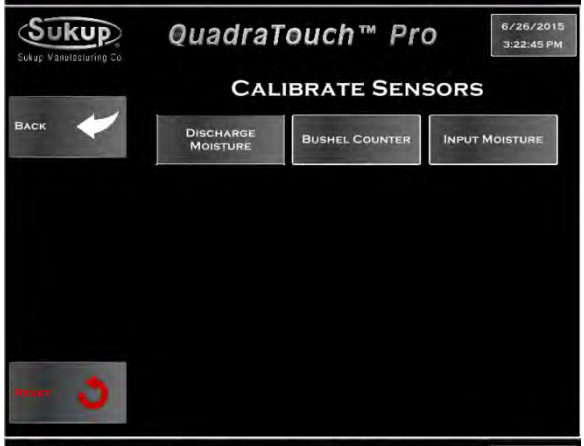
Settings → Set Defaults

If the need ever arises, setting defaults will return all values in the QuadraTouch Pro panel back to factory default settings.



Tools Menu

The Tools menu provides many helpful system settings and options to enhance the drying experience. From using the GSM modem to looking at live and historical graphs, the Tools menu is an important section of the QuadraTouch Pro platform.

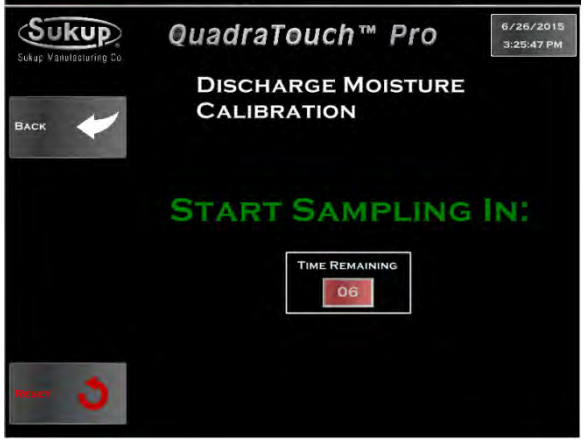


Tools → Calibrate Sensors

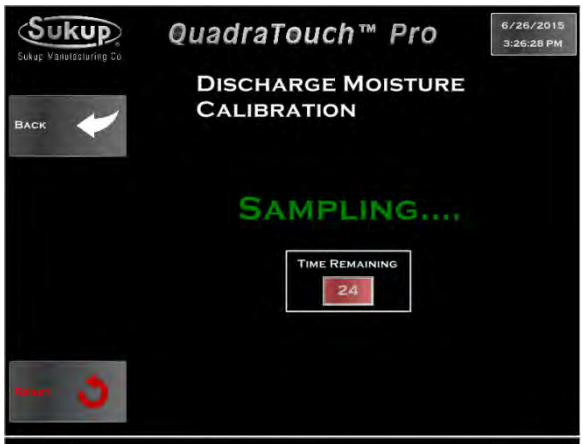
The dryer's moisture sensor(s), as well as the bushel counter, can be calibrated here. The bushel counter must be calibrated in order to access the counting and bushel shutdown features shown in the Tools menu.

Tools → Calibrate Sensors → Discharge Moisture

The dryer's moisture sensor may need to be calibrated during operation. It's important that the dryer is operating under good, usable data.

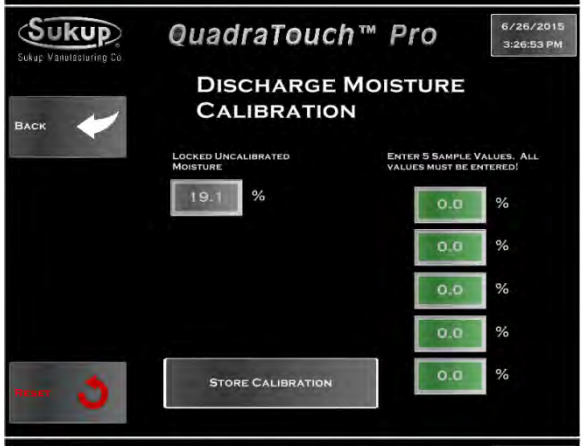


In a nutshell, the dryer will tell you when to go take a sample -- a period of 10 seconds after you are ready to sample. Take a bucket out to the discharge of the dryer and get samples over the course of the next minute. Then enter those samples in on the next page. The dryer retrieves data stored during the previous minute, and then compares it with your data.



Tools → Calibrate Sensors → Discharge Moisture

1-minute sampling period



Tools → Calibrate Sensors → Discharge Moisture

The Locked, Uncalibrated Moisture value is what the sensor recorded over the past minute. Fill in the 5 values on the left with samples you have taken from the bucket. The dryer will do the math for you and store the calibration.

Tools → Calibrate Sensors → Bushel Counter

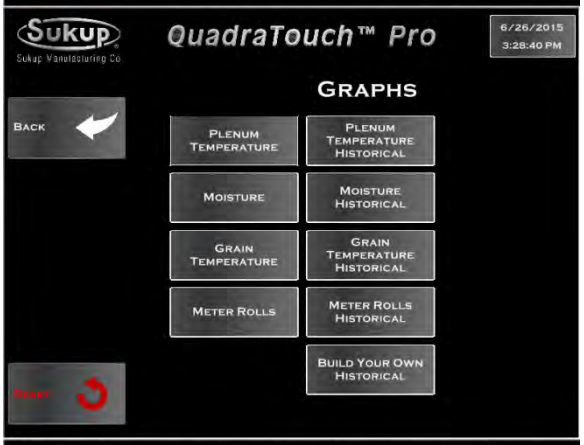
The bushel counter can be calibrated automatically or manually. Automatically is generally the most accurate way to calibrate the counter.

In automatic bushel counter calibration, the dryer needs to be discharging grain into a measurable space like a grain cart or semi load. Press the timer button to start the timer, then when the load is finished, press it again to stop the timer. Then enter the amount of bushels discharged during the time period. The dryer will do the bushel calculation for you.

In manual bushel counter calibration, the user inputs a meter roll speed and an approximate yield at that speed. The dryer will do the bushel/hr calculation for you.

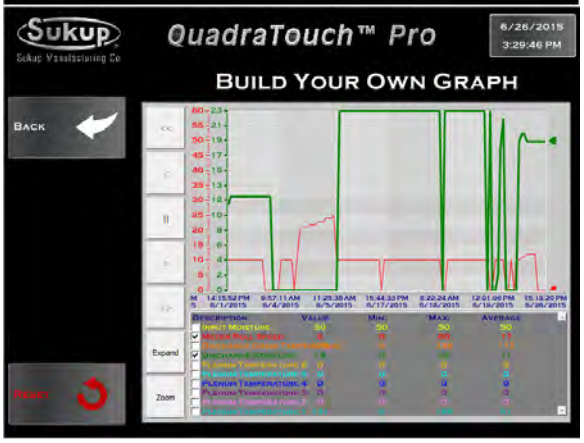
Tools → History Log

The history log contains all the alarms, settings changes, and fault history of the dryer.



Tools → Graphs

The QuadraTouch Pro system allows the user to look at graphs both in real-time and historical methods. Because this screen can contain a lot of data, a stylus may be required to touch the small sections of the screen.

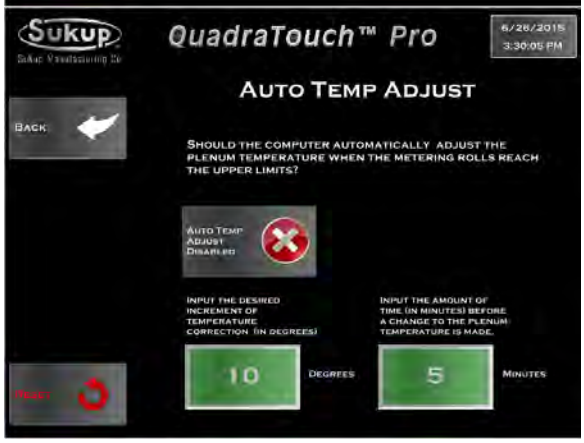


You can also build your own graph where multiple values can be compared.

Tools → GSM Options

If equipped, the GSM modem options give you an opportunity to receive text alerts from the dryer. Up to 2 people can receive them. Further information on the GSM modem can be found by pressing the .PDF logo on this page. It contains installation and operational instructions.

New with QuadraTouch Pro, there is also a GSM diagnostics section that helps with first time setup to ensure the modem is operating correctly.

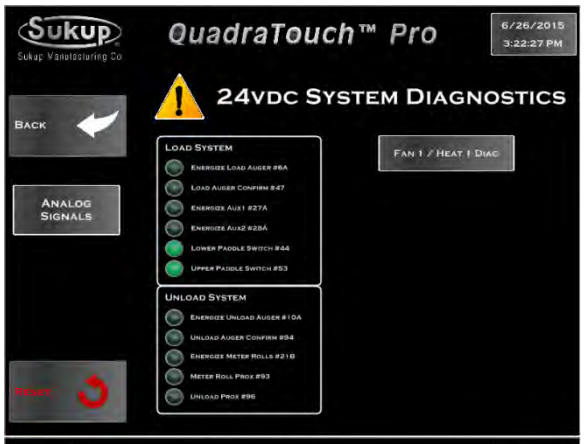


Tools → Auto Temp Adjust

If enabled, the Auto Temp adjust feature will turn down the temperature inside the plenum when the dryer reaches its upper roll speed limit. Therefore, when the dryer is trying to run faster than is allowed, it will automatically turn down its drying temperature.

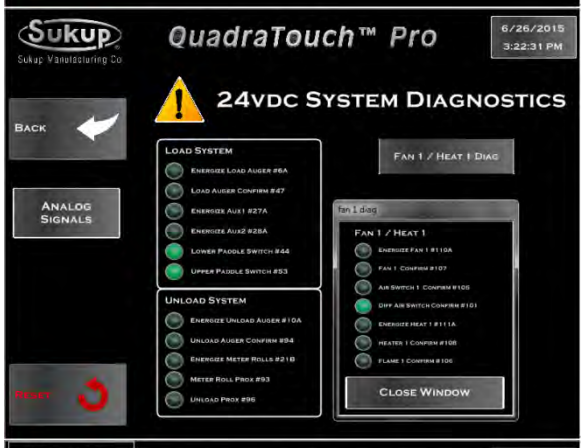
Tools → Language Selection

Coming 2016

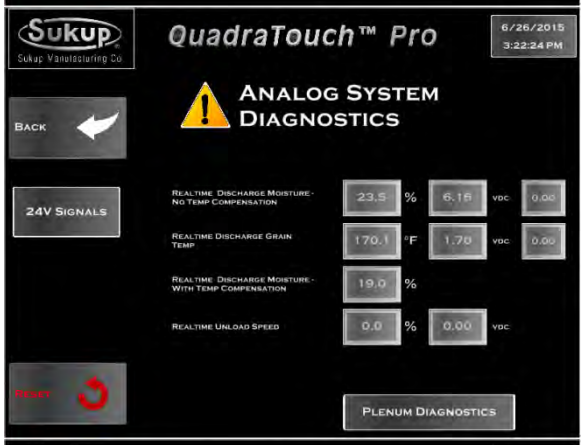


Tools → System Diagnostics

The System Diagnostics menu provides an overview of all the main system signals and those of the ones relating to the individual fan(s) and heater(s). A green light means that that circuit has 24vdc on it. This menu can be accessed at almost any time by pressing on the SUKUP logo on the top left of your screen.



The individual fan inputs/outputs are shown here.

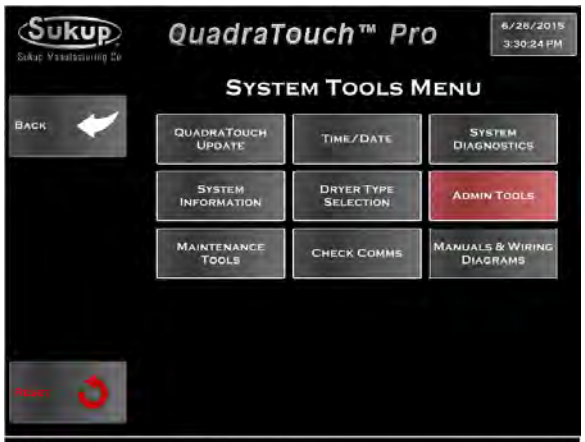


Tools → System Diagnostics → Analog Signals

The QuadraTouch Pro system provides real-time feedback of all the analog input sensors and output reference signals. Pressing “Plenum Diagnostics” will show each plenum feedback value, and the reference signal and percentage opening on the EMOV.

Tools → System Diagnostics → Analog Signals→ Plenum Diagnostics

Values for each individual plenum are shown here.



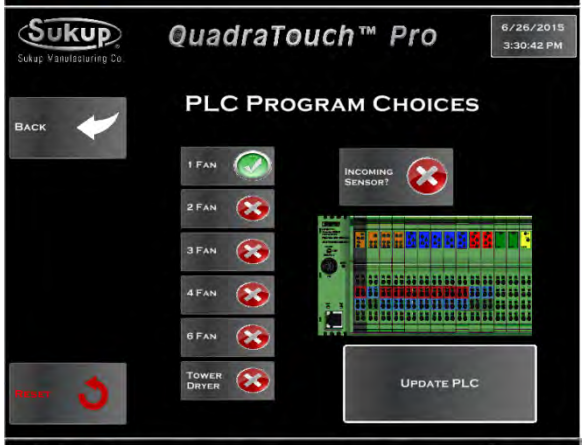
Tools → System Tools

The System Tools menu is very important to the QuadraTouch Pro system. It provides a wide range of functionality and has many features that help maintain and update the system.

Tools → System Tools → QuadraTouch Update

Download the newest QuadraTouch Pro software from our website, extract the contents. You will find a folder called "project" in the extracted contents. Copy that folder onto the root directory of a USB stick. Insert that stick into the external USB port of the QuadraTouch Pro (located on the bottom of the box), and press "Step 1" – if the files were put onto the USB stick correctly, the file transfer will begin automatically.

After the QuadraTouch Pro has restarted, it will prompt you to perform step 2. Here, you'll select which PLC is being programmed. Make sure the PLC setup you choose matches what's inside the power cabinet! If you choose the wrong one, it will tell you, and get you back to programming page to try again.

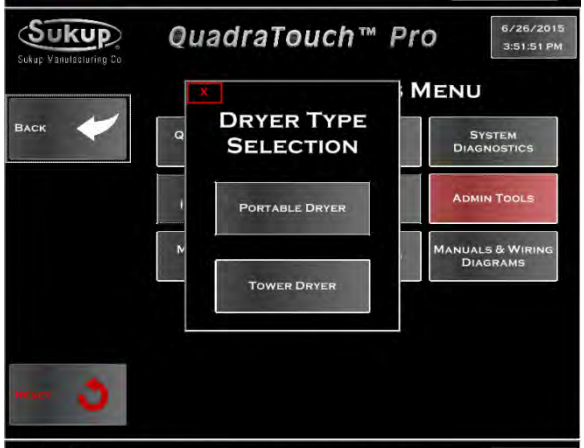


Tools → System Tools → System Information

This page shows the software versions of the PLC and the HMI. They are released together, so they should always match. If the HMI version is older than the PLC version somehow, make sure to perform a QuadraTouch™ update.

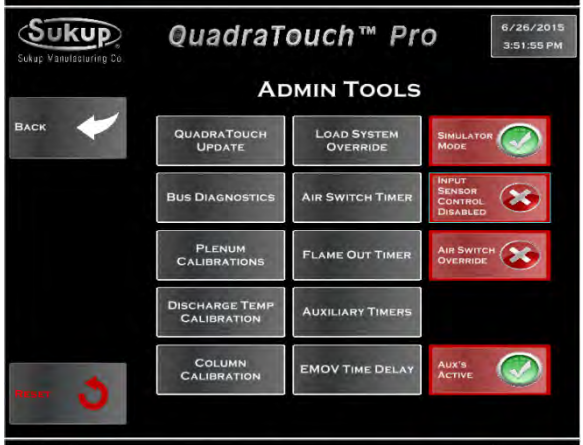
Tools → System Tools → Time and Date

Set system time and date information. It will be used for all graphing and historical data.



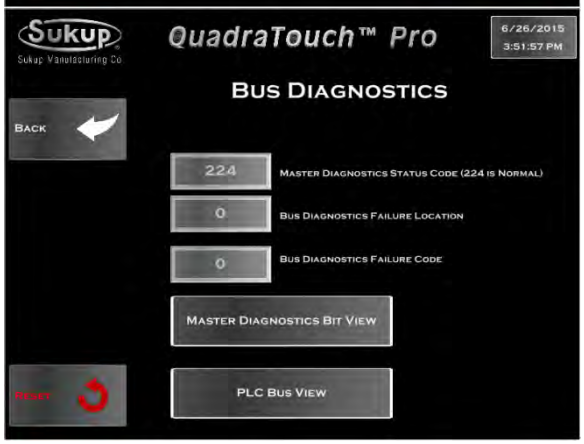
Tools → System Tools → Dryer Type

The QuadraTouch Pro software contains enough information to run an 8' single fan dryer and a 10,000 bu/hr Tower Dryer. Your system should be factory-preset for your specific dryer, but if needed, you can select that here. The QuadraTouch Pro needs to be restarted when changing this setting. It will do so automatically.



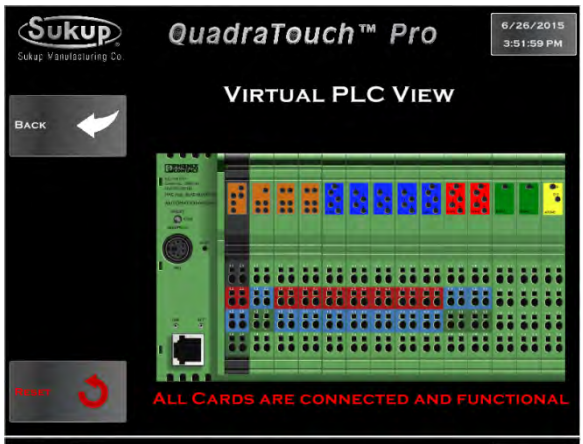
Tools → System Tools → Admin Tools

The Admin Tools menu provides the option to change critical settings inside the QuadraTouch Pro environment.
NOTICE: DO NOT CHANGE any of these settings without thorough knowledge of dryer operation and very close attention to detail. Changing settings and/or using the overrides can result in permanent damage to the dryer!



Tools → System Tools → Admin Tools →Bus Diagnostics

This section provides critical information about the PLC. This menu would only need to be accessed in the event of a PLC or I/O card failure.



Tools → System Tools → Admin Tools →Bus Diagnostics → PLC Bus View

This shows a picture of your PLC and identifies any problems with it. In the event a device is not functioning properly, it will be highlighted for easy serviceability.

Tools → System Tools → Admin Tools →Bus Diagnostics → Master Diagnostic Bit View

The information contained here will most likely only be needed by a Sukup Service Technician.

Tools → System Tools → Admin Tools →Load System Override

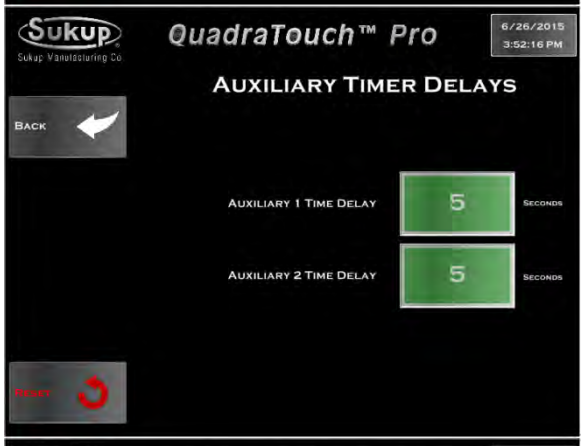
Sometimes it becomes necessary to run the load auger or auxiliary devices independently of each other irrespective of the paddle switch position. This mode allows you to do that. However, permanent damage can occur if it's not used properly.

Tools → System Tools → Admin Tools → Air Switch Timer

The air switch will need to be satisfied within 5 seconds after the fan contactor closes. With a Soft Start, the air switch is given until the fan reaches run state. In the event that the fan doesn't get up to speed during that amount of time, this timer can be adjusted to allow for longer ramp time.

Tools → System Tools → Admin Tools → Flame Out Timer

In the event the heater ignition isn't taking place within 45 seconds of heater power, a longer flame fault time may be needed.

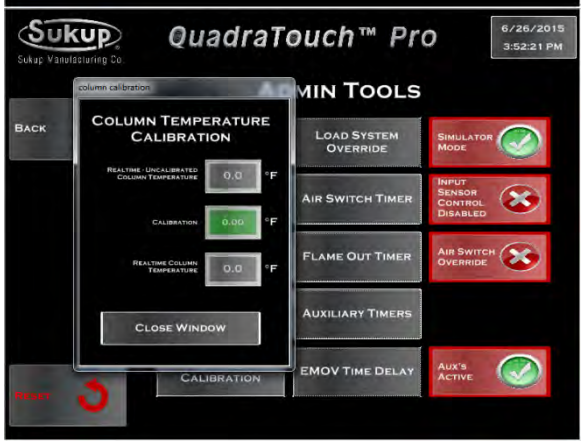


Tools → System Tools → Admin Tools → Auxiliary Timer Delays

This feature allows the user to select how much time delay takes place between when the load auger, aux 1, and aux 2 relays are pulled in. This feature is especially helpful in large incline situations.

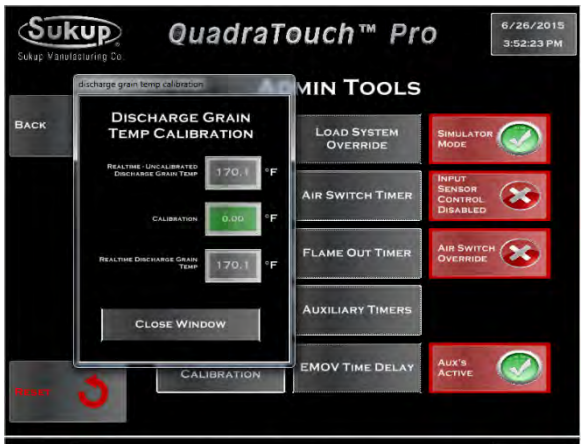
Tools → System Tools → Admin Tools → EMOV Time Delay

During Dry Fire mode, the heater will ignite, but wait a period of time before allowing the EMOV to take control of burner temperature. This time delay can be used to set the STEM valve of each heater. The factory setting is 5 PSI at low fire of 25% open.



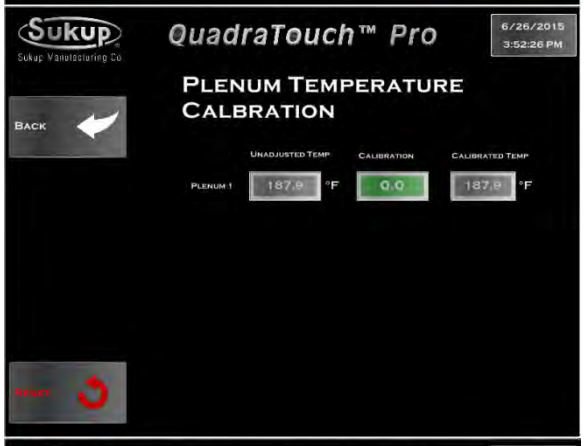
Tools → System Tools → Admin Tools → Column Calibration

Here is a quick menu to calibrate the column RTD if equipped. This sensor is generally very accurate, so exercise caution when adjusting this value.



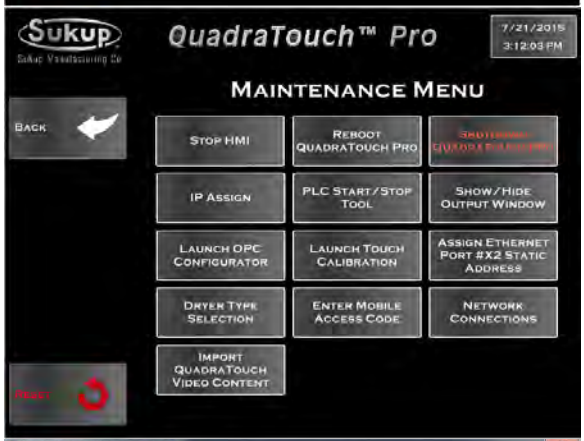
Tools → System Tools → Admin Tools → Discharge Grain Temp Calibration

Here is a quick menu to calibrate the discharge grain temp on the moisture sensor. This sensor is generally very accurate, so exercise caution when adjusting this value.



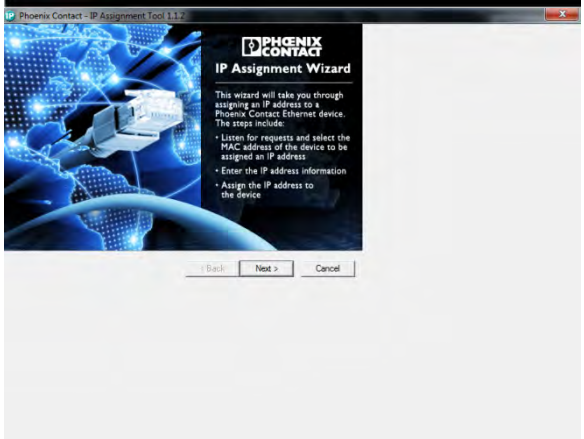
Tools → System Tools → Admin Tools → Plenum Temperature Calibration

Here is a quick menu to calibrate the individual Plenums. These sensors are generally very accurate, so exercise caution when adjusting these values.



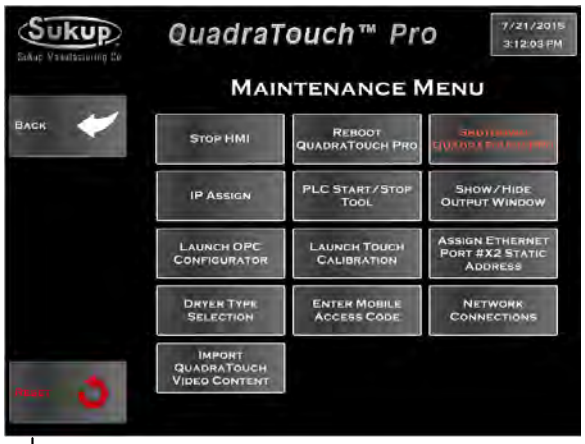
Tools → System Tools → Maintenance Menu

The QuadraTouch Pro System is equipped with many special Apps to make operation as reliable as possible. Most of these tools will never need to be used, but in the event they are needed, they are preloaded on your system for added convenience.



Tools → System Tools → Maintenance Menu → IP Assign

The IP Assign tool is used to give a PLC an IP address when it's reset to out-of-box condition. Consult your dealer before using this tool. A USB keyboard will be needed.



Tools → System Tools → Maintenance Menu → Launch Touch Calibration

In the event the cursor doesn't align exactly where your finger touches the screen, you can easily calibrate the touch panel to your desired specifications. Choose "Launch Touch Calibration" to open the calibration screen.

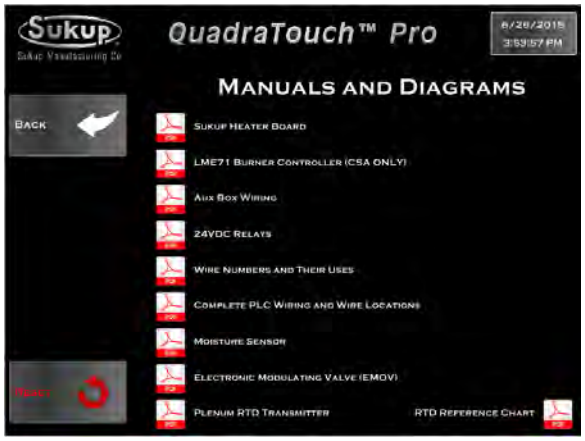
Touch the 4 Corners on the panel calibration shown left.

Tools → System Tools → Maintenance Menu → Mobile App Code

Coming in 2016: a full-blown remote access interface will be available from any phone or tablet. Directly access and partially control your dryer from anywhere in the world.

Tools → System Tools → Maintenance Menu → Comm Check

This value should read 192 when the OPC server is running. The xPLC Toggle Bit should be turning ON and OFF when the PLC and Touch Panel are talking to each other.



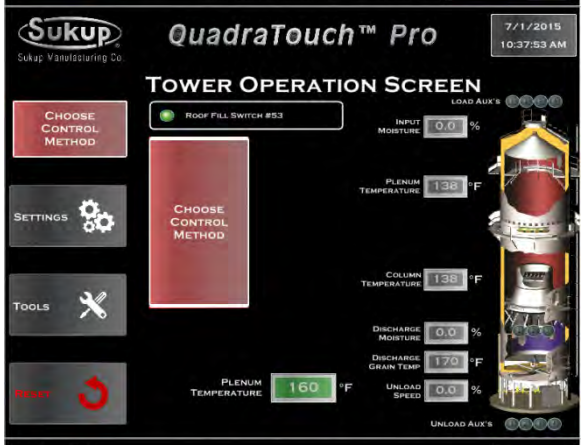
Tools → System Tools → Maintenance Menu → Manuals and Diagrams

Here, entire copies of the system manuals and wiring diagrams can be found. Information related to specific components and frequently asked questions is located here.

Tower Dryer Operation

When operating the Tower Dryer, the program flow is similar to that found on previous pages for portable dryers, with a few exceptions. They are described here.

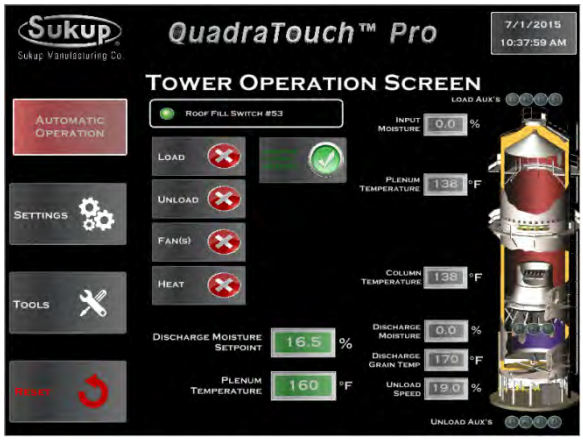
The first key difference is in the “Start” menu. It will prompt you to answer if the burner tarp has been removed.



Choosing Control Method

In Tower Operation, you will first choose the control method (automatic or manual). The control method can be changed by pressing either of the two red rectangles.

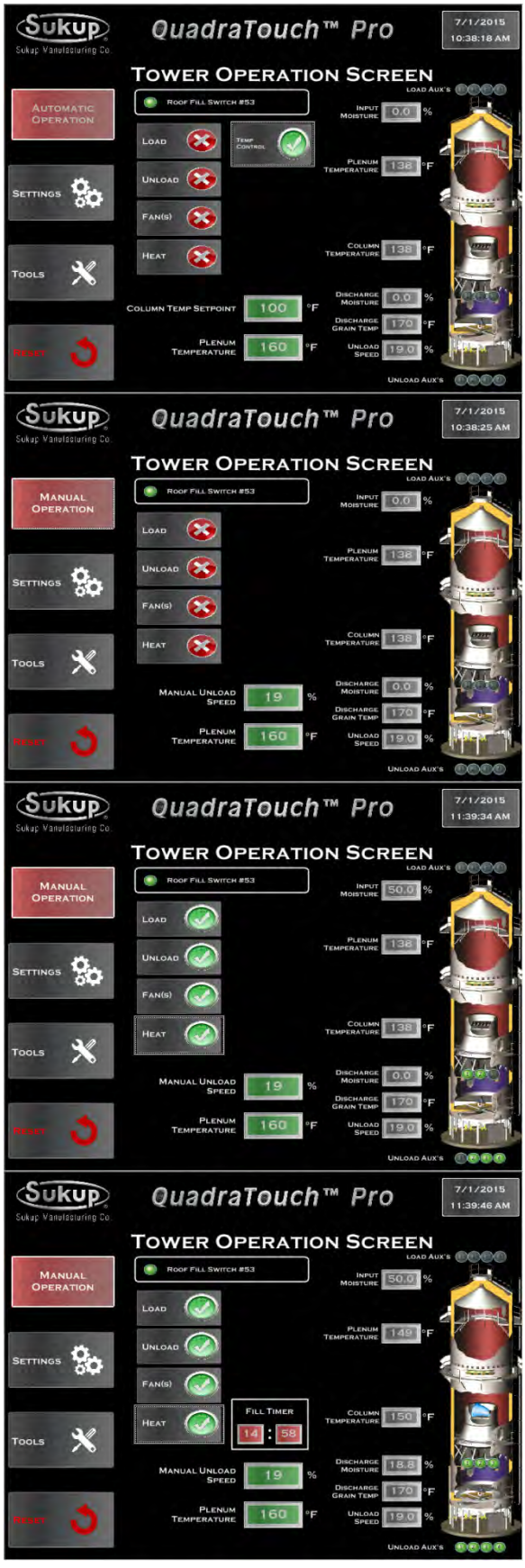
Choose how you’d like to operate the Tower Dryer.



Automatic Operation

Choosing Automatic Operation, the larger of the two red rectangles disappears, leaving the controls for the load and unload systems, fan(s) and heater.

Notice to the right there is a blinking button indicating you are discharging based on moisture or grain column temperature.



Changing from Moisture to Temperature Control

Toggling the blinking button will change from moisture to temperature control. You'll notice the temperature setpoint will appear on the bottom in place of the moisture setpoint.

Manual Operation

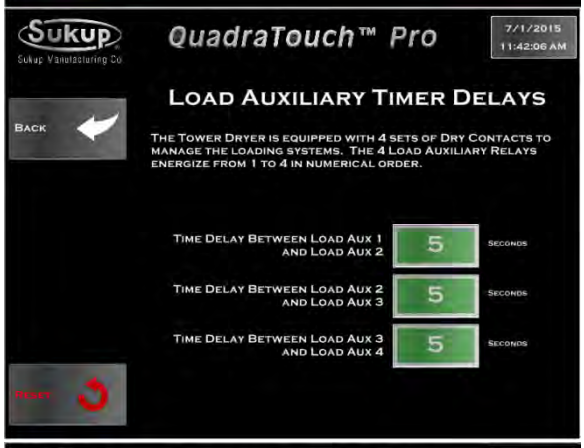
Choosing the red rectangle, you can change the operation method to manual operation, as shown here. Notice the temperature and moisture setpoints are removed, and they are replaced with a manual unload speed setting.

Turning the load, unload, fan(s), and heat on, you can see the devices turning on in order. The fans will start up in sequence along with the load and unload systems. An animated blue flame will show up when the burner control unit senses flame.

As soon as the unload table has started, any applicable countdown timers will be displayed. Notice the Fill Timer displayed in the bottom center of the screen.

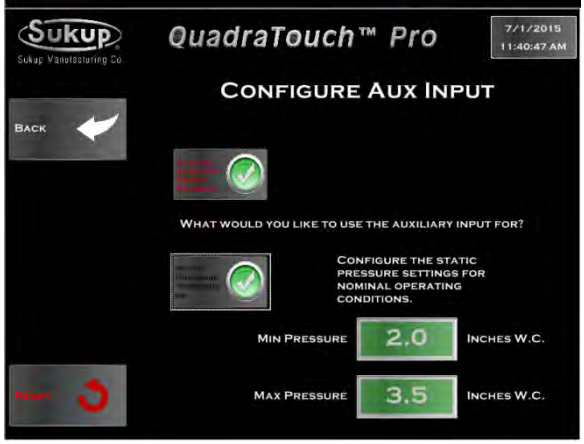
Settings Menu

The settings menu is relatively the same as the portable dryer software with an exception at the bottom of the page for load and unload auxiliary timers. (Settings menu for portable dryers begins on page 9 of this Software Manual.)



Time delays between load auxiliaries can be programmed here.

Time delays between unload auxiliaries can be programmed here.



Tools→System Tools → Maintenance Tools→ Configure Aux Input

New for QuadraTouch Pro, the available analog input can be configured for an additional temperature readout or static air pressure sensor. Ask your local Sukup dealer about this feature.

Sukup Manufacturing Co.
1555 255th Street, Box 677
Sheffield, Iowa, USA 50475-0677
Phone: 641-892-4222 **Fax: 641-892-4629**
Website: www.sukup.com **Email: info@sukup.com**

Wire Numbers and their Uses: QuadraTouch Pro™ 2016 Tower Dryer

Common System Wires		
Wire #	**Description**	**Use**
LINE	120VAC supply from transformer to CB7	Line power from Transformer
0	120VAC from bottom of CB2 to E-Stop	Conductor between CB2 and E-Stop
1	120VAC supply after E-Stop	Emergency Switched Control Supply
2	Neutral Wire	Provides Return for 110V circuits
4	Main shunt trip	Trips Main disconnect by breaking 110V Circuit
5A	28VDC Aux Load #1 PLC Load Relay Coil	28VDC energizes relays K12A & K12B
5	Aux Load #1 Dry Contacts	Customer supply's voltage then when K12A Relay closes power flows 5C
5C	Aux Load #1 Dry Contacts	Customer supply's voltage then when K12A Relay closes power flows 5
6A	28VDC Aux Load #2 PLC Load Relay Coil	28VDC energizes relay K13
6	Aux Load #2 Dry Contacts	Customer supply's voltage then when K13 Relay closes power flows 6C
6C	Aux Load #2 Dry Contacts	Customer supply's voltage then when K13 Relay closes power flows 6
7A	28VDC Aux Load #3 PLC Load Relay Coil	28VDC energizes relay K14
7	Aux Load #3 Dry Contacts	Customer supply's voltage then when K14 Relay closes power flows 7C
7C	Aux Load #3 Dry Contacts	Customer supply's voltage then when K14 Relay closes power flows 7
8A	28VDC Aux Load #4 PLC Load Relay Coil	28VDC energizes relay K15
8	Aux Load #4 Dry Contacts	Customer supply's voltage then when K15 Relay closes power flows 8C
8C	Aux Load #4 Dry Contacts	Customer supply's voltage then when K15 Relay closes power flows 8
9	120V Heater strips on gas valves	When main switch is on 110V is supplied
10A	28VDC unload power ON from PLC	28VDC energizes unload relay K21
10D	28VDC TO VFD LI1	28VDC energizes LI1 on the VFD
11A	28VDC Heater Enable from PLC	28VDC energizes relays K5A & K5B
11B	28VDC Heater Interlock from PLC	28VDC energizes relays K6A & K6B
12	120V Alarm Horn	120V Supplied when relay K7 is energized
12A	28VDC Alarm Horn from PLC	28VDC energizes relay K7

Wire Numbers and their Uses: QuadraTouch Pro™ 2016 Tower Dryer

Common System Wires		
Wire #	**Description**	**Use**
13	120V Red Light	120V Supplied when relay K8 is energized
13A	28VDC Red Light from PLC	28VDC energizes relay K8
14	120V Ignition Transformer	Supplies Voltage to Igniter
15	120V Pilot Solenoid Valve	Supplies Voltage to Solenoid Valves through LME 69
16	120V To the main Gas Valves	Supplies Voltage to Main Gas Valves through LME 69
17	Reference Voltage from PLC TO VFD	0 to 10 volt reference for AC Drive, 1V=10% meter roll, 10V=100% meter roll
18	24V supply	Powered from PLC DC supply, provides voltage for sensors
19	120V switch leg for Work Light	Provides switched 120V for work light (120V present, work light ON)
19A	24VDC K5 PLC Work Light Relay Coil	28VDC present energizes PLC Work light Relay K5
22	120V Low Gas Pressure Switch	Supplies Voltage to the Dungs Low Pressure Switch
23	120V High Gas Pressure Switch	Supplies Voltage to the Dungs High Pressure Switch
24	120V To Heater Interlock	120V To Heater Interlock relay K6A
25	120V To the 1st Gas Valve (P.O.C) Proof of Closure	120V To 1st Gas Valve and Heater on CR2A Relay
26	120V To the 2nd Gas Valve (P.O.C) Proof of Closure	120V To 2nd Gas Valve (P.O.C)
27	120V To Heater Enable Relay	120V from Heater On CR2A to Heater Enable K5A Relays
28	120V Low Fire Limit Switch	120V To Limit Switch and Heater On CR2B Relay
29	120V Low Fire Limit Switch	120V to the LME 69 Burner Control Unit
30A	28VDC Aux Unload #4 PLC Load Relay Coil	28VDC energizes relay K16
30	Aux Unload #4 Dry Contacts	Customer supply's voltage then when K16 Relay closes power flows 30C
30C	Aux Unload #4 Dry Contacts	Customer supply's voltage then when K16 Relay closes power flows 30
31A	28VDC Aux Unload #3 PLC Load Relay Coil	28VDC energizes relay K17
31	Aux Unload #3 Dry Contacts	Customer supply's voltage then when K17 Relay closes power flows 31C
31C	Aux Unload #3 Dry Contacts	Customer supply's voltage then when K17 Relay closes power flows 31
32A	28VDC Aux Unload #2 PLC Load Relay Coil	28VDC energizes relay K18

Wire Numbers and their Uses: QuadraTouch Pro™ 2016 Tower Dryer

Common System Wires		
Wire #	**Description**	**Use**
32	Aux Unload #2 Dry Contacts	Customer supply's voltage then when K18 Relay closes power flows 32C
32C	Aux Unload #2 Dry Contacts	Customer supply's voltage then when K18 Relay closes power flows 32
33A	28VDC Aux Unload #1 PLC Load Relay Coil	28VDC energizes relay K19
33	Aux Unload #1 Dry Contacts	Customer supply's voltage then when K18 Relay closes power flows 33C
33C	Aux Unload #1 Dry Contacts	Customer supply's voltage then when K18 Relay closes power flows 33
34	28VDC Load System Start	28VDC Signal from PLC Load On
35	28VDC Unload System Start	28VDC Signal from PLC Unload On
36	Rear door signal wire	28VDC present = Door closed, provides voltage at PLC for door status (Doors are in series)
37	Vapor Over Temp (L.P. Dryers Only)	28VDC present = status ok, provides voltage at PLC for over temp switch status
38	Burner Failure	28VDC Supplied to PLC for heater fault relay CR3 closes
39	Plenum Over Temp	28VDC = status ok, provides voltage at PLC for plenum high temperature
43	Heater Interlock LME 69	120V = status ok, provides voltage to LME 69 through relay K6B
45	Flame On Signal	28VDC Supplied to PLC for heater on signal when relay CR2C closes
46	Flame Sensing	Min. 5 Micro Amp signal required to the LME 69 Burner Control Unit
47	PLC load ON input	28VDC present = Load ON, provides PLC with status of load operation (on or off)
48	Heat On Signal	28VDC present = Heat ON, provides PLC with status of load operation (on or off)
49A	Motor overload- Unload Motor	28VDC present = status ok, provides voltage back to PLC for overload status of unload
49B	Motor overload--Fan #1	28VDC present = status ok, provides voltage back to PLC for overload status Fan#1
49C	Motor overload- Fan #2	28VDC present = status ok, provides voltage back to PLC for overload status Fan#2
49	Motor overload- Fan #3	28VDC present = status ok, provides voltage back to PLC for overload status Fan#3
52	Remote Reset for Burner Control Unit	120V = status ok, provides voltage to LME 69 Reset
53	Upper Grain paddle switch	24VDC present = Status Dryer FULL
57	Soft Start #1 Fault	28VDC present = status ok, provides voltage back to PLC for overload status soft start #1
58	Soft Start #2 Fault	28VDC present = status ok, provides voltage back to PLC for overload status soft start #2

Wire Numbers and their Uses: QuadraTouch Pro™ 2016 Tower Dryer

Common System Wires		
Wire #	**Description**	**Use**
59	Soft Start #3 Fault	28VDC present = status ok, provides voltage back to PLC for overload status soft start #3
61	DC Control Voltage to EMOV Valve	1-10 VDC Signal from PLC to the EMOV Valve
62	Static Sample Gate Motor	28VDC from K22A relay to top side CB1 Breaker
63	Static Sample Gate Motor	28VDC from K22B relay to top side CB1 Breaker
64	Static Sample Gate Motor	28VDC to Gate Motor after unload is running reverses polarity through relays
65	Static Sample Gate Motor	28VDC to Gate Motor after unload is running reverses polarity through relays
66	Static Sample Gate Prox Switch	28VDC present = status ok, provides voltage back to PLC for Gate
70	RTD Grain Column Temp Signal Wire	Provides signal from transmitter 0 – 5 volt DC reference voltage
71	RTD Grain Plenum Temp Signal Wire	Provides signal from transmitter 0 – 5 volt DC reference voltage
73	RTD Yellow Wire Plenum	Provides resistance signal from RTD measured in Ohms
74	RTD Red Wire Plenum	Provides resistance signal from RTD measured in Ohms
76	RTD White Wire Grain Column	Provides resistance signal from RTD measured in Ohms
77	RTD Yellow Wire Grain Column	Provides resistance signal from RTD measured in Ohms
80	Lower Column Over Temp Sensor	28VDC present = status ok, provides voltage back to PLC for over temp status
81	Lower Column Over Temp Sensor	28VDC present = status ok, provides voltage back to PLC for over temp status
82	Middle Column Over Temp Sensor	28VDC present = status ok, provides voltage back to PLC for over temp status
83	Middle Column Over Temp Sensor	28VDC present = status ok, provides voltage back to PLC for over temp status
84	Upper Column Over Temp Sensor	28VDC present = status ok, provides voltage back to PLC for over temp status
85	Upper Column Over Temp Sensor	28VDC present = status ok, provides voltage back to PLC for over temp status
94	Unload VFD ON signal	28VDC present = status ok, provides voltage back to PLC for VFD On
95	Common reference on PLC for 24V supply	24VDC ground. DC Common
U	User Fault Circuit	24VDC = User Fault OK – Jumped out from the factory.
D3	Moisture sensor blue, 0V to 3VDC temperature signal to the PLC	Provides the processor with a voltage signal corresponding to temperature
D4	Moisture sensor black, 0 to 9VDC moisture signal to the PLC	Provides the processor with a voltage signal corresponding to moisture
D5	Moisture sensor black, 0 to 9VDC moisture signal to the PLC	Provides the processor with a voltage signal corresponding to moisture

Wire Numbers and their Uses: QuadraTouch Pro™ 2016 Tower Dryer

Common System Wires

Fan # 1		
Wire #	**Description**	**Use**
110A	28VDC from PLC to K2 Fan# 1 Relay	28VDC present energizes Fan# 1 Relay K2
110	110V power from K2 Fan# 1 Relay to Soft Start & Hour Meter	110V present energizes Fan#1 contactor or soft start and supply power Fan# 1
111A	28VDC from PLC to K9 Fan# 1 Shunt Trip Relay	28VDC present energizes Shunt Trip Relay K9
111	110V power from K9 Fan# 1 Shunt Trip Relay	110V present energizes Shunt Trip Fan# 1
116A	24VDC K20 PLC Liquid Gas Solenoid Relay	24VDC present energizes Main Liquid Gas Solenoid Relay K20
116	110V Liquid Gas Solenoid ON	110V present energizes Liquid Gas Solenoid
143	28VDC Fan# 1 Air Pressure Switch	28VDC from Fan #1 Air Switch to Input on the PLC
146	28VDC Fan# 1 ON Signal	28VDC from Soft Start to Input on the PLC

Fan # 2		
Wire #	**Description**	**Use**
210A	28VDC from PLC to K3 Fan# 2 Relay	28VDC present energizes Fan# 2 Relay K3
210	110V power from K3 Fan# 2 Relay to Soft Start & Hour Meter	110V present energizes Fan# 2 contactor or soft start and supply power Fan# 2
211A	28VDC from PLC to K10 Fan# 2 Shunt Trip Relay	28VDC present energizes Shunt Trip Relay K10
211	110V power from K10 Fan# 2 Shunt Trip Relay	110V present energizes Shunt Trip Fan# 2
243	28VDC Fan# 2 Air Pressure Switch	28VDC from Fan# 2 Air Switch to Input on the PLC
246	28VDC Fan #2 ON Signal	28VDC from Soft Start to Input on the PLC

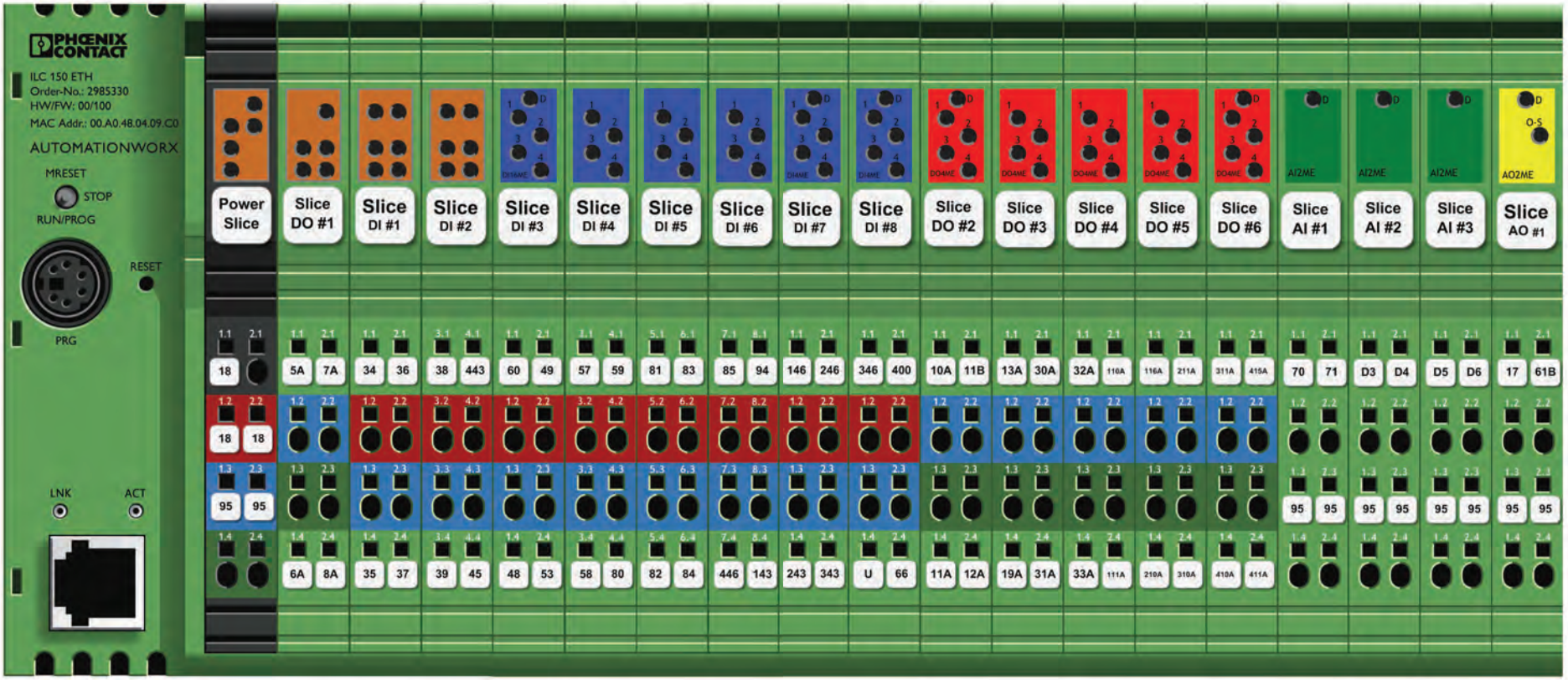
Fan # 3		
Wire #	**Description**	**Use**
310A	28VDC from PLC to K4 Fan# 3 Relay	28VDC present energizes Fan# 3 Relay K4
310	110V power from K4 Fan# 3 Relay to Soft Start & Hour Meter	110V present energizes Fan# 3 contactor or soft start and supply power Fan# 3
311A	28VDC from PLC to K11 Fan# 3 Shunt Trip Relay	28VDC present energizes Shunt Trip Relay K11
311	110V power from K11 Fan# 3 Shunt Trip Relay	110V present energizes Shunt Trip Fan# 3
343	28VDC Fan# 3 Air Pressure Switch	28VDC from Fan# 3 Air Switch to Input on the PLC
346	28VDC Fan #3 ON Signal	28VDC from Soft Start to Input on the PLC

Wire Numbers and their Uses: QuadraTouch Pro™ 2016 Tower Dryer

Common System Wires

Fan # 4		
Wire #	**Description**	**Use**
410A	28VDC from PLC to K23 Fan# 4 Relay	28VDC present energizes Fan# 4 Relay K23
410	110V power from K23 Fan# 4 Relay to Soft Start & Hour Meter	110V present energizes Fan# 4 contactor or soft start and supply power Fan# 4
411A	28VDC from PLC to K24 Fan# 4 Shunt Trip Relay	28VDC present energizes Shunt Trip Relay K24
411	110V power from K24 Fan# 4 Shunt Trip Relay	110V present energizes Shunt Trip Fan# 4
415A	28VDC Static Sampler	28VDC present energizes Relay K22A & K22B Static Sample Relay
443	28VDC Fan# 4 Air Pressure Switch	28VDC from Fan# 4 Air Switch to Input on the PLC
446	28VDC Fan #4 ON Signal	28VDC from Soft Start to Input on the PLC

Tower Dryer PLC Setup



Title:	Tower Dryer PLC Setup		
Author:	SUKUP MFG CO - MRK		
Date:	8/15	Sheet:	101.4
Revision:			

Emergency Stop and System Control Switch Wiring

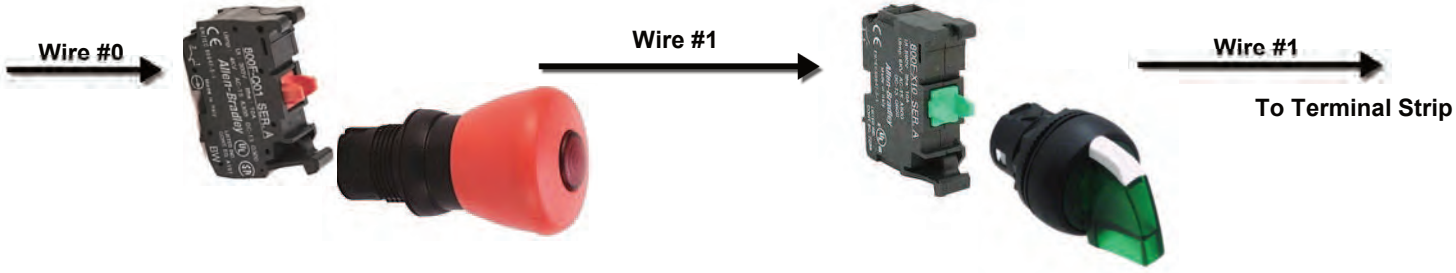
Main Supply Voltage
(From Distribution Block)

2 Pole Primary,
High Side Breaker

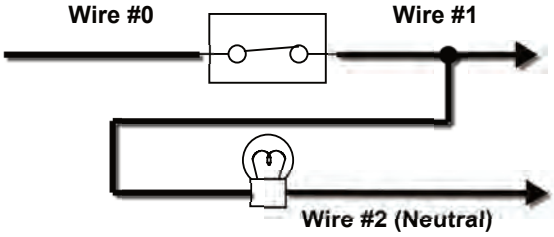
Control Transformer
(High Voltage to 120VAC)

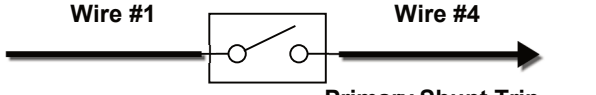
1 Pole Secondary,
Low Side Breaker

NOTE: 575VAC is Fused
Instead of 2 Pole breaker shown



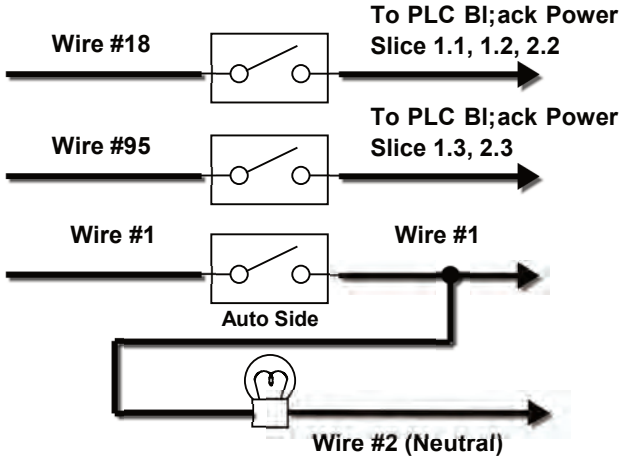
E-STOP
(Emergency Stop Switch)





Primary Shunt Trip
(Main Disconnection Switch)

System Control Switch
Manual ---- OFF ----- Auto
(3 Position)



Title: Tower Dryer: Emergency Stop and System Control Switch Wiring	
Author: SUKUP MFG CO - MRK	
Date: 06/16	Sheet: 101.5
Revision:	

Altivar 312 Tower VFD Control Wiring

#95 Black → COM
#17 Gray → AI1
#10D Blue → LI1
#18 Orange → R1C & R2C
#49A Purple → R1A
#94 Purple → R2A

K21 Relay Pin#14

#21D

#17 Meter Roll Reference Voltage

#17

#95 DC Common (-)

#95

#18 24vdc (+)

#18

#94 Unload Confirmation

#94

#49A Motor Overload Series Circuit

#49A

Title: Tower DRYER: VFD Control Wiring ATV312	
Author: SUKUP MFG CO - MRK	
Date: 06/16	
Revision:	107.5

Heater Control Unit LME69.200C1BM

Factory Jumper Installed between 25, 26, and 27 in *Pipe Train Junction Box on Mod Towers ONLY*

#1 — 3AMP CB 4 — 22 — Dungs Low Pressure Gas Switch — 23 — Dungs High Pressure Gas Switch — 24 — HEATER INTERLOCK RELAY K6A (#11, #14) — 25 — Proof of Closure Switches on *Stick Built Towers Only* — 26 — CR2A P.O.C Switch Bypass (#11, #14) — 27 — HEATER ENABLE RELAY K5A (#11, #14) — 28 — LOW FIRE LIMIT SWITCH — CR2B Low Fire Switch Bypass (#11, #14) — 29 — To LME69 Pin#11

Pin #1 Pin #12

LME69 Pin #1

LME69 Pin #1 — 46 — Flame Rod

LME69 Pin #2 — 2 — Neutral #2

LME69 Pin #4 — 15 — Open Solenoid Valves (Mod Tower) or Pilot Valves (Stick Built) — Mod Towers: To Asco Valve and Siemens Solenoid Valve; Stick Built: To Pilot Valves

LME69 Pin #5 — 16 — CR2A(P.O.C Bypass), CR2B(Low Fire Switch Bypass), CR2C (Flame OK #45) — (#A1) To A1 Coil of Heater On CR2A, CR2B, and CR2C Relays. + To Gas Valve Actuators 1 and 2 *(Stick Built Towers Only)*

LME69 Pin #6 — 43 — Heater InterlockK6B (#14) — White Wire #43 From Heater Interlock K6B Pin #14

LME69 Pin #7 — 14 — To Spark Transformer

LME69 Pin #8 — 52 — White Wire #52 from Heater Reset Push Button (Push to Reset Heater Ignition Sequence)

LME69 Pin #10 — 38A — CR3 (#A1) To A1 Coil of Burner Alarm CR3 Relay (Burner Unit Failure #38)

LME69 Pin #11 — 29 — OK to Start Heater Signal Wire#29 — Red Wire #29 from Control Circuit (shown top of page)

LME69 Pin #12 — 1 — Line 110VAC #1

46 — FLAME ROD

THERMOSTAT & HEATER FOR 1ST GAS VALVE

0 — 9 — VALVE HEATER CB 3 — 9 — 2 — 9 — 2

Main Gas Valve Relay

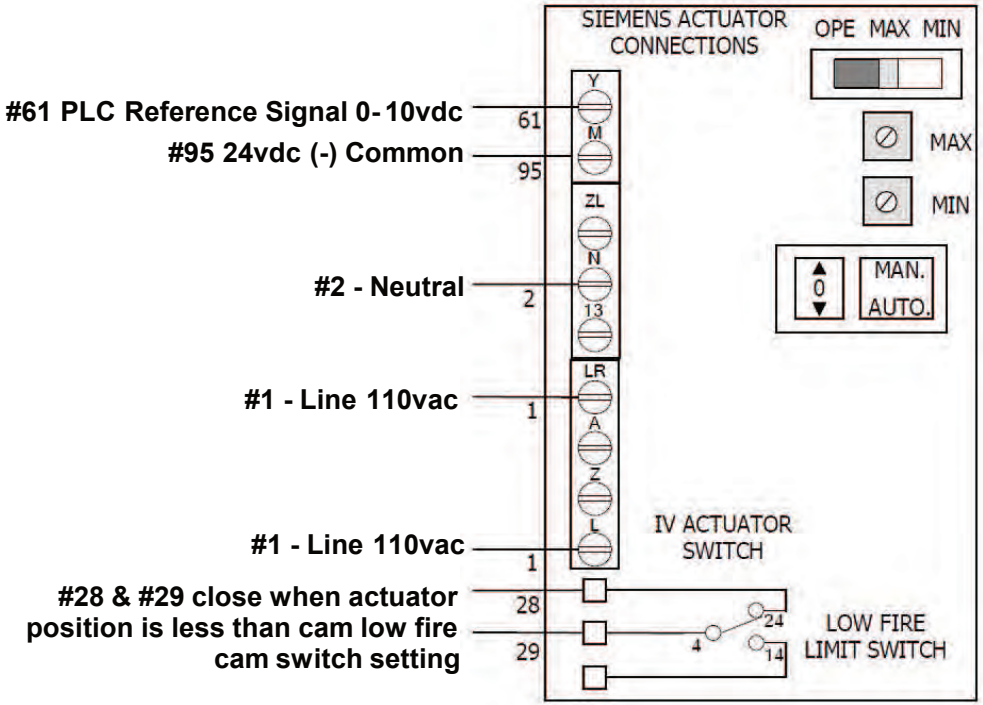
#A1 -- 116A from PLC
#A2 -- Coil return #95
#11 -- 120VAC
#14 -- To Main Gas Valve Coil (120VAC)

Title:	Tower Dryer Heater Control Unit - LME69	
Author:	SUKUP MFG CO - MRK	
Date:	11/15	Sheet: 107.12
Revision:		

Sukup Electronic Modulating Valve Actuator- J62281

Electronic Actuator (EMOV) J62281

The EMOV actuator opens and closes the stem valve on the gas section of the pipe train. The PLC controls the position of the stem valve with the DC reference signal on Pin Y (Wire#61). When the valve is not being controlled, its reference position should be the low fire position (factory default 1.5vdc).



Low Fire Switch Cam #4 (20) →

Loss of Signal Cam #3 (0) →

Min Opening Cam #2 (0) →

Max Opening Cam #1 (85) →

Title:	Sukup Electronic Modulating Valve Actuator (EMOV) J62281	
Author:	SUKUP MFG CO - MRK	
Date:	9/2015	Sheet: 107.14
Revision:	7/2016	

Sukup Electronic Modulating Valve Actuator- J6124

Electronic Actuator (EMOV) J6124

The EMOV actuator opens and closes the stem valve on the vapor section of the pipe train. The PLC controls the position of the control valve with the DC reference signal on Pin 3.

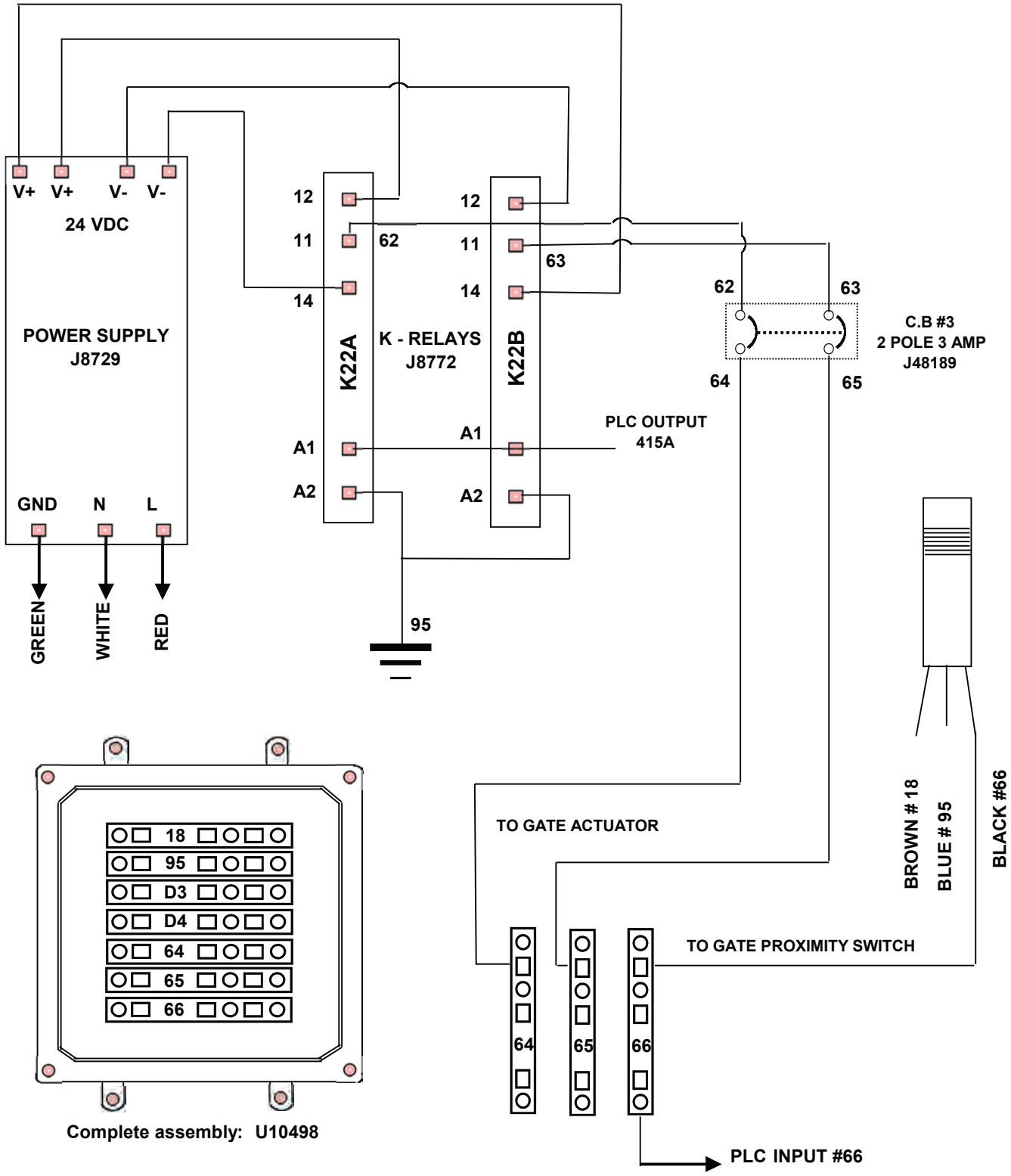
The EMOV actuator also has a clip-on Low Fire Switch on modular Tower Dryers. This ensures that the stem valve has returned to its low-fire position to provide safe burner lighting.

Left to Right
Pin 1: #95
Pin 2: #18
Pin 3: DC Reference
Pin 4: Not Used

Low Fire Switch Pinout
Purple #S1 - Wire #28
Red #S2 - Wire #29
White #S3 - Not Used

Title:	Sukup Electronic Modulating Valve Actuator (EMOV)		
Author:	SUKUP MFG CO - MRK		
Date:	6/2016	Sheet:	107.16
Revision:			

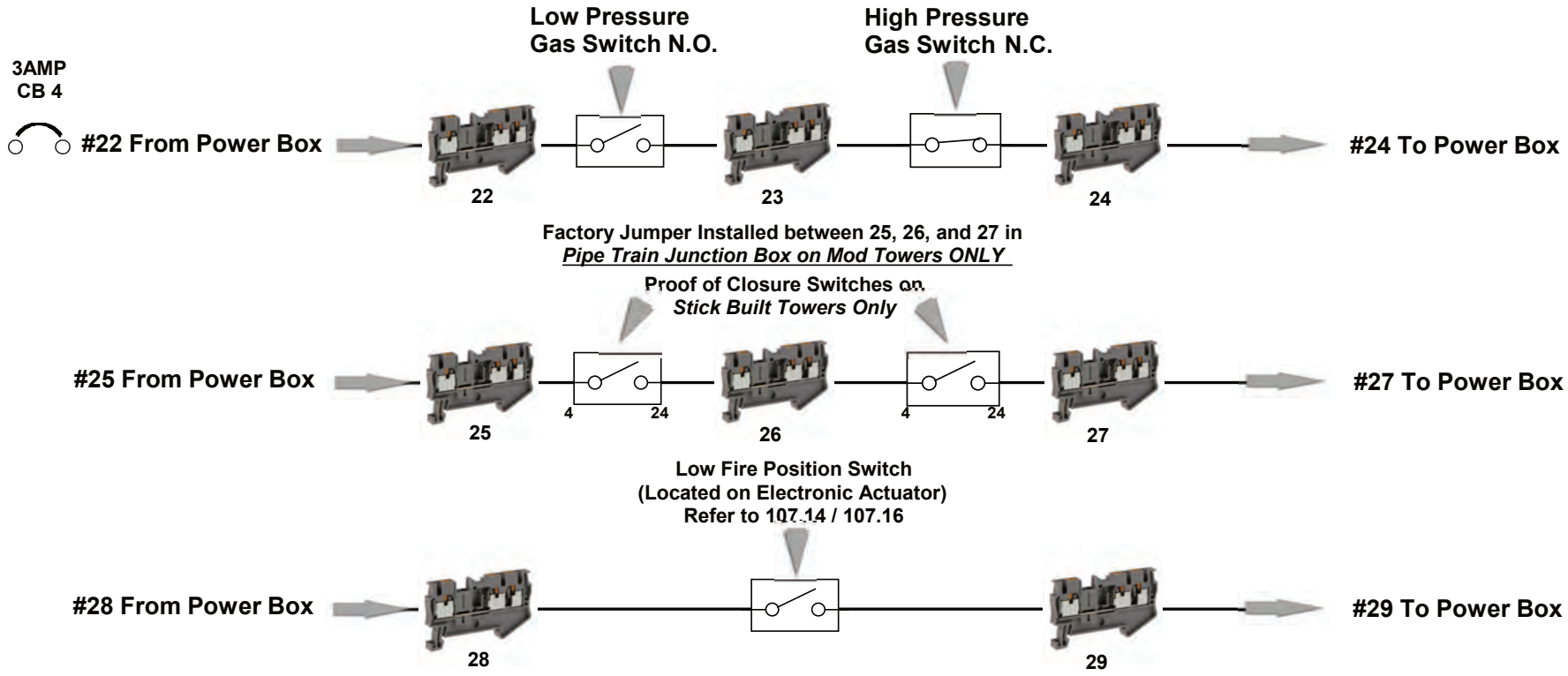
TOWER - STATIC MOISTURE SAMPLE



Complete assembly: U10498

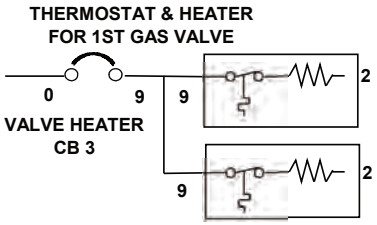
Title: TOWER - STATIC MOISTURE SAMPLER	
Author: SUKUP MANUFACTURING CO.	
Date: 6/16 Revision:	Sheet: 107.18

Heater Pipe Train Junction Box Wiring

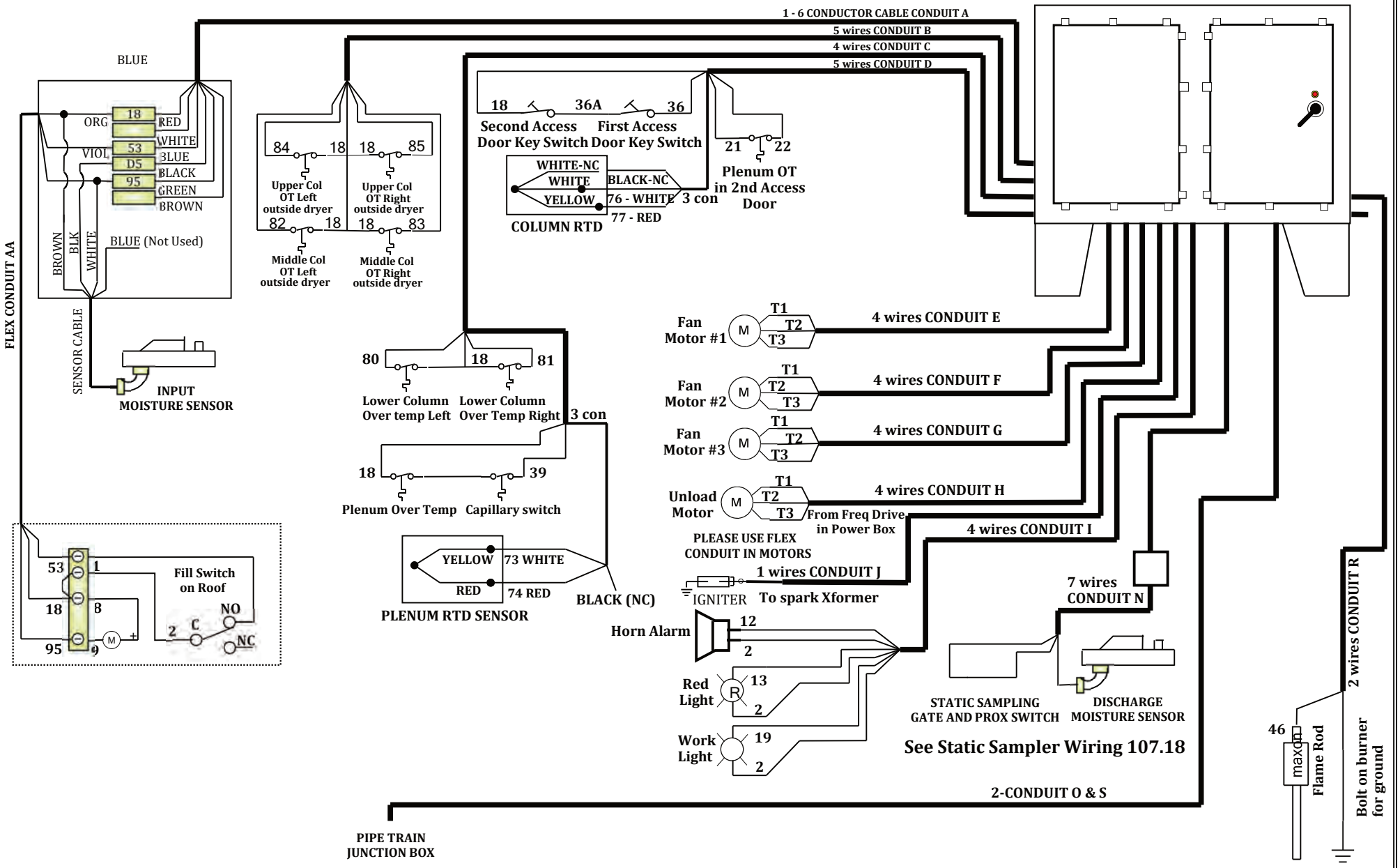


Main Gas Valve Relay

#A1 -- 116A from PLC
#A2 -- Coil return #95
#11 -- 120VAC
#14 -- #116 To Main Gas Valve Coil (120VAC)



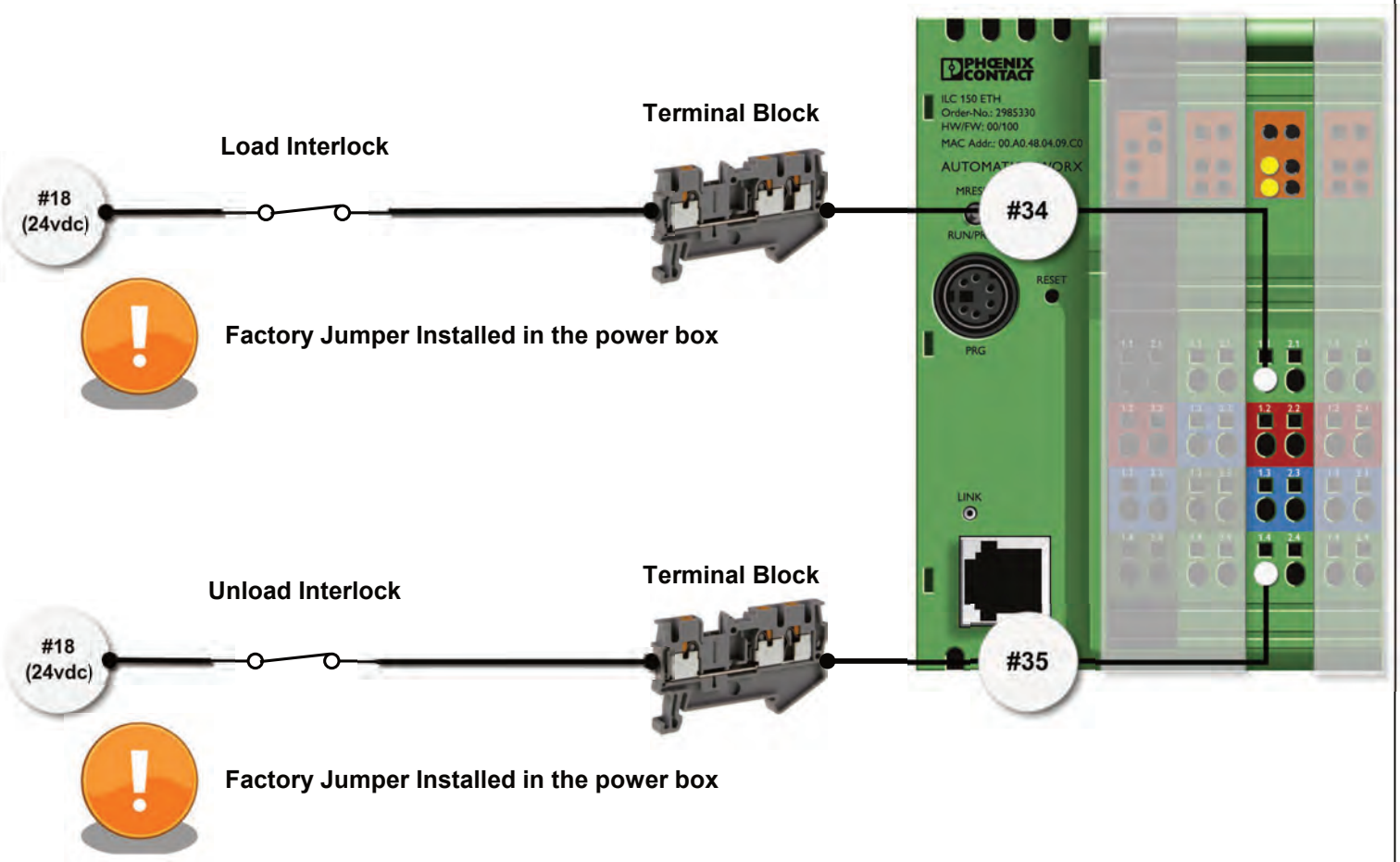
Title:	Tower Dryer - Heater PipeTrain Junction Box		
Author:	SUKUP MFG CO - MRK		
Date:	6/16	Sheet:	107.19
Revision:			



See Heater Junction Box Wiring SHEET 107.19

Title: Sukup Mfg Co. Tower Dryer Installation Wiring	
Author: Sukup Mfg. Co.	
Date: 07/16	Sheet: 107.20
Revision:	

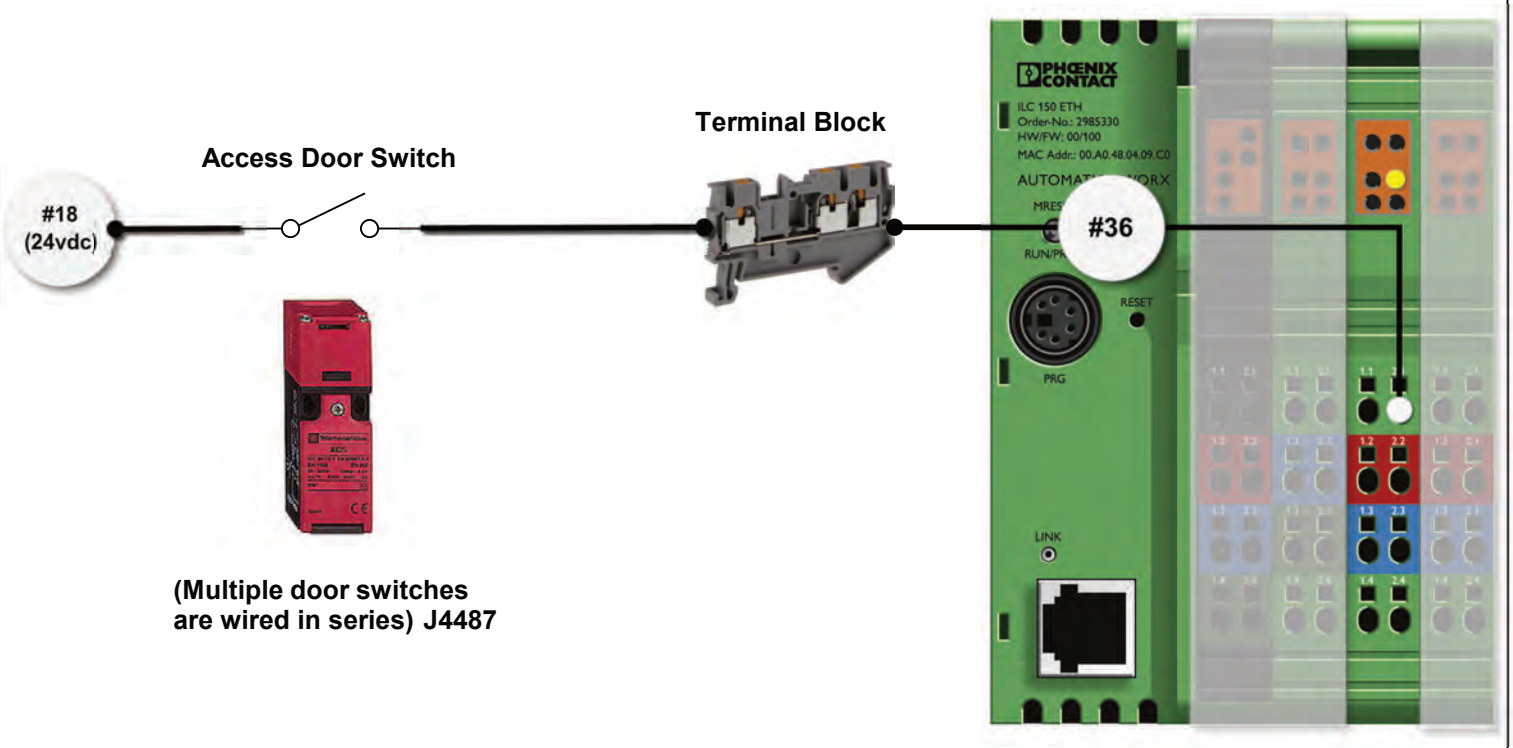
PLC DI SLICE #1 (Load/Unload Interlock Circuits #34, #35)



The customer load and unload interlock circuits must have 24vdc on wire # 34 and #35 respectively. Typically, these circuits are used as a safety interlock to tell the PLC that it's safe to load or unload the dryer. If the load circuit (#34) does not have DC voltage on it, the load will be unable to run. If the unload circuit (#35) does not have DC voltage on it, the unload will still run, but will shutdown after a 7 minute timeout period has expired. The 7 minute timer is also displayed on-screen if applicable.

Title: Tower Dryer Customer Load/Unload Circuits	
Author: SUKUP MFG CO - MRK	
Date: 8/15	Sheet: 108.1
Revision: 5/16	

PLC DI SLICE #1 Access Door Fault #36

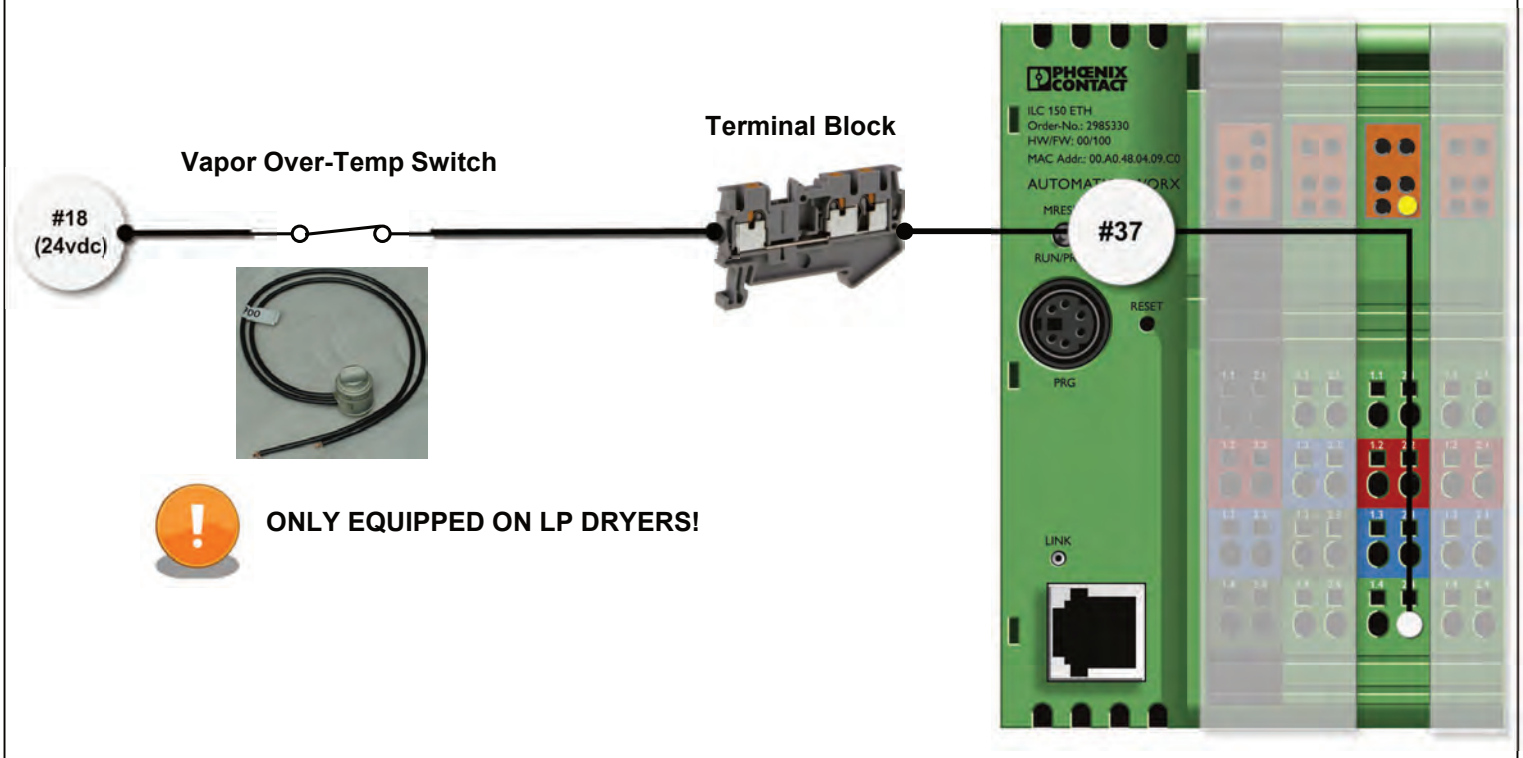


(Multiple door switches are wired in series) J4487

The Access Doors on the tower dryer are required to be shut for operation. Multiple doors are wired in series. The door switch requires the key to be inserted in normal operation, thus sending 24vdc back to the PLC.

Title: Tower DRYER: Access Door Fault #36	
Author: SUKUP MFG CO - MRK	
Date: 08/15	Sheet: 108.2
Revision:	

PLC DI SLICE #1 Vapor Over-Temp #37

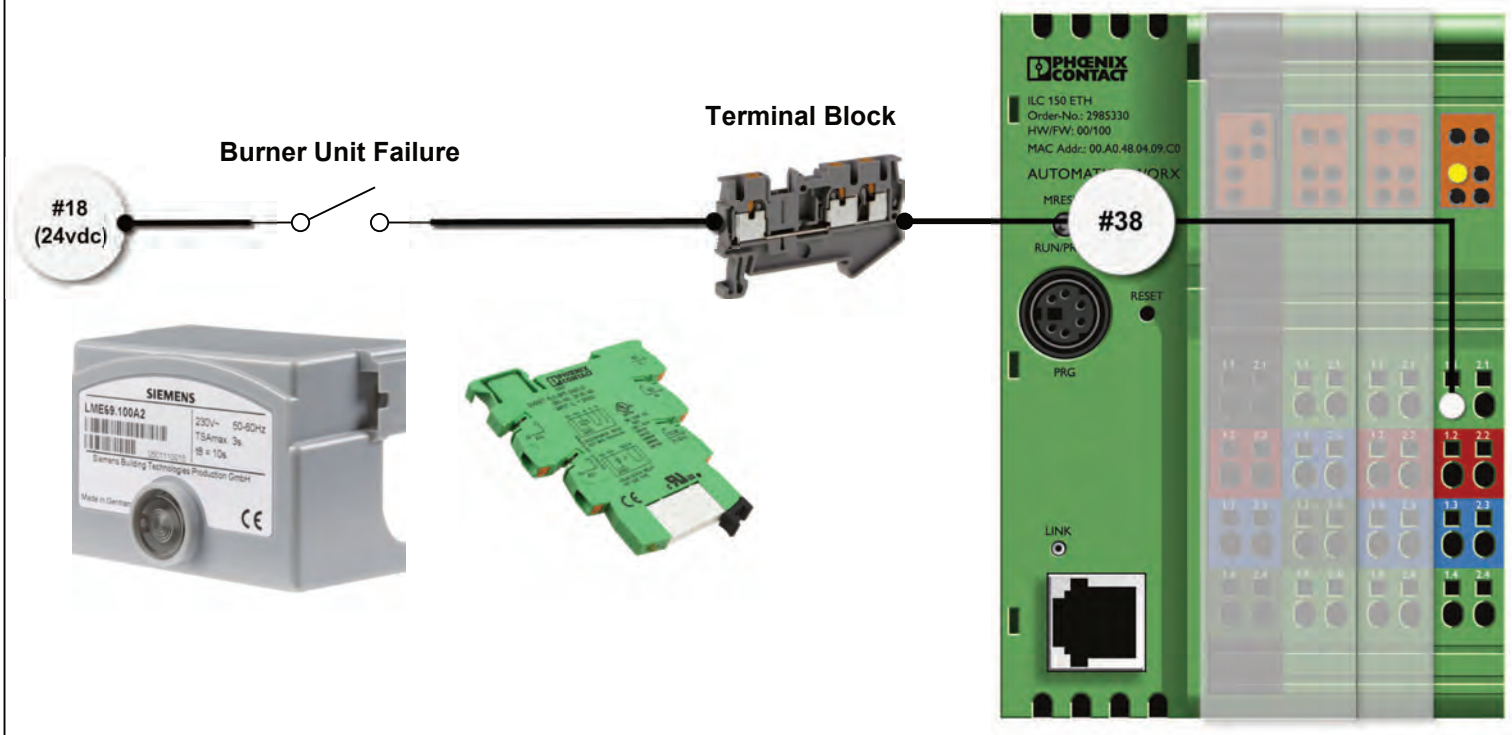


ONLY EQUIPPED ON LP DRYERS!

The Vapor Over-Temp switch monitors the temperature of the LP vapor. If the temperature rises above 140°F, the switch opens and the circuit loses its 24vdc - causing a fault condition.

Title: Tower DRYER: Vapor Over-Temp #37	
Author: SUKUP MFG CO - MRK	
Date: 08/15	Sheet: 108.3
Revision: 5/16	

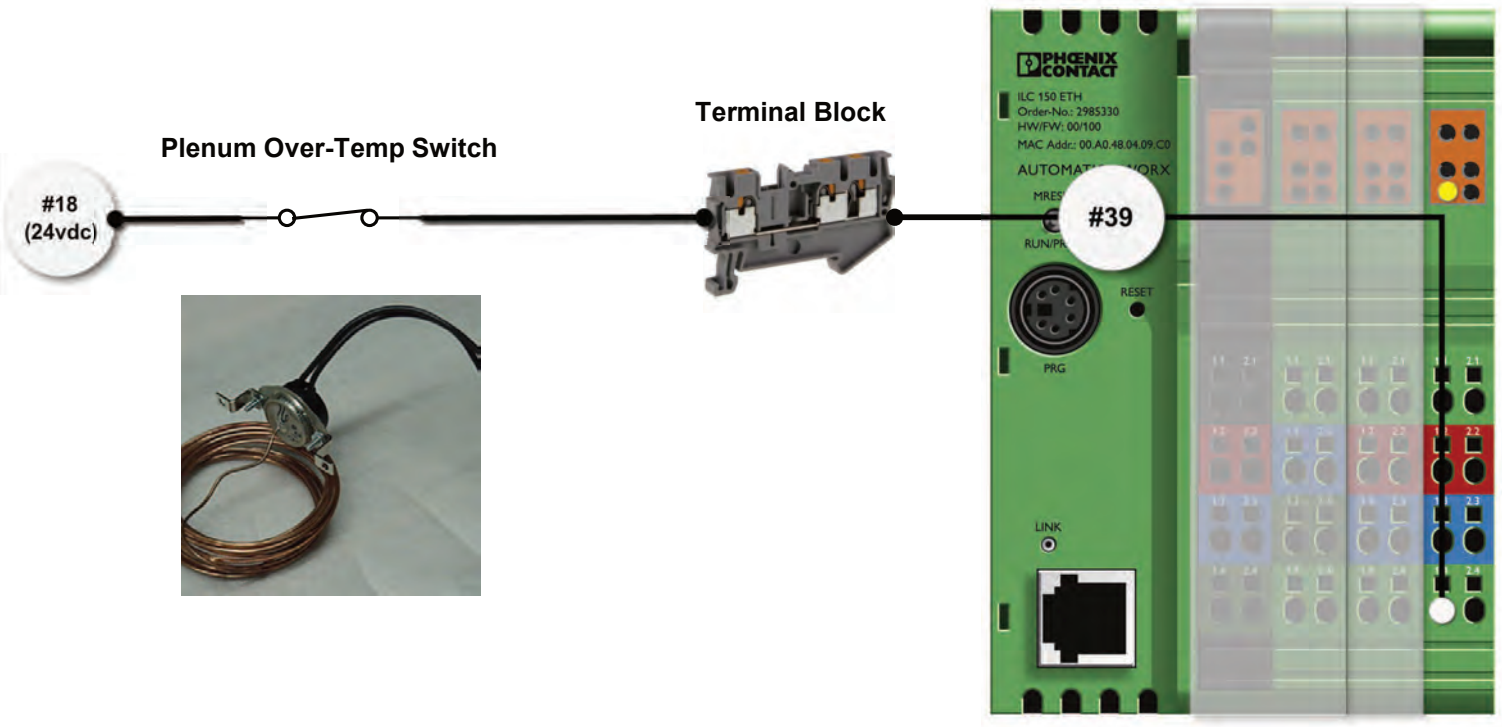
PLC DI SLICE #2 Burner Unit Failure #38



The Burner Unit Controller has a programmable output to tell the PLC if there is a problem with the ignition sequence or burner operation. Pin #10 on the LME69 will pull in the CR3 relay (120vac), sending 24vdc to wire #38. If the PLC sees 24vdc on wire #38, the dryer will shut down if the dryer is trying to unload (#94 ON). Otherwise, the unit can be reset without shutting the dryer down.

Title: Tower DRYER: Burner Unit Failure #38	
Author: SUKUP MFG CO - MRK	
Date: 08/15	Sheet: 108.4
Revision: 5/16	

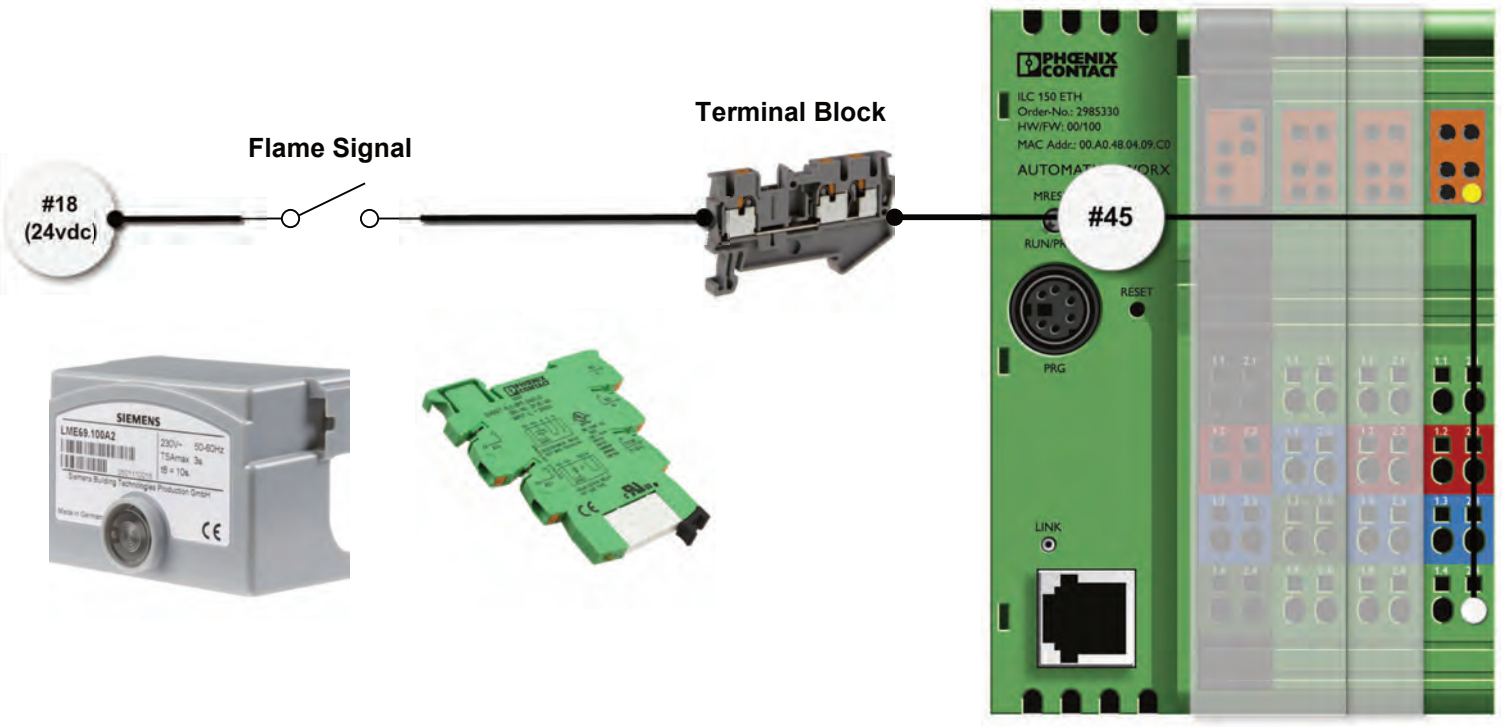
PLC DI SLICE #2 Plenum Overtemp #39



The Plenum Over-Temp Switch is a capillary switch that opens its circuit when any part of the sensor sees at temperature greater than 325°F. Loss of 24vdc on this circuit will cause and immediate shutdown.

Title: Tower DRYER: Plenum Overtemp #39	
Author: SUKUP MFG CO - MRK	
Date: 08/15	Sheet: 108.5
Revision: 5/16	

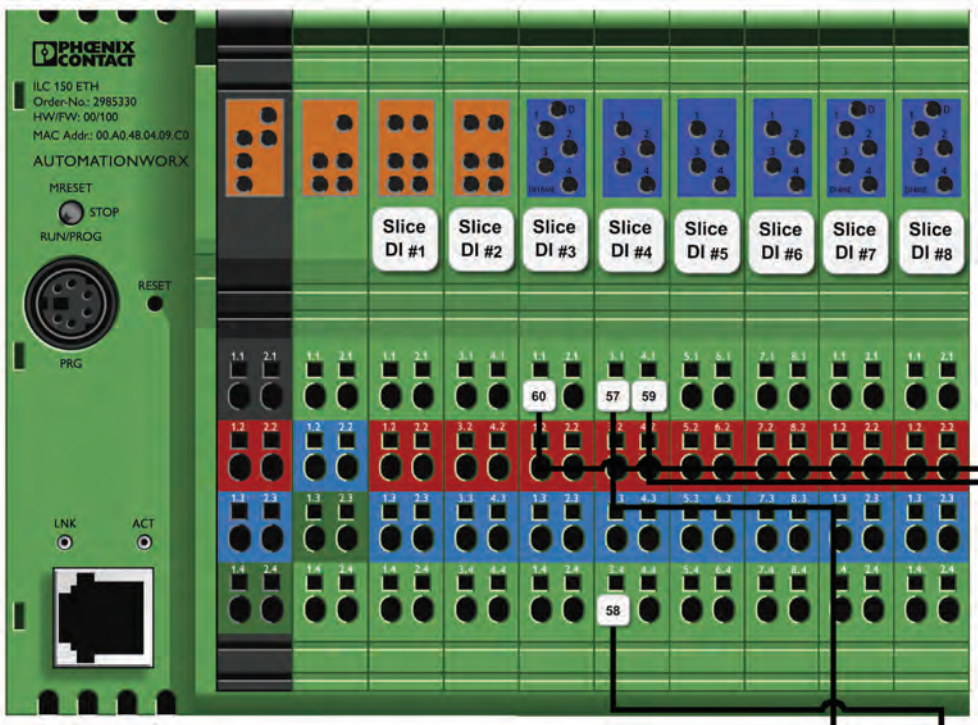
PLC DI SLICE #2 Flame Signal #45

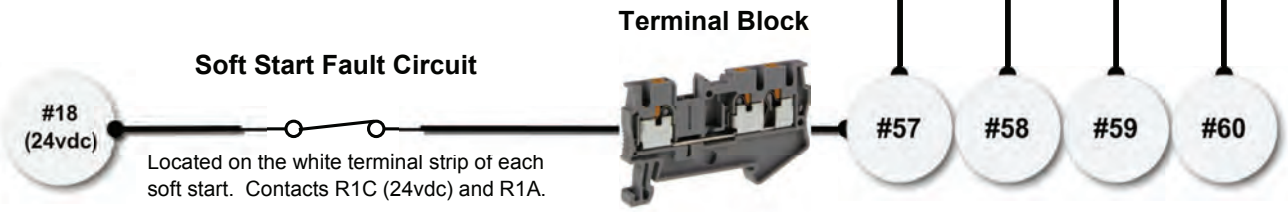


The Flame Circuit starts as a signal that is monitored by the Burner Control unit. The Burner Control unit is connected to a Flame Rod located inside the tower dryer at the heating element. When Flame is sensed, a 120VAC output it sent from Burner Control unit to a PLC relay, converting the signal to 24vdc, and input into the PLC on wire #45.

Title: Tower DRYER: Flame Signal #45	
Author: SUKUP MFG CO - MRK	
Date: 08/15	Sheet: 108.6
Revision:	

Tower Dryer Soft Start Fault #57, #58, #59, #60



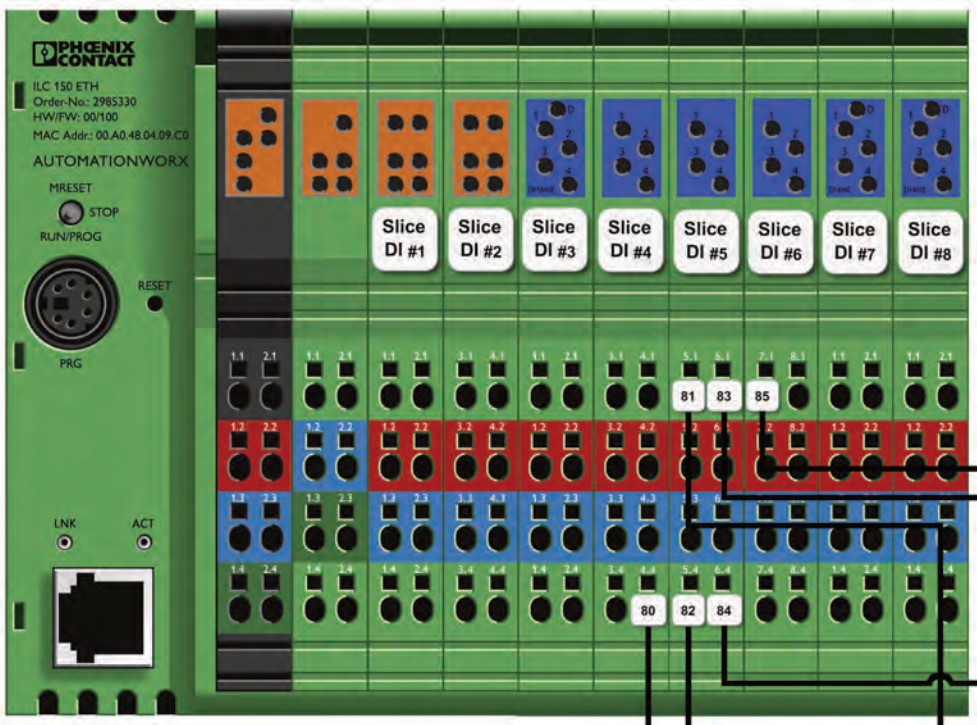


Located on the white terminal strip of each soft start. Contacts R1C (24vdc) and R1A.

The Soft Start Fault Circuit is designed to monitor each soft start for any failures. In the event the soft start faults, the contact on R1A opens, and the dryer will shutdown.

Title: Tower DRYER: Soft Start Fault Circuit	
Author: SUKUP MFG CO - MRK	
Date: 8/15	
Revision: 5/16	108.7

Tower Dryer Column Over-Temp Fault #80, #81, #82, #83, #84, #85



Terminal Block

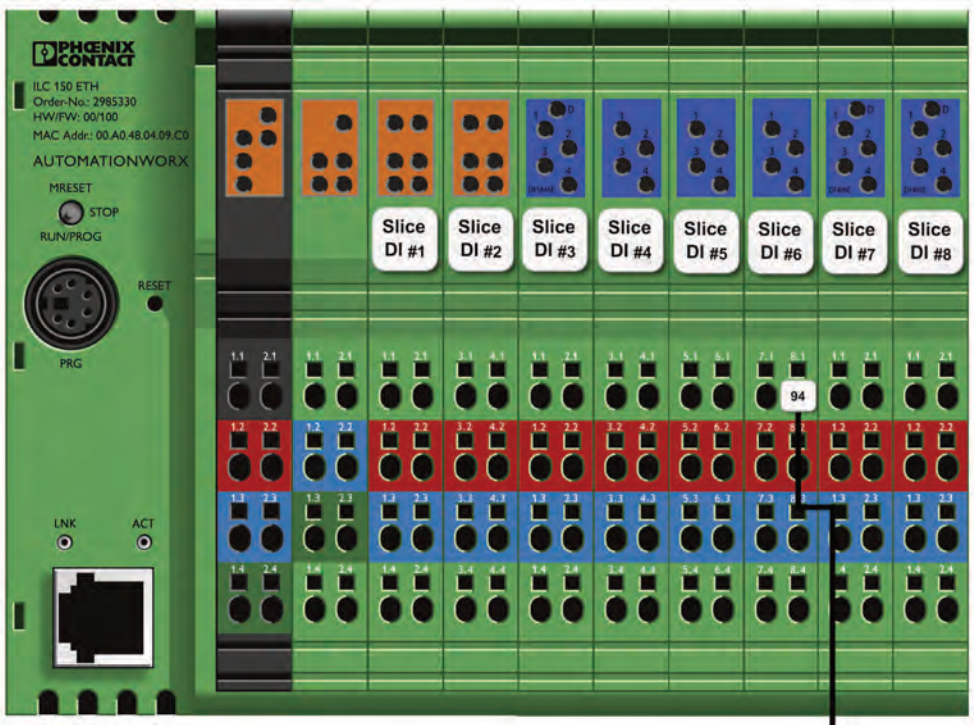
Column Over-Temp Switches

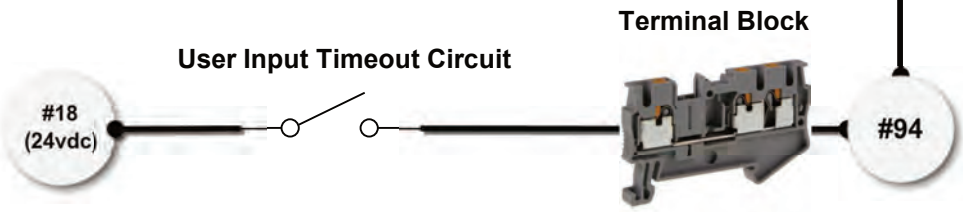
Located on the outside columns of the tower dryer in plastic junction boxes

The Column Over-Temp fault circuit monitors the temperature of the grain inside the column. Each of these circuits will open if the temperature rises above 240°F. Modular Tower Dryers are not equipped with middle column over-temp switches. Therefore signals #82 and #83 are not used on these models.

Title: Tower DRYER: Column Over-Temp	
Author: SUKUP MFG CO - MRK	
Date: 8/15	
Revision: 5/16	108.8

Tower Dryer User Input Timeout

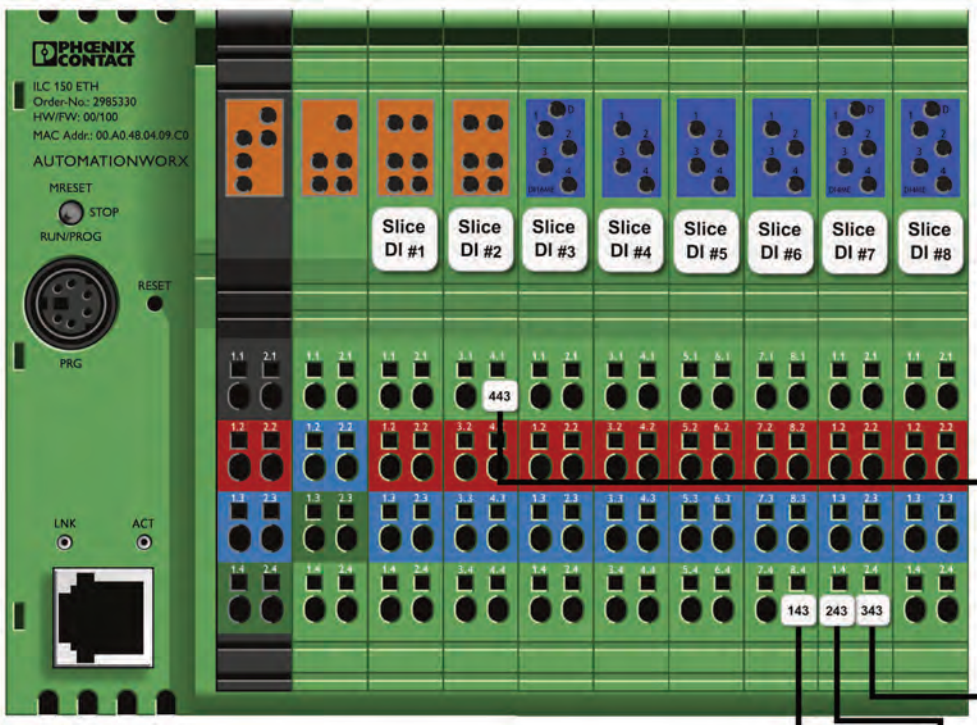


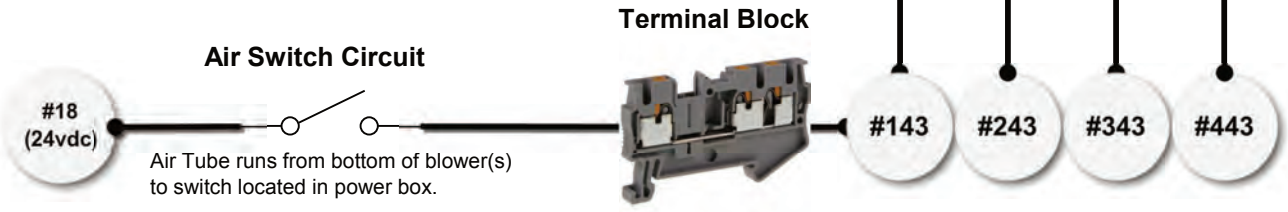


The User Input Timeout Fault happens when the system is expecting information to be entered into the touchpanel, but it is never received. This most frequently happens when the unload table is paused but never restarted before the timer expires.

Title: Tower DRYER: Unload User Timeout	
Author: SUKUP MFG CO - MRK	
Date: 8/15	
Revision:	108.9

Tower Dryer Air Switch Circuit #143, #243, #343, #443

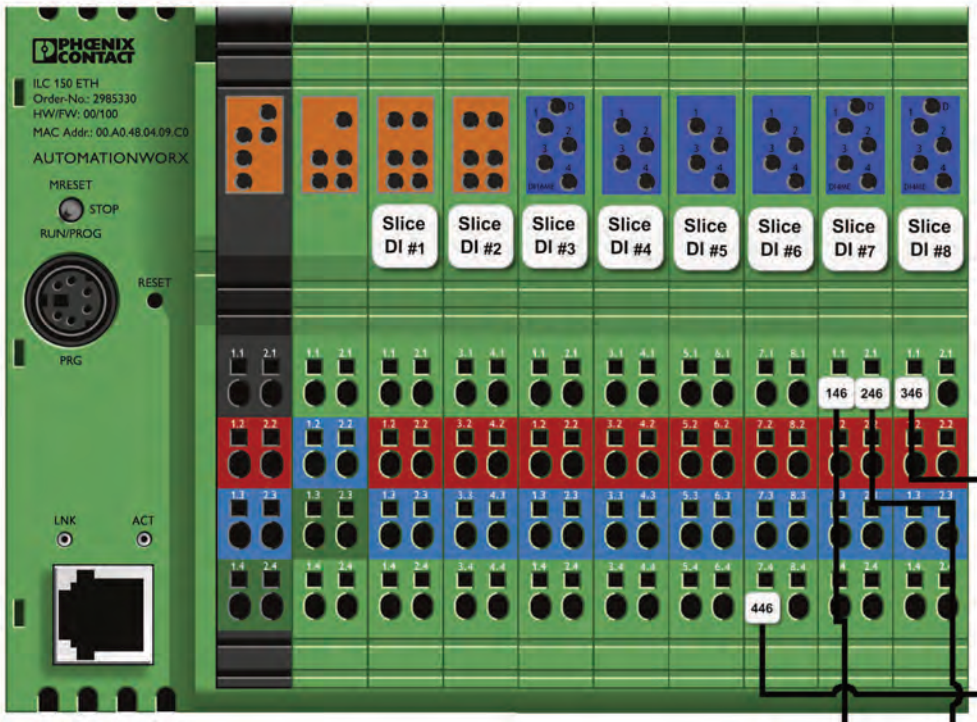


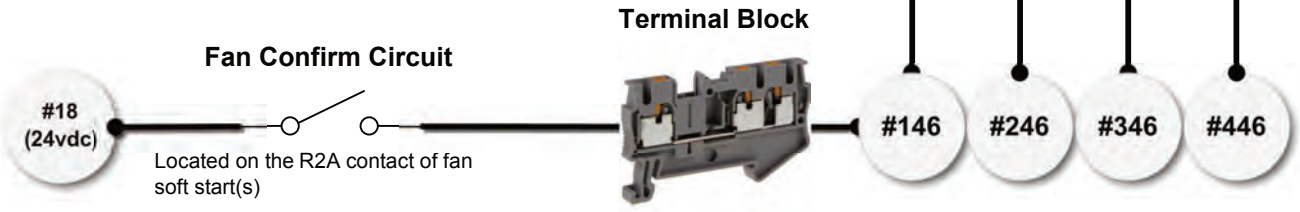


The air switch circuit monitors the static pressure level of the blower(s). The negative pressure created by the rotating fan(s) causes the switch to close, telling the PLC that the blower is running.

Title: Tower DRYER: Air Switch Circuit	
Author: SUKUP MFG CO - MRK	
Date: 8/15	
Revision:	108.10

Tower Dryer Fan Confirmation Circuit #146, #246, #346, #446

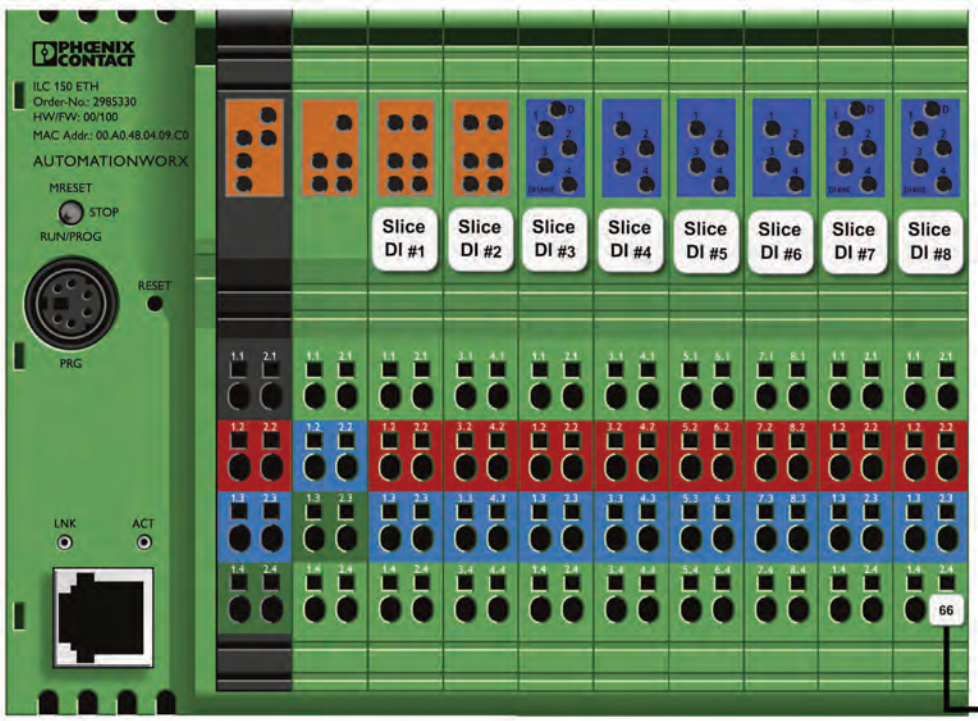




The fan confirmation circuit tells the PLC that the soft start is finished with its ramp and in full run mode. This signal needs to come back to the PLC or a strange I/O combination error will be present.

Title: Tower DRYER: Fan Confirmation Circuit	
Author: SUKUP MFG CO - MRK	
Date: 8/15	
Revision:	108.11

Tower Dryer MST Prox Circuit #66



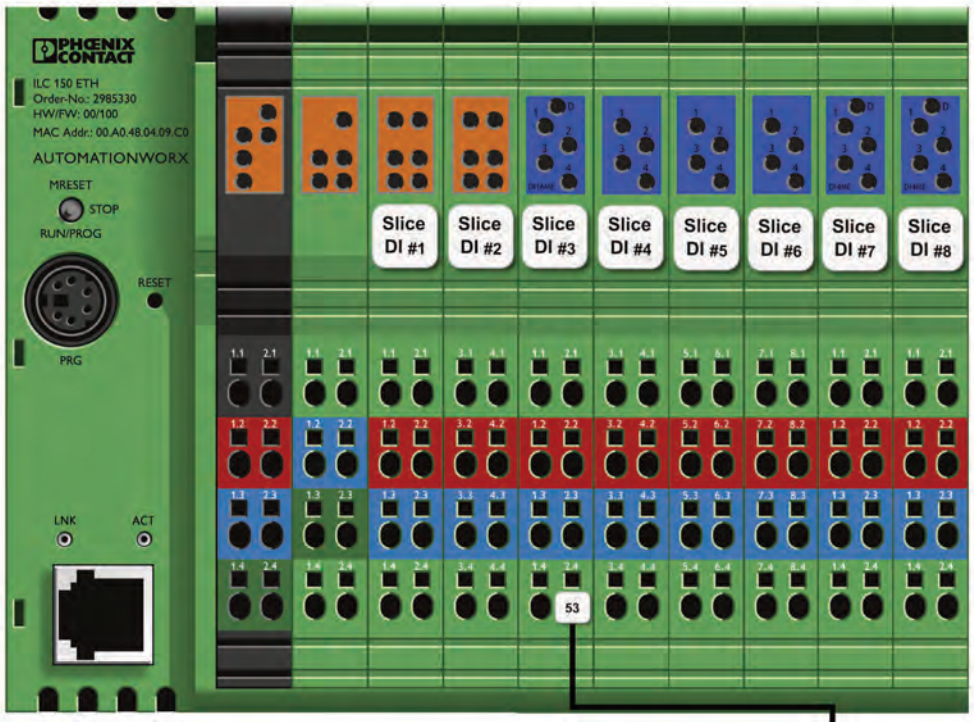
MST Prox Circuit

Terminal Block

The MST Prox Circuit is monitored when the tower dryer is unloading and sampling grain. Every time the dryer tells the static sampling device to close the sample gate, the MST prox detects for gate closure. When the gate is told to close, but the MST prox doesn't register a gate closure, this fault is displayed on the screen.

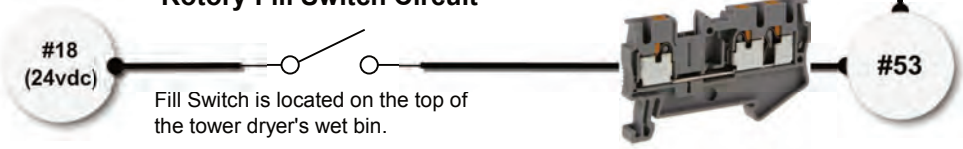
Title: Tower DRYER: Moisture Sensor Prox Switch	
Author: SUKUP MFG CO - MRK	
Date: 8/15	
Revision: 5/16	108.12

Tower Dryer Fill Switch #53
Out of Wet Grain Fault, Fill Timer Fault

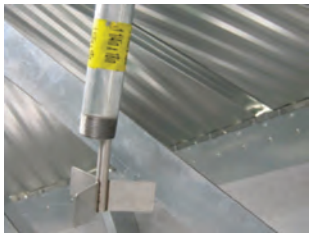


Terminal Block

Rotory Fill Switch Circuit



Fill Switch is located on the top of the tower dryer's wet bin.

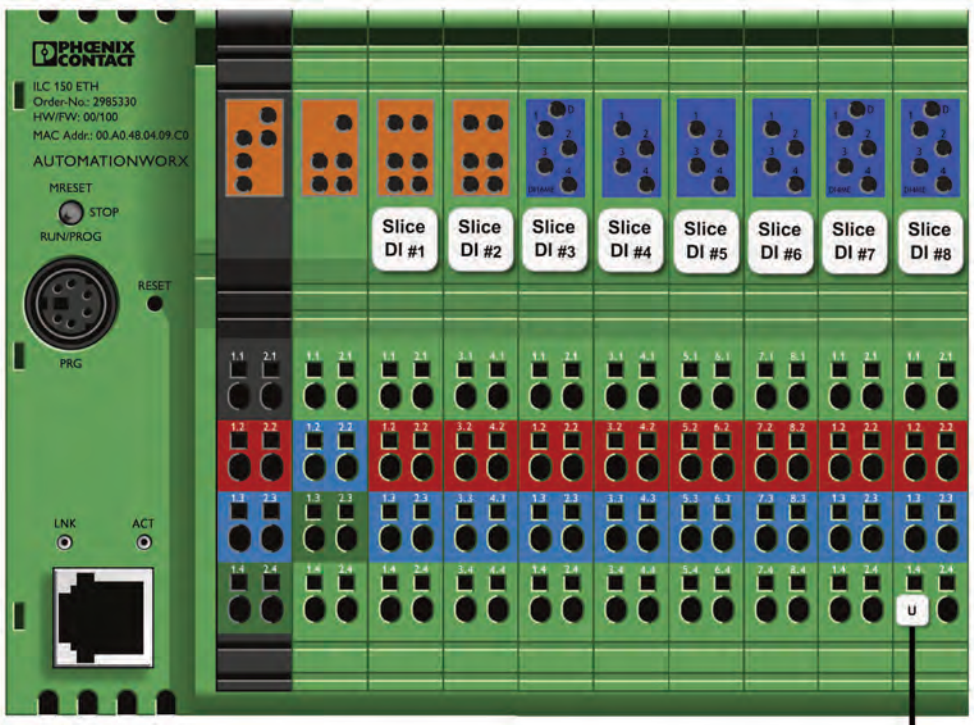


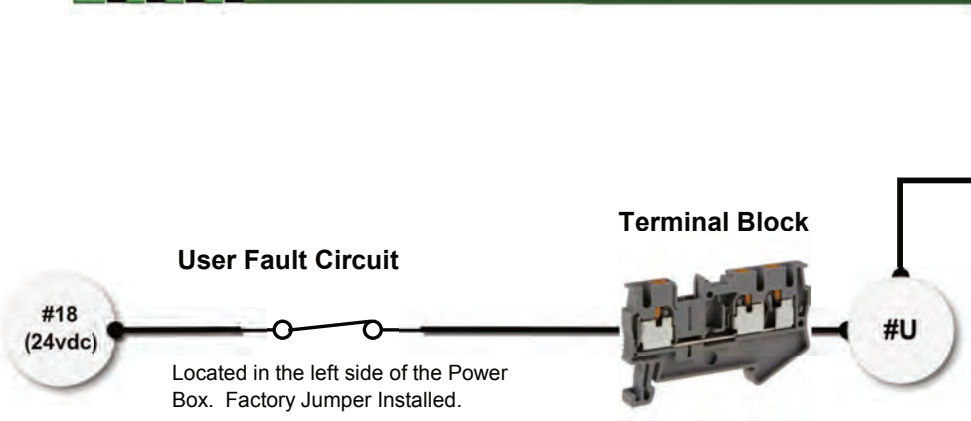
Fill Switches tend to change from time to time, Actual switch may differ from picture..

The Rotory Fill Switch is located on the top of the tower dryer and tells the PLC when to energize the load auxiliaries (5A, 6A, 7A, 8A). When the switch is rotating, opening the #53 circuit, the dryer energizes the load auxiliary equipment. When the switch is not rotating, indicating that the paddle is surrounded by grain, the dryer stops the load auxiliaries so as not to overfill the system. When the dryer stops on a fill timer fault, the dryer has been unloading for 15 min (system default, user selectable) without opening the #53 circuit. When the dryer stops on an Out of Wet Grain Fault, the dryer has been running for 10 min (system default, user selectable) without making the #53 circuit. Both the Fill Timer and Out of Wet Grain Timers are displayed on-screen during operation.

Title: Tower DRYER: Fill Switch #53 Out of Wet Grain Fault, Fill Timer Fault	
Author: SUKUP MFG CO - MRK	
Date: 8/15	
Revision: 5/16	108.13

Tower Dryer User Fault #U



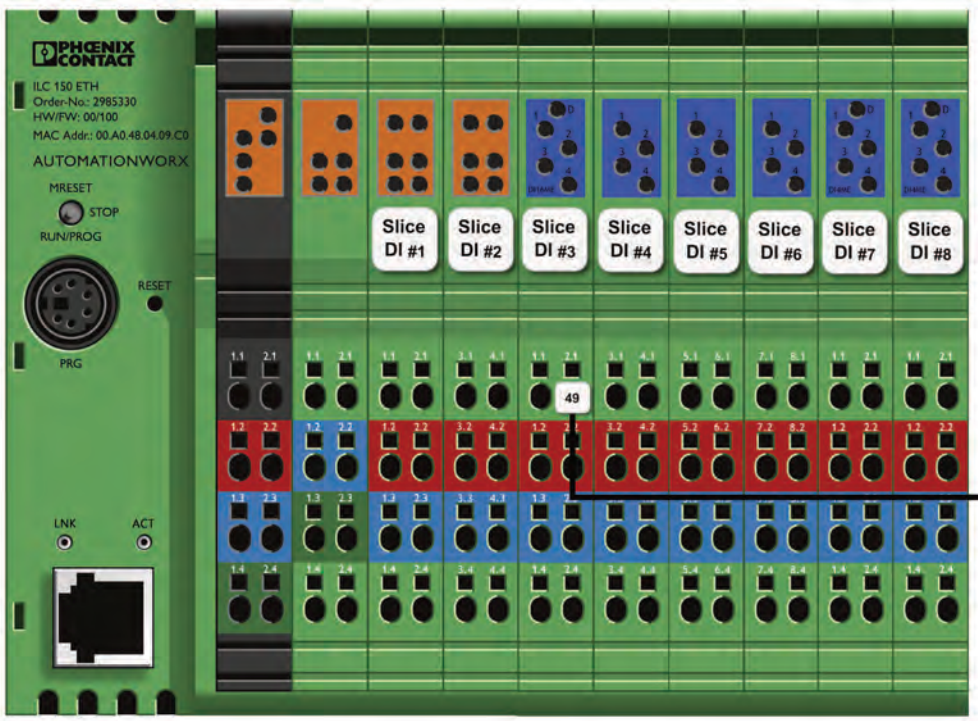


The User Fault Circuit #U is an additional fault circuit provided to the dryer operator for additional equipment monitoring. For example, the dryer operator has a custom unload system that needs to be running in order for the dryer to keep running. The operator can interlock the unload system with the user fault circuit. 24vdc needs to be present under normal operating conditions. An open circuit results in a shutdown.

Factory Jumper Installed in the power box

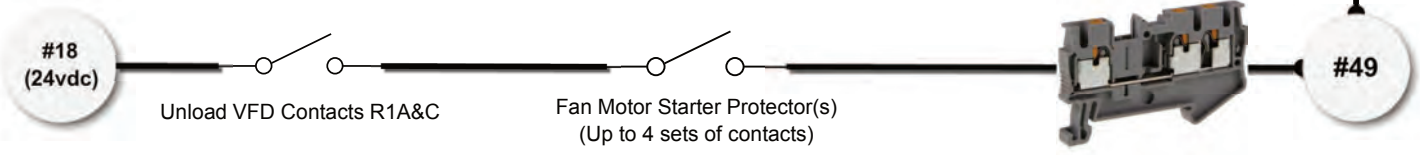
Title: Tower Dryer User Fault	
Author: SUKUP MFG CO - MRK	
Date: 8/15	
Revision: 5/16	108.14

Tower Dryer Motor Overload Circuit #49



Motor Overload Circuit

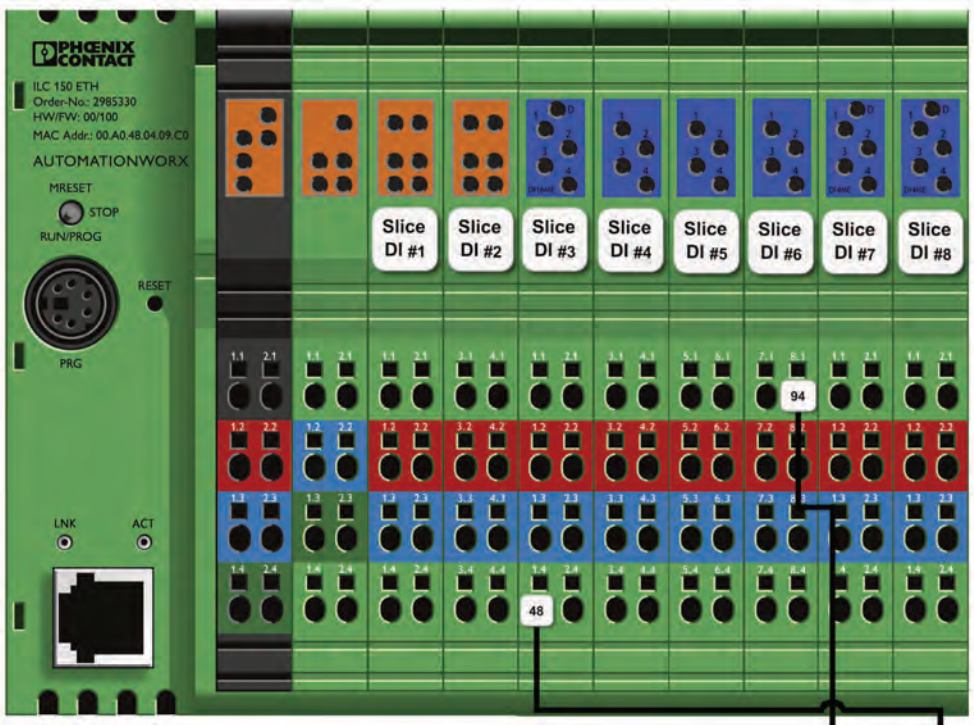
Terminal Block

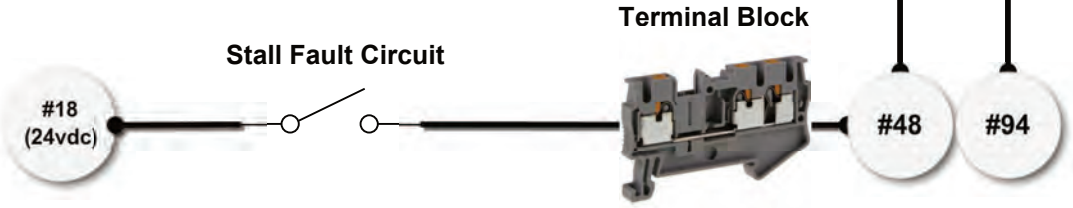


The Motor Overload circuit is a series circuit that starts with 24vdc being applied to Terminal R1C in the Unload VFD. Coming out of R1A, the signal then travels to the fan starter protector's auxiliary contact. As long as the VFD and the Fan Starter(s) are all in normal operation, the 24vdc will return to the to the PLC as wire #49.

Title: Tower DRYER: Motor Overload	
Author: SUKUP MFG CO - MRK	
Date: 8/15	
Revision:	108.15

Tower Dryer Stall Fault

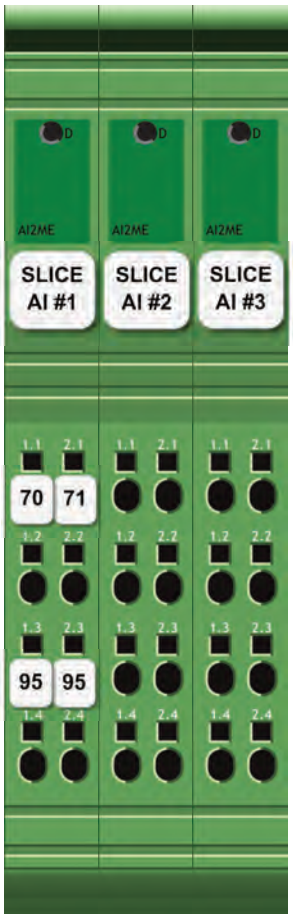


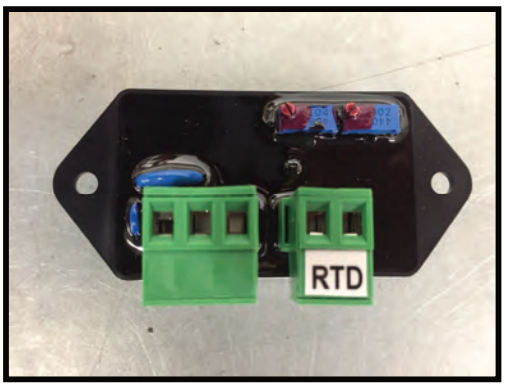


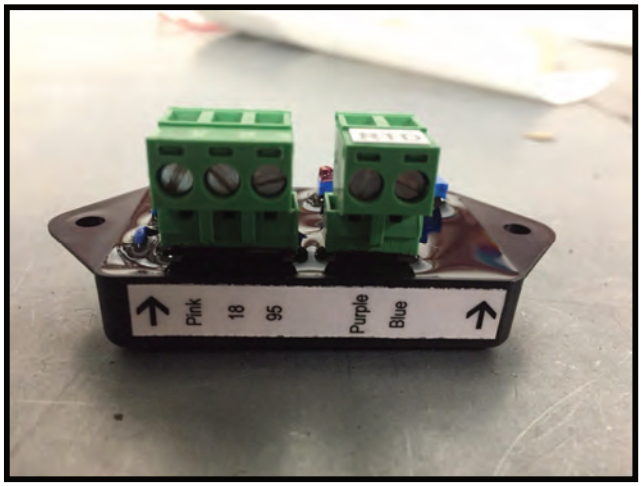
The Stall Fault occurs when the fan(s) and heater(s) have been running for more that 20 minutes without energizing the unload motor (#94). The stall fault timer is displayed on-screen during operation.

Title: Tower DRYER: Stall Fault	
Author: SUKUP MFG CO - MRK	
Date: 8/15	
Revision:	108.16

Column and Plenum RTD Transmitters
Plenum > 275°F







Pink - DC voltage Reference to PLC
#70-Column
#71-Plenum

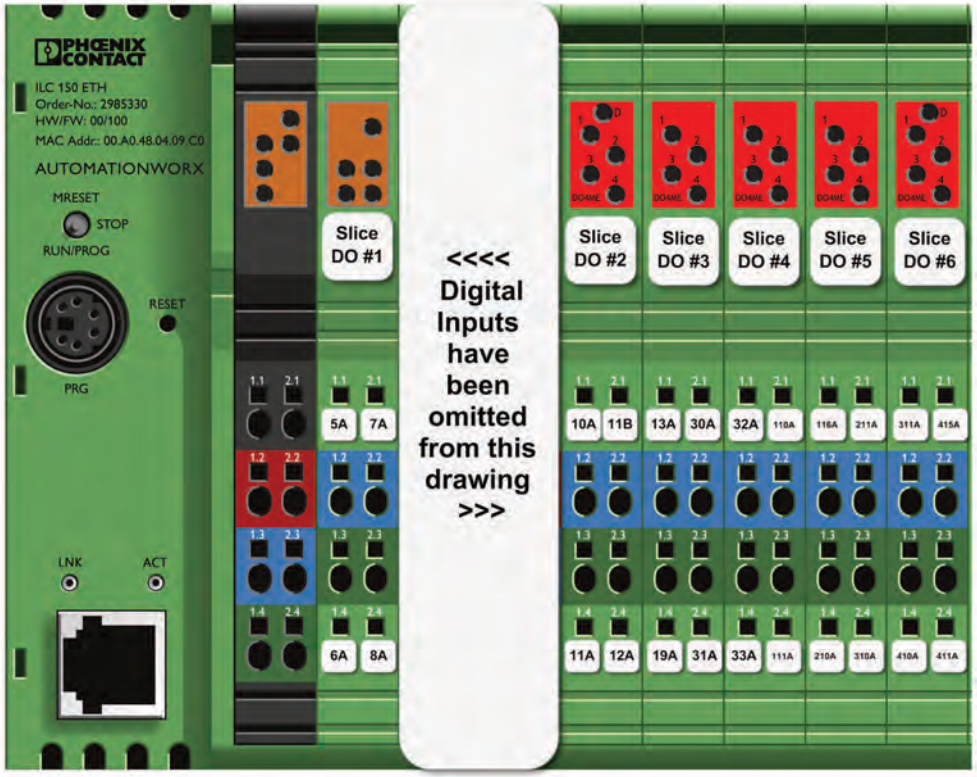
Wire #18 - 24vdc Power
Wire #95 - dc common (-)

Purple - Resistance from RTD
Blue - Resistance from RTD

The Plenum > 275°F fault is a software shutdown that occurs when the Plenum RTD transmitter sends a reference voltage back to the PLC that indicates an average plenum temperature above 275°F. Typically, another fault device would trip out first, such as the Plenum OT device (#39) or any one of the Column OT devices (#80-#85). If you are experiencing this fault frequently, it's probably an issue with the Plenum RTD, the Plenum RTD transmitter, or a wiring problem.

Title: Tower DRYER: Column and Plenum RTD Transmitter	
Author: SUKUP MFG CO - MRK	
Date: 03/15	Sheet: 108.17
Revision:	

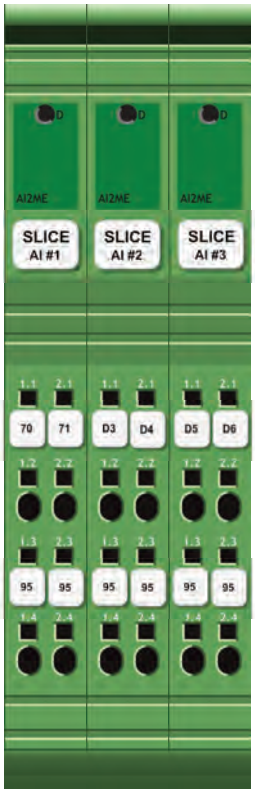
Tower Dryer Digital Outputs



See PLC Relay Wiring for all wiring terminations. Sheets: 112.1 -- 112.4

Title:	Tower Dryer Digital Outputs		
Author:	SUKUP MFG CO - MRK		
Date:	10/15	Sheet:	109.1
Revision:			

Tower PLC Analog Inputs



From Column Temp Transmitter (Located in Power Box)	#70 Column RTD Feedback Voltage 1-5Vdc	To PLC Slice AI #1 Input #1 (Top Left Input 1.1)
From Plenum Temp Transmitter (Located in Power Box)	#71 Plenum RTD Feedback Voltage 1-5Vdc	To PLC Slice AI #1 Input #2 (Top Right Input 2.1)
From Discharge Moisture Sensor (Located in static sampling box at bottom middle of Tower)	#D3 Discharge Grain Temp Voltage 0-3Vdc	To PLC Slice AI #2 Input #1 (Top Left Input 1.1)
From Discharge Moisture Sensor (Located in static sampling box at bottom middle of Tower)	#D4 Discharge Moisture Voltage 0-9Vdc	To PLC Slice AI #2 Input #2 (Top Right Input 2.1)
From Input Moisture Sensor (Located on the top of the Tower)	#D5 Input Moisture Voltage 0-9Vdc	To PLC Slice AI #3 Input #1 (Top Left Input 1.1)
Auxiliary Device (Can be an additional RTD input or Static Pressure transducer)	#D6 Aux Device	To PLC Slice AI #3 Input #2 (Top Right Input 2.1)

Title: Tower Dryer: Analog Inputs	
Author: SUKUP MFG CO - MRK	
Date: 10/15	Sheet: 110.1
Revision:	

Tower PLC Analog Outputs

From PLC Slice AO#1 Output #1
Top Left Output 1.1

#17
Unload VFD Reference
Voltage 0-10Vdc

To Electronic Mod Valve on
Heater Pipe Train

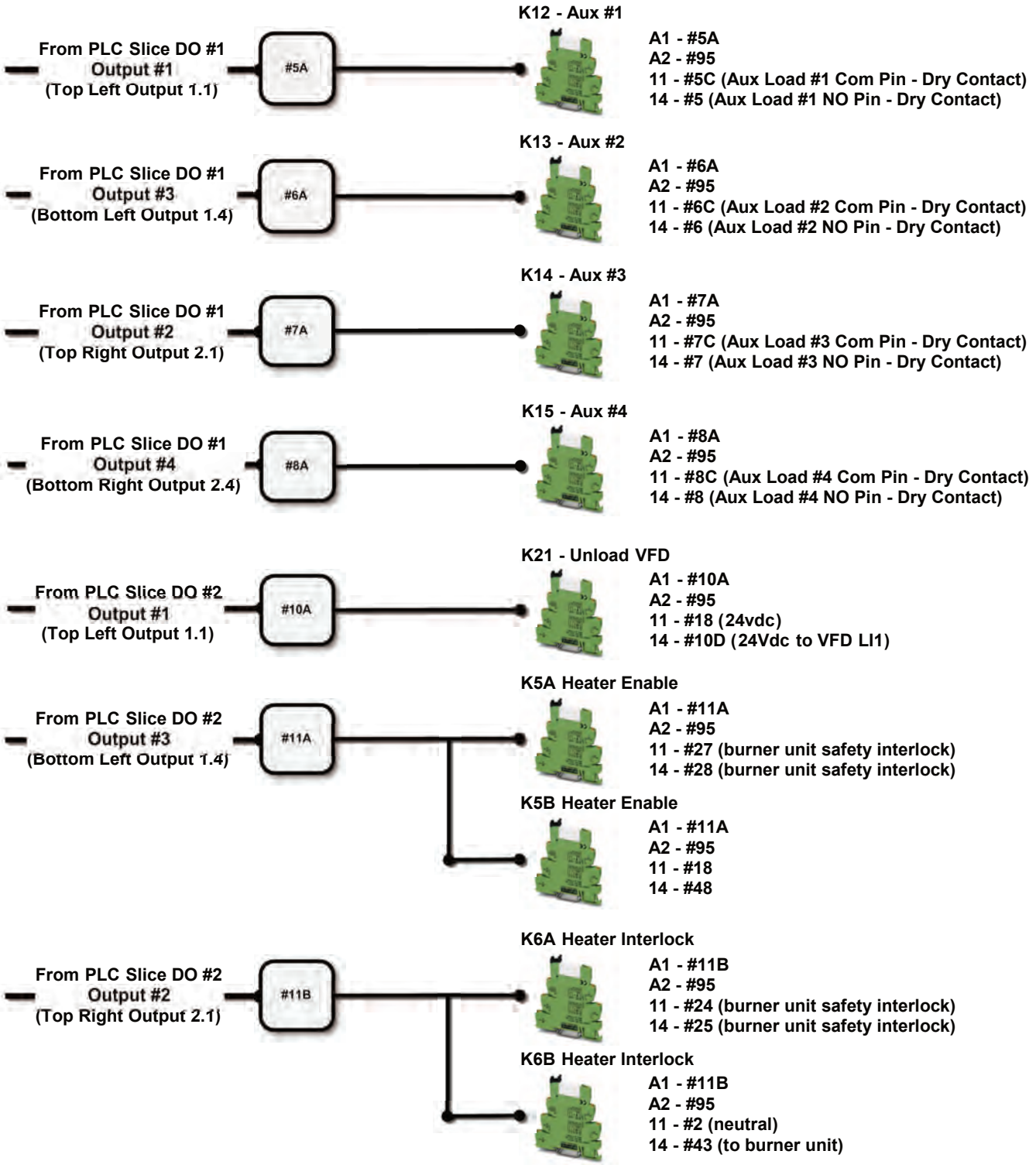
From PLC Slice AO#1 Output #2
Top Right Output 2.1

#61
Electronic Mod Valve
Reference Voltage 0-10Vdc

To Unload VFD Pin AI1

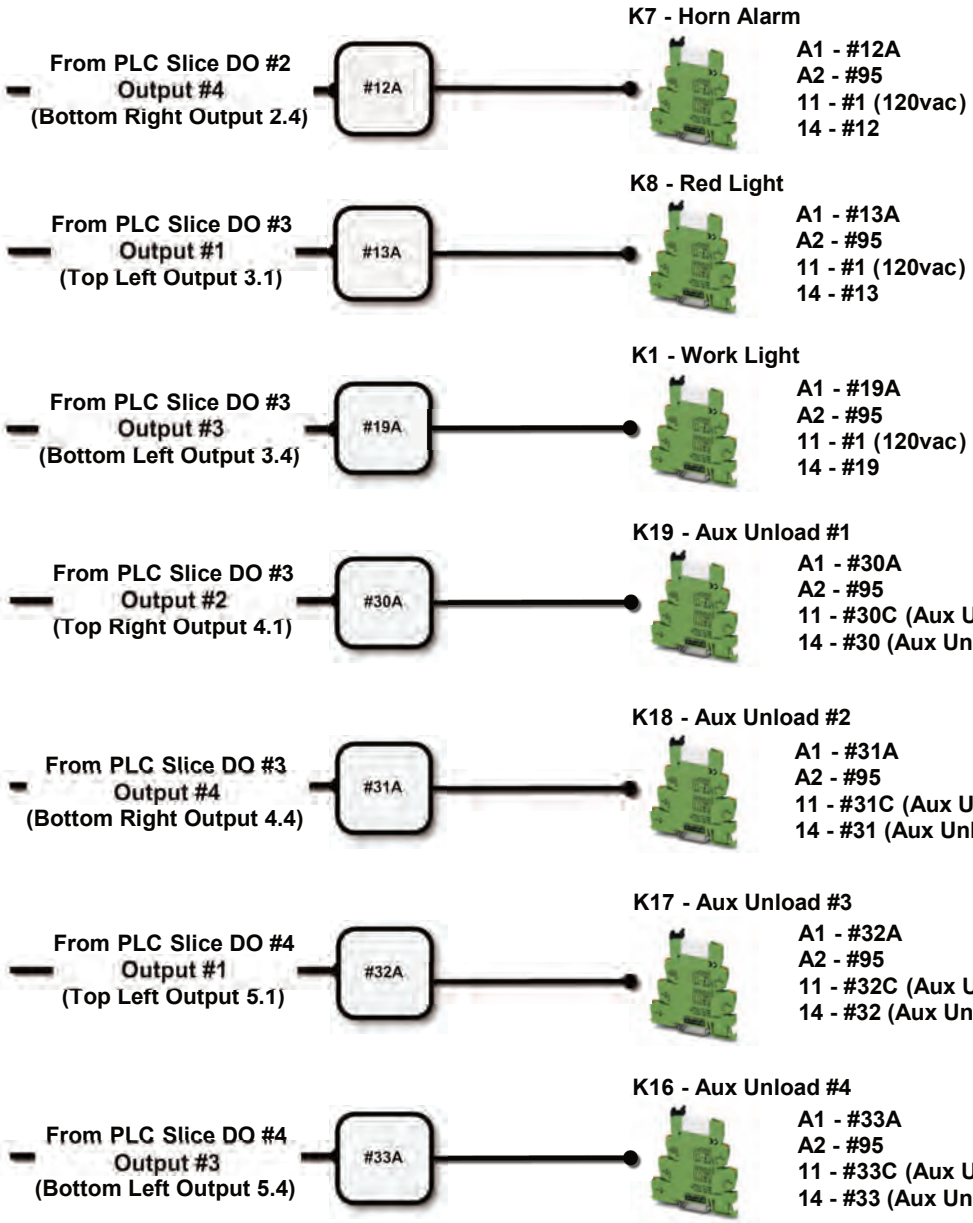
Title: Tower Dryer: Analog Outputs	
Author: SUKUP MFG CO - MRK	
Date: 10/15	Sheet: 111.1
Revision:	

Tower Dryer PLC Relay Wiring



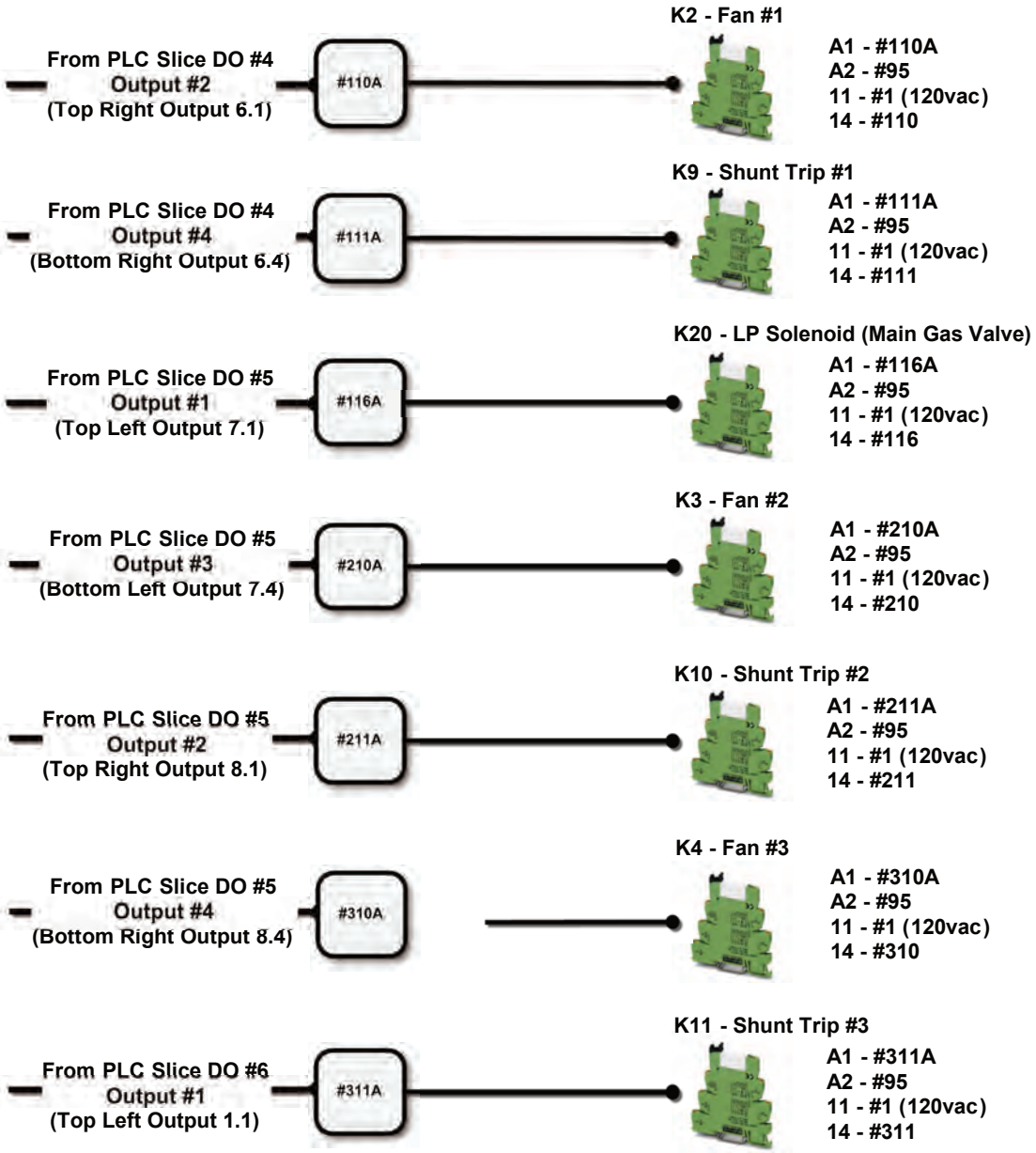
Title: Tower DRYER: PLC Relay Wiring	
Author: SUKUP MFG CO - MRK	
Date: 10/15	Sheet: 112.1
Revision:	

Tower Dryer PLC Relay Wiring



Title: Tower DRYER: PLC Relay Wiring Page 2	
Author: SUKUP MFG CO - MRK	
Date: 10/15	Sheet: 112.2
Revision:	

Tower Dryer PLC Relay Wiring



Title: Tower DRYER: PLC Relay Wiring Page 3	
Author: SUKUP MFG CO - MRK	
Date: 10/15	Sheet: 112.3
Revision:	

Tower Dryer PLC Relay Wiring

From PLC Slice DO #6
Output #2
(Top Right Output 2.1)

#415A

K22A - Gate Actuator (Static Sampler Positive (+))

A1 - #415A
A2 - #95
11 - #
14 - #

K22B - Gate Actuator (Static Sampler Reverse (-))

A1 - #415A
A2 - #95
11 - #
14 - #

From PLC Slice DO #6
Output #3
(Bottom Left Output 1.4)

#410A

K23 - Fan #4

A1 - #410A
A2 - #95
11 - #1 (120vac)
14 - #410

From PLC Slice DO #6
Output #4
(Bottom Right Output 2.4)

#411A

K24 - Shunt Trip #4

A1 - #411A
A2 - #95
11 - #1 (120vac)
14 - #411

Pin #5, Wire #16 on LME69 (shown above)

CR2A - P.O.C Bypass Relay (120vac coil)

A1 - #16 (from burner control unit)
A2 - #2
11 - #25
14 - #27

CR2B - Low Fire Switch Bypass Relay (120vac coil)

A1 - #16 (from burner control unit)
A2 - #2
11 - #28 (low fire switch bypass)
14 - #29 (low fire switch bypass)

CR2C - Flame ON/OK Relay (120vac coil)

A1 - #16 (from burner control unit)
A2 - #2
11 - #18
14 - #45

CR3 - Burner Unit Fail (120vac coil)

A1 - #38A (from burner control unit)
A2 - #2
11 - #18 (24vdc)
14 - #38

Title: Tower DRYER: PLC Relay Wiring Page 4	
Author: SUKUP MFG CO - MRK	
Date: 10/15	Sheet: 112.4
Revision:	

Tower Dryer

QuadraTouch Pro™ Dryer Control System

Appendices

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Appendix A

Foundations

Modular Tower Dryers

Stick-built Tower Dryers

DATE	REVISIONS	PAGES
01/23/2018	– Updated references to ASCE wind code	2-6

Foundations

DISCLAIMER: Sukup Manufacturing Co. assumes no responsibility regarding the foundation specifications. This is not an engineered foundation and shall not be constructed as such. The specifications given are intended for quoting and estimating purposes only. It shall be the sole responsibility of the customer to obtain actual foundation drawings designed by and constructed to the specifications of a licensed professional structural engineer with knowledge of the actual soil and load specific to the project and location. Consideration should also include, but not be limited to, live loads, dead loads, wind loads, soil bearing loads, seismic zone, proper moisture run-off on top of base, and types of aeration applied for the project.

Sukup Manufacturing Co. will not be responsible for any damage to a product, including, but not limited to, any damage that results from poor soil conditions or inadequate concrete type, grade, bearing strength, and construction method. Soil bearing tests must be performed by a competent, independent, engineering firm. Concrete foundation construction must be done by a competent concrete contractor.

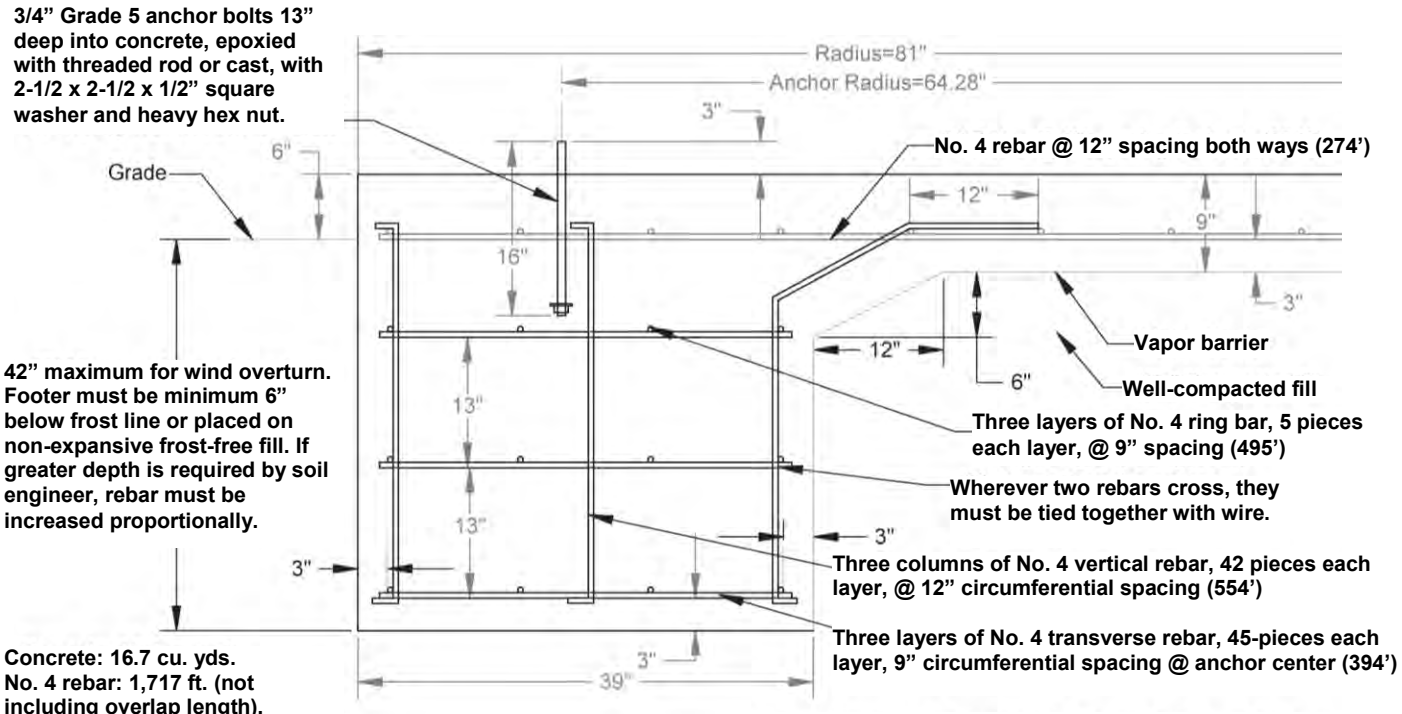
Drawings in this section show foundation recommendations for each type of Sukup Tower Dryer. The following conditions apply to all:

Soil must be able to support 3,000 pounds per square foot. Concrete must be able to support 3,500 pounds per square inch with grade 60 rebar.

All material used for backfill on inside of ring wall should be clean, well-graded crushed stone or sand/gravel mixture. Backfill should be placed in 6” layers and well compacted.

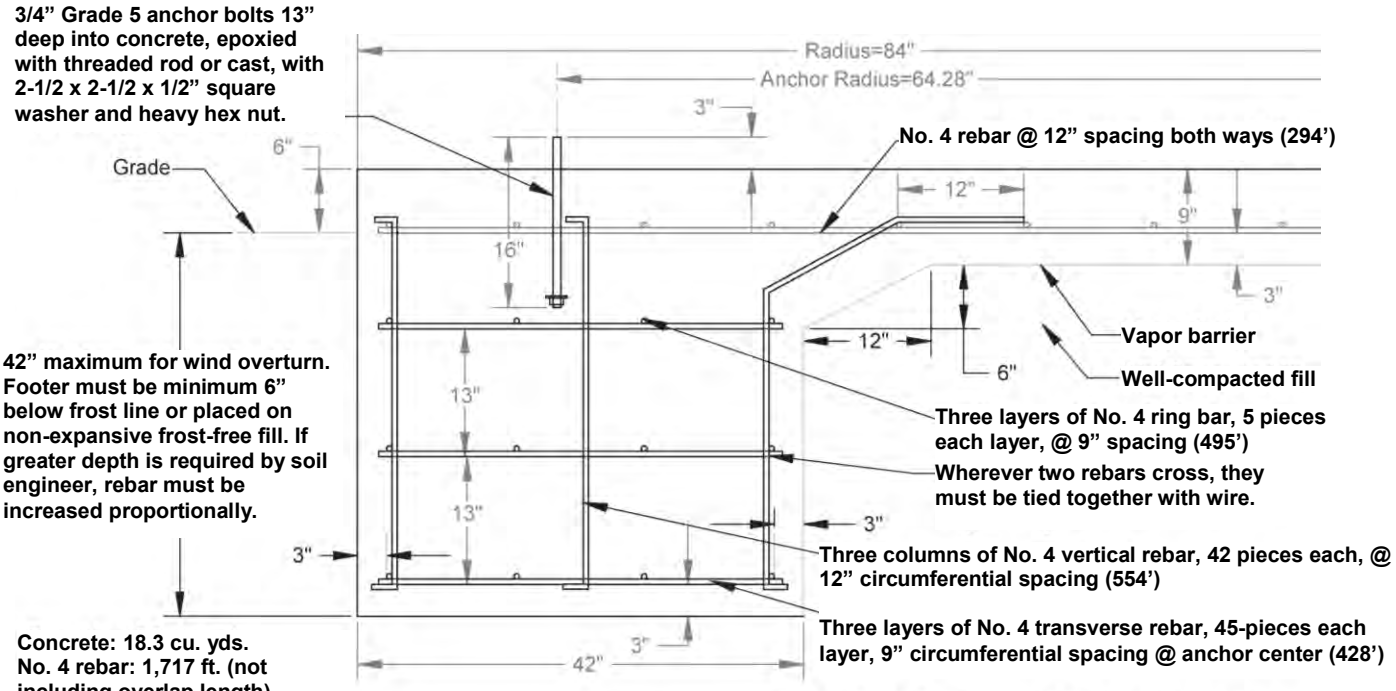
All sections of rebar that overlap must be connected together by wire.

For some soil types, bottom of footing must be below frost line. Consult with local soil engineer.



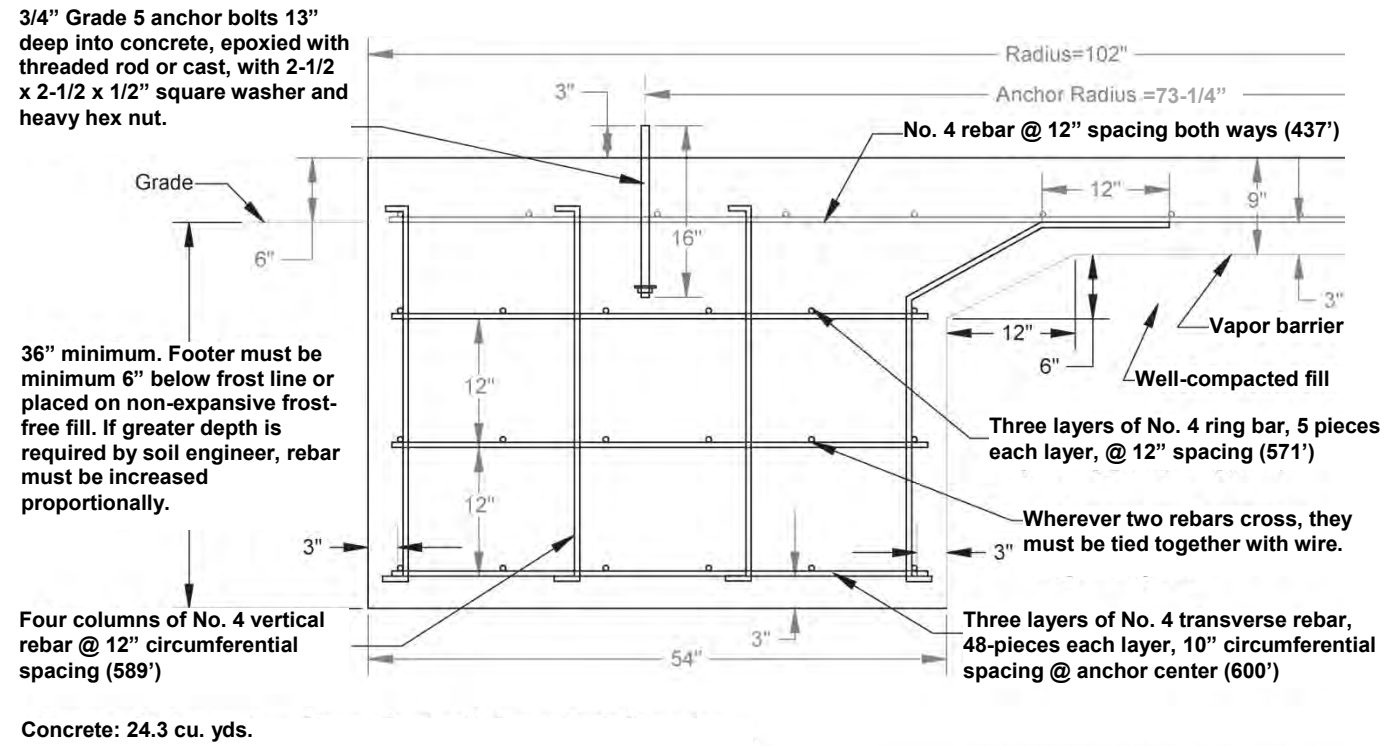
For ASCE 7-10-defined 105 mph wind zone and seismic category A only!

Model U1010 (Modular)



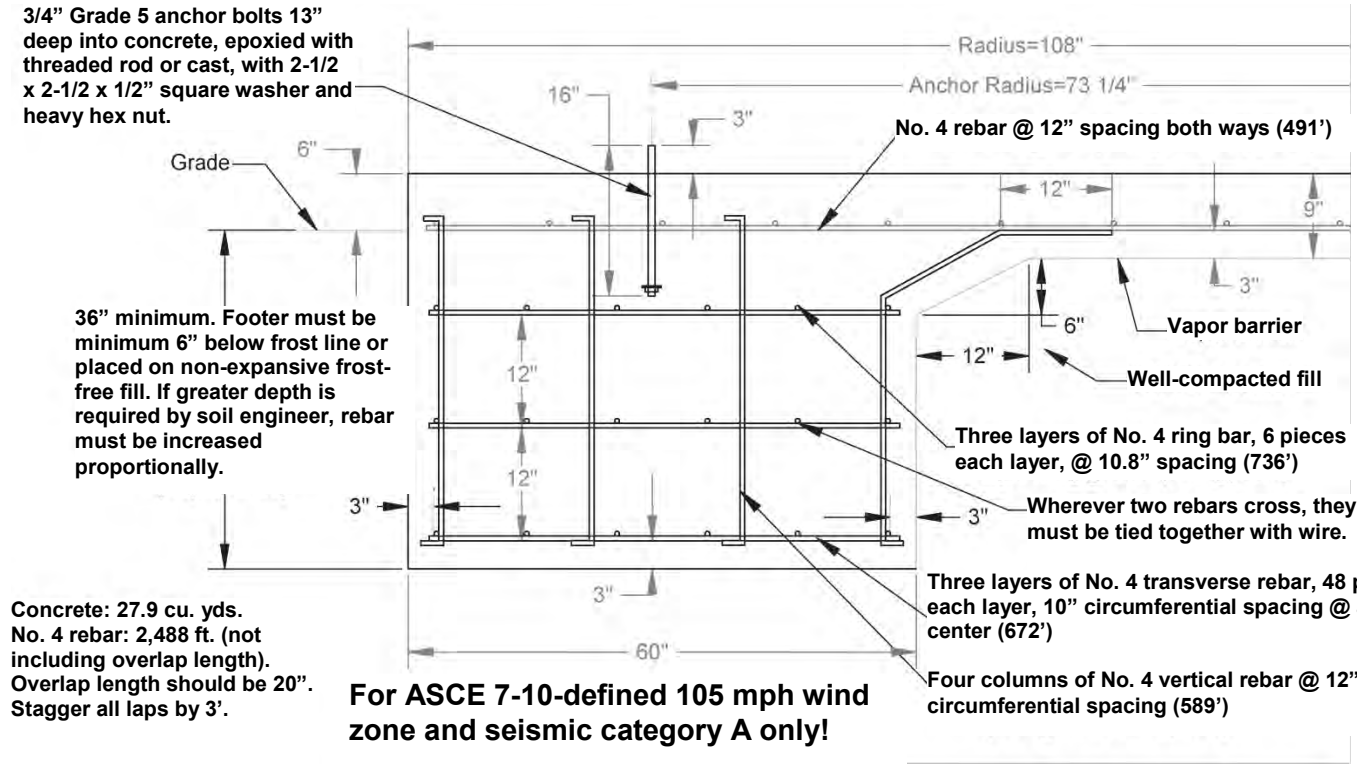
For ASCE 7-10-defined 105 mph wind zone and seismic category A only!

Model U1510 (Modular)



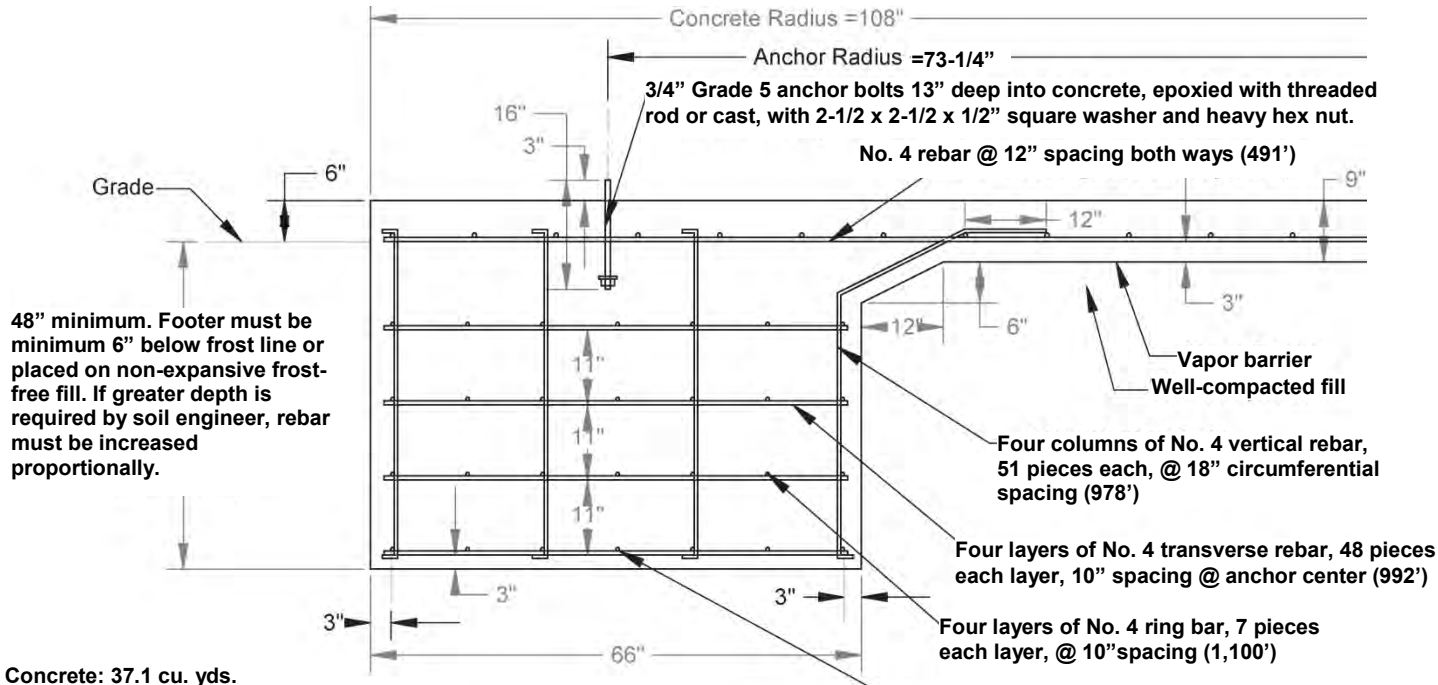
For ASCE 7-10-defined 105 mph wind zone and seismic category A only!

Model U1812 (Stick-built)



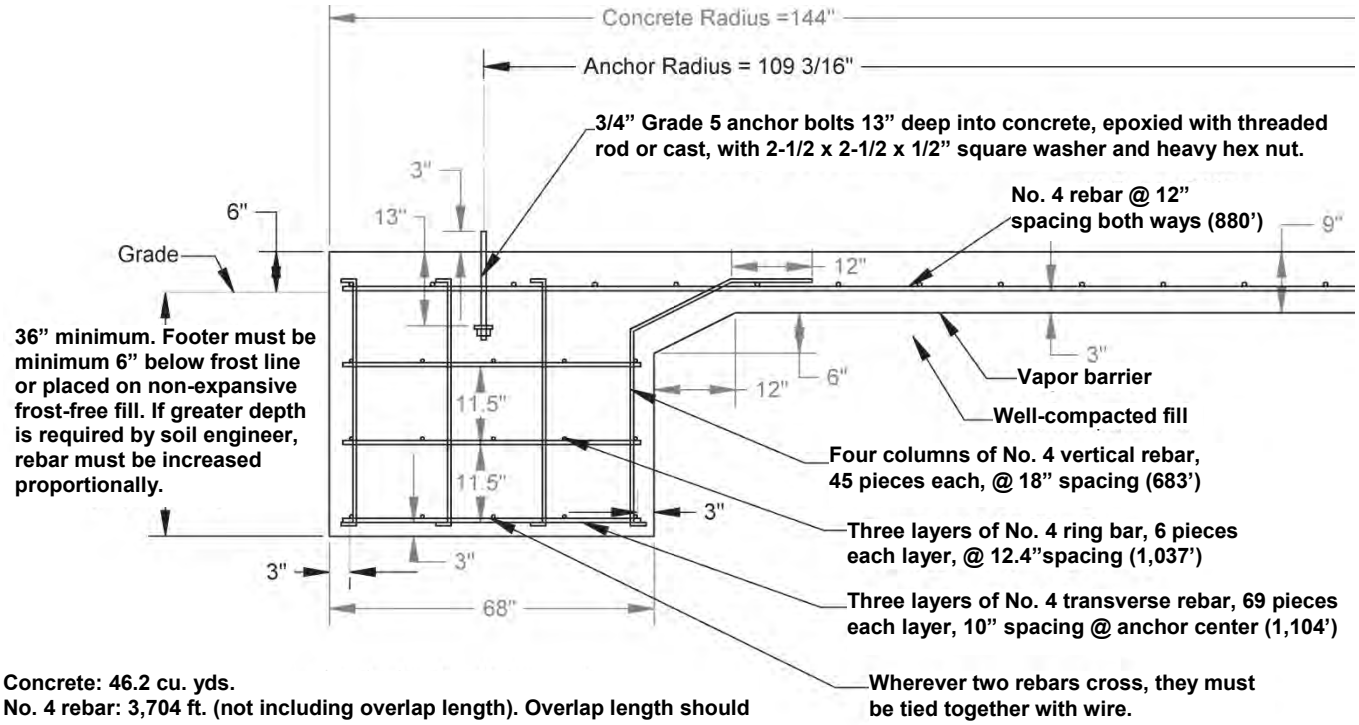
For ASCE 7-10-defined 105 mph wind zone and seismic category A only!

Model U2012 (Stick-built)



For ASCE 7-10-defined 105 mph wind zone and seismic category A only!

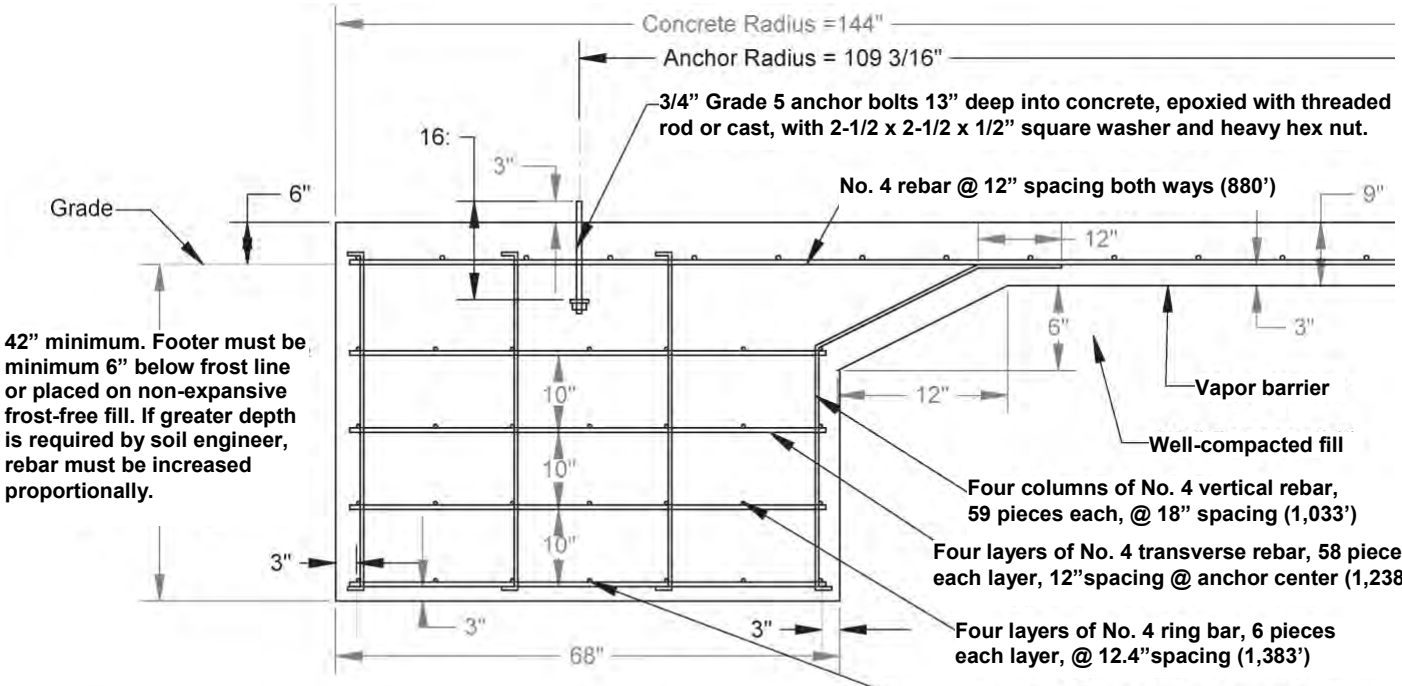
Model U2412 (Stick-built)



Concrete: 46.2 cu. yds.
No. 4 rebar: 3,704 ft. (not including overlap length). Overlap length should be 20". Stagger all laps by 3'.

For ASCE 7-10-defined 105 mph wind zone and seismic category A only!

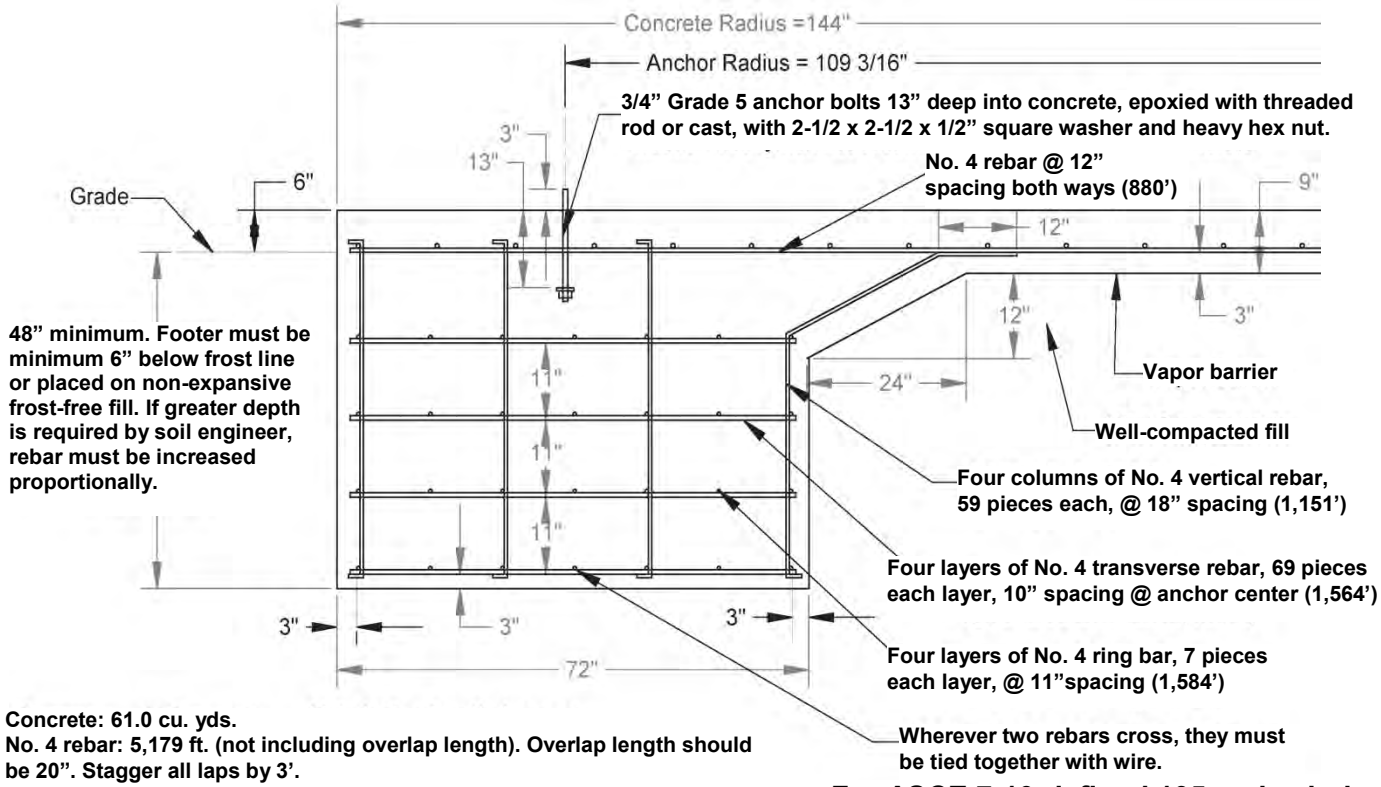
Model U3018 (Stick-built)



Concrete: 52.5 cu. yds.
No. 4 rebar: 4,534 ft. (not including overlap length). Overlap length should be 20". Stagger all laps by 3'.

For ASCE 7-10-defined 105 mph wind zone and seismic category A only!

Models U3518 and U4018 (Stick-built)

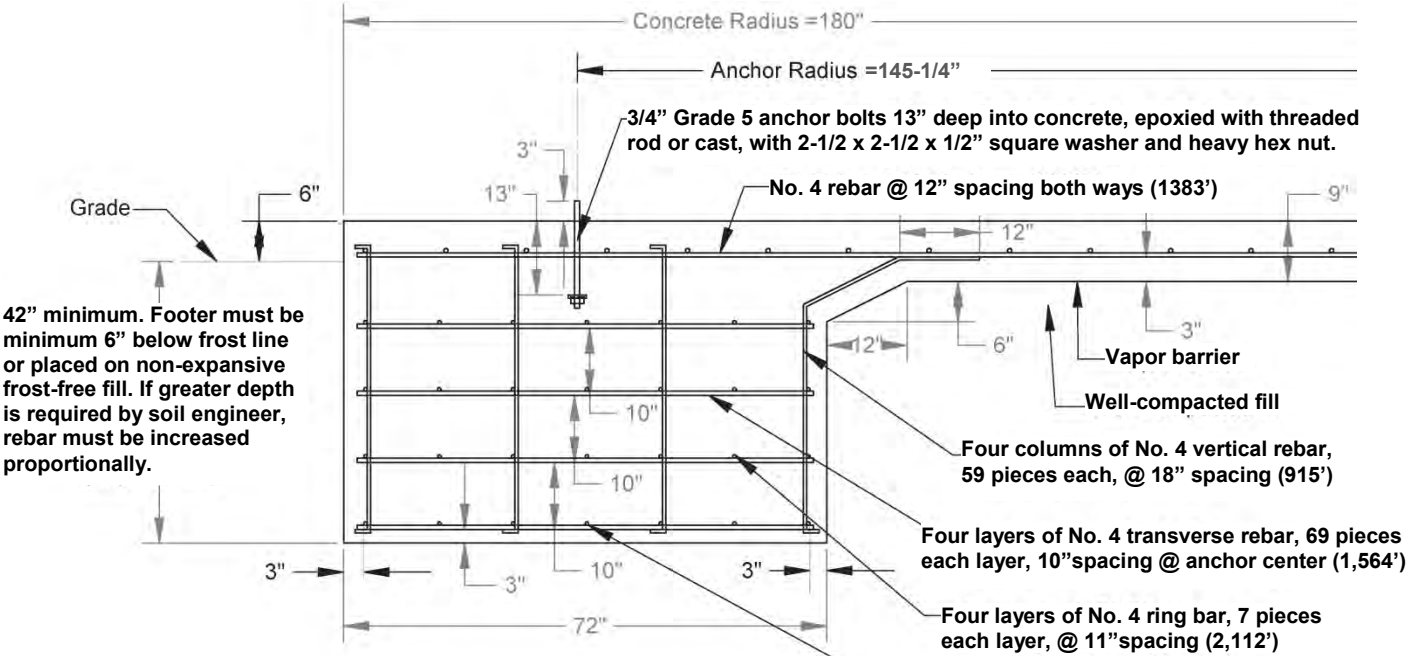


48" minimum. Footer must be minimum 6" below frost line or placed on non-expansive frost-free fill. If greater depth is required by soil engineer, rebar must be increased proportionally.

Concrete: 61.0 cu. yds.
No. 4 rebar: 5,179 ft. (not including overlap length). Overlap length should be 20". Stagger all laps by 3'.

For ASCE 7-10-defined 105 mph wind zone and seismic category A only!

Model U4718 (Stick-built)



42" minimum. Footer must be minimum 6" below frost line or placed on non-expansive frost-free fill. If greater depth is required by soil engineer, rebar must be increased proportionally.

Concrete: 74.6 cu. yds.
No. 4 rebar: 5,974 ft. (not including overlap length). Overlap length should be 20". Stagger all laps by 3'.

For ASCE 7-10-defined 105 mph wind zone and seismic category A only!

Models U5024, U6024 and U7024 (Stick-built)

Appendix B

Specifications

Specifications Tables

Unload Rates

Fuel Consumption

Specifications

Bushels per hour estimates in tables below are based on wet No. 2 shelled yellow corn at listed moisture content and are based on drying principles, field results and/or computer simulation at 50° F ambient temperature and 60% humidity at 220° F average plenum temperature.

Factors such as grain variety, maturity levels, grain cleanliness, weather conditions and operation/management can affect performance of tower dryer. Results may vary. This information is calculated and is not a guarantee of product or performance. These specifications should only be used as estimates and not as a warranty, express or implied, of how a particular Sukup unit will perform under your operating conditions. Because products are continually improved, changes may have occurred that are not reflected in these specifications.

Model #	U1010	U1510
Bu/hr. 20-15% corn	1,000	1,500
Bu/hr. 25-15% corn	600	900
Heat holding bushels	670	924
Cool holding bushels	219	308
Total holding bushels	1,208	1,551
Drying CFM	48,000	67,000
Cooling CFM	24,000	33,500
Overall height (ft.)	50’ 2”	63’ 7”
Tower diameter	10’ 6”	10’ 6”
Max dia. with catwalks	17’ 10”	17’ 10”
Max. burner BTU/hr.	10,000,000	15,000,000
Avg. burner BTU/hr.	6,300,000	9,400,000
Blower horsepower	50	75
Outer platforms	2	2
Full load amp. (230v/460v)	142/71	204/102
Foundation (cubic yds.)	18	18

Model #	U1812	U2012	U2412	U3018	U3518	U4018	U4718	U5024	U6024	U7024
Bu/hr 20-15% corn	1800	2000	2400	3000	3500	4000	4700	5000	6000	7000
Bu/hr 25-15% corn	1080	1200	1440	1800	2100	2400	2820	3000	3600	4200
Heat holding bushels	1113	1275	1521	1925	2208	2642	2941	3469	4026	4436
Cool holding bushels	400	434	481	642	812	831	1136	1238	1295	1499
Total holding bushels	1982	2178	2471	3543	3996	4449	5053	6336	6950	7564
Drying airflow (CFM)	85,600	94,600	110,300	148,200	174,300	206,400	226,200	275,100	296,100	343,500
Burner cap. (BTUx1000)	18,490	20,434	23,825	32,011	37,649	44,582	48,859	59,422	63,958	74,196
Avg. heat (BTUx1000)	10,632	11,749	13,699	18,406	21,648	25,635	28,094	34,167	36,776	42,663
Blower hp	75	100	100	(3) 50	(3) 60	(3) 75	(3) 75	(3) 100	(3) 100	(3) 125
AC drive metering hp	1-1/2	1-1/2	1-1/2	2	2	2	2	3	3	3
Grain column	12.75”	12.75”	12.75”	12.75”	12.75”	12.75”	12.75”	12.75”	12.75”	12.75”
Tower diameter	12’	12’	12’	18’	18’	18’	18’	24’	24’	24’
Overall height	69’	76’	86’	76’	86’	96’	109’	100’	110’	120’

Unload Rates

Tables below show approximate unload rates for Sukup Tower Dryers. They are approximate and can vary due to flow gate and paddle arm settings, varieties of grain, and amount of fines. For an accurate rate, an actual flow test should be done on site.

10' Tower Dryer										
Speed (%)	10	20	30	40	50	60	70	80	90	100
RPM	0.21	0.42	0.63	0.84	1.04	1.25	1.46	1.67	1.88	2.09
Freq. (Hz)	6	12	18	24	30	36	42	48	54	60
BU/HR*	210	420	630	840	1050	1260	1470	1680	1890	2100

12' Tower Dryer										
Speed (%)	10	20	30	40	50	60	70	80	90	100
RPM	0.21	0.42	0.63	0.84	1.04	1.25	1.46	1.67	1.88	2.09
Freq. (Hz)	6	12	18	24	30	36	42	48	54	60
BU/HR*	300	600	900	1200	1500	1800	2100	2400	2700	3000

18' Tower Dryer										
Speed (%)	10	20	30	40	50	60	70	80	90	100
RPM	0.17	0.35	0.52	0.7	0.87	1.05	1.22	1.4	1.58	1.74
Freq (Hz)	6	12	18	24	30	36	42	48	54	60
BU/HR*	550	1100	1650	2200	2750	3300	3850	4400	4950	5500

24' Tower Dryer										
Speed (%)	10	20	30	40	50	60	70	80	90	100
RPM	0.17	0.35	0.52	0.7	0.87	1.05	1.22	1.4	1.57	1.74
Freq (Hz)	6	12	18	24	30	36	42	48	54	60
BU/HR*	800	1600	2400	2800	4000	4800	5600	6400	7200	8000

Fuel Consumption

Gas pressure supplied to dryer must be 6 to 9 psi.

- For natural gas dryers, if gas supply is above 9 psi, end user must provide regulator.
- For vaporized propane dryers, end user must provide external vaporizer and regulator between LP tank and dryer.
- For liquid propane dryers, internal vaporizer and regulator are included with dryer (available in domestic models U1010-U2412 only).

All work needs to be in accordance with local, state and national standards.

Table below shows maximum fuel consumption rate per hour for each model of dryer.

Model	Max Btu/hr.	LP gal/hr.	NG $ft.^3$/hr.
U1010	10,000,000	108.7	10,000
U1510	15,000,000	163.0	15,000
U1812	18,490,000	201.0	18,490
U2012	20,434,000	222.1	20,434
U2412	23,825,000	259.0	23,825
U3018	32,011,000	347.9	32,011
U3518	37,649,000	409.2	37,649
U4018	44,582,000	484.6	44,582
U4718	48,859,000	531.1	48,859
U5024	59,422,000	645.9	59,422
U6024	63,958,000	695.2	63,958
U7024	74,196,000	806.5	74,196

Table shows maximum fuel consumption at a 200°F plenum temperature rise, without heat recovery factored in.
Actual consumption will typically be less than amounts stated.

Heating capacity of fuel used

Natural gas: 1,000 $Btu/ft.^3$
Vaporized propane: 2,500 $Btu/ft.^3$
Liquid propane: 92,000 Btu/gal.

Table below shows average fuel consumption rate per hour for each model of dryer.

Model	Avg. Btu/hr.	LP gal/hr.	NG ft^3/hr.
U1010	6,300,000	68.5	6,300
U1510	9,400,000	102.2	9,400
U1812	10,632,000	115.6	10,632
U2012	11,749,000	127.7	11,749
U2412	13,699,000	148.9	13,699
U3018	18,406,000	201.0	18,406
U3518	21,648,000	235.3	21,648
U4018	25,635,000	278.6	25,635
U4718	28,094,000	305.4	28,094
U5024	34,167,000	371.4	34,167
U6024	36,776,000	399.7	36,776
U7024	42,663,000	463.7	42,663

Table shows average fuel consumption at a 115°F plenum temperature rise, without heat recovery factored in.

Appendix C

Electrical Requirements

Single-fan Dryers

Three-fan Dryers

DATE	REVISIONS	PAGES
01/23/2018	– Updated electrical requirements tables	3-4

Electrical Requirements

IMPORTANT: Grain Dryer power box contains a molded case disconnect switch for incoming power. **IT IS NOT A CIRCUIT BREAKER!** A service-rated, fused disconnect needs to be installed ahead of grain dryer power distribution box. This disconnect is not included with dryer and should be installed by a qualified electrician. **Grain dryer should be only device connected to this disconnect.**

NOTE: Incoming Current (Amps) shows the total current required (with Service Factor) to **continuously** operate a dryer's fan motor(s), unload motor and control circuitry. **During fan startup,** the Soft Start will limit fan motor(s) amp draw to 350% of nameplate FLA. If this 350% inrush current cannot be provided by main transformer, motor may not get up to speed before a fault condition occurs, especially in cold weather. Changing Soft Start settings and timing may be required to start fan. Consult Sukup dealer before making any settings adjustments. If motors still will not start after adjustments, a larger transformer or a different starting method, variable frequency drive (VFD) may be needed.

The following tables provide information for the electrician wiring the grain dryer. It is recommended that the local power company be contacted to have a representative inspect installation to ensure wiring is compatible with their system, and that sufficient power is supplied to dryer.

Standard electrical safety practices and codes should be used. Refer to the National Electrical Code (NEC) Handbook by the National Fire Protection Association (NFPA).

All electrical work should be completed by a qualified electrician.

Electrical Requirements by Panel # (3-Phase)

Panel #	Start Method	Voltage	Fan(s) HP	Fan Motor #1	Fan Motor #2	Fan Motor #3	Fan Motor #4	Load Motor #	Unload Motor #	Fan 1	Fan 2	Fan 3	Fan 4	VFD Setting (A)	4 Aux Amps	Panel Amps	Main Switch Size (A)	Total Max Amps
U05960	SS	230	50	H7210	--	--	--	H1445	H1445	134.6	--	--	--	4.4	0	139	250	139
U05975	SS	230	60	H7260	--	--	--	H1445	H1445	159.9	--	--	--	4.4	0	164	250	164
U05962	SS	460	50	H7210	--	--	--	H1445	H1445	66.7	--	--	--	2.3	0	69	250	69
U05964	SS	230	50	H7210	--	--	--	H1445	H1445	134.6	--	--	--	4.4	0	139	250	139
U05965	SS	230	75	H7505	--	--	--	H1445	H1445	196.7	--	--	--	4.4	0	201	250	201
U05965X	VFD	230	75	H7505	--	--	--	H1445	H1445	196.7	--	--	--	4.4	0	201	250	201
U05967	SS	460	75	H7505	--	--	--	H1445	H1445	98.3	--	--	--	2.3	0	101	250	101
U05967X	NA	460	75	H7505	--	--	--	H1445	H1445	98.3	--	--	--	2.3	0	101	250	101
U05968	LS	460	75	H7505	--	--	--	H1445	H1445	98.3	--	--	--	2.3	0	101	250	101
U05969	SS	575	75	H7503	--	--	--			74.8	--	--	--	2.3	0	77	250	77
U05970	SS	208	75	H7505	--	--	--	H1445	H1445	217.4	--	--	--	4.4	0	222	250	222
U10995	SS	230	50	H7210	--	--	--	H1445	H1445	134.6	--	--	--	4.4	0	139	250	139
U10997	SS	460	50	H7210	--	--	--	H1445	H1445	66.7	--	--	--	2.3	0	69	250	69
U12992	SS	230	60	H7260	--	--	--	H1445	H1445	159.9	--	--	--	4.4	0	164	250	164
U12993	LS	460	75	H7505	--	--	--	H1445	H1445	98.3	--	--	--	2.3	0	101	250	101
U12994	SS	380	125	H7511	--	--	--	L3080	L3080	153.5	--	--	--	--	0	154	250	154
U12995	SS	230	100	H7510	--	--	--	H1445	H1445	258.8	--	--	--	4.4	0	263	400	263
U129959	SS	208	100	H7510	--	--	--	H1445	H1445	286.1	--	--	--	4.4	0	291	400	291
U12996	SS	460	100	H7510	--	--	--	H1445	H1445	129.4	--	--	--	2.3	0	132	250	132
U129961	VFD	460	100	H7510	--	--	--	H1445	H1445	129.4	--	--	--	2.3	0	132	250	132
U12997	SS	460	60	H7260	--	--	--	H1445	H1445	79.9	--	--	--	2.3	0	82	250	82
U12998	SS	460	75	H7505	--	--	--	H1445	H1445	98.3	--	--	--	2.3	0	101	250	101
U12999	SS	575	100	H7509	--	--	--	H1445	H1445	104.1	--	--	--	2.3	0	106	250	106
U129931	SS	230	40	H7200	H7200	H7200	--	H2040	H2040	105.8	105.8	105.8	--	6.0	0	323	400	323
U129951	SS	460	40	H7200	H7200	H7200	--	H2040	H2040	52.9	52.9	52.9	--	3.0	0	162	250	162
U18994	SS	460	60	H7260	H7260	H7260	--	H2040	H2040	79.9	79.9	79.9	--	3.0	0	243	250	243
U18995	SS	230	75	H7505	--	--	--	H1445	H1445	196.7	--	--	--	2.3	0	199	250	199

Information is organized by panel number. Panel number and other important information can be found on white sticker inside main power box.

Electrical Requirements by Panel # (3-Phase) - continued

Panel #	Start Method	Voltage	Fan(s) HP	Fan Motor #1	Fan Motor #2	Fan Motor #3	Fan Motor #4	Load Motor #	Unload Motor #	Fan 1	Fan 2	Fan 3	Fan 4	VFD Setting (A)	4 Aux Amps	Panel Amps	Main Switch Size (A)	Total Max Amps
U18996	SS	460	75	H7505	H7505	H7505	--	H2040	H2040	98.3	98.3	98.3	--	3.0	0	298	400	298
U189951	SS	380	75	H7505	--	--	--	L3077	L3077	95.0	--	--	--	3.0	0	98	250	98
U189981	SS	380	75	H7505	H7505	H7505	--	L3077	L3077	95.0	95.0	95.0	--	--	0	285	400	285
U189982	SS	460	50	H7210	H7210	H7210	--	H2040	H2040	66.7	66.7	66.7	--	3.0	0	203	250	203
U189983	SS	460	60	H7260	H7260	H7260	--	H2040	H2040	79.9	79.9	79.9	--	3.0	0	243	250	243
U189986	SS	380	60	H7270	H7270	H7270	--	H2560	H2560	95.0	95.0	95.0	--	--	0	285	400	285
U189987	SS	575	60	H7262	H7262	H7262	--	H1445	H1445	60.3	60.3	60.3	--	2.3	0	183	250	183
U189991	SS	230	50	H7210	H7210	H7210	--	H2040	H2040	134.6	134.6	134.6	--	6.0	0	410	600	410
U189992	SS	575	75	H7505	H7505	H7505	--	H2040	H2040	95.5	95.5	95.5	--	6.0	0	292	400	292
U189993	LS	230	75	H7505				H1445	H1445	115.0	115.0	115.0	--	--	0	197	250	197
U189994	SS	380	100	H7510	H7510	H7510	--	L3077	L3077	115.0	115.0	115.0	--	--	0	345	400	345
U189997	SS	230	60	H7260	H7260	H7260	--	H2040	H2040	159.9	159.9	159.9	--	6.0	0	486	600	486
U189998	SS	230	75	H7505	H7505	H7505	--	H2040	H2040	196.7	196.7	196.7	--	6.0	0	596	600	596
U24995	SS	460	100	H7510	H7510	H7510	--	H2980	H2980	129.4	129.4	129.4	--	4.0	0	392	400	392
U24997	SS	380	125	H7511	H7511	H7511	--	L3081	L3081	153.5	153.5	153.5	--	4.0	0	465	600	465
U24998	SS	460	125	H7511	H7511	H7511	--	H2980	H2980	171.9	171.9	171.9	--	4.0	0	520	600	520
U24999	SS	460	125	H7511	H7511	H7511	H7511	H2980	H2980	171.9	171.9	171.9	171.9	4.0	0	692	800	692

Information is organized by panel number. Panel number and other important information can be found on white sticker inside main power box.

Appendix D

Drying Rate Tables

Modular Tower Dryers

Stick-built Tower Dryers

DATE	REVISIONS	PAGES
01/23/2018	Added instructions for setting unload rotor speed	2

Drying Rate Tables

Following are tables showing suggested unloading (drying) rates based on plenum temperatures and amount of moisture to be removed. **Example:** On a U2412 dryer, to remove 5 points of moisture with a plenum temperature of 170 degrees, unload rate should be set to 59%. Use “Manual Mode” on QuadraTouch Pro controller and adjust Unload Speed Set Point to 59%.

Numbers in charts are a good **starting point** when running in Manual. Final running speed may differ from charts as user may adjust speed as dryer runs. Distance between bottom of flow gate and unload table should be 5-1/2 inches.

These suggested rates are not guaranteed, nor should they be used as a capacity rating. Many factors such as flow gate setting, grain hybrid, fines, weather conditions, etc. may affect drying rate.

Setting Unload Rotor Speed

1. Using your grain input moisture and desired plenum temperature, use appropriate table on following pages to calculate approximate unload rate. Start dryer unload.
2. See table below for the approximate time it will take to turn the dryer over one complete time.
3. Calibrate discharge moisture sensor. See Operation section.
4. After the time from table below has expired, adjust unload rotor speed accordingly. If grain moisture is too wet, decrease speed, if too dry, increase speed. Typically it is only necessary to adjust by a few percentage points at a time. Allow at least 20-30 minutes between changes.
5. Once moisture sensor has been calibrated and you are seeing your desired output moisture on the screen, let the dryer run for at least half the amount of time initially calculated to turn the dryer completely. Outgoing grain moisture should be within .5% of desired moisture content before switching unload from Manual to Automatic.

MINUTES TO TURN OVER DRYER PER UNLOAD RATE %										
MODEL	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
U1010	345	173	115	86	69	58	49	43	38	35
U1510	443	222	148	111	89	74	63	55	49	44
U1812	396	198	132	99	79	66	57	50	44	40
U2012	436	218	145	109	87	73	62	54	48	44
U2412	493	247	165	124	99	82	71	62	55	49
U3018	387	193	129	97	77	64	55	48	43	39
U3518	436	218	145	109	87	73	62	54	48	44
U4018	485	243	162	121	97	81	69	61	54	49
U4718	551	276	184	138	110	92	79	69	61	55
U5024	475	238	158	136	95	79	68	59	53	48
U6024	386	187	126	95	75	63	54	47	42	38
U7024	567	284	189	162	113	95	81	71	63	57

MODEL U1010 Unload Rate % at Listed Moisture Removal			
PLENUM TEMP (F)	18 – 15 %	20 – 15 %	25 – 15 %
140	40	30	18
150	45	33	20
160	49	37	22
170	54	40	23
180	58	43	25
190	63	46	26
200	68	49	28
210	73	52	29
220	78	55	30

MODEL U1510 Unload Rate % at Listed Moisture Removal			
PLENUM TEMP (F)	18 – 15 %	20 – 15 %	25 – 15 %
140	55	42	25
150	61	46	28
160	68	51	31
170	74	55	33
180	81	59	35
190	87	64	38
200	94	68	41
210	100	72	43
220	---	76	46

MODEL U1812 Unload Rate % at Listed Moisture Removal			
PLENUM TEMP (F)	18 – 15 %	20 – 15 %	25 – 15 %
140	37	32	19
150	42	36	22
160	47	40	24
170	51	44	27
180	56	48	29
190	61	53	32
200	66	57	34
210	71	61	37
220	75	65	39

MODEL U2012 Unload Rate % at Listed Moisture Removal			
PLENUM TEMP (F)	18 – 15 %	20 – 15 %	25 – 15 %
140	41	35	21
150	46	40	24
160	52	44	27
170	57	49	29
180	62	54	32
190	68	58	35
200	73	63	38
210	78	67	40
220	84	72	43

MODEL U2412 Unload Rate % at Listed Moisture Removal			
PLENUM TEMP (F)	18 – 15 %	20 – 15 %	25 – 15 %
140	49	43	26
150	56	48	29
160	62	54	32
170	69	59	36
180	75	65	39
190	82	70	42
200	88	76	46
210	95	81	49
220	99	87	52

MODEL U3018 Unload Rate % at Listed Moisture Removal			
PLENUM TEMP (F)	18 – 15 %	20 – 15 %	25 – 15 %
140	32	27	16
150	36	31	19
160	40	35	21
170	44	38	23
180	48	42	25
190	53	45	27
200	57	49	29
210	61	52	31
220	65	56	34

MODEL U3518 Unload Rate % at Listed Moisture Removal			
PLENUM TEMP (F)	18 – 15 %	20 – 15 %	25 – 15 %
140	37	32	19
150	42	36	22
160	47	40	24
170	51	44	27
180	56	48	29
190	61	53	32
200	66	57	34
210	71	61	37
220	75	65	39

MODEL U4018 Unload Rate % at Listed Moisture Removal			
PLENUM TEMP (F)	18 – 15 %	20 – 15 %	25 – 15 %
140	42	36	22
150	48	41	25
160	53	46	27
170	59	50	30
180	64	55	33
190	69	60	36
200	75	65	39
210	80	69	42
220	86	74	44

MODEL U4718 Unload Rate % at Listed Moisture Removal			
PLENUM TEMP (F)	18 – 15 %	20 – 15 %	25 – 15 %
140	49	43	26
150	56	48	29
160	62	54	32
170	69	59	36
180	75	65	39
190	82	70	42
200	88	76	46
210	95	81	49
220	99	87	52

MODEL U5024 Unload Rate % at Listed Moisture Removal			
PLENUM TEMP (F)	18 – 15 %	20 – 15 %	25 – 15 %
140	36	31	19
150	40	35	21
160	45	39	23
170	50	43	26
180	54	47	28
190	59	51	31
200	64	55	33
210	68	59	35
220	73	63	38

MODEL U6024 Unload Rate % at Listed Moisture Removal			
PLENUM TEMP (F)	18 – 15 %	20 – 15 %	25 – 15 %
140	43	37	22
150	48	42	25
160	54	46	28
170	59	51	31
180	65	56	34
190	70	61	36
200	76	65	39
210	81	70	42
220	87	75	45

MODEL U7024 Unload Rate % at Listed Moisture Removal			
PLENUM TEMP (F)	18 – 15 %	20 – 15 %	25 – 15 %
140	50	43	26
150	57	49	29
160	63	54	33
170	70	60	36
180	76	66	39
190	83	71	43
200	89	77	46
210	96	82	49
220	99	88	53

Appendix E

Setting Unload System

Setting Unload System

This should be done before/during first time dryer is used, and checked yearly.

It is critical that unload system of dryer is set properly so all grain columns will flow at same rate. If a column flows much slower than others, grain will be over-dried. If a column flows much faster than others, grain will be under-dried. Uneven drying is energy-inefficient, reduces dryer capacity, and reduces quality of grain.

To get columns to discharge a consistent amount of grain, first make sure that scraper blades on unload rotor are parallel with grain floor. If scrapers are nearly touching the floor on one side of dryer and are 2" above floor on other side, dryer will discharge grain unevenly. If grain floor is not perfectly level, then rotor shaft and scraper blades will need to be adjusted. Once rotor is parallel to grain floor, flow gates on each column are used to fine-tune discharge rate. **See Fig. 1 for component identification and follow steps 1-7 to set unload system.**

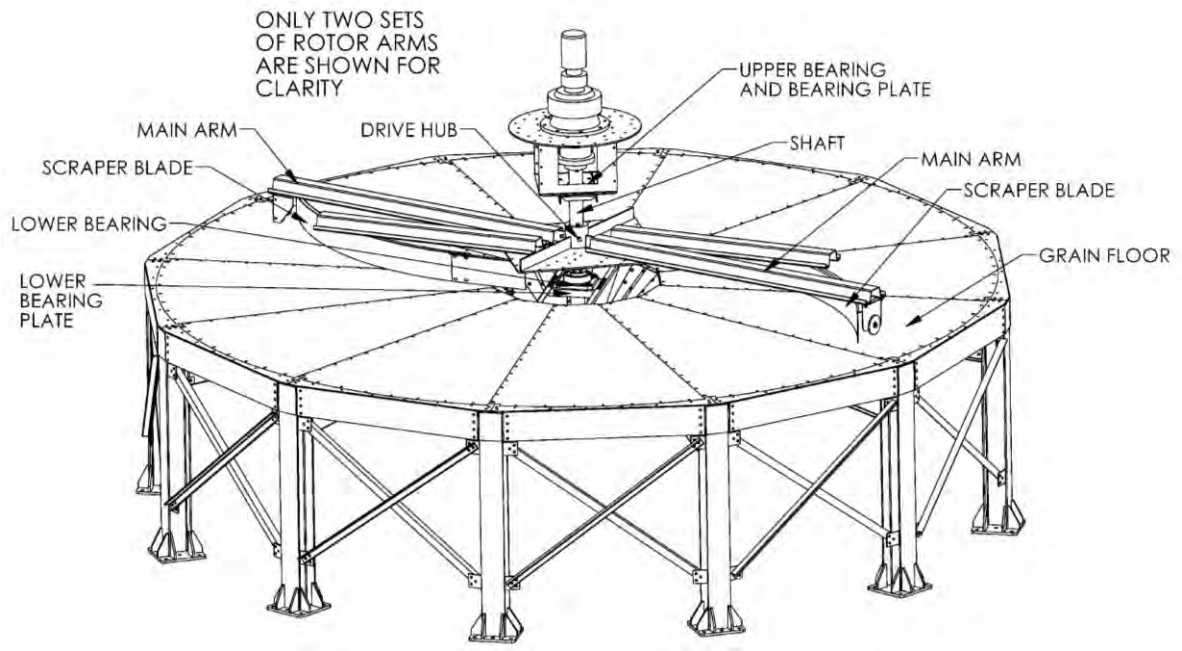


Fig. 1 – Unload system components

1. **Make sure bottom of scraper blades are parallel to grain floor**. Choose one scraper blade and measure distance from bottom of blade to grain floor. See Fig. 2. Run unload rotor and stop it every 90° to check the same measurement. If measurements vary by more than 1/2", adjust angle of rotor and shaft.

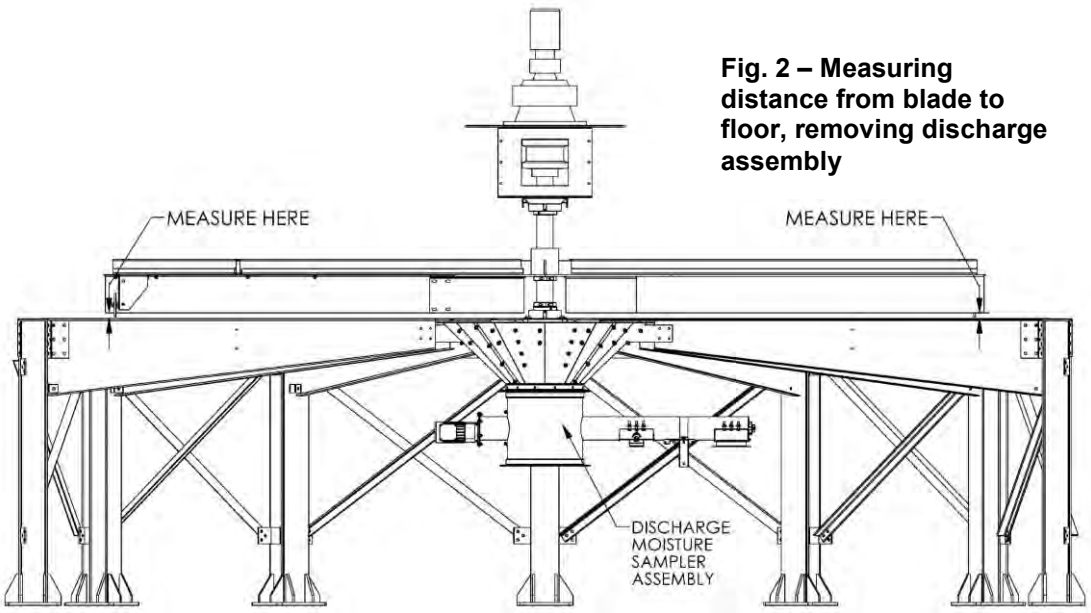


Fig. 2 – Measuring distance from blade to floor, removing discharge assembly

2. **Adjust rotor/shaft angle to grain floor.** Start by loosening four bolts for upper bearing, but do not remove bolts. Next, remove discharge moisture sampler assembly. See Fig. 2. This will provide access to lower bearing bolts and bottom of rotor shaft. Loosen four bolts on lower bearing and 10 bolts on lower bearing plate, but do not remove bolts. Lower bearing bolts are in slots in one direction and bolts holding bearing plate in are slotted in other direction. See Fig. 3. Using a pry bar from under dryer, push rotor shaft in direction needed to equalize measurements taken in Step 1. **NOTE:** On some tower dryers there may not be slots in lower bearing plate. If necessary, use a grinder to make slots or use slightly smaller bolts for lower bearing. Retighten all bolts once shaft has been adjusted.

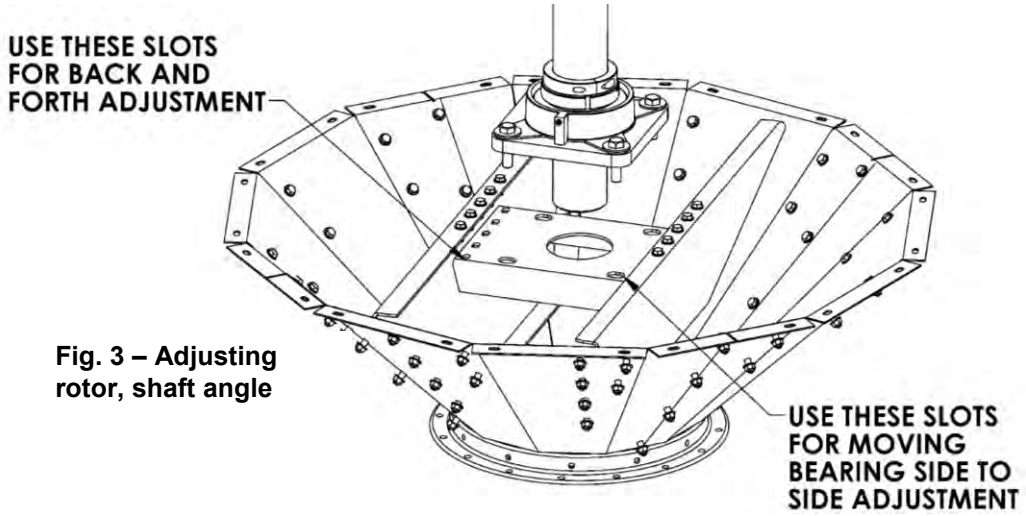


Fig. 3 – Adjusting rotor, shaft angle

3. **Set height of rotor on shaft.** Scraper blades should be as close to grain floor as possible without touching it. Make sure all washers/spacers are removed between drive hub and main arms. Raise (or lower) drive hub until scraper blades are just higher than highest point of grain floor. To raise rotor, loosen setscrews on drive hub and use a bottle jack between drive hub and lower bearing support plate. See Fig. 4. Two jacks may be needed if hub binds on shaft.

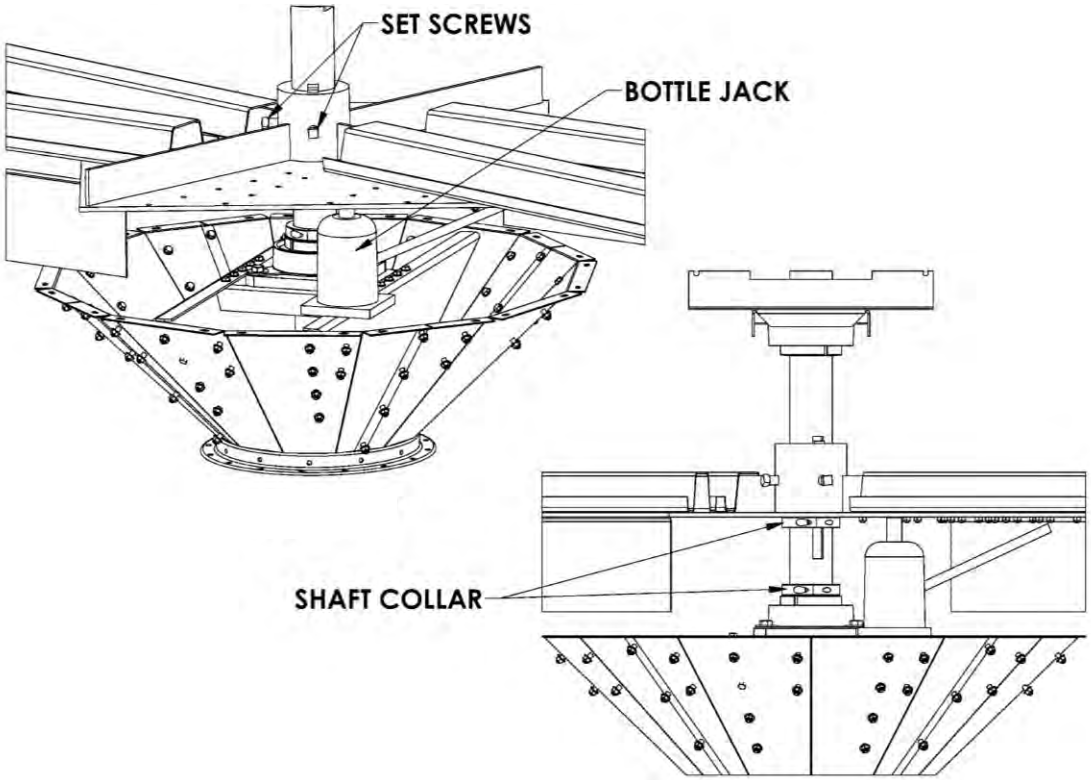


Fig. 4 – Securing rotor height with shaft collars

After drive hub is raised up on shaft, tighten setscrews and position two shaft collars between bottom of drive hub and top of lower bearing as shown in Fig. 4.This keeps shaft and drive hub from slipping down.

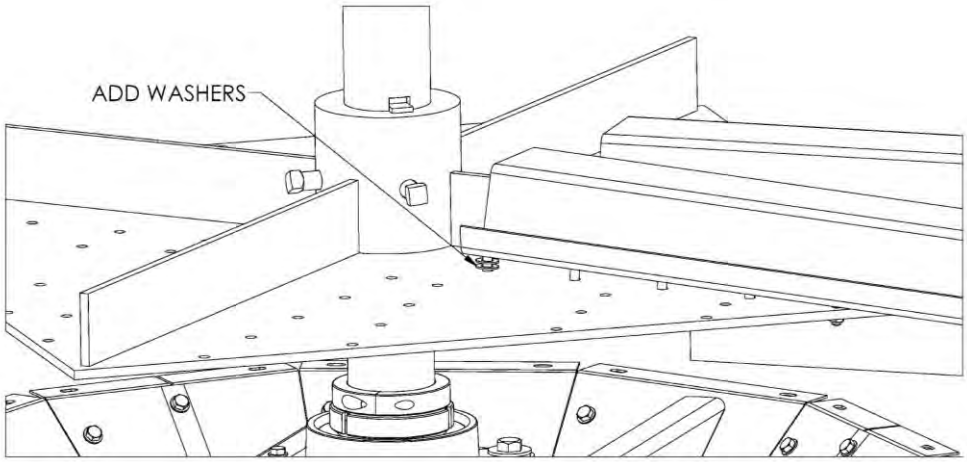


Fig. 5 – Using shims to position scraper blades

4. **Shim main arms so scraper blades are as close to grain floor as possible without touching it.** Use washers as shims between each main arm and drive hub. See Fig. 5. Shim washers should go only on bolts closest to center. If scraper blade needs to be higher on outside, entire drive hub should be jacked up higher. Run rotor a full revolution and make sure scraper blades do not touch grain floor. Adjust white poly wheels so they barely touch grain floor.

5. **Adjust flow gates**. Each column of tower dryer has its own independently adjustable flow gate. Check that each flow gate is set at distance of 5-1/2” from grain floor. **Tip:** Use two blocks of wood 5-1/2” in height as gauges on each side of gate. **NOTE:** When dryer is full of grain, it is easier to raise flow gates than lower them.

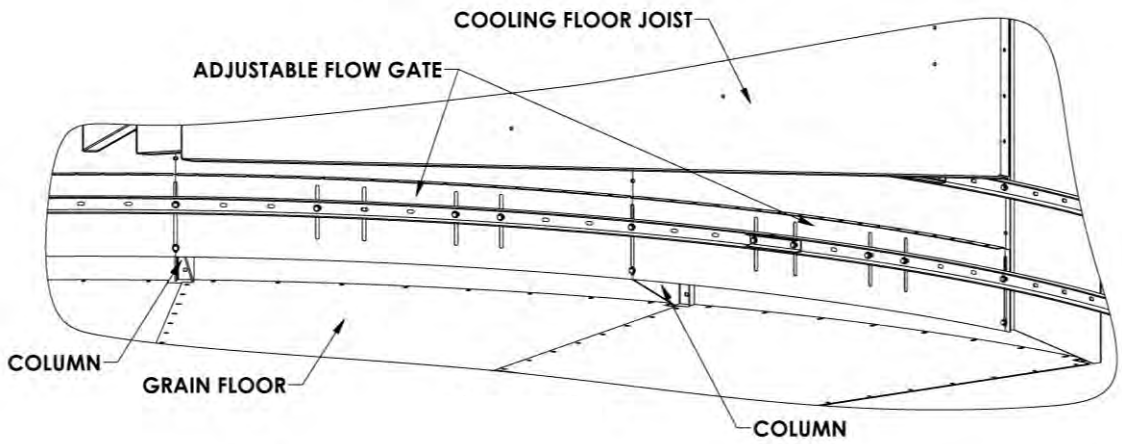


Fig. 6 – Adjusting flow gates

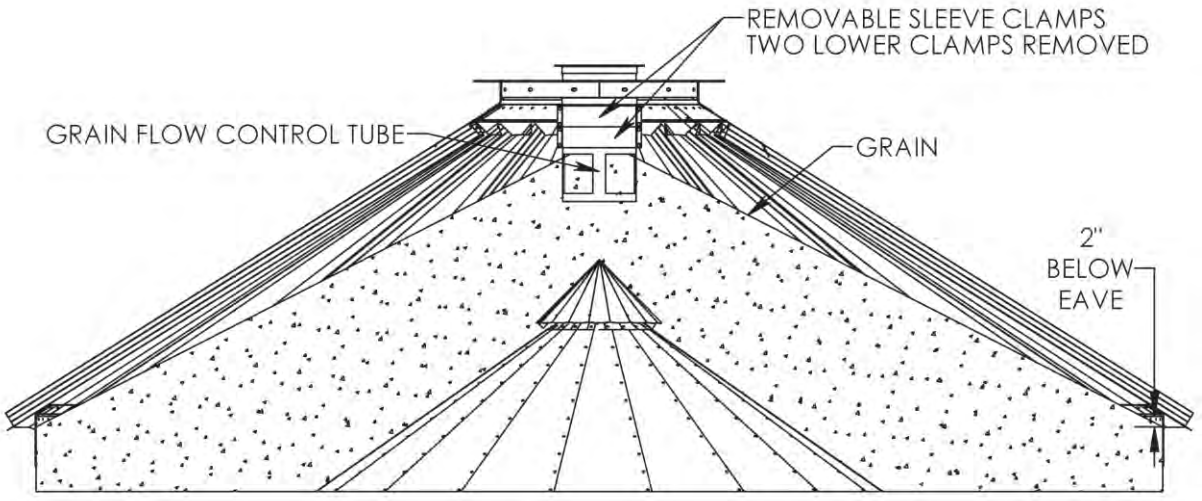
6. **Check grain levels.** Fill dryer with grain and then turn **load** system off. Run **unload** system for 10-20 minutes. Check level of grain in each column. Raising flow gates makes grain flow down columns faster; lowering flow gates makes grain flow down columns slower. Scraper blades should be full of grain to top of scraper, with just a little flowing over, to get maximum capacity. If scrapers are not full of grain, raise flow gates 1/4” to 1/2” on columns with more grain in them. If a lot of grain is flowing over scrapers, lower flow gates 1/4” to 1/2” on columns with less grain in them.

7. **Fine-tune flow rates.** Repeat Step 6 until grain flows are consistent in all columns. **NOTE:** Columns with pass-thru doors into dryer will flow faster than other columns because there is less grain in them. Flow gate settings will likely have to be higher than those for other columns.

Appendix F

Adjusting Grain Flow Tube

Adjusting Grain Flow Tube



Adjusting grain flow tube

Grain flow control tube near top of dryer is adjustable. See drawing above. Sleeve clamps can be removed or added as needed to ensure grain does not press against roof of dryer. As shown above, grain should be no higher than 2 inches below eave of tower roof.

Appendix G

Altistart 22 Soft Start

Programming ATS22 Soft Start

Motor Full-load Amps

Troubleshooting ATS22

DATES	REVISIONS	PAGES
01/23/2018	Updated ATS Soft Start programming	2-3

The following information is needed from motor nameplate before programming the ATS22 Soft Start:

Motor voltage: _____

Motor horsepower: _____

Steps to program ATS22 Soft Start

1. Press down arrow until **conF (Configuration Menu)** is shown on screen.
2. Press Enter.
3. Press down arrow until **UIn (Line Voltage)** is shown on screen.
4. Press Enter.
5. Press up or down arrow until display shows line voltage of dryer. If dryer is 230VAC, set to 240. If dryer is 380VAC, set to 400. If dryer is 460VAC, set to 480. If dryer is 575VAC, set to 600.
6. Press Enter. Display should blink, indicating that new value is set into memory.
7. Press the down arrow until **In (Motor Rated Current)** is shown on display.
8. Press Enter.
9. Press up or down arrows to set motor current. Find panel number on white sticker in power box and in tables on pages C-3 and C-4. Motor current will be listed in Fan 1 column.
10. Press Enter. Display should blink indicating that new value is set into memory.
11. Press down arrow until **LAC (Advanced Mode)** is shown on screen.
12. Press Enter.
13. Press down or up arrow until **on** is shown on screen.
14. Press Enter. Display should blink indicating that new value is set into memory.
15. Press Escape.
16. Display should show **ConF**.
17. Press down arrow until **SEt (Settings Menu)** is shown on screen.
18. Press Enter.
19. Display should show **t90 (Initial voltage)**. If not, press down arrow until it appears on screen.
20. Press Enter.
21. Press down or up arrow until **50** is displayed on screen.
22. Press Enter. Display should blink indicating that new value is set into memory.
23. Press down arrow until **tLS (Max Start Time)** is shown on screen.
24. Press Enter.
25. Press down or up button until **50** is displayed on screen.
26. Press Enter. Display should blink indicating that new value is set into memory.
27. Press down arrow until **ACC (Acceleration time)** is displayed on screen.
28. Press Enter.
29. Press down or up arrow until **15** is displayed on screen.
30. Press Enter. Display should blink indicating that new value is set into memory.
31. Press down arrow until **tHP (Motor Thermal Protection)** appears on screen.
32. Press Enter.
33. Press down or up arrow until **20** appears on screen.
34. Press Enter. Display should blink indicating that new value is set into memory.
35. Press Escape.

36. Display should show **SEt**.
37. Press down arrow until **ADJ (Advanced adjustments menu)** appears on screen.
38. Press Enter.
39. Display should show **Snb (Number of starts)**. If not, press down button until it appears on screen.
40. Press Enter.
41. Press down or up button until **I** appears on screen.
42. Press Enter. Display should blink indicating that new value is set into memory.
43. Press down arrow until **SLG (Start period)** shows up on screen.
44. Press Enter.
45. Press down or up arrow until **5** appears on screen.
46. Press Enter. Display should blink indicating that new value is set into memory.
47. Press down arrow until **SSC (Start-stop control)** appears on screen.
48. Press Enter.
49. Press down or up arrow until **oFF** appears on display.
50. Press Enter. Display should blink indicating that new value is set into memory.
51. Press Escape.
52. Press Escape again. Display should show **ADJ**.
53. Press down arrow until **IO (Advanced Input/Output Menu)** appears on screen.
54. Press Enter.
55. Press down arrow until **r1 (Relay 1)** appears on screen.
56. Press Enter.
57. Press down or up arrow until **Tr Ip** appears on the screen.
58. Press Enter. Display should blink indicating that new value is set into memory.
59. Press down arrow until **r2 (Relay 2)** appears on screen.
60. Press Enter.
61. Press down or up arrow until **rUn** appears on screen.
62. Press Enter. Display should blink indicating that new value is set into memory.
63. Press Escape.
64. Display should show **IO**.
65. Press Escape again or until **rdY** appears on display.
66. Turn off control power to soft start.
67. Restore power to soft start and allow it to reboot.

Troubleshooting ATS22 Soft Start for Towers

NOTE: The following pages are from Altistart 22 Soft Start User Manual, BBV51330, dated 09/2015. A complete copy can be found at www.schneider-electric.com.

Diagnostics / Troubleshooting

Soft starter does not start, no trip code displayed

- No display:
  - check that the line supply is present on the control supply CL1/CL2,
  - check if a short circuit is not existing on the Modbus network cable (especially between RJ45 pin 7 and RJ45 pin3 or pin8. See pages 35 and 36).
- Check that the code displayed does not correspond to the normal state of the soft starter (see page 46).
- Check for the presence of the RUN/STOP commands (see page 37).

Soft starter does not start, trip code displayed

- Trip code flashes on the display.
- Storing of the last 7 trips, visible with SoMove software workshop.
- The soft starter locks and the motor stop with to freewheel mode.

⚠⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Read and understand the precautions in "Before you begin" chapter, before performing any procedure in this section.

Failure to follow these instructions will result in death or serious injury.

Trip code displayed	Name	Remedy
bPF	Bypass contactor detected fault	• Switch-off the soft starter and contact Schneider Electric services.
CFF	Invalid configuration on power-up	• Revert to the factory setting in the soft starter UtIL menu • Reconfigure the soft starter
EtF	External detected fault	• Clear the cause of the detected fault
GrdF	Ground leakage current detected fault	• Check the electrical insulation of the motor • Check the installation • Check the values of Grdd, Grdt parameters in PrO menu page 57
InF	Internal detected fault	• Disconnect and reconnect the control supply. If the detected fault persists, contact Schneider Electric product support
OCF	Motor overcurrent	• Check the values of OId and OIt parameters in PrO menu page 56
OHF	Over heat detected fault Low temperature detected fault	• Check the sizing of the soft starter in relation to the motor and the mechanical requirement • Check the operation of the fan (if the Altistart 22 used has one), ensuring that the air passage is not obstructed in any way and the heatsink is clean. Ensure that the mounting recommendations are observed • Wait for the Altistart 22 cooling before restarting, keeping the starter powered on
OLF	Overload motor	• Check the mechanism (wear, mechanical play, lubrication, blockages, etc.) • Check the sizing of the soft starter motor in relation to the mechanical requirement • Check the value of tHP parameter in SEt menu page 52 and In parameter in conF menu page 50 • Wait for the motor to cool before restarting
OSF	Overvoltage	• Check ULn parameter in conF menu • Check the power supply circuit and voltage • Check OSd and OSt parameters in PrO menu
OtF	Motor Over Temperature • Motor thermal trip detected by the PTC probes	• Check the mechanism (wear, mechanical play, lubrication, blockages, etc.) • Check the sizing of the soft starter motor in relation to the mechanical requirement • Check the value of PtC setting in PrO menu page 59 • Wait for the motor to cool before restarting

Diagnostics / Troubleshooting

Trip code displayed	Name	Remedy
PHbd	Phase unbalance	• Check the line voltage. • Check the values of Ubd, UbL parameters in PrO menu page 57.
PHF	Loss of a line phase	• Check the line voltage, the connection to the soft starter and any isolating devices located between the line and the soft starter (contactors, fuses, circuit breakers, etc.). • Check the motor connection and any isolating devices located between the soft starter and the motor (contactors, circuit breakers, etc.). • Check the motor state.
	Line frequency, out of tolerance This detected fault can be configured in PrO menu	• Check the line frequency. • Check the configuration of PHL.
P IF	Phase inversion Line phase inversion does not conform to the selection made by PHr in PrO menu	• Invert two lines phases or set PHr = oFF.
trAP	Trap code	• Disconnect and reconnect the control supply. If the detected fault persists, contact Schneider Electric support.
SCF	Short circuit: • short-circuit on soft starter output	• Switch-off the soft starter. • Check the motor connections and the motor insulation. • If connections and insulation are OK, contact Schneider Electric services.
SLF	Modbus Time Out	• Serial link detected fault. Check the RS485 connection.
SnbF	Too many starts	• The number of soft starts has exceeded the maximum allowed by Snb in SLG period. See Snb page 53.
SSCr	Shorted thyristor or wrong connection	• Switch-off the soft starter. • Check the motor connections and the motor insulation. • If connections and insulation are OK, contact Schneider Electric services.
StF	Starting time detected fault • Too long start time	• Check the mechanism (wear, mechanical play, lubrication, blockages, etc.) • Check that tLS (Max start time) is bigger than ACC (Acceleration time). See SEt menu page 51. • Check the sizing of the soft starter motor in relation to the mechanical requirement • Check ILt value : if the value is too low, the motor may not reach acceleration and full speed.
tbS	Too many starts	• Wait 5 minutes for frame size A. • Wait 15 minutes for frame sizes B, C, D and E. tbS appears after SnbF trip message, when trying to reset the soft starter before end of the timer.
UCF	Motor underload (undercurrent)	• Check the values of UCd and UCL parameters in PrO menu page 57.
USF	Under voltage or no voltage	• Check UCn, USd and USt parameters in PrO menu • Check line voltage.

Remote keypad messages

Display		Message	Description
InIt		On initializing itself	Microcontroller initializing. Communication configuration searching.
COME	flashing	Communication interruption	It has 50 ms time out. This message is shown after 20 times retrying.
A - 17	flashing	Key alarm	• Key has been held consecutively more than 10 seconds. • Membrane switch disconnected. • Keypad waked up while a key is holding.
CLr	flashing	Confirm trip reset	This is shown when : First time STOP key has been pressed while the soft starter has tripped in detected fault.
dEUE	flashing	Soft starter mismatch	Soft starter type (brand) did not match with keypad type (brand).
rOME	flashing	ROM trip	Keypad ROM detected fault.
rAME	flashing	RAM trip	Keypad RAM detected fault.
CPUE	flashing	CPU trip	Keypad CPU detected fault.

Appendix H

Altivar Variable Frequency Drive

Programming ATV 320
VFD Starter Protector Settings
Troubleshooting ATV 320

DATES	REVISIONS	PAGES
01/23/2018	– Updated Altivar VFD programming & troubleshooting pages	2, 4-8

Programming Altivar 320 Variable Speed Drive

Use green jog dial for navigation by turning clockwise or counterclockwise. Pressing jog dial enables user to make a selection or confirm information. Use adjacent ESC button to quit a menu or parameter or to clear value displayed in order to revert to value in memory.

To enter each setting below, press RDY, CONF, FULL and then scroll to setting name. Press Enter after each entry, then ESC until get to RDY.

Settings for 230V 3HP 1Ø or 3Ø 60HZ

ITH	(Motor Thermal Current)	8A
IDC1	(DC Injection Level 1)	7.7A
IDC2	(DC Injection Level 2)	4A
CLI	(Internal Current Limit)	12A
BFR	(Standard Motor Frequency)	60Hz NEMA
R2	(Relay Output 2 Assignment)	Drv. Running
OPL	(Output Phase Loss)	Yes
NRD	(Noise Reduction)	Yes
NSP	(Rated Motor Speed)	1750

Settings for 380V 3HP 3Ø 50HZ

ITH	5.4A
IDC1	3.8A
IDC2	2.7A
CLI	8.1A
R2	Drv. running
OPL	Yes
NRD	Yes
NSP	1750

Settings for 460V 3HP 3Ø 60HZ

ITH	4A
IDC1	3.8A
IDC2	2A
CLI	6A
BFR	60Hz NEMA
R2	Drv. running
OPL	Yes
NRD	Yes
NSP	1750

Settings for 575V 3HP 3Ø 60HZ

ITH	2.8A
IDC1	2.7A
IDC2	1.4A
CLI	5.8A
BFR	60Hz NEMA
R2	Drv. running
OPL	Yes
NRD	Yes
NSP	1750

Variable Frequency Drive Starter Protector Settings

3/4HP through 3HP, add 1.15 Service Factor to Starter Protector Settings

Motor Horsepower		Voltage	Method of Starting	Starter Protector Setting	Comp. #	Motor Chart Setting
¾HP	10' Tower	208VAC	ALL	4.3AMP	J5234	3.7AMP
		230VAC		3.7AMP	J5234	3.2AMP
		460VAC		1.8AMP	J5233	1.6AMP
		575VAC		1.5AMP	J5233	1.3AMP
1-½HP	12' Tower	208VAC	ALL	7.9AMP	J5236	6.9AMP
		230VAC		6.9AMP	J5236	6.0AMP
		380VAC		4.1AMP	J5234	3.6AMP
		460VAC		3.5AMP	J5234	3.0AMP
		575VAC		2.8AMP	J5233	2.4AMP
2HP	18' Tower	208VAC	ALL	9.0AMP	J5236	7.8AMP
		230VAC		7.8AMP	J5236	6.8AMP
		380VAC		6.7AMP	J5236	5.8AMP
		460VAC		3.9AMP	J5234	3.4AMP
		575VAC		3.1AMP	J5234	2.7AMP
3HP	24' Tower	380VAC	ALL	6.7AMP	J5236	5.8AMP
		460VAC		5.5AMP	J5234	4.8AMP
		575VAC		4.5AMP	J5234	3.9AMP

Troubleshooting Altivar 320 Variable Speed Drive

NOTE: The following pages are from Altivar Machine ATV320 Variable Speed Drives Programming Manual, NVE41295, dated 10/2017. A complete copy can be found at www.schneider-electric.com

Error code

- If the display does not light up, check the power supply to the drive.
- The assignment of the Fast stop or Freewheel functions will help to prevent the drive starting if the corresponding logic inputs are not powered up. The ATV320 then displays **[Freewheel]** (nSt) in freewheel stop and **[Fast stop]** (FSt) in fast stop. This is normal since these functions are active at zero so that the drive will be stopped if there is a wire break.
- Check that the run command input is activated in accordance with the selected control mode (**[2/3 wire control]** (tCC) and **[2 wire type]** (tCt) parameters, page 85).
- If an input is assigned to the limit switch function and this input is at zero, the drive can only be started up by sending a command for the opposite direction (see page 224).
- If the reference channel or command channel is assigned to a communication bus, when the power supply is connected, the drive will display **[Freewheel]** (nSt) and remain in stop mode until the communication bus sends a command.

Code	Name / Description
dGt-	**[DIAGNOSTICS]** This menu can only be accessed with the graphic display terminal. It displays detected faults and their cause in plain text and can be used to carry out tests, see page 64.

Clearing the detected fault

In the event of a non resettable detected fault:

- Disconnect all power, including external control power that may be present.
- Lock all power disconnects in the open position.
- Wait 15 minutes to allow the DC bus capacitors to discharge (the drive LEDs are not indicators of the absence of DC bus voltage).
- Measure the voltage of the DC bus between the PA/+ and PC/– terminals to ensure that the voltage is less than 42 Vdc.
- If the DC bus capacitors do not discharge completely, contact your local Schneider Electric representative. Do not repair or operate the drive.
- Find and correct the detected fault.
- Restore power to the drive to confirm the detected fault has been rectified.

In the event of a resettable detected fault, the drive can be reset after the cause is cleared:

- By switching off the drive until the display disappears completely, then switching on again.
- Automatically in the scenarios described for the **[AUTOMATIC RESTART]** (Atr-) function, page 252.
- By means of a logic input or control bit assigned to the **[FAULT RESET]** (rSt-) function, page 251.
- By pressing the STOP/RESET key on the graphic display keypad if the active channel command is the HMI (see **[Cmd channel 1]** (Cd1) page 155).

Fault detection codes which require a power reset after the detected fault is cleared

The cause of the detected fault must be removed before resetting by turning off and then back on.

ASF, brF, SoF, SPF and EnF detected faults can also be cleared remotely by means of a logic input or control bit ([Fault reset] (rSF) parameter, page 251).

Detected Fault	Name	Probable cause	Remedy
AnF	[Load slipping]	• The difference between the output frequency and the speed feedback is not correct.	• Check the motor, gain and stabillity parameters. • Add a braking resistor. • Check the size of the motor/drive/load. • Check the encoder's mechanical coupling and its wiring. • Check the setting of parameters
ASF	[Angle Error]	• This occurs during the phase-shift angle measurement, if the motor phase is disconnected or if the motor inductance is too high.	• Check the motor phases and the maximum current allowed by the drive.
brF	[Brake feedback]	• The brake feedback contact does not match the brake logic control. • The brake does not stop the motor quickly enough (detected by measuring the speed on the "Pulse input" input).	• Check the feedback circuit and the brake logic control circuit. • Check the mechanical state of the brake. • Check the brake linings.
CrF1	[Precharge]	• Charging relay control detected fault or charging resistor damaged.	• Turn the drive off and then turn on again. • Check the internal connections. • Contact Schneider Electric Product Support.
EEF1	[Control Eeprom]	• Internal memory detected fault, control block.	• Check the environment (electromagnetic compatibility). • Turn off, reset, return to factory settings. • Contact Schneider Electric Product Support.
EEF2	[Power Eeprom]	• Internal memory detected fault, power card.	
FCF1	[Out. contact. stuck]	• The output contactor remains closed although the opening conditions have been met.	• Check the contactor and its wiring. • Check the feedback circuit.
HdF	[IGBT desaturation]	• Short-circuit or grounding at the drive output.	• Check the cables connecting the drive to the motor, and the motor insulation.
iLF	[internal com. link]	• Communication interruption between option card and drive.	• Check the environment (electromagnetic compatibility). • Check the connections. • Replace the option card. • Contact Schneider Electric Product Support.
inF1	[Rating error]	• The power card is different from the card stored.	• Check the reference of the power card.
inF2	[Incompatible PB]	• The power card is incompatible with the control block.	• Check the reference of the power card and its compatibility.
inF3	[Internal serial link]	• Communication interruption between the internal cards.	• Check the internal connections. • Contact Schneider Electric Product Support.
inF4	[Internal-mftg zone]	• Internal data inconsistent.	• Recalibrate the drive (performed by Schneider Electric Product Support).
inF6	[Internal - fault option]	• The option installed in the drive is not recognized.	• Check the reference and compatibility of the option. • Check that the option is well inserted into the ATV320.
inF9	[Internal- I measure]	• The current measurements are incorrect.	• Replace the current sensors or the power card. • Contact Schneider Electric Product Support.
inFA	[Internal-mains circuit]	• The input stage is not operating correctly.	• Contact Schneider Electric Product Support.
inFb	[Internal- th. sensor]	• The drive temperature sensor is not operating correctly.	• Replace the drive temperature sensor. • Contact Schneider Electric Product Support.
inFE	[Internal- CPU]	• Internal microprocessor detected fault.	• Turn off and reset. • Contact Schneider Electric Product Support.
SAFF	[Safety fault]	• Debounce time exceeded. • SS1 threshold exceeded. • Wrong configuration. • SLS type overspeed detected.	• Check the safety functions configuration. • Check the ATV320 Integrated safety Functions manual • Contact Schneider Electric Product Support.

Detected Fault	Name	Probable cause	Remedy
SoF	[Overspeed]	• Instability or driving load too high.	• Check the motor, gain and stability parameters. • Add a braking resistor. • Check the size of the motor/drive/load. • Check the parameters settings for the [FREQUENCY METER] (FqF-) function page 266, if it is configured.
SPF	[Speed fdback loss]	• Signal on "Pulse input" missing, if the input is used for speed measurement. • Encoder feedback signal missing	• Check the wiring of the input cable and the detector used. • Check the configuration parameters of the encoder. • Check the wiring between the encoder and the drive. • Check the encoder.

Fault detection codes that can be cleared with the automatic restart function after the cause has disappeared

These detected faults can also be cleared by turning on and off or by means of a logic input or control bit ([Fault reset] (rSF) parameter page 251).

Detected Fault	Name	Probable cause	Remedy
bLF	[Brake control]	• Brake release current not reached. • Brake engage frequency threshold [Brake engage freq] (bEn) only regulated when brake logic control is assigned.	• Check the drive/motor connection. • Check the motor windings. • Check the [Brake release I FW] (Ibr) and [Brake release I Rev] (Ird) settings page 194. • Apply the recommended settings for [Brake engage freq] (bEn).
CnF	[Com. network]	• Communication interruption on communication card.	• Check the environment (electromagnetic compatibility). • Check the wiring. • Check the time-out. • Replace the option card. • Contact Schneider Electric Product Support.
CoF	[CANopen com.]	• Communication interruption on the CANopen® bus.	• Check the communication bus. • Check the time-out. • Refer to the CANopen® User's manual.
EPF1	[External flt-LI/Bit]	• Event triggered by an external device, depending on user.	• Check the device which caused the triggering and reset.
EPF2	[External fault com.]	• Event triggered by a communication network.	• Check for the cause of the triggering and reset.
FbES	[FB stop flt.]	• Function blocks have been stopped while motor was running.	• Check [Stop FB Stop motor] (FbSM) configuration.
FCF2	[Out. contact. open.]	• The output contactor remains open although the closing conditions have been met.	• Check the contactor and its wiring. • Check the feedback circuit.
LCF	[input contactor]	• The drive is not turned on even though [Mains V. time out] (LCt) has elapsed.	• Check the contactor and its wiring. • Check the time-out. • Check the supply mains/contactor/drive connection.
LFF3	[AI3 4-20mA loss]	• Loss of the 4-20 mA reference on analog input AI3.	• Check the connection on the analog inputs.
obF	[Overbraking]	• Braking too sudden or driving load. • Supply voltage too high.	• Increase the deceleration time. • Install a braking resistor if necessary. • Activate the [Dec ramp adapt.] (brA) function page 172, if it is compatible with the application. • Check the supply voltage.
oCF	[Overcurrent]	• Parameters in the [SETTINGS] (SEt-) and [MOTOR CONTROL] (drC-) menus are not correct. • Inertia or load too high. • Mechanical locking.	• Check the parameters. • Check the size of the motor/drive/load. • Check the state of the mechanism. • Decrease [Current limitation] (CLI). • Increase the switching frequency.
oHF	[Drive overheat]	• Drive temperature too high.	• Check the motor load, the drive ventilation and the ambient temperature. Wait for the drive to cool down before restarting.
oLC	[Proc. overload flt]	• Process overload.	• Check and remove the cause of the overload. • Check the parameters of the [PROCESS OVERLOAD] (oLd-) function, page 272.
oLF	[Motor overload]	• Triggered by excessive motor current.	• Check the setting of the motor thermal protection, check the motor load. Wait for the motor to cool down before restarting.
oPF1	[1 output phase loss]	• Loss of one phase at drive output.	• Check the connections from the drive to the motor.

Detected Fault	Name	Probable cause	Remedy
oPF2	[3 motor phase loss]	• Motor not connected or motor power too low. • Output contactor open. • Instantaneous instability in the motor current.	• Check the connections from the drive to the motor. • If an output contactor is being used, set [Output Phase Loss] (oPL) to [Output cut] (oAC), page 256. • Test on a low power motor or without a motor: In factory settings mode, motor phase loss detection is active [Output Phase Loss] (oPL) = [Yes] (YES). To check the drive in a test or maintenance environment, without having to use a motor with the same rating as the drive (in particular for high power drives), deactivate motor phase loss detection [Output Phase Loss] (oPL) = [No] (noo), see instructions given page 256. • Check and optimize the following parameters: [IR compensation] (uFr) page 90, [Rated motor volt.] (UnS) and [Rated mot. current] (nCr) page 86 and perform [Auto tuning] (tUn) page 87.
oSF	[Mains overvoltage]	• Supply voltage too high. • Disturbed mains supply.	• Check the supply voltage.
otFL	[LI6=PTC overheat]	• Overheating of PTC probes detected on input LI6.	• Check the motor load and motor size. • Check the motor ventilation. • Wait for the motor to cool before restarting. • Check the type and state of the PTC probes.
PtFL	[LI6=PTC probe]	• PTC probe on input LI6 open or short-circuited.	• Check the PTC probe and the wiring between it and the motor/drive.
SCF1	[Motor short circuit]	• Short-circuit or grounding at the drive output.	• Check the cables connecting the drive to the motor, and the motor insulation. • Reduce the switching frequency. • Connect chokes in series with the motor. • Check the adjustment of speed loop and brake. • Increase the [Time to restart] (tAr), page 101. • Increase the switching frequency.
SCF3	[Ground short circuit]	• Significant earth leakage current at the drive output if several motors are connected in parallel.	• Check the cables connecting the drive to the motor, and the motor insulation. • Reduce the switching frequency. • Connect chokes in series with the motor. • Check the adjustment of speed loop and brake. • Increase the [Time to restart] (tAr), page 101. • Reduce the switching frequency.
SCF4	[IGBT short circuit]	• Power component detected fault.	• Contact Schneider Electric Product Support.
SCF5	[Motor short circuit]	• Short-circuit at drive output.	• Check the cables connecting the drive to the motor, and the motor's insulation. • Contact Schneider Electric Product Support.
SLF1	[Modbus com.]	• Communication interruption on the Modbus bus.	• Check the communication bus. • Check the time-out. • Refer to the Modbus User's manual.
SLF2	[PC com.]	• Communication interruption with PC Software.	• Check the PC Software connecting cable. • Check the time-out.
SLF3	[HMI com.]	• Communication interruption with the graphic display terminal or remote display terminal.	• Check the terminal connection • Check the time-out.
SSF	[Torque/current lim]	• Switch to torque or current limitation.	• Check if there are any mechanical problems. • Check the parameters of [TORQUE LIMITATION] (tOL-) page 216 and the parameters of the [TORQUE OR I LIM. DETECT.] (tId-), page 264.
tJF	[IGBT overheat]	• Drive overheated.	• Check the size of the load/motor/drive. • Reduce the switching frequency. • Wait for the motor to cool before restarting.

Detected Fault	Name	Probable cause	Remedy
tnF	[Auto-tuning]	• Special motor or motor whose power is not suitable for the drive. • Motor not connected to the drive. • Motor not stopped	• Check that the motor/drive are compatible. • Check that the motor is present during auto-tuning. • If an output contactor is being used, close it during auto-tuning. • Check that the motor is stopped during tune operation.
uLF	[Proc. underload Flt]	• Process underload.	• Check and remove the cause of the underload. • Check the parameters of the [PROCESS UNDERLOAD] (uLd-) function, page 270.

Fault detection codes that are cleared as soon as their cause disappears

Detected Fault	Name	Probable cause	Remedy
CFF	[Incorrect config.]	• Option card changed or removed.	• Check that there are no card errors. • In the event of the option card being changed/removed deliberately, see the remarks below.
		• Control block replaced by a control block configured on a drive with a different rating.	• Check that there are no card errors. • In the event of the control block being changed deliberately, see the remarks below.
		• The current configuration is inconsistent.	• Return to factory settings or retrieve the backup configuration, if it is valid (see page 81).
CFi CFi2	[Invalid config.]	• Invalid configuration. The configuration loaded in the drive via the bus or communication network is inconsistent.	• Check the configuration loaded previously. • Load a compatible configuration.
CSF	[Ch. Sw. fault]	• Switch to not valid channels.	• Check the function parameters.
dLF	[Dynamic load fault]	• Abnormal load variation.	• Check that the load is not blocked by an obstacle. • Removal of a run command causes a reset.
FbE	[FB fault]	• Function blocks error.	• See [FB Fault] (FbFE) for more details.
HCF	[Cards pairing]	• The [CARDS PAIRING] (PPi-) function page 269 has been configured and a drive card has been changed.	• In the event of a card error, reinsert the original card. • Confirm the configuration by entering the [Pairing password] (PPi) if the card was changed deliberately.
PHF	[Input phase loss]	• Drive incorrectly supplied or a fuse blown. • One phase missing. • 3-phase ATV320 used on a single-phase supply mains. • Unbalanced load. This protection only operates with the drive on load.	• Check the power connection and the fuses. • Use a 3-phase supply mains. • Disable the detected fault by [Input phase loss] (iPL) = [No] (nO) page 86.
USF	[Undervoltage]	• Supply mains too low. • Transient voltage dip.	• Check the voltage and the parameters of [UNDERVOLTAGE MGT] (USb-), page 259.

Option card changed or removed

When an option card is removed or replaced by another, the drive locks in [Incorrect config.] (CFF) fault mode on power-up. If the card has been deliberately changed or removed, the detected fault can be cleared by pressing the ENT key twice, which causes the factory settings to be restored (see page 81) for the parameter groups affected by the card. These are as follows:

Card replaced by a card of the same type

- Communication cards: only the parameters that are specific to communication cards

Control block changed

When a control block is replaced by a control block configured on a drive with a different rating, the drive locks in [Incorrect config.] (CFF) fault mode on power-up. If the control block has been deliberately changed, the detected fault can be cleared by pressing the ENT key twice, which **causes all the factory settings to be restored.**

Fault detection codes displayed on the remote display terminal

Code	Name	Description
init	[Initialization in progress]	The microcontroller is initializing. Search underway for communication configuration.
COM.E (1)	[Communication error]	Time out detected fault (50 ms). This message is displayed after 20 attempts at communication.
A- 17 (1)	[Alarm button]	A key has been held down for more than 10 seconds. The keypad is disconnected. The keypad wakes up when a key is pressed.
CLr (1)	[Confirmation of detected fault reset]	This is displayed when the STOP key is pressed once if the active command channel is the remote display terminal.
dEU.E (1)	[Drive disparity]	The drive brand does not match that of the remote display terminal.
rOM.E (1)	[ROM anomaly]	The remote display terminal detects a ROM anomaly on the basis of checksum calculation.
rAM.E (1)	[RAM anomaly]	The remote display terminal detects a RAM anomaly.
CPU.E (1)	[Other detected faults]	Other detected faults.

(1) Flashing

Appendix I

Optional Features

GSM Modem
Remote Mobile App Access
Auxiliary Motor Control Wiring

DATES	REVISIONS	PAGES
01/23/2018	– Added auxiliary motor control wiring guidance	8-10

GSM Modem Kit (T24999) Installation for QuadraTouch Pro

Kit Contents

Antenna
SIM card (pre-installed)
Ethernet 3G GSM modem
SMA male to female connector
4” DIN rail
1/4” Metal screws
6’ Ethernet Cat5e STP cable
8’ 24VDC power wires

Installation

WARNING: Lock out power to main power box before installation to eliminate potential for electrocution or shock. Modem operates on 24VDC, but higher voltage is present in power box. Failure to take this precaution could result in death or serious injury.

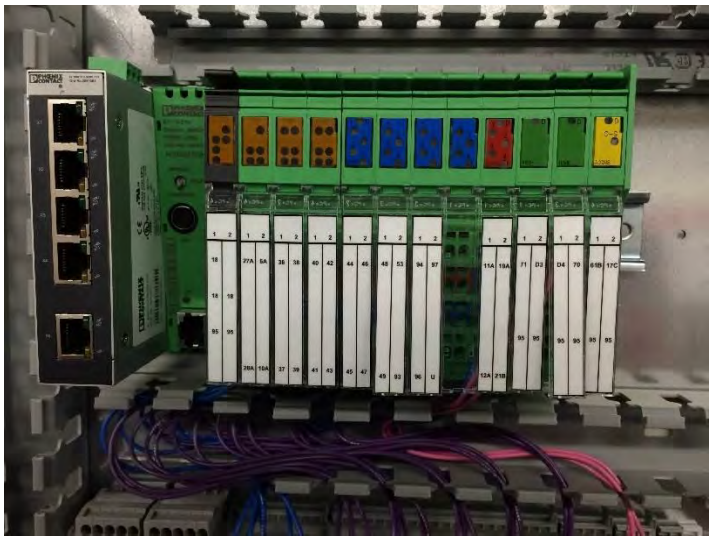
1. Antenna requires a 5/8” hole for through-panel mounting. Drill hole in top of auxiliary box as shown.

2. Ethernet 3G GSM modem mounts easily on DIN rail. If there is no space on DIN rail in auxiliary box, use self-drilling metal screws to attach a small piece of DIN rail (provided) in top left of auxiliary box. To avoid any water-related failures, do not mount modem directly below antenna hole.

3. Connect antenna to Ethernet 3G GSM modem using threaded connection. Make sure SMA male to female coupler is between antenna and modem as shown.

4. Connect 3G modem to power using provided orange (+24VDC to #18 terminal) and black (– to #95 terminal) wires.

5. Connect GSM Modem to Ethernet switch with provided 6’ Ethernet cable.



Ensure PLC and QuadraTouch Pro HMI are connected to Ethernet switch, shown at left in adjacent photo.

PLC, Ethernet 3G GSM modem, and QuadraTouch Pro touch screen should now each be connected to Ethernet switch.

Activation

Activation of GSM cellular service can be done in two ways.

OPTION 1:

SIM card provided with T24999 kit comes preinstalled in Ethernet 3G GSM modem. Contact your Sukup dealer for activation through Sukup Manufacturing Co. Dealers can electronically request GSM activation from Sukup using their dealer access at www.sukup.com.

OPTION 2:

You are also welcome to get GSM service on your own. There are typically at least two options for GSM service no matter where you live, such as AT&T, T-Mobile, & SmartTalk Wireless. Here is a brief description of what to do if you want your own GSM service.

1. Check for GSM coverage in your area. Check each one for best coverage/price.

2. Buy a **standard sized** SIM card from company selected. Some companies offer multiple kinds of SIM cards. Get one that can be activated on any phone. For instance, standard AT&T SIM card and GoPhone SIM card are available. While AT&T is the provider of both, AT&T SIM card is the one to use.

3. Remove existing SIM card and install new SIM card into back of Ethernet 3G GSM modem. Use SIM#1 (left slot). Use a paper clip or SIM tool to eject SIM tray.

4. Activate new SIM card online (usually easiest) or over phone.
   a. You will need to know the 20 digit SIM# on the SIM card.
   b. You may need 15-digit IMEI# found on sticker on inside of GSM modem.

Prepaid is usually the easiest way to go. Each company has different plans. GSM modem operates with text messages over *VOICE NETWORK*. **Do not get a data plan**. **DON'T ADD A LINE if it's not necessary! It will be much less expensive to use prepaid option. Keep in mind that if service expires at end of drying season, SIM will expire in 60 days and can never be reactivated.**

GSM Modem Operation Instructions

GSM Modem interacts with PLC by relaying text messages to a preprogrammed number in the touch-panel. In the event of a fault condition, the system will automatically text message that preprogrammed number one time per minute for 10 minutes. It will include the reason for the fault as well as a wire number if applicable.

If you have received the fault message and do not wish to keep receiving the same message for the next 10 minutes, simply send a text response of “00” to the GSM modem.

In addition to receiving text alerts on fault conditions, you can also query the dryer for its running status. Text message the GSM modem with “1234” and the modem will respond with the dryer’s running status, including time remaining (if applicable), plenum temperatures, moisture content, grain temperature, and roll speed.

If you wish to shut the dryer down without being there, a remote shutdown feature can be used. Text “8888” to GSM modem to shut down dryer remotely. You will not, however, be able to remotely start the dryer.

V2.60 and above software allows changing of plenum temperature setpoint(s) and discharge moisture setpoint.

Text “P#XXX” to give dryer a new plenum temperature setpoint.
Example: “P1220” would give plenum 1 (lowest plenum) a new setpoint of 220°
This command ***is not*** case sensitive. “P” or “p” will work.
PLC will send an acknowledgement SMS after setpoint has been changed.

Text “MSTXXX” to give dryer a new discharge moisture setpoint.
Example: “MST145” would give dryer a new setpoint of 14.5%.
This command ***is slightly*** case sensitive. “MST”, “Mst”, and “mst” will work.
PLC will send an acknowledgement SMS after setpoint has been changed.

Dryer can be texted from ANY phone with messages “00”, “1234”, “8888”, “P#XXX” or “MSTXXX”. However, only the preprogrammed number in touch panel will receive fault condition text message alerts.

Remote Mobile App Access

Requires QuadraTouch Pro™ Software V1.14 or later.

Talk to your Sukup Dealer about buying a Remote Access Key **T7101** from Sukup Manufacturing. This can be done online by your dealer with immediate digital delivery. The key will give you full remote access to the system for 1 full calendar year. You will also get free text message notifications with remote access. You will be able to renew the key annually.

Provide your dealer with the Device ID, located in the QuadraTouch Pro™ panel under **Tools → System Tools → Maintenance Tools → Enter Remote Access Key**. (*This can also be done from the app interface after it's successfully connected*). Once you've obtained the Remote Access Key, enter it below the Device ID.

Go to the App Store or Google Play Store and search for "Phoenix Contact Visu + Mobile". The APP logo is shown on the top right.

Download and Open the App.

Click "+" on the top left corner.

For "**Profile Name**" insert something like "My Dryer" or whatever you want to name the connection.

"Server Address" is very important. This is the device ID you have on your panel followed by the domain space: mysukup.com

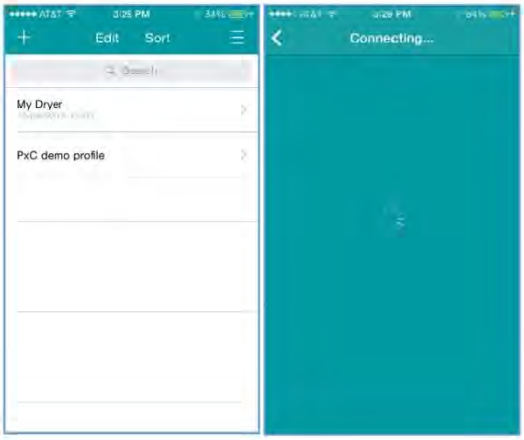
Example: 11111111.mysukup.com (shown right)

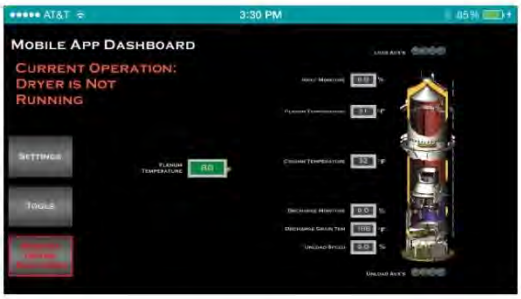
"Server Port": Always 12233 unless otherwise specified by Sukup Manufacturing Co.

"Startup Screen": "Mobile Dashboard" – No exceptions, case sensitive.

After the settings have been entered correctly, touch the "<" button on the top left. This will save your configuration.

Touch the new profile you created. The app will try to connect the with address you entered.





*The APP is designed for Landscape orientation. It will be helpful to use the "Lock Orientation" feature on your phone or tablet to reduce the amount of times the information refreshes.

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10.1.2016

Example -- Remote Access from anywhere in the world!

The QuadraTouch Pro™ system with V1.14 software is designed to be plug and play with any router. The software automatically configures the router to allow remote access*.

Go to Tools → System Tools → Maintenance Tools → Network Configuration

And choose the option for: "Auto-Configure Internet Access for Customer Provided Broadband"

There are two Ethernet ports on the back of the touchpanel. Use the open "X3" port on the back of the panel (pictured above) for remote access. The "X3" port is designated for DHCP assignment. This is meant to be used to connect the touchpanel to your home network. The "X2" port is already used to communicate directly to the PLC located in the power box. It has a static address of 192.168.1.98.

Important

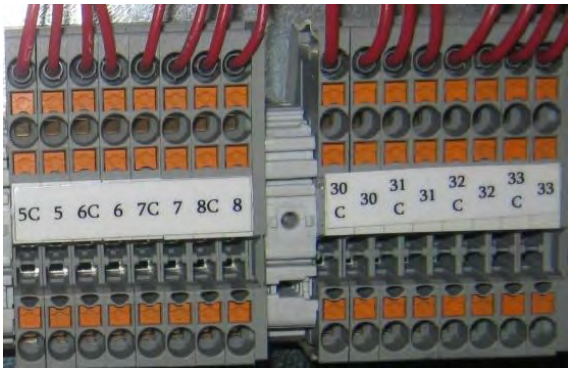
*UPNP must be supported/enabled on your router. Otherwise, a manual port forwarding rule will need to be added to your router's configuration. If you get internet access from a wireless provider and/or are behind an additional firewall or private network, you will need to contact your internet provider directly and provide this instructions sheet to them.

Note to internet providers: This system relies on port fortwarding to provide customers direct access to the system via the app. **A provisioned Public IP is preferred** as Sukup Manufacturing use a DDNS in conjuction with their Remote Access Key (see server address on first page) to direct web traffic to the QuadraTouch Pro™ panel. The UPNP ports are **12233** (if using DHCP Ethernet Adapter X3) and **12234** (if using Statically Assigned Ethernet Adapter X2). If the private network must stay intact, special routing rules will need to be setup on the front end to make sure incoming traffic on the WAN side reaches the QuadraTouch Pro™ panel. This is all the information needed to properly configure remote access. Sukup Manufacturing will not be able to assist in setting up / troubleshooting custom network solutions.

L7101
10.1.2016

Auxiliary Motor Control Wiring

Auxiliary motor control terminals are located in main power box. First picture shows terminals and second shows K relays for auxiliaries. There are eight (8) optional control circuits – four for loading system (K12 through K15) and four for unloading system (K16 through K19).



Customer Load/Unload DRY CONTACT terminals

K relays energized by 24VDC from PLC

AUXILIARY LOAD SYSTEM

NOTE: K relays are rated for 6 amps and are NOT fused.

Starting Load Sequence

1. Turn Load On
2. Call for Grain Signal
    a. Fill Switch (Wire 53) Opens (If two fill switches used, both Wire 53 and Wire 44 must be open to start loading process).
    b. Or Choke Fill is enabled
    c. 24VDC Customer Load Interlock Wire 34 signals to PLC to that customer is ready. **NOTE:** Dryer ships with factory-installed jumper from Wire 18 to Wire 34.
3. When conditions above are met, a factory-programmed 10-second delay starts.

4. There is a user-defined load delay setting (Settings > Load Delay Timer)
    a. Default is 0, 0-600 seconds range **NOTE:** This is in addition to 10-second factory-programmed delay.
5. Aux Load # 1 DRY CONTACTS are closed. K12 Relay. Wire 5 and Wire 5C are connected.
6. There is a user-defined time delay between Aux Load 1 and Aux Load 2.
    a. Settings > Load Auxiliary Timers (Default is 5 seconds, 1-30 Sec Range)
7. Aux Load # 2 DRY CONTACTS are closed. K13 Relay. Wire 6 and Wire 6C are connected.
8. There is a user-defined time delay between Aux Load 2 and Aux Load 3.
    a. Settings > Load Auxiliary Timers (Default is 5 seconds, 1-30 Sec Range)
9. Aux Load # 3 DRY CONTACTS are closed. K14 Relay. Wire 7 and Wire 7C are connected.
10. There is a user-defined time delay between Aux Load 3 and Aux Load 4.
    a. Settings > Load Auxiliary Timers (Default is 5 seconds, 1-30 Sec Range)
11. Aux Load # 4 DRY CONTACTS are closed. K15 Relay. Wire 8 and Wire 8C are connected.

Stopping Load Sequence (Dryer Full)

NOTE: Turn Load Off (Manual Shutdown) will stop load sequence no matter the state of fill switch.

1. Fill switch (Wire 53) closes, sending 24VDC to PLC
2. Aux Load # 4 DRY CONTACTS are opened. K15 Relay. Wire 8 and Wire 8C are disconnected.
3. There is a user-defined time delay between Aux Load 3 and Aux Load 4.
4. Aux Load # 3 DRY CONTACTS are opened. K14 Relay. Wire 7 and Wire 7C are disconnected.
5. There is a user-defined time delay between Aux Load 2 and Aux Load 3.
6. Aux Load # 2 DRY CONTACTS are opened. K13 Relay. Wire 6 and Wire 6C are disconnected.
7. There is a user-defined time delay between Aux Load 1 and Aux Load 2.
8. Aux Load # 1 DRY CONTACTS are opened. K12 Relay. Wire 5 and Wire 5C are disconnected.

AUXILIARY UNLOAD SYSTEM

NOTE: K relays are rated for 6 amps and are NOT fused.

Starting Unload Sequence

1. Turn Unload On
2. Unload Aux # 4 DRY CONTACTS are closed. K16 Relay. Wire 30 and Wire 30C are connected.

3. There is a user-defined time delay between Aux Unload 3 and Unload Aux 4.
    a. Settings > Unload Auxiliary Timers (Default is 3 seconds, 1-30 Sec Range)
4. Unload Aux # 3 DRY CONTACTS are closed. K17 Relay. Wire 31 and Wire 31C are connected.
5. There is a user-defined time delay between Aux Load 2 and Unload Aux 3.
    a. Settings > Unload Auxiliary Timers (Default is 3 seconds, 1-30 Sec Range)
6. Unload Aux # 2 DRY CONTACTS are closed. K18 Relay. Wire 32 and Wire 32C are connected.
7. There is a user-defined time delay between Aux Load 1 and Unload Aux 2.
    a. Settings > Unload Auxiliary Timers (Default is 3 seconds, 1-30 Sec Range)
8. Unload Aux # 1 DRY CONTACTS are closed. K19 Relay. Wire 33 and Wire 33C are connected.
9. There is a user-defined time delay between Tower Unload Table and Unload Aux 1.
    a. Settings > Unload Auxiliary Timers (Default is 3 seconds, 1-30 Sec Range)
    b. 24VDC Customer Unload Interlock Wire 35 Signal to PLC to tell it that customer is ready. **NOTE:** Dryer ships with factory installed jumper from Wire 18 to Wire 35.
10. Tower Unload Table Starts

Stopping Unload Sequence

NOTE: Turn Unload Off (Manual Shutdown) will start the stopping sequence.

1. Tower Unload Table Stops
2. There is a user-defined time delay between Tower Unload Table and Unload Aux 1.
3. Unload Aux # 1 DRY CONTACTS are opened. K19 Relay. Wire 33 and Wire 33C are disconnected.
4. There is a user-defined time delay between Unload Aux 1 and Unload Aux 2.
5. Unload Aux # 2 DRY CONTACTS are opened. K18 Relay. Wire 32 and Wire 32C are disconnected.
6. There is a user-defined time delay between Unload Aux 2 and Unload Aux 3.
7. Unload Aux # 3 DRY CONTACTS are opened. K17 Relay. Wire 31 and Wire 31C are disconnected.
8. There is a user-defined defined time delay between Unload Aux 3 and Unload Aux 4.
9. Unload Aux # 4 DRY CONTACTS are opened. K16 Relay. Wire 30 and Wire 30C are disconnected.