



*Precision Built Solutions™*

# FRYER / SIEMENS 828 CONTROL

## ELECTRICAL MAINTENANCE MANUAL MILLING & TURNING



# TABLE OF CONTENTS

## **1.0 - GENERAL INFORMATION**

1.1 Electrical System .....	3
1.2 Setting Axes Home Positions .....	3
1.3 Adjusting Backlash Compensation .....	4
1.4 Accessing Machine Parameters .....	5
1.5 Accessing the Software Version .....	5
1.6 Revert to the Factory Set Password .....	5
1.7 Adjusting Input Voltage Parameters .....	5
1.8 Siemens Alarms .....	6
1.9 Clearing an Alarm .....	7
1.10 File Types .....	7
1.11 Back-Up An 828 Archive File to A USB Stick .....	7
1.12 Reloading an Archive File .....	8
1.13 Backing Up Tool Data on the 828 Control .....	8
1.14 Adding a Software Option on the 828 Control .....	9
1.15 Set up the Network Drive in the 828.....	11

## **2.0 - MILLING INFORMATION**

2.1 Mill M-Codes .....	13
2.2 Fryer PLC Alarms and Descriptions – Mills .....	14
2.3 828 Control Electrical Panel Layout – Mills.....	15
2.4 828 Control Panel Layout – Mills.....	16
2.5 828 3-Handwheel Operator Console (Option) .....	17

### **CAROUSEL TYPE ATC OPERATION**

2.6 Safety Rules -- READ BEFORE OPERATING ATC .....	18
2.7 Manual Operation of the Tool Changer .....	18
2.8 Setting Tool Change Height.....	18
2.9 Recovering from a Tool Change Failure.....	19
2.10 Tool Carousel HOME Position and Tool Bin# Reset.....	20
2.11 Spindle Orient Adjustment .....	20

### **ARM STYLE ATC OPERATION**

2.12 Safety Rules -- READ BEFORE OPERATING ATC .....	21
2.13 Manual Operation of the Tool Changer .....	22
2.14 Setting Tool Change Height.....	22
2.15 Recovering from a Tool Change Failure.....	23
2.16 ATC HOME Position and Tool Bin# Reset .....	23
2.17 Spindle Orient Adjustment .....	24

## **3.0 - TURNING INFORMATION**

3.1 Lathe M-Codes .....	25
3.2 Fryer PLC Alarms and Descriptions – Lathes .....	26
3.3 828 Control Electrical Panel Layout – Lathes .....	27
3.4 828 Front Console – Lathes.....	28
3.5 Duplomatic Turret Error Alarm Codes.....	29

# 1.0 GENERAL INFORMATION

## 1.1 Electrical System

- Schematics (1) – The Electrical and Pneumatic Schematics are inside electrical cabinet
- Cabinet Filter Type (2) – Purolator A23465 or equivalent
- Check Filter Interval - Weekly
- Change Filter Interval – As Required (depending on environment)



## 1.2 Setting Axes Home Positions

### PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

The 828 control comes standard with absolute encoders which generally do not require homing. However, if you have an issue with the battery or the machine is not turned on for an extended length of time the machine may need to be re-homed according to the following procedure. In addition, if an axis motor is removed or there is an issue with a motor coupling or pulley / belt assembly, one or more axes may need to be re-homed.

Refer to Section 1.4 for directions to access parameter screens.

1. Press **MENU SELECT**
2. Select **SETUP**
3. Select **MACHINE DATA**
4. Select **AXIS MD**
5. Select **SEARCH**
6. Enter **34210 [0]** in the search field (This will read **ENC\_REFP\_STATE**)
7. Select **OK**
8. Select the proper axis with the **AXIS + AND AXIS -**
9. Change the parameter **34210 [0]** to **0** for an axis with a motor encoder
10. Change the parameters **34210 [0]** and **34210 [1]** to **0** for an axis with a scale
11. Press **INPUT**
12. Cycle power to machine leaving it off for a minimum of 30 seconds
13. **Take extreme caution now as the machine can be crashed!**
14. Line up the home markers for all axes that need to be homed
15. Press the **E-STOP** button to turn off the servos
16. Press **MENU SELECT**

17. Select **SETUP**
18. Select **MACHINE DATA**
19. Select **AXIS MD**
20. Select **SEARCH**
21. Enter **34210 [0]** in the search field (This will read **ENC\_REFP\_STATE**)
22. Select **OK**
23. Select the proper axis with the **AXIS + AND AXIS -**
24. Make sure Parameter **34210 [0]** and **34210 [1]** (if axis has a scale) **are set to 0**. If it is not, it is probable that the wrong axis is selected.
25. Change the parameter **34210 [0]** to **1** for an axis with a motor encoder
26. Change the parameters **34210 [0]** and **34210 [1]** to **1** for an axis with a scale
27. Press **INPUT**
28. Turn the feed rate override all the way down
29. Pull the **E-Stop** button out
30. Select **RESET**
31. Press **HOME RETURN** (should say Jog Ref at the top of the screen)
32. For a mill, press **AXIS+** (refers to the hard key on the manual panel you have selected)
33. For a lathe, press **CYCLE START**
34. When done make sure parameter **34210 [0]** shows **2** for all axes (axis with motor encoder)
35. When done make sure parameter **34210 [0]** and parameter **34210 [1]** shows **2** for all axes (axis with scale)

### ***1.3 Adjusting Backlash Compensation***

---

#### **PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY**


Refer to Section 1.4 for directions to access parameter screens.

- Press **MENU SELECT**
- Select **SETUP**
- Select **MACHINE DATA**
- Select **AXIS MD**
- Using **AXIS+ AND AXIS-**, select the correct axis
- Select **SEARCH**
- Enter **32450 [0]** or **32450 [1]** if the machine is equipped with glass scales on the selected axis
- Adjust the backlash on each axis
- Select **SET MD ACTIVE (cf)**
- Select **RESET (po)** to reboot the control

## 1.4 Accessing Machine Parameters

---

### PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

 **WARNING**

**Malfunctions of the machine as a result of incorrect or changed parameter settings**

As a result of incorrect or changed parameterization, machines can malfunction, which in turn can lead to injuries or death.

- Protect the parameterization (parameter assignments) against unauthorized access.
- Handle possible malfunctions by taking suitable measures, e.g. emergency stop or emergency off.

1. Press **MENU SELECT**
2. Select **SETUP**
3. Select **MACHINE DATA**
4. Available folders: **GENERAL MD / CHANNEL MD / AXIS MD**

## 1.5 Accessing the Software Version

---

To find out the version of the software you are running on your 828 control:

1. Press **MENU SELECT**
2. Select **DIAGNOSIS**
3. Select **VERSION**
4. The Software Version number is on the first line and will read: **“V###.## + SP ## + HF ##”**

## 1.6 Revert to the Factory Set Password

---

### PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

1. Press **MENU SELECT**
2. Select **SETUP**
3. Select **SET PASSWORD**
4. Enter the password: **SUNRISE**
5. Press **OK**
6. The lower part of the screen should now read “Current Access Level: Manufacturer”

## 1.7 Adjusting Input Voltage Parameters

---

### PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

The Siemens control will shut itself off if the line voltage is more than 10% different than the voltage set in the control. You must adjust the parameter to match your line voltage to the machine.

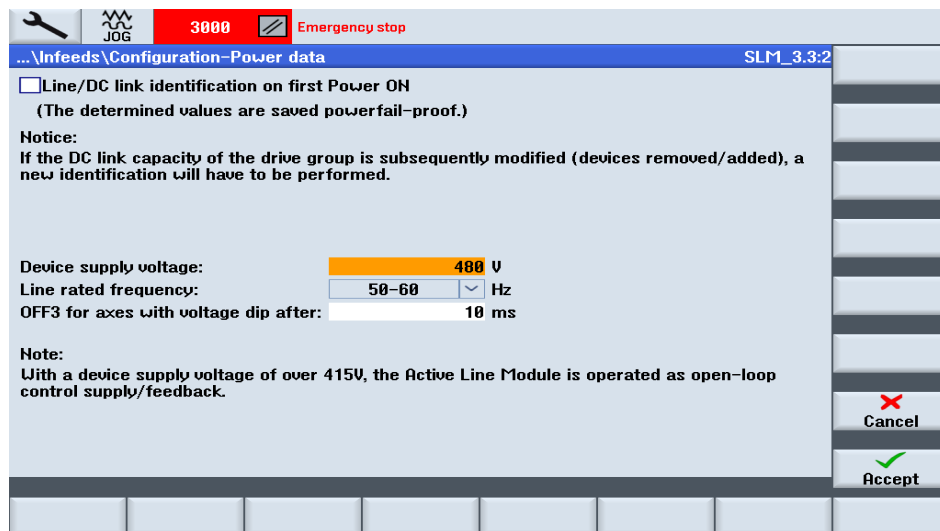
The first step to accurately measure your line voltage. There are two ways to do this.

- Measure the incoming line voltage across all three legs with a voltmeter. Average your readings and write down the value.  
- OR -
- Read the line voltage from the control, follow the following steps:
  - **MENU SELECT** key

- **SETUP** key
  - **INFEED PARAMETER** key
  - **Find r25[0] =** and write down the voltage value in this parameter.
- Now you have the proper line voltage value to enter in the control.

Follow the steps below:

- Press E-stop
- **MENU SELECT** key
- **SETUP** key
- Press  $\wedge$  (up arrow hard key next to machine hard key)
- **DRIVE SYSTEM** key
- **SUPPLY** key
- **POWER DATA** key See screen below:



- Scroll down to the **Device Supply Voltage** field like in the screen shot above. Enter the line voltage value you obtained in the previous steps, press enter
- Press **ACCEPT** key
- There will be a message that states, “Confirm You Want to Change the Parameter”, Press **YES** key to accept the change
- You are done.

## 1.8 Siemens Alarms

An alarm will be displayed once a fault occurs.

**! Warning:** *If you do not heed an alarm that is issued and do not resolve the cause of the alarm, it can present a hazard to the machine, the work piece, the saved settings, and in certain circumstances, may cause injury.*

1. If a familiar alarm number / description appears carefully check the machine and resolve the cause of the alarm.
2. If you are unfamiliar with the alarm in question, proceed to the alarm list as follows:
  - a. Press **MENU SELECT**

- b. Select **DIAGNOSTICS**
  - c. Select **ALARM LIST**
3. \*Once "**ALARM LIST**" has been selected, press **HELP** key and additional information will be provided on the control screen.

### **1.9 Clearing an Alarm**

---

1. Carefully check the machine according to the description given in the alarm. Clarification of the alarm codes can be found by using the **HELP** as described above.
2. Resolve the cause of the alarm.
3. Press **RESET**
4. Certain alarms will require a reboot of the control to clear.

### **1.10 File Types**

---

- **NC** archive contains the machine **PARAMETERS**
- **PLC** archive contains the **LADDER LOGIC** for the machine functions
- **DRV** archive contains the **AXIS DRIVE SETTINGS**

### **1.11 Back-Up An 828 Archive File to A USB Stick**

---

For a download of the machine archive to a USB, press these three keys at the same time on the control:

**CTRL + ALT + S**

This will create a complete standard Easy Archive (.ARD) on a USB.

If a specific file or additional files need to be backed up to a USB, do the following:

#### **PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY**

1. Select the **MENU SELECT**.
2. Select the **STARTUP**.
3. Press the **SYSTEM DATA** key. The data tree will open.
  - i. In the data tree, select the required files from which you want to generate an archive.
4. Press the **ARCHIVE** and **GENERATE ARCHIVE** keys.
5. The **GENERATE ARCHIVE: SELECT STORAGE LOCATION** window opens. Select the **USB** location for archiving.
6. Save the file as serial number of machine and the file name (i.e., for drive archive: "25123DRV")
7. Enter a name and press the **OK** key. The directory is created below the selected folder.
8. Press the **OK** key.
9. Select the format archive **ARD** for 828, enter the desired name and press the **OK** key to archive the file/files.
  - a. A message informs you if archiving was successful.
10. Press the **OK** key to confirm.
11. An archive file in the **.ARD (828)** format type is created in the selected directory.

\*Note: When backing up an entire machine you should generate an individual file for NC, PLC, Drive, and HMI. When that step is completed, you should generate an archive for all these together.

### 1.12 Reloading an Archive File

---

#### PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

**NOTE:** Set the password protection to “Current Access Level: Manufacturer”. Refer to Section 1.6 above.

1. Select the **PROGRAM MANAGER** key.
2. Press the **ARCHIVE** and **READ IN ARCHIVE** keys.
3. Select the archive storage location (i.e., **USB**) and position the cursor on the required archive.
4. Note: When the option is not set, the folder for user archives is only displayed if the folder contains at least one archive.

OR

5. Press the **SEARCH** key and in the search dialog, enter the name of the archive file with file extension **ARD** if you wish to search for a specific archive and press the **OK** key.
6. Press the **OK** or **OVERWRITE ALL** key to overwrite existing files.

OR

7. Press the **DO NOT OVERWRITE** key if you do not want to overwrite already existing files.

OR

8. Press the **SKIP** key if the read-in operation is to be continued with the next file.
9. The **READ IN ARCHIVE** window opens and a progress message box appears for the read-in process.
10. You will then obtain a **READ ERROR LOG FOR ARCHIVE** in which the skipped or overwritten files are listed.
11. Press the **CANCEL** key to cancel the read-in process.

\*Note: You may only archive one file at a time.

### 1.13 Backing Up Tool Data on the 828 Control

---

**NOTE:** Setup data from part programs can only be backed up if they have been saved in the **WORKPIECES** directory.

For part programs, which are located in the **PART PROGRAMS** directory, **SAVE SETUP DATA** is not listed.

1. Select the **PROGRAM MANAGER** operating area.
2. Position the cursor on the program whose tool and zero-point data you wish to back up.
3. Press the **>>** and **ARCHIVE** keys.
4. Press the **SETUP DATA** key.
5. The **BACKUP SETUP DATA** window opens. Select the data you want to back up.
6. Change the specified name of the originally selected program in the **FILE NAME** field, if needed.
7. Press the **OK** key.
8. The setup data will be set up in the same directory in which the selected program is stored as an INI file.



## 1.14 Adding a Software Option on the 828 Control

When you receive your machine all license numbers applicable to your order are activated prior to the machine leaving the factory. If you purchase a control option after the machine arrives at your facility you will receive a license number to enter into your control. The license will either require you to go online and create a new license key, or this will be already done for you. If you receive a license certificate like pictured in figure one go to step 1, if not and you already have a license (see figure 2) then proceed to step 8.

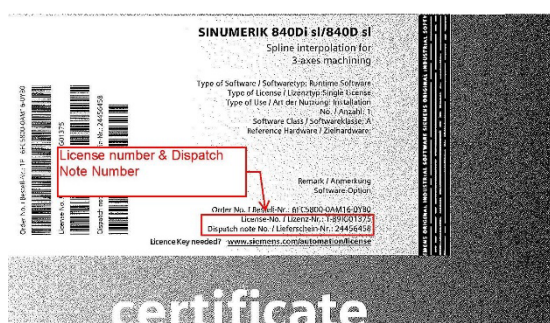
1. You need to obtain the hardware serial # (this not the same as the control serial number) follow these steps:

- Press **MENU SELECT**
- Press **SETUP**
- Select **LICENSE** (you may have to press the ^ or > key to see the soft key)
- Record the **CF CARD SERIAL #**

This number can also be found in the CF card located in your electrical cabinet. The number on the card is labeled as CFC SN. **CAUTION:** Machine must be powered down before the card is removed.

2. Once you have obtained your Control Hardware Serial Number you are ready to activate your new license number. Using the internet, log onto: [www.Siemens.com/Automation/License](http://www.Siemens.com/Automation/License)

- Click on the link for **DIRECT ACCESS**
- Enter the **LICENSE # AND DISPATCH NOTE #** from the paperwork into the areas indicated on the web page.



3. Click **NEXT**
4. On the next screen enter your hardware serial number.
5. Next select the control model. Your machine has a 828.
6. The system will now return a software license key
7. Download PDF and save for your records. Also print the PDF so you can refer to it at the machine to type in new license key.
8. Already have printed license see below:



- Follow step 1 to get to the license screen. Type in (overwriting old license key) current license key and press input. The field is highlighted, make sure to enter correctly.

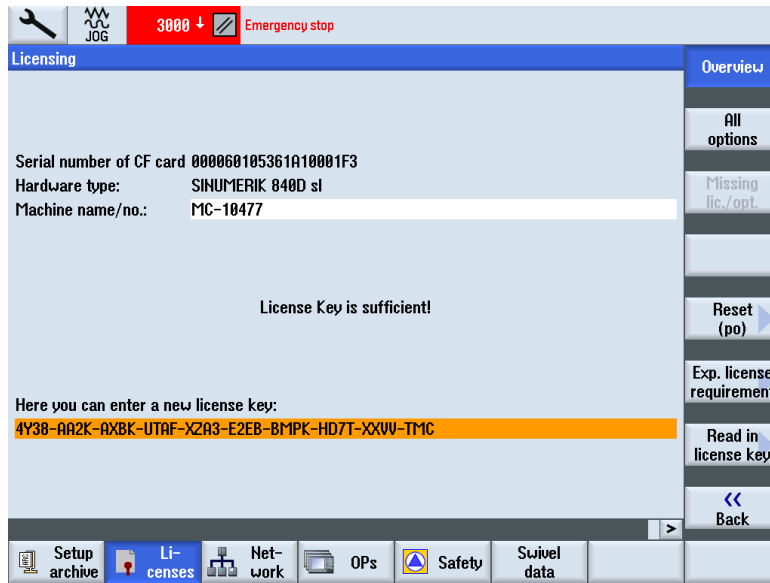


Figure 3

- Press all options soft key
- Search for the particular option you want to activate. Set the box with the select key. See figure 4.

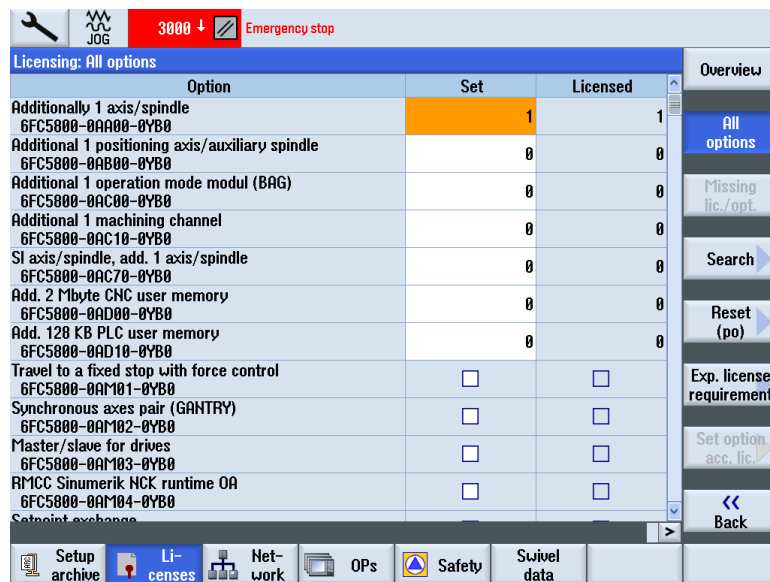


Figure 4

- Press back soft key and power machine down. When you turn the machine back on the option should be activated.

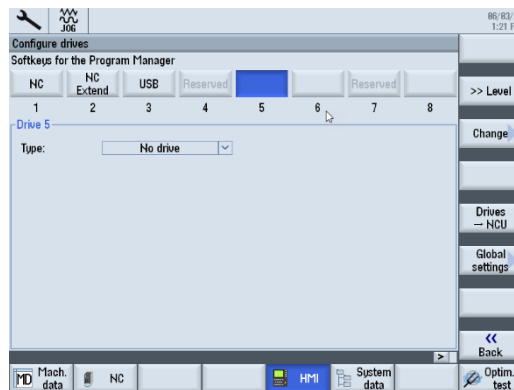
**! NOTE:** *It is recommended that this procedure be performed by an experienced network administrator.*

The transfer of programs can be achieved by mapping a soft- key to a networked computer. The soft key will appear in the Program Manager screen of the controller.

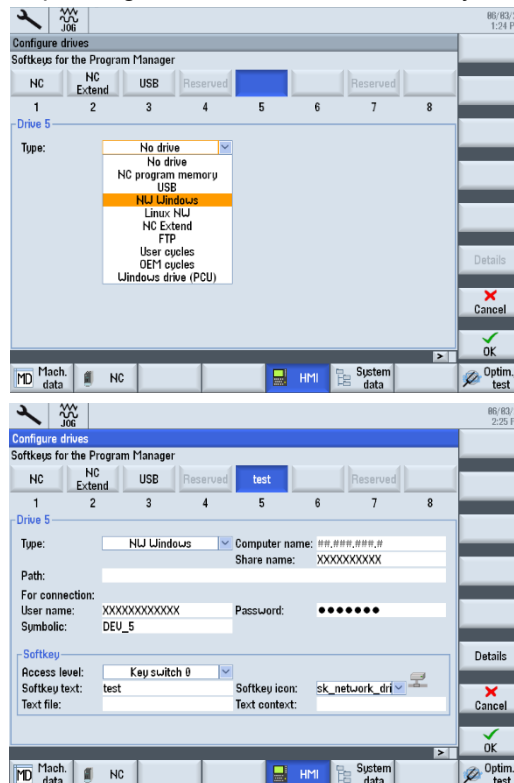
The computer connected to the network must be configured with a unique username and password. This information will be required for inputting on the controller. A dedicated shared folder is required on the PC for the storage of files.

Refer to Section 1.4 for directions to access parameter screens.

1. Press **MENU SELECT**
2. Select **SETUP**
3. Select **START-UP**



4. Press the **HMI** and **LOG. DRIVE** keys. The **SET UP DRIVES** window opens.
5. Select the open key that you want to configure (**example #5**).
6. To allow entry fields to be edited, press the **CHANGE** key.
7. Select the data for the corresponding drive or enter the necessary data.



8. Press the **OK** key. The entries are checked. A window with the appropriate message opens if the data is incomplete or incorrect. Acknowledge the message with **OK** key. If you press the **CANCEL** key, then all of the data that has not been activated is rejected.
9. Restart the control in order to activate the configuration and to obtain the keys in the **PROGRAM MANAGER** screen.



## 2.0 MILLING INFORMATION

### 2.1 Mill M-Codes

---

An M code in CNC programming controls miscellaneous machine functions, including starting and stopping specific actions or programs.

M00	PROGRAM STOP
M01	OPTIONAL PROGRAM STOP
M02	END OF PROGRAM
M03	SPINDLE CLOCKWISE
M04	SPINDLE COUNTERCLOCKWISE
M05	SPINDLE STOP
M06	TOOL CHANGE REQUESTED
M07	MIST COOLANT OR PROGRAMMABLE AIR BLAST
M08	FLOOD COOLANT (SPINDLE MAY HAVE TO BE ON)
M09	COOLANT (FLOOD AND MIST) OFF
M10	INDEXER CYCLE START WAIT FOR COMPLETION
M11	MISC. MCODE M11=ON
M12	MISC. MCODE M12=OFF
M13	1 <sup>ST</sup> ROTARY TABLE AXIS BRAKE ON
M14	1 <sup>ST</sup> ROTARY TABLE AXIS BRAKE OFF
M15	2 <sup>ND</sup> ROTARY TABLE AXIS BRAKE ON
M16	2 <sup>ND</sup> ROTARY TABLE AXIS BRAKE OFF
M17	END OF MACRO PROGRAM
M18	HIGH PRESSURE THRU SPINDLE COOLANT OFF
M19	SPINDLE ORIENT
M21	CHIP AUGER ON (CHIP WASHDOWN. PRIME PUMP FIRST)
M22	CHIP AUGER OFF
M23	2 <sup>ND</sup> PROGRAMMABLE. AIR BLAST ON
M24	2 <sup>ND</sup> PROGRAMMABLE. AIR BLAST OFF
M25	URNS ON PART PROBE
M26	URNS OFF PART/TOOL PROBE
M27	URNS ON TOOL PROBE
M30	END OF PROGRAM
M31	MISC. MCODE M31=ON
M32	MISC. MCODE M32=OFF(M31)
M33	MISC. MCODE M33=ON
M34	MISC. MCODE M34=OFF(M33)
M41	SHIFT GEARBOX INTO LOW RANGE
M42	SHIFT GEARBOX INTO HIGH RANGE
M50	ATC SLIDE EXTEND (SX TOOL CHANGE POSITION)
M51	ATC SLIDE RETRACT (SX TOOL CHANGE RETRACTED)
M52	ATC CAROUSEL IN (ARM ATC POT DOWN)
M53	ATC CAROUSEL OUT (ARM ATC POT UP)
M54	DRAWBAR ON
M55	DRAWBAR OFF
M58	ATC CAROUSEL CW 1 POSITION
M59	ATC CAROUSEL CCW 1 POSITION

M61 HOME ATC CAROUSEL TO POCKET 1, ASUMES TOOL 0 IN SPINDLE  
M62 ARM ATC GRAB TOOL (ON ELECTRIC ATC ALSO SWAPS TOOLS AND GOES UP)  
M63 ARM ATC ARM ORIGIN  
M64 PNEUMATIC ARM ATC ARM DOWN AND SWAP TOOLS  
M65 PNEUMATIC ARM ATC ARM UP  
M66 SERVICE MODE FOR ATC SETUP  
M88 HIGH PRESSURE THRU SPINDLE COOLANT ON

Note: M-codes may change depending on options the machine is equipped with.

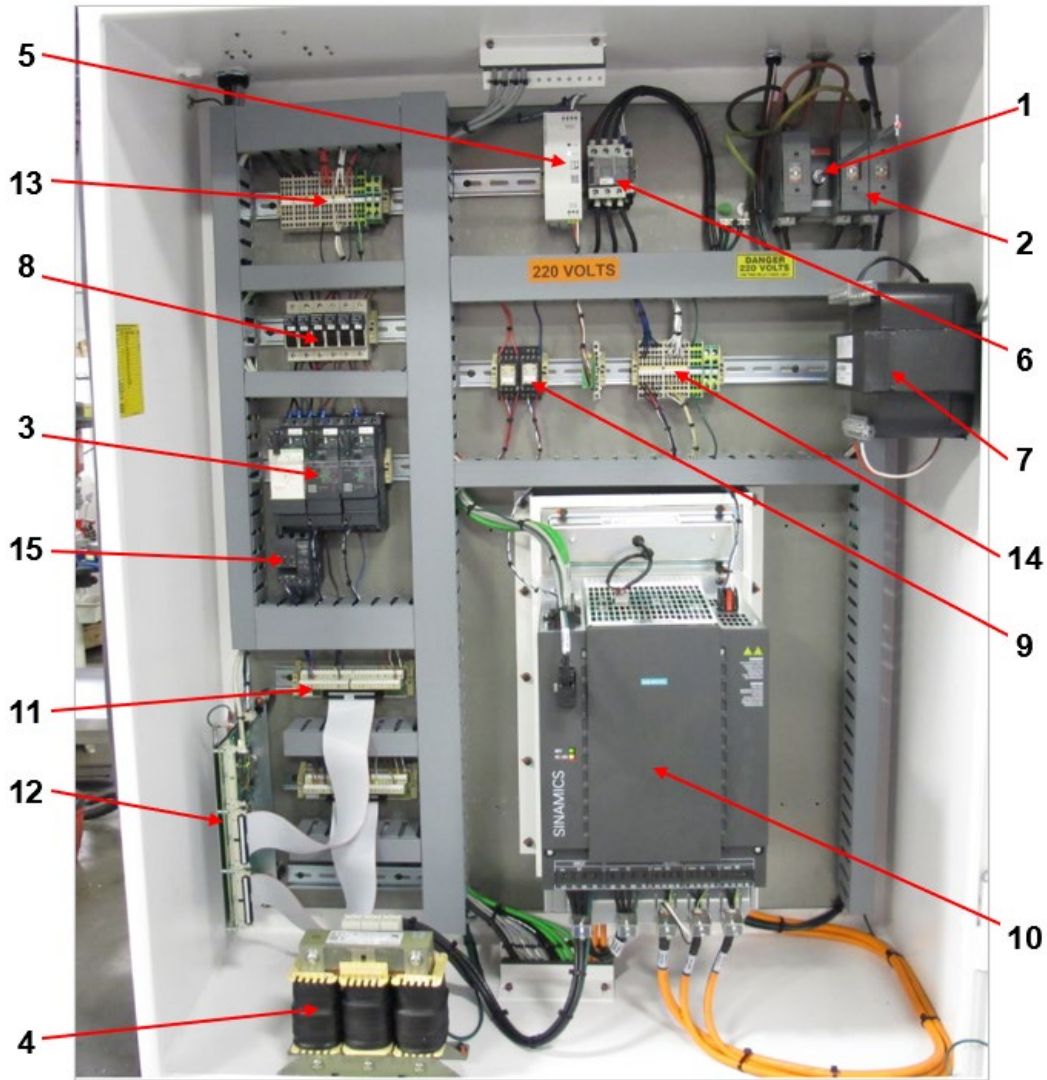
## ***2.2 Fryer PLC Alarms and Descriptions - Mills***

---

There are certain PLC alarms in the 700000 range which are not in the **HELP** screen. These are FRYER Machine specific alarms that are for optional equipment installed on the machine. The alarms are listed below:

700000 ATC CAROUSEL NOT REFERENCED: EXECUTE M61  
700001 LOW WAY LUBE [I32.6]  
700002 LOW AIR PRESSURE [I32.2]  
700003 HOME REQUIRED! PRESS CYCLE START  
700004 PROBE ERROR / SIGNAL LOSS  
700005 GEAR CHANGE FAULT  
700006 SPINDLE OUT OF GEAR  
700008 CHILLER FAULT  
700009 HYDRAULIC PRESSURE FAULT  
700011 THRU SPINDLE COOLANT FAULT, CHECK COOLANT SUPPLY  
700013 EMERGENCY STOP PRESSED DURING TOOL CHANGE  
700014 COUNTER-BALANCE CYLINDER PRESSURE LOW!  
700015 ATC CAROUSEL TIMED OUT-CHECK THERMAL MCCAR  
700016 CAROUSEL CANNOT INDEX POT NOT RETRACTED  
700024 M52-TOOL POT DOWN TIMED OUT  
700025 M53-TOOL POT UP TIMED OUT  
700026 M69 CAUSED SERVO OFF  
700027 M62 TIMED OUT CHECK TC HEIGHT, ORIENT, THERMAL MCATC  
700028 M63 TIMED OUT CHECK THERMAL MCATC  
700029 M54 DRAWBAR ON TIMED OUT  
700030 M55 DRAWBAR OFF TIMED OUT  
700032 CONTOUR HANDWHEEL ACTIVE  
700033 Z MOTION AND ATC ARM NOT AT HOME POSITION  
700034 RESET SUPPRESSED UNTIL TOOL CHANGE COMPLETION  
700035 HOME RETURN: DEPRESS CYCLE START  
700037 REPLACE PROBE BATTERY  
700038 TOOL SETTER ACTIVE  
700039 PART PROBE ACTIVE  
700040 WAY OILER PRESSURE FAULT  
700041 DOOR IS OPEN ~ CLOSE DOOR; PRESS CYCLE START TO CONTINUE  
700042 Y AXIS MOTION AND ATC ARM NOT AT HOME POSITION  
700043 DRAWBAR FAILURE  
700044 QUILL SCALE POSITION UPDATE ON PRESS BUTTON AGAIN TO TURN OFF

**2.3 828 Control Electrical Panel Layout – Mills**



**828 CONTROL ELECTRICAL PANEL – PARTS**

REF	PART NO.	DESCRIPTION	PARTS NAME	QTY
1	SWT-5064	Main Disconnect		1
2	MSE-1912	Fuse Block		1
3		Motor Controller Overloads		1
4		Line Choke		1
5	MSE-2940	24 VDC POWER SUPPLY		1
6	MSE-1410	MC1 Magnetic Contactor		1
7	MSE-1610	Transformer		1
8		Fuse Panel		1
9		Contact Relays		1
10		Combi Drive		1
11		I/O Breakout Board		1
12	MSE-1330	I/O Card		1
13		Terminal Block		1
14		Terminal Block		1

## 2.4 828 Control Panel Layout – Mills



828 CONTROL PANEL – PARTS

REF	PART NO.	DESCRIPTION	PARTS NAME	QTY
1	MON-4378	Siemens Monitor NCU		1
2	CMB-3202	Siemens Control Panel		1
3	MSM-8210	Keys (3)		1 set
4	SWT-6210	E-Stop w/ Contact Block		1



## 2.5 828 3-Handwheel Operator Console (Option)



828 3-HANDWHEEL OPERATOR CONSOLE – PARTS

REF	PART NO.	DESCRIPTION	PARTS NAME	QTY
1	MON-4378	Siemens Monitor NCU		1
2	CMB-3202	Siemens Control Panel		1
3	SWT-6210	E-Stop w/ Contact Block		1
4	70131528	Fine / Course Switch		1
5	ASY-6192	Handwheel (3-Panel)		3
6	MSM-8210	Keys (3)		1 set
7	SWT-5052	Joystick Switch		1

## CAROUSEL TYPE ATC OPERATION

---

### 2.6 Safety Rules -- READ BEFORE OPERATING ATC

---

**CAUTION!** Always follow all Lock Out Tag Out procedures before performing any maintenance

- Due to the complexity and timing of the ATC, it should only be operated with the **M6** command.
- **Never interrupt the tool changer in the middle of cycle, wait for it to complete the tool change.**
- The carousel motor is a 3-phase motor and must be phased correctly for proper direction. The machine is phased properly at the factory before shipment, so if the carousel rotates in the wrong direction, switch any two incoming power wires at the disconnect. **Make sure the main power breaker is off!**
- **M58** moves carousel position CW one position, **M59** moves carousel position CCW one position.
- If the T code is programmed on the same line as the M6 command, make sure the M6 is before the T code (example: M6T4).

### 2.7 Manual Operation of the Tool Changer

---

#### PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

The following is the process to manually step through the tool change operation in MDI.

**NOTE:** *Make sure you follow these steps in sequence to prevent damage to the ATC or machine.*

The proper sequence of a tool change and the respective M-codes are as follows:

1. T-code executes to move carousel to pending tool.
2. **M19** orient spindle.
3. **G75 FP=2 Z0**, moves z axis to tool change clearance position. (Tool change clearance position is stored in Axis MD Z1 parameter 30600 – FIX\_POINT\_POS[1] ).
4. **M52** – Tool change carousel in position.
5. **M54** - Drawbar open to unclamp tool.
6. **G75 FP=1 Z0**, moves z axis to tool change height position. (Tool change height position is stored in Axis MD Z1 parameter 30600 – FIX\_POINT\_POS[0] ).
7. **M55** Drawbar close to clamp tool in spindle.
8. **M53** Tool change carousel out position.

### 2.8 Setting Tool Change Height

---

#### PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

The proper tool change height must be set for the ATC to perform correctly. The tool change height (machine coordinates from home position) is stored in parameter **MD30600**.

**NOTE:** To manually get the tool grab fingers of a carousel style ATC under the spindle you will need to disconnect the air from the machine and manually push the carousel toward the spindle. With the air disconnected you will be able to move the carousel in and out by hand.

- Refer to Section 1.4 for directions to access parameter screens.
1. Press **MENU SELECT**
  2. Select **SETUP**
  3. Select **MACHINE DATA**
  4. Select **GENERAL MD**

**Caution!** Take extreme care as changing these parameters will defeat built in safeties for TC collision!

5. Select **SEARCH**
6. Type in **14512**
7. Select **OK**
8. There will be multiple **14512** parameters
  - **14512 [2]** is for carousel tool changers
9. You need to make a change to this parameter to turn the tool changer off
  - For carousel style tool changers subtract **1** from the current value
10. Cycle power to the machine leaving it off for at least 30 seconds
11. Insert a tool in the spindle
12. Now you need to get the tool grab component of the tool changer under the spindle
  - \*See note above on how to do this
13. To line up the “V” profile in the tool holder with the mating profile in the arm, use the handwheel on a fine setting to carefully move the head up or down
14. Remove air from machine
15. Manually move the carousel towards the spindle so the “v” profile in the tool holder needs to line up with the mating profile in the carousel fingers
  - Use a flashlight to get this alignment as close as possible
16. If “V” profile does not match
17. Record the **Z** axis machine position
18. Complete steps **1 – 8** to get back to setting the **14512** parameter
19. You need to change this parameter back to the previously noted values
  - For carousel style tool changers add **1** to the current value
20. Select **AXIS MD**
21. Select **AXIS +** until you are on **Axis Z**
22. Select **SEARCH**
23. Type in **30600**
24. Select **OK**
25. Set **30600[0]** equal to the value that you recorded in step **15**
26. Cycle power to the machine leaving it off for at least 30 seconds
27. Execute a manual tool change to verify proper function

## ***2.9 Recovering from a Tool Change Failure***

### **PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY**

If the tool changer fails, you may get an alarm. This means that after 30 seconds of waiting, a function did not receive its proper finish signal. At this point, **do not E-stop or hit reset**. This can cause a tool to drop and possibly cause an injury to the operator.

- Locate the pneumatic solenoid for the carousel in/out function. You can do this by referring to the pneumatic system decal and labeled air lines.
- Once the proper solenoid is located, lock the carousel in the “in” position by pushing in the blue switch and turning it clockwise to keep it locked.
- At this point, the value of parameter **14512[2]** will need to be reduced by **1**. Use extreme caution as this will allow the Z-axis to move freely with the ATC in the “in” position.
- Cycle power leaving the machine off for at least 30 seconds.
- Execute an **M54** (drawbar on) to unclamp the tool from the spindle.
- The Z-axis can now be moved to the positive soft limit, clearing it from the tool in the tool changer.

- The solenoid can now be unlocked, which will return the carousel to the “out” position.
- Execute an **M55** (drawbar off) to clamp the tool in the spindle
- At this point the tool bin locations are potentially compromised. Refer to Section 2.10 to reset the tool bin locations.
- If there is a tool in the spindle and in the carousel and they crash into one another, hit E-stop to send the carousel to the out position. Refer to Section 2.10 to reset the tool bin locations.

### ***2.10 Tool Carousel HOME Position and Tool Bin# Reset***

---

To reset all the tool bin locations, follow this procedure:

1. Remove the tool from the spindle
2. In **MDI** command: Type in **M6T0** and press **CYCLE START**
3. Remove all new tools from the spindle
4. Go to command **M61** to index the carousel to bin #1
5. Go to tool table and select the **MAGAZINE** function.
6. Select **UNLOAD ALL** to remove the tools from the table.
7. Now select **TOOL LIST**. At this point all the current tool definitions are still in the table. They moved to the bottom below the highest tool number in your carousel.
8. You can now begin loading each tool definition up to the appropriate number that matches the physical location of the tool in the carousel. Do this by selecting **LOAD** and selecting a location number.

### ***2.11 Spindle Orient Adjustment***

---

#### **PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY**

This procedure will outline how to adjust the spindle orient position when an M19 is commanded to perform a tool change. Read all instructions carefully and do not skip steps.

1. Put a tool in the spindle, make sure the carousel location in the load position (directly opposite the spindle) is empty.
2. In **MDI** clear out any previous commands and type in:
 

**G75 FP=0 Z0**

**M19**
3. Press **CYCLE START** to execute. Notice the direction the spindle goes in (Forward or Reverse)
4. Press **MENU SELECT**
5. **DIAGNOSTICS**

6. **AXIS DIAG**, (If you do not see key press “>” arrow key to see more buttons.

Signal	Value	Unit
Following error	-0.012	deg.
Controller error	-0.012	deg.
Contour deviation (axially)	-0.012	deg.
Servo gain factor (calculated)	0.000	1000/min
Active measuring system	1	
Status of measuring system 1	Active	
Status of measuring system 2	Park	
Pos. actual value measuring system1	257.812	deg.
Pos. actual value measuring system2	0.000	deg.
Position setpoint	257.800	deg.
Abs. compens. value meas. system 1	0.000	deg.
Abs. compens. value meas. system 2	0.000	deg.
Compensation sag + temperature	0.000	deg.
Act. speed value of active encoders	0.000	%
Setpoint speed of drive	0.001	%
Spindle speed set value programmed	0.000	rpm
Spindle speed setpoint current	0.000	rpm
Pos. offset to master axis/spindle act. value	0.000	deg.
Pos. offset to master axis/spindle setpoint	0.000	deg.

7. Press **SERVICE AXIS**
8. Use **Axis +** or **Axis -** key to display **AX4:MSP1/3.3.3/SPINDLE** see screen below:
9. Press **RESET** and slowly turn the spindle in the direction the **M19** orient command turned in step 3, until the spindle keys line up with the ATC carousel key.
10. Remove the air pressure and push the ATC carousel under the spindle make sure the spindle key is lined up. While looking at the above screen turn the spindle CW and CCW. Note the max and minimum values of the Pos. actual value measuring system 1. Calculate the average of the two values. This is the new orient position.
11. Press **MENU SELECT**
12. Press **SETUP**
13. Press **MACH DATA**
14. Press **AXIS SD** ( you may have to press “>” to show additional buttons)
15. Use **Axis+** until spindle axis is displayed.
16. Scroll down to parameter **43240 \$SA\_M19\_SPOS**, this is the current orient position. Add the value you obtained in step 10 and input into this field.
17. Press reset and make sure the spindle orient goes to the correct position before doing a tool change

## ARM STYLE ATC OPERATION

### 2.12 Safety Rules -- READ BEFORE OPERATING ATC

**CAUTION!** Always follow all Lock Out Tag Out procedures before performing any maintenance

- Due to the complexity and timing of the ATC, it should only be operated with the **M6** command.
- **Never interrupt the tool changer in the middle of cycle, wait for it to complete the tool change.**
- The carousel motor is a 3-phase motor and must be phased correctly for proper direction. The machine is

phased properly at the factory before shipment, so if the carousel rotates in the wrong direction, switch any two incoming power wires at the disconnect. **Make sure the main power breaker is off!**

- **M58** moves carousel position CW one position, **M59** moves carousel position CCW one position.
- If the T code is programmed on the same line as the M6 command, make sure the M6 is before the T code (example: M6T4).

### ***2.13 Manual Operation of the Tool Changer***

---

#### **PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY**

The following is the process to manually step through the tool change operation in MDI.

**NOTE: Make sure you follow these steps in sequence to prevent damage to the ATC or machine.**

The proper sequence of a tool change and the respective M-codes are as follows:

1. T-code executes to move carousel to pending tool
2. **M52** tool pot down
3. **M19** orient spindle.
4. **G75 FP=1 Z0**, moves z axis to tool change position.

(Tool change position is stored in **Axis MD Z1** parameter **30600 - FIX\_POINT\_POS[0]** )

5. **M62** Arm moves under spindle to grab tool and carousel pot
6. **M54** Drawbar open to unclamp tool
7. **M62** Arm removes tool from spindle and carousel tool pot and swaps them
8. **M55** Drawbar off to clamp tool in spindle.
9. **M63** Arm to origin position.
10. **M53** Carousel tool pot up..

### ***2.14 Setting Tool Change Height***

---

#### **PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY**

The proper tool change height must be set for the ATC to perform correctly. The tool change height (machine coordinates from home position) is stored in parameter **30600**:

**Axis MD Z1** parameter **30600 - FIX\_POINT\_POS [0]**

**! This must be checked if the home position is different due to the removal of the axis motor, home switch or dog.**

Refer to Section 1.4 for directions to access parameter screens.

There is some allowance (**play**) allowed for the tool change height (about .03"). This is the difference between the V- flange groove of the tool and the V location of the arm. You will see this vertical play if you install a tool into the arm when the machine is in **E-Stop**. **Make sure you do not leave the tool there!**

1. Home the machine.
2. Manually move the axis to the tool change height specified in parameter **30600** or use **G75 FP=1 Z0** and the machine will position to the tool change location.
3. Orient the spindle with an **M19** command.
4. Install a tool in the spindle.
5. Command **M81** to set TC service mode. Allows axis movement when arm is not at origin.

6. Command **M52** for tool pot down
7. Command **M62** to move arm and grab tool.
8. Using the handwheel at its finest setting jog .001” increments to move the Z axis so the V-flange groove of the tool is in the center of the arm’s V-notch. Be careful not to put stress on the ATC arm. **(This is “play” as described above.)**
9. When the correct **Z** axis tool change position is found, record the machine coordinate value, and retain for entry into parameter **30600** for the appropriate axis.
10. Command **M54** to release drawbar.
11. Command **M62** to exchange tools.
12. Command **M55** for drawbar off.
13. Command **M63** to move arm to origin position.
14. Command **M53** for tool pot up.
15. Command **M82** to disable TC service mode.
16. Update parameter **30600 FIX\_POINT\_POS [0]** with the new tool change height for **Z**.

### ***2.15 Recovering from a Tool Change Failure***

---

#### **PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY**

- If a tool change fails, record all of the alarm messages that are displayed on the alarm screen. Make sure the number is written down.
- The tool change recovery button will be flashing. Press E-stop. Remove tools out of spindle, arm and carousel pot that is extended for tool change.
- Turn on drives. Press Rest Button. Momentarily press the tool change recovery button multiple times until arm is a rest location and carousel pot is retracted into carousel.
- Make sure you catch any tool still in the spindle as it will be ejected. Press reset when complete. Check tool table to install tools in correct location.
- Repair any problems that have caused the failure.

### ***2.16 ATC HOME Position and Tool Bin# Reset***

To reset all the tool bin locations, follow this procedure:

9. Remove the tool from the spindle
10. In **MDI** command: Type in **M6T0** and press **CYCLE START**
11. Remove all new tools from the spindle
12. Go to command **M61** to index the carousel to bin #1
13. Go to tool table and select the **MAGAZINE** function.
14. Select **UNLOAD ALL** to remove the tools from the table.
15. Now select **TOOL LIST**. At this point all the current tool definitions are still in the table. They moved to the bottom below the highest tool number in your carousel.
16. You can now begin loading each tool definition up to the appropriate number that matches the physical location of the tool in the carousel. Do this by selecting **LOAD** and selecting a location number.

## 2.17 Spindle Orient Adjustment

### PROCEDURE TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY

This procedure will outline how to adjust the spindle orient position when an **M19** is commanded to perform a tool change. Read all instructions carefully and do not skip steps.

1. In **MDI** clear out any previous commands and type in:  
**G75 FP=0 Z0**  
**M19**
2. Command **M62** to move arm under the spindle.
3. With **Z** axis at maximum positive limit and **ATC** arm under spindle nose, make sure the spindle can be spun without spindle keys hitting **ATC** arm.
4. Press **MENU SELECT**
5. Press **DIAGNOSTICS**
6. Press **AXIS DIAG**, (If you do not see key press ">" arrow key to see more buttons.
7. Press **SERVICE AXIS** Use **Axis +** or **Axis -** key to display **AX4:MSP1/3.3.3/SPINDLE** see screen below:
8. Press **RESET** and slowly turn the spindle until the spindle keys line up with the **ATC** carousel key.
9. Note what the degrees are reading on the highlighted line above and write it down. Compare it with the **Position Setpoint** below the highlighted line.
10. Press **MENU SELECT**
11. Press **SETUP**
12. Press **MACH DATA**
13. Press **AXIS SD** (you may have to press ">" to show additional buttons)
14. Use **Axis+** until spindle axis is displayed.
15. Scroll down to parameter **43240 \$SA\_M19\_SPOS**, this is the current orient position. Add the value you obtained in step **10** and input into this field.
16. Command **M63** to move arm to origin position.
17. Press **RESET** and make sure the spindle orient goes to the correct position before doing a tool change.

Service axis/spindle	AX4:MSP1/3.3.3/SPINDLE		Axis +
Signal	Value	Unit	Axis -
Following error	-0.012	deg.	
Controller error	-0.012	deg.	
Contour deviation (axially)	-0.012	deg.	
Servo gain factor (calculated)	0.000	1000/min	
Active measuring system	1		Select axis
Status of measuring system 1	Active		
Status of measuring system 2	Park		
Pos.actual value measuring system1	257.812	deg.	
Pos.actual value measuring system2	0.000	deg.	
Position setpoint	257.800	deg.	
Abs. compens. value meas. system 1	0.000	deg.	
Abs. compens. value meas. system 2	0.000	deg.	
Compensation sag + temperature	0.000	deg.	
Act.speed value of active encoders	0.000	%	
Setpoint speed of drive	0.001	%	
Spindle speed set value programmed	0.000	rpm	
Spindle speed setpoint current	0.000	rpm	
Pos. offset to master axis/spindle act. value	0.000	deg.	
Pos. offset to master axis/spindle setpoint	0.000	deg.	Back

Bus TCP/IP
Axis diag.
Safety
Trace
Serv. planr.
System utiliz.
Drive system



## 3.0 TURNING INFORMATION

### 3.1 Lathe M-Codes

An M code in CNC programming controls miscellaneous machine functions, including starting and stopping specific actions or programs.

M00	Program stop		
M01	Optional program stop (button on panel must be on		
M02	End of Program		
M03	Spindle clockwise	M1=3 MAIN SPINDLE	M2=3 LT SPINDLE only
M04	Spindle counterclockwise	M1=4 MAIN SPINDLE	M2=4 LT SPINDLE only
M05	Spindle stop	M1=5 MAIN SPINDLE	M2=5 LT SPINDLE only

If equipped with live tool and sub spindle then M2=sub spindle and M3= live tool

Same for spindle speed S2=sub spindle S3=live tool

M07	Spray mist coolant or air blast
M08	Flood coolant
M09	Coolant off (M07, M08 and M88)
M10	Optional indexer start with wait for completion
M11	Miscellaneous M-code function on
M12	Miscellaneous M-code function off
M17	Reference turret to tool #1
M19	Main spindle orient
M20	Main spindle collet or chuck open (with ID-OD grip switch in OD)
M21	Main spindle collet or chuck close (with ID-OD grip switch in OD)
M22/M23	Tailstock or Sub-spindle collet or chuck close/open
M25	Wireless Part Probe On
M26	Wireless Part and Tool Probe off
M27	Wireless Tool Probe On
M28	Second M code function on
M29	Second M code function off
M30	End of program
M33/M34	C axis Brake On/Off
M36/M37	LT Disengage/Engage
M41	Low Gear
M42	High Gear
M46	Barfeed cycle-edit barfeed program for alterations
M48	Tool Arm down
M49	Tool Arm up
M69	Force E-stop (drives off)
M70	C axis Mode Enable
M73/M74	Sub Spindle Brake on/off
M75/M76	Y axis brake on/off
M77/M78	Tailstock Un-Lock/Lock
M80/M81	Steady rest Un-Lock/Lock
M82/M83	Steady Rest Open/close
M84/M85	Tailstock Extend/Retract
M86/M87	Steady Rest second Open/close
M88	Thru tool coolant high pressure
M90/M91	Parts catcher catch position/retract
M92/M93	Washdown On/Off

**NOTE:** M-codes may change depending on options the machine is equipped with

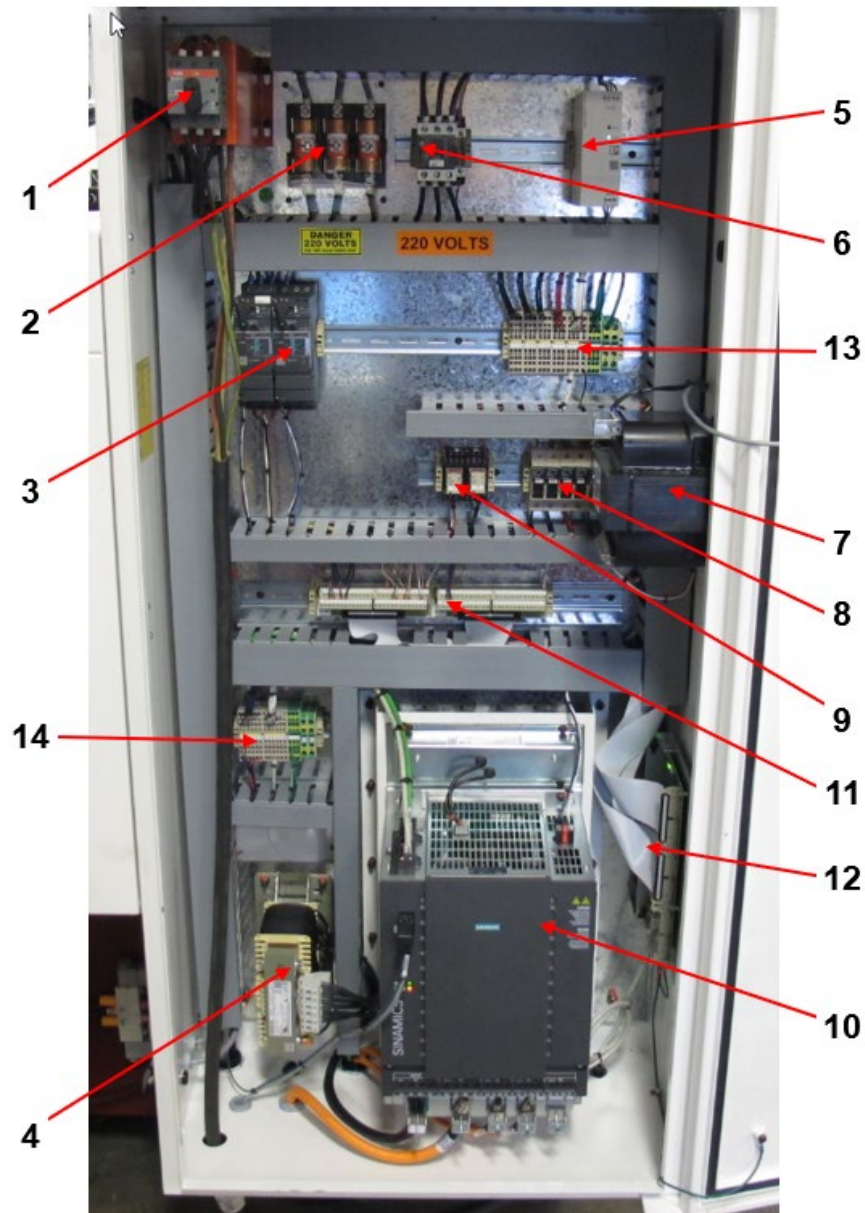
### **3.2 Fryer PLC Alarms and Descriptions – Lathes**

---

There are certain PLC alarms in the 700000 range which are not in the **HELP** screen. These are FRYER Machine specific alarms that are for optional equipment installed on the machine. The alarms are listed below:

- 700000 HEADSTOCK OIL PRESSURE FAULT
- 700001 LOW WAY LUBE
- 700002 TURRET THERMAL OVERLOAD
- 700004 GEARSHIFT FAULT-CHECK AIR PRESSURE
- 700005 LOW AIR PRESSURE FAULT
- 700006 LOW HYDRAULIC PRESSURE FAULT
- 700007 C AXIS HANDWHEEL ACTIVE (X AXIS OFF)
- 700008 LIVE TOOL DRIVE GEAR NOT ENGAGED!!
- 700009 CHUCK OR COLLET MUST BE CLOSED TO RUN SPINDLE
- 700010 HIGH PRESSURE COOLANT ALARM
- 700012 TURRET NOT INDEXED OR CLAMPED!
- 700013 TAILSTOCK NOT CLAMPED!
- 700014 SPINDLE OUT OF GEAR
- 700015 TAILSTOCK DRAG ARM NOT AT REST POSITION!
- 700016 WAY OIL PRESSURE SWITCH
- 700032 CONTOUR HANDWHEEL ACTIVE
- 700033 DEPRESS HOLD THEN STOP TO STOP SPINDLE DURING AUTO CYCLE
- 700034 TAILSTOCK NOT CLAMPED
- 700035 REFERENCE RETURN: PRESS START
- 700037 DOOR IS OPEN CLOSE DOOR AND PRESS CYCLE START
- 700038 TOOL SETTER ACTIVE
- 700039 PART PROBE ACTIVE
- 700042 TURRET NOT FULLY CLAMPED

### 3.3 828 Control Electrical Panel Layout – Lathes



828 CONTROL ELECTRICAL PANEL – PARTS

REF	PART NO.	DESCRIPTION	PARTS NAME	QTY
1	SWT-5064	Main disconnect		1
2	MSE-1912	Fuse block		1
3		Motor controller overloads		1
4		Line choke		1
5	MSE-2940	24 VDC power supply		1
6	MSE-1410	MC1 magnetic contactor		1
7	MSE-1610	Transformer		1
8		Fuse panel		1
9		Contact relays		1
10		Combi drive		1
11		I/O breakout board		1
12	MSE-1330	I/O card		1
13		Terminal block		1
14		Terminal block		1

### 3.4 828 Front Console – Lathes



828 FRONT CONTROL LAYOUT – PARTS

REF	PART NO.	DESCRIPTION	PARTS NAME	QTY
1	MON-4378	Siemens Monitor NCU		1
2	CMB-3202	Siemens Control Panel		1
3	DCL-6052	Apron Panel Decal		1
4	HDL-6094	Handwheel for ET-18/21/25 X & Z		2
5	MSM-8210	Keys (3)		1 set
6	SWT-5052	Joystick Switch		1
7	70131528	Fine / Coarse Toggle Switch		1
8	SwT-6210	e-Stop w/ Contact Block		1



## 5. DIAGNOSTIC

### ALARMS AND WARNINGS

The electronic unit constantly executes self-diagnosis and can signal alarms condition.

An alarm is present if **READY is LOW and an ALPOSEX output is different from zero**

Turret is in normal operation if READY= ON: in this case the ALPOSxx outputs give the code of the current position.

When an alarm occurs the READY = OFF: in this case AL.POSxx outputs give the alarm code in binary format (ALPOS01= LSB).

Starting from FW 2.0 there is no more separation in group and subgroup.

OUTPUTS						Actual position (READY= ON)	ALARM CODE (READY= OFF)	ALARM DESCRIPTION (READY= OFF)
ALPOS32	ALPOS16	ALPOS08	ALPOS04	ALPOS02	ALPOS01			
0	0	0	0	0	0	Out of position	0.0	No alarm
0	0	0	0	0	1	1	0.1	Non consistent parameters in memory.
0	0	0	0	1	0	2	0.2	Failure in internal power supply.
0	0	0	0	1	1	3	0.3	External 24V DC supply is too low.
0	0	0	1	0	0	4	0.4	Thermal I <sup>2</sup> t threshold reached.
0	0	0	1	0	1	5	0.5	Motor overspeed.
0	0	0	1	1	0	6	0.6	Overload: check inertia and friction, check motor and resolver wirings.
0	0	0	1	1	1	7	0.7	Short circuit on power stage: check servomotor wiring or internal damage. (1)
0	0	1	0	0	0	8	0.8	Ground leakage in power stage, check wirings to motor and servomotor. (1)
0	0	1	0	0	1	9	0.9	Internal braking resistor circuit error. (1)
0	0	1	0	1	0	10	1.0	Trouble on power stage control section. (1)
0	0	1	0	1	1	11	1.1	Overvoltage during motor braking. Reduce inertia on the disk. (1)
0	0	1	1	0	0	12	1.2	Undervoltage on threephase
0	0	1	1	0	1	13	1.3	Short circuit on resolver power line (RPOW+, RPOW-) or broken wire on (RSIN+, RSIN-, RCOS+, RCOS-).
0	0	1	1	1	0	14	1.4	Fault on digital outputs: check for external shorts or overloads.
0	0	1	1	1	1	15	1.5	Profile generator fault.
0	1	0	0	0	0	16	1.6	HW ENABLE is not present.
0	1	0	0	0	1	17	1.7	Positioning timeout
0	1	0	0	1	0	18	1.8	Heatsink overtemperature. (1)
0	1	0	0	1	1	19	1.9	Overvoltage on threephase line. Check main supply. (1)
0	1	0	1	0	0	20	2.0	Reached maximum positioning error.
0	1	0	1	0	1	21	2.1	Timeout in cycle execution.
0	1	0	1	1	0	22	2.2	Motor overtemperature. (1)
0	1	0	1	1	1	23	2.3	The signal of Locking switch does not go OFF during unclamping.
0	1	1	0	0	0	24	2.4	The signal of Locking switch has gone ON while turret is unclamped.
0	1	1	0	0	1	N.A.	2.5	The unclamping phase is too slow, check the pressure, and purge the hydraulic circuit.
0	1	1	0	1	0	N.A.	2.6	N.A.
0	1	1	0	1	1	N.A.	2.7	N.A.
0	1	1	1	0	0	N.A.	2.8	The signal of Locking switch has gone OFF while turret is clamped.
0	1	1	1	0	1	N.A.	2.9	Clamping timeout.
0	1	1	1	1	0	N.A.	3.0	N.A.
0	1	1	1	1	1	N.A.	3.1	Need to run the the setup procedure.
1	0	0	0	0	0	N.A.	3.2	Requested tool is not existing
1	0	0	0	0	1	N.A.	3.3	Parity error on tool number request.
1	0	0	0	1	0	N.A.	3.4	PBITXX are changed but PSTART did not came on time.
1	0	0	0	1	1	N.A.	3.5	PLC set EMERGENCY MODE during turret cycle
1	0	0	1	0	0	N.A.	3.6	Trouble during setup procedure execution
1	0	0	1	0	1	N.A.	3.7	Cannot clamp during setup procedure.
1	0	0	1	1	0	N.A.	3.8	Error in D current controller. Check motor and resolver wirings.
1	0	0	1	1	1	N.A.	3.9	Error in Q current controller. Check motor and resolver wirings.
1	0	1	0	0	0	N.A.	4.0	Error in speed controller.
1	0	1	0	0	1	N.A.	4.1	Error in position controller.



1	0	1	0	1	0	N.A.	4.2	N.A.
1	0	1	0	1	1	N.A.	4.3	N.A.
1	0	1	1	0	0	N.A.	4.4	N.A.
1	0	1	1	0	1	N.A.	4.5	N.A.
1	0	1	1	1	0	N.A.	4.6	N.A.
1	0	1	1	1	1	N.A.	4.7	N.A.
1	1	0	0	0	0	N.A.	4.8	N.A.
1	1	0	0	0	1	N.A.	4.9	N.A.
1	1	0	0	1	0	N.A.	5.0	N.A.
1	1	0	0	1	1	N.A.	5.1	N.A.
1	1	0	1	0	0	N.A.	5.2	N.A.
1	1	0	1	0	1	N.A.	5.3	N.A.
1	1	0	1	1	0	N.A.	5.4	N.A.
1	1	0	1	1	1	N.A.	5.5	N.A.
1	1	1	0	0	0	N.A.	5.6	N.A.
1	1	1	0	0	1	N.A.	5.7	N.A.
1	1	1	0	1	0	N.A.	5.8	N.A.
1	1	1	0	1	1	N.A.	5.9	N.A.
1	1	1	1	0	0	N.A.	6.0	N.A.
1	1	1	1	0	1	N.A.	6.1	N.A.
1	1	1	1	1	0	N.A.	6.2	N.A.
1	1	1	1	1	1	N.A.	6.3	N.A.

N/A = No alarm and/or position associated to this code.

(1) = strongly suggested to switch off the threephase supply to TMC controller when power driver alarms are detected.

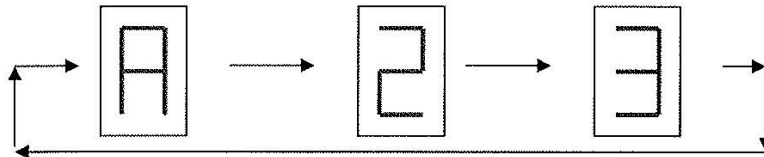
Display:

A 7-segment display is available.

When the driver is in normal condition all the segments are blinking in sequence.

When the alarm is present, the display will show in sequence, A->(first alarm digit)-> (second alarm digit)

As example, the alarm 2.3 is



Alarm are stored and can be reset with EMERGENCY/RESET function.

Power off causes the reset of the active alarm.

A PC software is available to improve the stat-up procedure and troubleshooting.

**Fault of electronic unit:**

After recognizing the fault, the problem can be easily solved.

In case of electronic unit fault, it can be easily replaced.