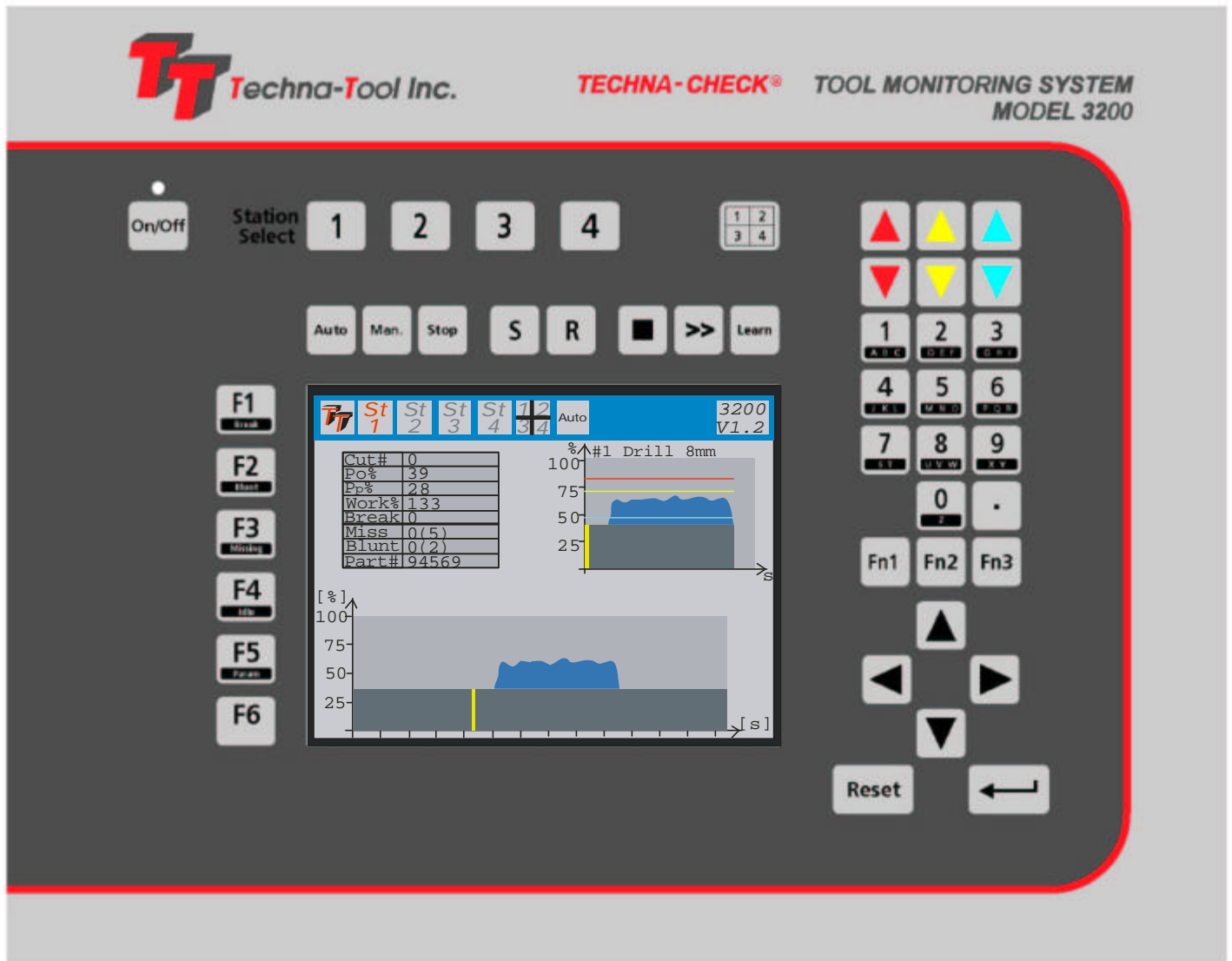


TECHNA-CHECK[®]

MODEL 3200



Tool Monitoring System
Technical Documentation
Released: October 2003

© Copyright 2003, Techna-Tool Inc., Hartland, Wisconsin, USA.

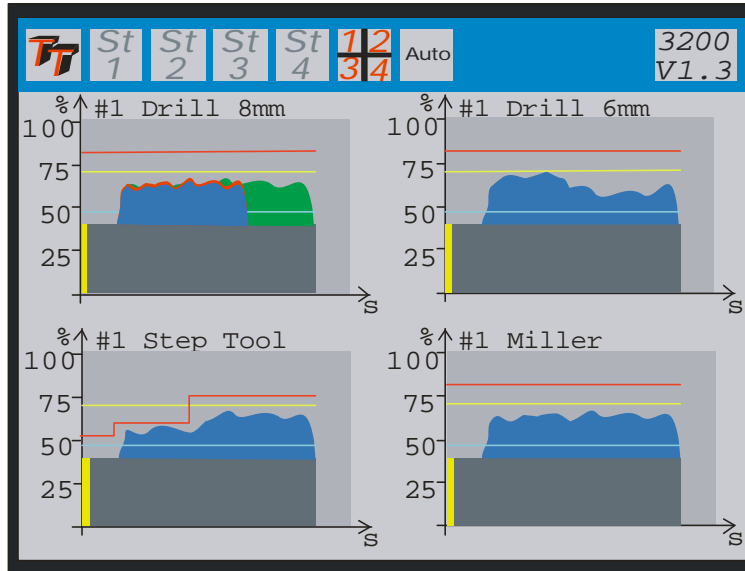
The information in this document is subject to change without notice.

TECHNA-CHECK® is a registered trademark of Techna-Tool Inc.

Table Of Contents:

1. The Concept.....	4
2. Key Benefits.....	5
3. Operating the unit.....	6
3.1 On/Off Key.....	6
3.2 Station Select.....	6
3.3 Auto Man. and Stop mode select.....	6
3.4 Spindle and Roll Mode.....	8
3.5 Spindle expand mode.....	8
3.6 F1-Break Parameters.....	9
3.7 F2-Blunt Parameters.....	10
3.8 F3-Missing Parameters.....	11
3.9 F4-Idle Parameters.....	12
3.10 F5-Measurement Parameters.....	13
3.11 F6-Miscellaneous Parameters.....	14
3.12 Stop Mode.....	15
3.13 Learn Command.....	16
3.14 Reset Command.....	17
3.15 Password Protection.....	18
4. Wiring of the PWM325 Module.....	19
4.1 Current Measurement Range.....	19
4.2 Filter Time Constants.....	19
4.3 PWM350 Technical Specifications.....	20
Appendix A-Interface to 3-Phase Transducer-PWM350.....	21
Appendix B-Interface to Single-Phase Transducer-UG105.....	22
Appendix C-TC3200 Back Side Print.....	23
Appendix D-Dip. Switch Usage.....	24
Appendix E-Cut Select Chart.....	25
Appendix F-Panel Cut-Out Profile.....	26

1. The Concept



The **Techna Check**[®] TC3200 is a modular Tool Monitoring system.

The TC3200 is hardware configurable and is able to monitor 1/2/3 or 4 tooling spindles (stations). The stations are electrically isolated and can be used with (4) machines in a cell.

The Techna Check TC3200 has been exclusively developed for the **supervision of cutting tools on single spindle automatic machine tools. It is capable of detecting missing, blunt, and broken or damaged tooling.** The TC3200 measures, from external measurement transducer(s), the electrical power consumption of the spindle motor. A blunt (or worn) tool needs more energy to complete a machining cycle, and when a tool breaks a short energy peak or spike is created. If no tool is present, the power consumption drops back to the idle power of the spindle.

The TC3200 is designed to monitor motor power in the primary or secondary of a variable frequency motor drive (see the specification of the external measurement transducer PWM 325). It is also capable of storing 32 complete sets of monitoring parameters. These features make it ideal for monitoring flexible transfer machines utilizing single spindle CNC heads.

The unit may be interfaced and operated from a PC through its RS232 or RS485 interface. The TOOLMON application adds statistic features to the tool monitoring. The function of the TOOLMON application is covered by a separate manual.

2. Key Benefits

Improved part quality

The detection of missing or broken tools helps insure that the proper machining is being performed. Detection of tool wear and damage can help improve surface finish and tolerances.

Maximized tool life

By detecting for tool wear and damage, expensive tooling can be changed before the damage gets too severe. This detection also reduces dependence on hit or miss part counting schemes.

Protection of spindle and feed mechanism

By detecting catastrophic tool failures, the TC3200 can prevent serious damage to your head and feed mechanisms, not just at the station being monitored, but at down-stream stations where "chain reaction" effects can occur.

Improved up time

By creating the process improvements listed above, TC3200 keeps your machine running longer.

Easy installation

No mechanical modification of the machinery is necessary. The entire system mounts easily in your electrical cabinet.

3. Operating the unit

3.1 On/Off key



The On/Off key may be used to switch the display On/Off, only if the machine is not running. If the display is turned off, it will be switched on again as soon as one of the stations is activated (start-signal active). A parameter 'Backlight On Period' is used to program how long the display will stay on after the start signal has been removed or a key has been activated. Switching of the display, when the machine is not running, increases the lifetime of the display. When the display is switched off (black) the green On/Off LED will be flashing.

3.2 Station Select



The 4 station select keys are used to select the station, which will be displayed. If a channel is not hardware activated (not present), it cannot be selected. There also is a button for selecting a display of all channels simultaneously. Some of the actions that are carried out from the keyboard require a single station to be displayed. The 'Reset' command can only be issued while a single station is selected, while the reset will only apply to the currently displayed channel. The same is true for the 'Learn' command and the 'Parameter Modify' command.

3.3 Auto, Man. and Stop mode select



In Auto mode the display follows the current operation cycle of the tooling machine. When the machine selects a new tool (cut) the display **Automatically** displays this cut. In manual mode the user is allowed to select/display and alter other cuts rather than the currently active cut. When Manual mode is selected the bottom half of the display is used to select the cut.

The screenshot shows the following data:

Cut#	0
Po%	39
Pp%	28
Work%	133
Break	0
Miss	0(5)
Blunt	0(2)
Part#	94569

Manual Cut Select - Station 1, 32 Cuts

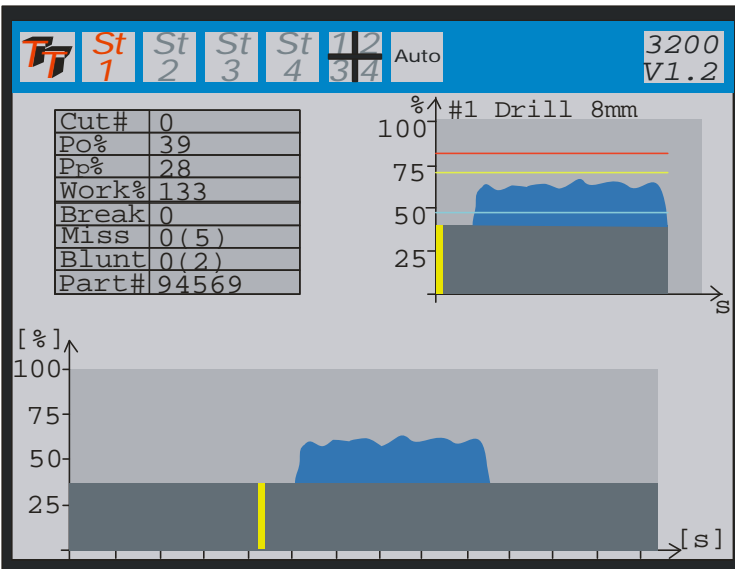
Cut #00	Cut #08	Cut #16
Cut #01	Cut #09	Cut #17
Cut #02	Cut #10	Cut #18
Cut #03	Cut #11	Cut #19
Cut #04	Cut #12	Cut #20
Cut #05	Cut #13	Cut #21
Cut #06	Cut #14	Cut #22
Cut #07	Cut #15	Cut #23

Function keys and controls:

- F1: Break
- F2: Blunt
- F3: Missing
- F4: Idle
- F5: Param
- F6: (unlabeled)

In **Manual** mode the arrow keys are used to select a cut. As soon as a cut is selected its last profile is displayed in the spindle window in the upper half of the screen. If a Parameter key is activated the parameter for the cut selected may be viewed or modified. In manual mode it is possible to display the LAST ALARM cut also.

3.4 Spindle and Roll mode

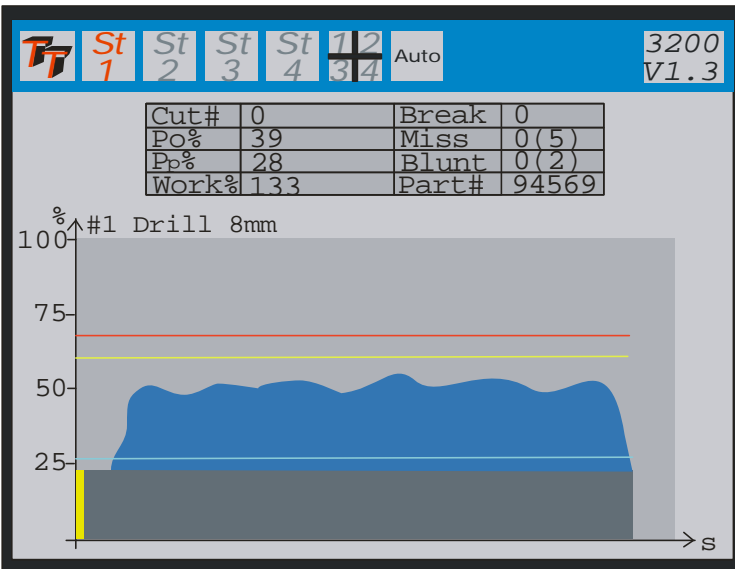


R

■ >>

The 'R' key is used to select this display mode. The bottom of the screen shows all measurement in a 'Rolling' fashion. This display may be used when analyzing, if the start signal appears at the right point. The rolling may be stopped and started again by two keys on the panel.

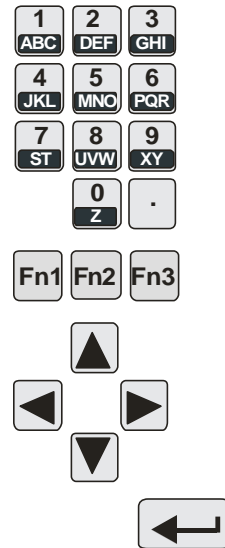
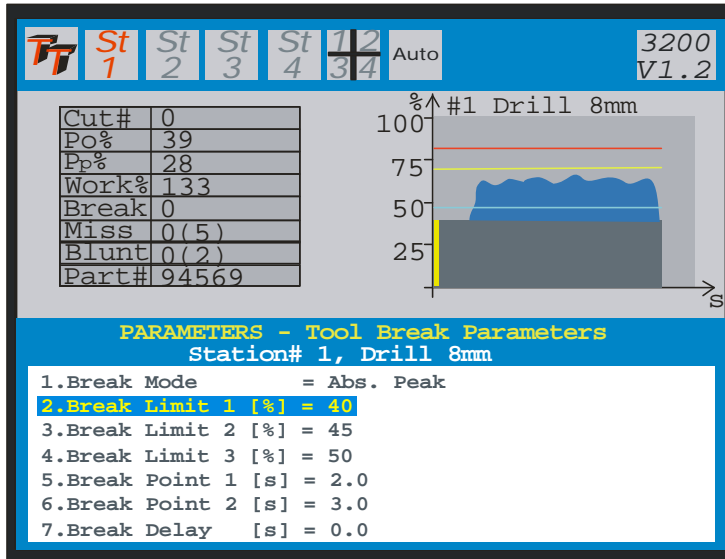
3.5 Spindle expand mode



S

The 'S' key is used to select this display mode. The whole screen displays the current cycle (zoom mode).

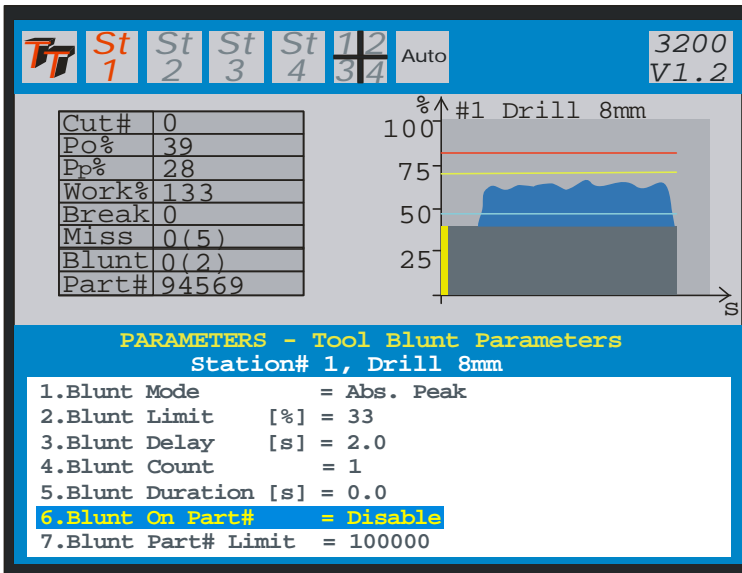
3.6 F1—Break Parameters



A parameter is selected by the arrow-up and down keys. The enter key may be pushed to activate the parameter. When activated the arrow-up and down key may be used to alter the variable. When the enter-key is activated again the modification is made permanent. The numerical keys may also be used to alter a variable. The enter-key or the arrow-up/down keys are used to make the change permanent.

Parameter	Range
1. Break Mode	Abs. Peak Learn Peak Abs. Peak Curve
2. Break Limit1 [%]	Break Limit 1 (0-100)%, 0 = Off
3. Break Limit2 [%]	Break Limit 2 (0-100)%, 0 = Off Active only in Abs. Peak Curve mode
4. Break Limit3 [%]	Break Limit 3 (0-100)%, 0 = Off Active only in Abs. Peak Curve mode
5. Break Point 1 [s]	Break Point 1 (0.0-999.9 seconds) Active only in Abs. Peak Curve mode
6. Break Point 2 [s]	Break Point 2 (0.0-999.9 seconds) Active only in Abs. Peak Curve mode
7. Break Delay [s]	Break Delay (0.0-25.0 seconds) Break Reaction Time-Keep as low as possible

3.7 F2—Blunt Parameters



A parameter is selected by the arrow-up and down keys. The enter key may be pushed to activate the parameter. When activated the arrow-up and down key may be used to alter the variable. When the enter-key is activated again the modification is made permanent. The numerical keys may also be used to alter a variable. The enter-key or the arrow-up/down keys are used to make the change permanent.

Parameter	Range
1. Blunt Mode	Abs. Peak Learn Peak Learn Work
2. Blunt Limit [%]	Blunt Limit (0-100%), 0 = Off Blunt Limit (101-999%), Learn Work Mode
3. Blunt Delay [s]	Blunt Delay (0.0-25.0 seconds) Active only in Abs. Peak and Learn Peak mode
4. Blunt Count	Blunt Count (1-15 cont. cycles)
5. Blunt Duration [s]	Blunt Duration (0.0-999.9 seconds), 0.0 = Off
6. Blunt On Part#	Enable Disable
7. Blunt Part# Limit	(100-1000000)

3.8 F3—Missing Parameters

PARAMETERS - Tool Missing Parameters
Station# 1, Drill 8mm

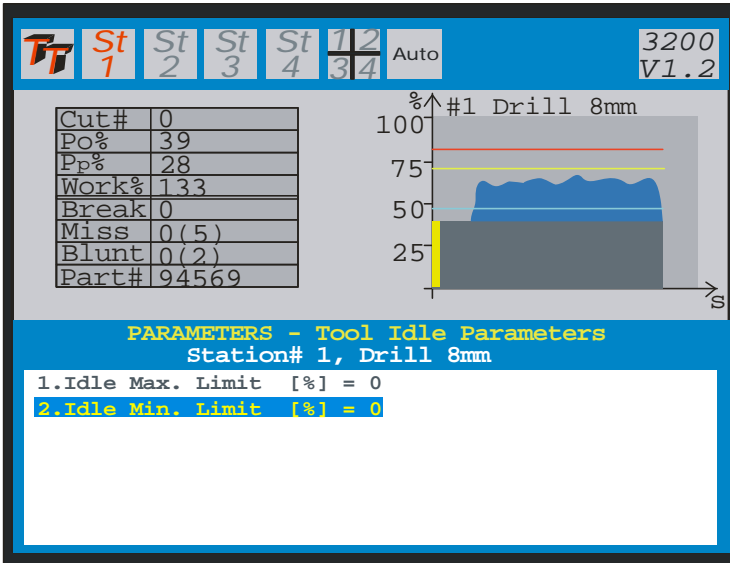
- 1. Missing Mode = Absolute
- 2. Missing Limit [%] = 5
- 3. Missing Delay [s] = 1.0
- 4. Missing Count = 1
- 5. Missing Tw [s] = 0.0



A parameter is selected by the arrow-up and down keys. The enter key may be pushed to activate the parameter. When activated the arrow-up and down key may be used to alter the variable. When the enter-key is activated again the modification is made permanent. The numerical keys may also be used to alter a variable. The enter-key or the arrow-up/down keys are used to make the change permanent.

Parameter	Range
1. Missing Mode	Absolute Learn Work
2. Missing Limit [%]	Missing Limit (0-99%), 0 = Off
3. Missing Delay [s]	Missing Delay (0.1-25.0 seconds) Active only in Absolute mode
4. Missing Count	Missing Count (1-15 cont. cycles)
5. Missing Tw [s]	(0.0-999.9 seconds), 0.0 = Off

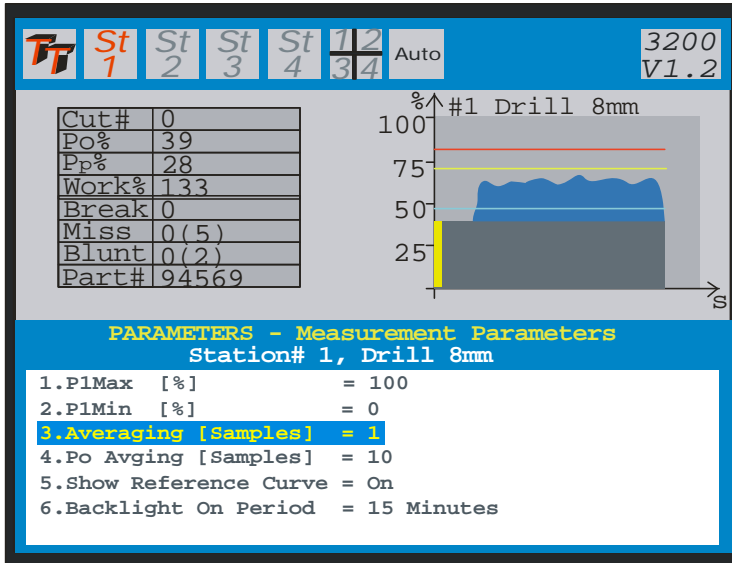
3.9 F4—Idle Parameters



A parameter is selected by the arrow-up and down keys. The enter key may be pushed to activate the parameter. When activated the arrow-up and down key may be used to alter the variable. When the enter-key is activated again the modification is made permanent. The numerical keys may also be used to alter a variable. The enter-key or the arrow-up/down keys are used to make the change permanent.

Parameter	Range
1. Idle Max. Limit [%]	Idle Max. Limit (0-100%), 0 = Off
2. Idle Min. Limit [%]	Idle Min. Limit (0-100%), 0 = Off

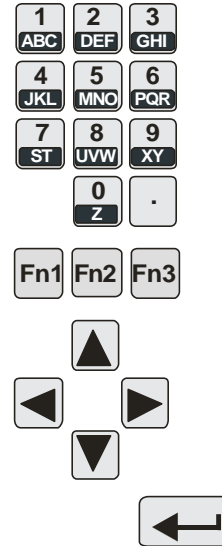
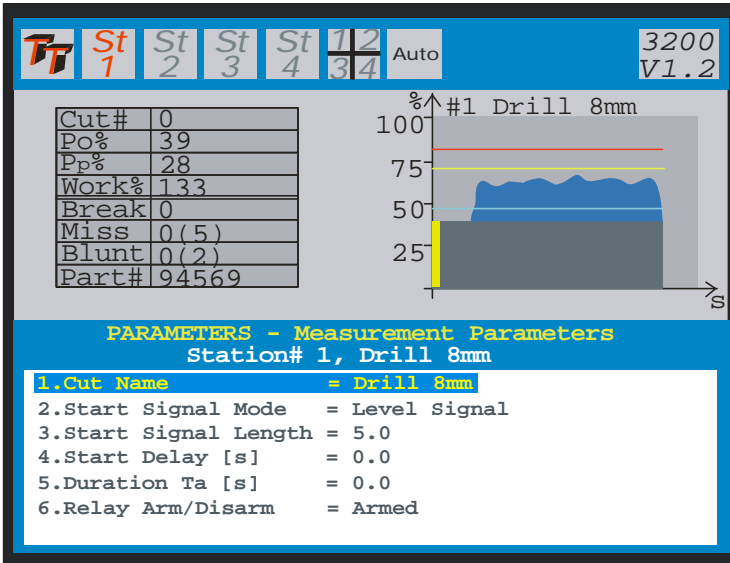
3.10 F5—Measurement Parameters



A parameter is selected by the arrow-up and down keys. The enter key may be pushed to activate the parameter. When activated the arrow-up and down key may be used to alter the variable. When the enter-key is activated again the modification is made permanent. The numerical keys may also be used to alter a variable. The enter-key or the arrow-up/down keys are used to make the change permanent.

Parameter	Range
1. PlMax [%]	PlMax ((PlMin+10)-100%) Measurement zoom function
2. PlMin [%]	PlMin (0-(PlMax-10)%) Measurement zoom function
3. Averaging	(1-10 samples) Keep as low as possible
4. Po Avging [Samples]	(0-250 samples), 0 = Off (no Po measurement)
5. Show Reference Curve	On Off
6. Backlight On Period	15 Minutes 30 Minutes 1 Hour 2 Hour

3.11 F6—Miscellaneous Parameters

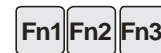
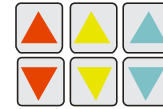
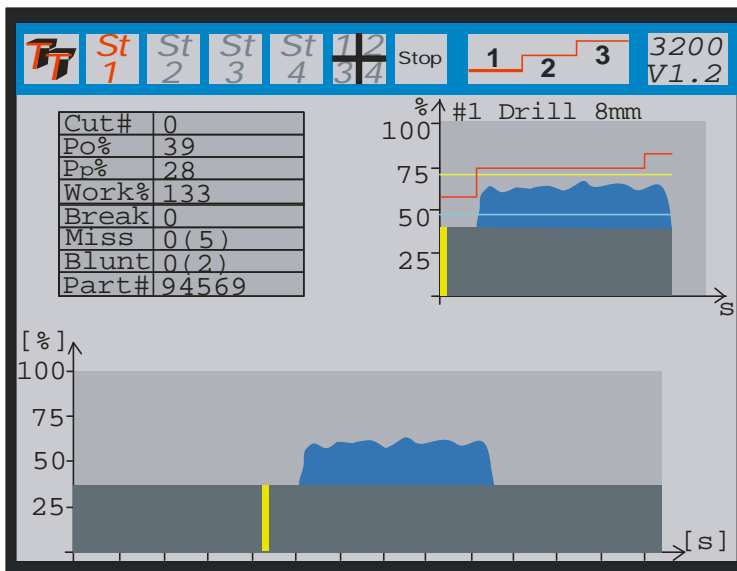


A parameter is selected by the arrow-up and down keys. The enter key may be pushed to activate the parameter. When activated the arrow-up and down key may be used to alter the variable. When the enter-key is activated again the modification is made permanent. The numerical keys may also be used to alter a variable. The enter-key or the arrow-up/down keys are used to make the change permanent.

Parameter	Range
1. Cut Name	Drill 8mm
2. Start Signal Mode	Level Signal Strobe Signal (Pulse)
3. Start Signal length	(0.0-999.9 seconds) Only used in strobe signal mode
4. Start Delay [s]	(0.0-25.0 seconds)
5. Duration Ta [s]	(0.0-999.9 seconds), 0.0 = Off
6. Relay Arm/Disarm	Armed Disarmed

The Cut name has a maximum of 14 characters. Letters are entered by first pressing a Fn1,Fn2 or Fn3 key followed by a numerical key. Arrow right is the space character and arrow left is the delete key.

3.12 Stop Mode



When stop mode is selected the current cut is latched in the window and only updated at the end of the cut cycle. When stop mode is selected the limits may be changed by the arrow keys in the upper right corner. If step curve is selected the step to modify is selected by the three function keys Fn1, Fn2 and Fn3.

3.13 Learn Command

The screenshot shows a CNC control interface with the following elements:

- Top Bar:** Includes a tool icon, station indicators (St 1, St 2, St 3, St 4, St 1/2, St 3/4), 'Auto' mode, and parameters '3200' and 'V1.2'.
- Table:** A table with the following data:

Cut#	0
Po%	39
Pp%	28
Work%	133
Break	0
Miss	0(5)
Blunt	0(2)
Part#	94569
- Graph:** A graph titled '#1 Drill 8mm' showing a blue profile of a drill cut. The y-axis is labeled '%' and ranges from 25 to 100. The x-axis is labeled 'S'.
- Instructional Text:** A blue box contains the text 'Press Enter Key To Learn Current Cut'. Below it, the text 'Use Arrow Keys to Change Mode' is displayed.

Learn

The learn command is used to cause the station selected to learn a cut. It is possible to learn the current cut or to learn all cuts.

3.14 Reset Command

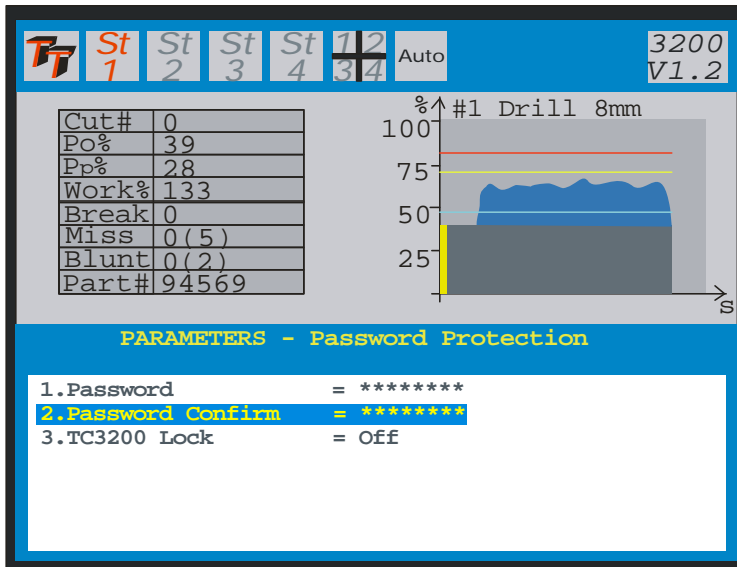
The screenshot shows a CNC control interface with the following elements:

- Top Bar:** Includes a logo, station indicators (St 1, 2, 3, 4, 12, 34), 'Auto' mode, and '3200 V1.2'.
- Table:** A table of machine parameters:

Cut#	0
Po%	39
Pp%	28
Work%	133
Break	0
Miss	0(5)
Blunt	0(2)
Part#	94569
- Graph:** A graph titled '#1 Drill 8mm' showing performance metrics over time. The y-axis is labeled '%' and ranges from 0 to 100. The x-axis is labeled 's'. A blue area represents the data, with a red horizontal line at approximately 85% and a yellow horizontal line at approximately 75%.
- RESET COMMAND Section:** A blue header with 'Station# 1' and a white box containing the text 'Press Enter Key To Confirm RESET'.
- Reset Button:** A button labeled 'Reset' located to the right of the main interface.

An alarm is signaled by a flashing station number.
The reset command resets the alarm on the selected station.

3.15 Password Protection



The password menu is activated by first pressing Fn1 followed by F6. In order to enter a password a password must be entered and confirmed also. When a valid password is entered it is possible to lock the TC3200.

When locked it must be unlocked before the parameter functions are accessible. Unlocking is done by entering the password followed by the enter key. The password dialog appears when one of the F-keys is activated.

When the unit is unlocked it may be locked again from the password menu.

4. Wiring of the PWM350 Module

For proper operation of the system, it is important that the PWM350 be set up properly (see Appendix A). Incorrect settings of **Current Measurement Range** or **Filter Time Constant** may severely reduce the functionality of the system.

4.1 Current Measurement Range

The current measurement range is set by applying 24 VDC input signals to pins 13 and 14, according to the logic diagram shown on page 20. The appropriate measuring range is selected by determining the Full Load Current (FLA) of the motor, which should be marked on the motor housing. Then the percentage of the rating of the PWM350 should be calculated. For example, when using a motor with an FLA rating of 5 Amps with a PWM350 rated at 25 A, the percentage of the PWM350 rating would be 20%. In this case, the 20% range on the PWM350 would be used. In cases where the percentage does not exactly correspond to one of the current ranges on the unit, the next larger range should be used.

It should also be noted that it is permissible to use external current transformers (CT's) in cases where the motor current is above the rating of the PWM350. As an example, if it was desired to monitor a motor having an FLA of 100 Amps, a 20:1 current transformer might be employed. Since the CT has a ratio of 20:1, the maximum current on its secondary would be 5 Amps. Applying the example above, the current measurement range would be set to 20%.

4.2 Filter Time Constant

The Filter Time Constant is set by applying a 24 VDC control signal to pins 11 and 12 of the PWM350, according to the logic diagram shown on page 20. The Filter Time Constant sets the sampling and averaging characteristics of the PWM350 module. For most tool monitoring applications, since it is desirable to try to catch very short duration power spikes caused by a tool breaking, the Filter Time Constant should initially be set to its minimum level of 20ms. This is accomplished simply by leaving pins 11 and 12 without connection.

If the system experiences nuisance faults due to short duration power transients, it may be necessary to raise the time constant to filter out these transients. In these cases, consideration should also be given to adjusting the **Power Averaging** feature of the TC3200 to attempt to filter these transients out of the monitoring.

4.3 PWM350 Technical Specifications

Mechanical

Housing: Polycarbonate.
Mounting: 35 mm DIN-rail.
Protection Class: IP40.
Temp. Range: -15 to + 50 C.
Weight: App. 500g (1 lb).
Dimensions: D 118 x B 45 x H 137,5 mm.
Connections: Max 2,5 mm² (AVG 24).

Electrical

Voltage Input: 3 x 0-500 V PWM (0-600V max).
Current Input: 3 x 50 Amp. 5Hz - 5kHz.
Power Range: 0 - 43.3 kW.
Supply: 9-36 V DC max. 2.5 Watt.
Analogue output: 0 - 20mA, 0 - 400 ohm isolated.
Digital Inputs: 10-30 VDC.
CE marked to: EN50081-1, EN50082-2,
EN61010-1.

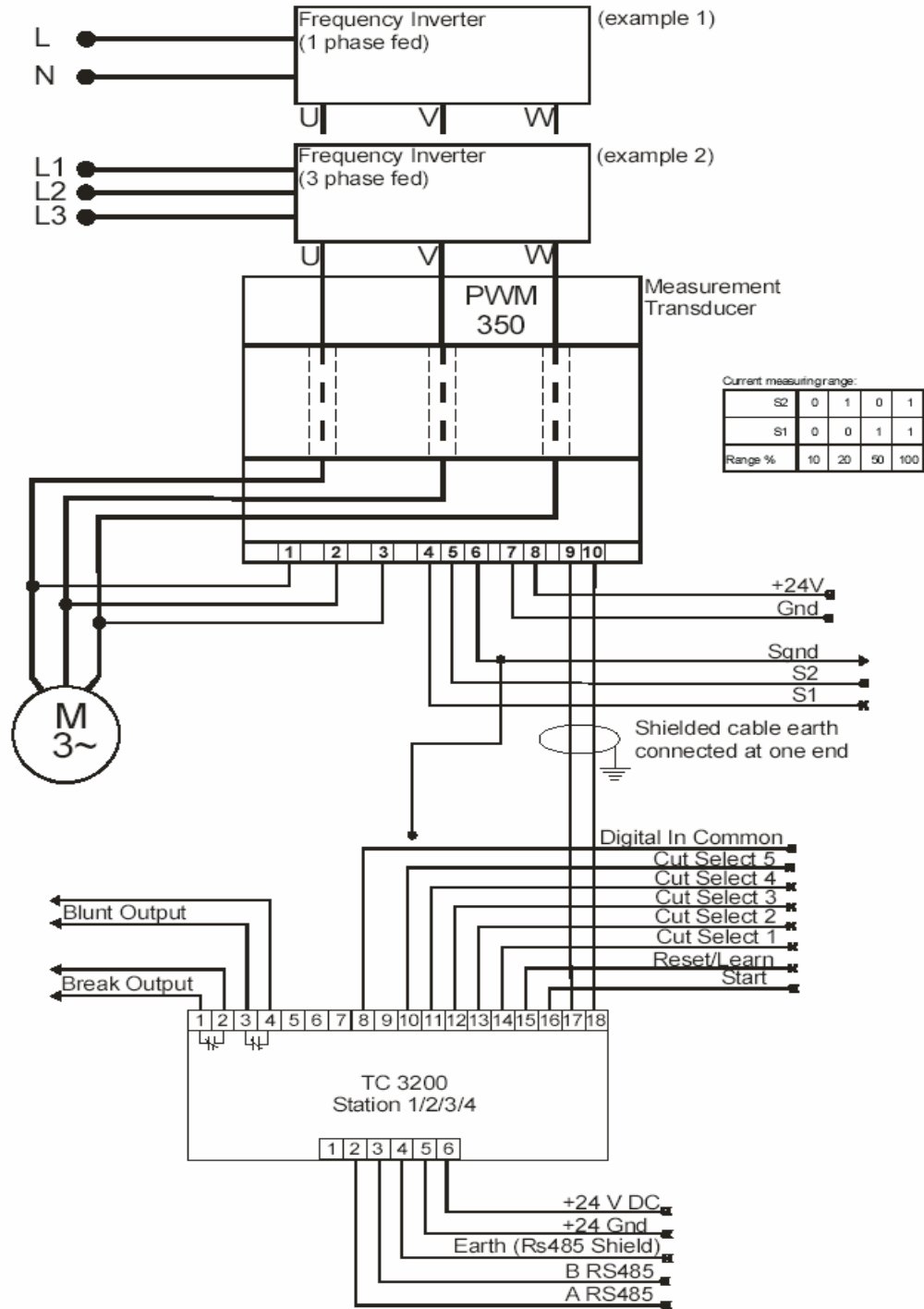
Measurement Ranges

PLC control of the two inputs S1 and S2.
100% 43.3 kW
50% 21.7 kW
20% 8.66 kW
10% (1 CT turn) 4.33 kW
10% (2 CT turns) 2.17 kW
10% (3 CT turns) 1.44 kW
The 10% measurement range must be selected when the PWM350 is used with external (cascading) N/5 current transducers.

A special PWM350 version where the 10% range is modified to 5% may be provided for ultra small motors.

Appendix A-Interface to 3-Phase Transducer—PWM350

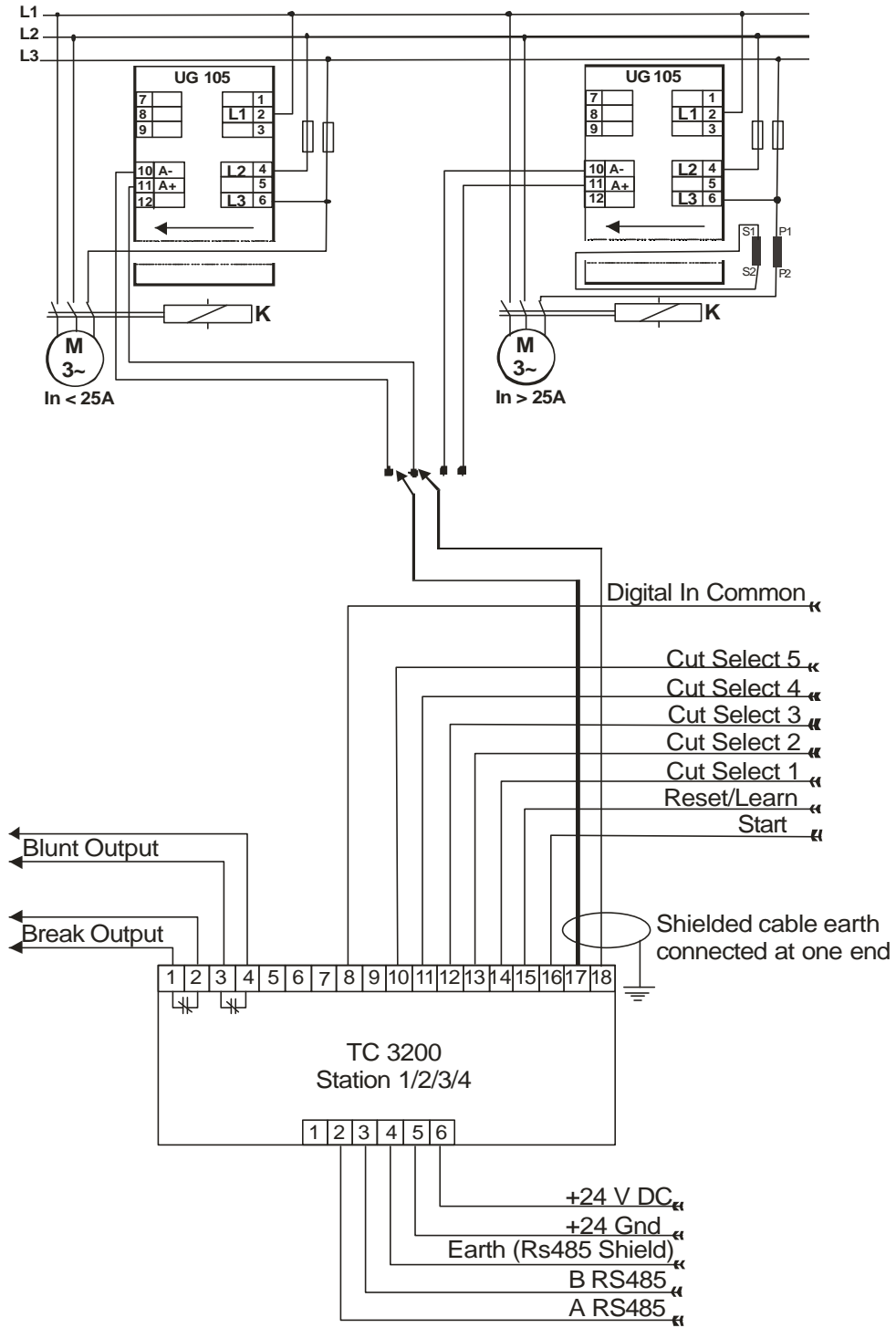
PWM350 Connection to TC3200



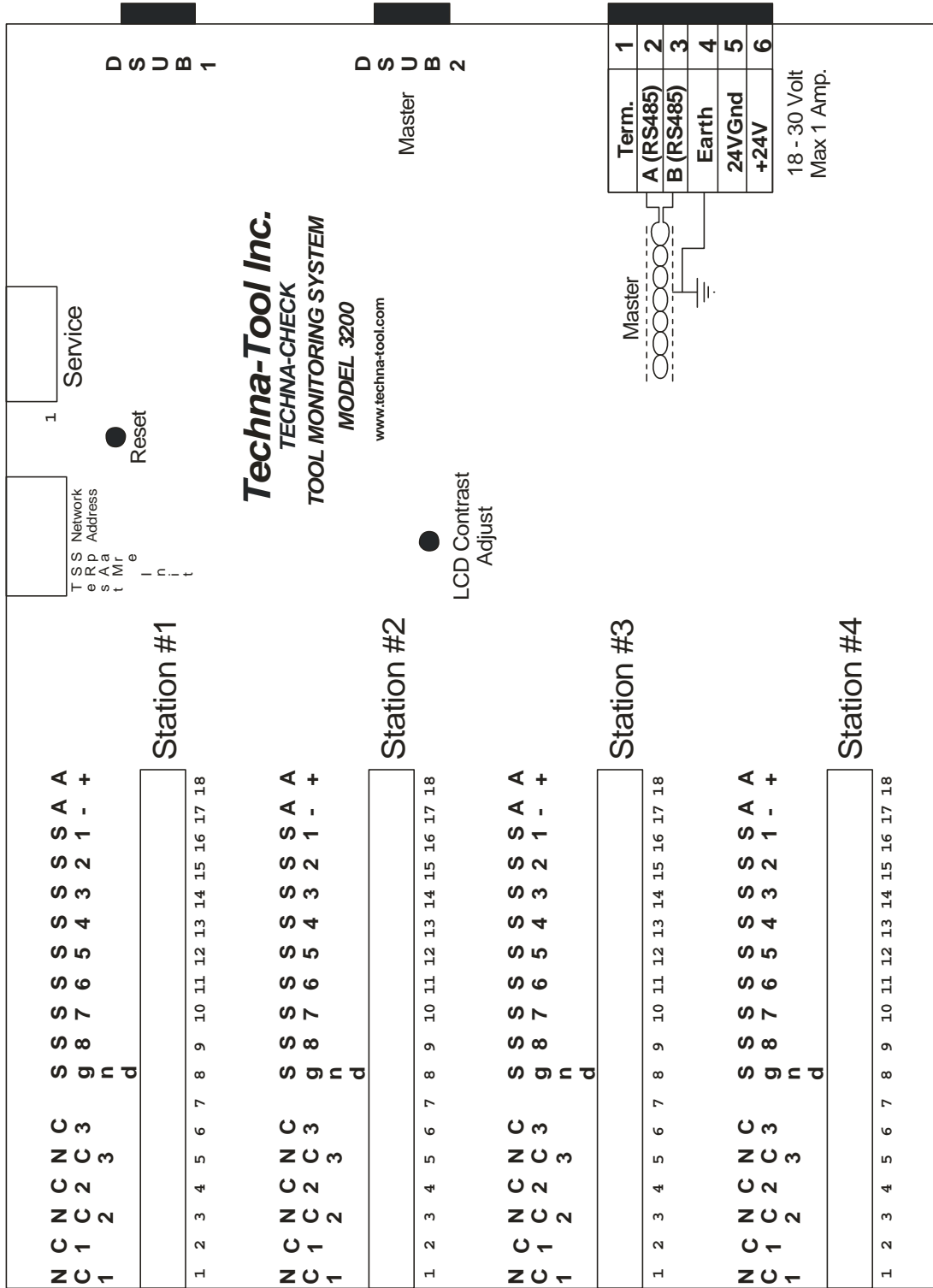
Note! Earth connected to housing inside TC3200

Appendix B-Interface to Single-Phase Transducer—UG 105

Note! The wire that feeds through the UniGuard device *must* be the wire which connects to L3.



Note! Earth connected to housing inside TC3200



Dip Switch #	Function	Default
S1	Factory Test Only	On
S2	SRAM Initialize On Power On	On
S3	Spare	On
S4	Network Address	On
S5	Network Address	On
S6	Network Address	On
S7	Network Address	On
S8	Network Address	On

S4	S5	S6	S7	S8	Network Address
On	On	On	On	On	1
Off	On	On	On	On	2
On	Off	On	On	On	3
Off	Off	On	On	On	4
On	On	Off	On	On	5
Off	On	Off	On	On	6
On	Off	Off	On	On	7
Off	Off	Off	On	On	8
On	On	On	Off	On	9
Off	On	On	Off	On	10
On	Off	On	Off	On	11
Off	Off	On	Off	On	12
On	On	Off	Off	On	13
Off	On	Off	Off	On	14
On	Off	Off	Off	On	15
Off	Off	Off	Off	On	16
On	On	On	On	Off	17
Off	On	On	On	Off	18
On	Off	On	On	Off	19
Off	Off	On	On	Off	20
On	On	Off	On	Off	21
Off	On	Off	On	Off	22
On	Off	Off	On	Off	23
Off	Off	Off	On	Off	24
On	On	On	Off	Off	25(Outside Range)
Off	On	On	Off	Off	26(Outside Range)
On	Off	On	Off	Off	27(Outside Range)
Off	Off	On	Off	Off	28(Outside Range)
On	On	Off	Off	Off	29(Outside Range)
Off	On	Off	Off	Off	30(Outside Range)
On	Off	Off	Off	Off	31(Outside Range)
Off	Off	Off	Off	Off	32(Outside Range)

CUT SELECT INPUT 5	CUT SELECT INPUT 4	CUT SELECT INPUT 3	CUT SELECT INPUT 2	CUT SELECT INPUT 1	CUT #
Off	Off	Off	Off	Off	1
Off	Off	Off	Off	On	1
Off	Off	Off	On	Off	2
Off	Off	Off	On	On	3
Off	Off	On	Off	Off	4
Off	Off	On	Off	On	5
Off	Off	On	On	Off	6
Off	Off	On	On	On	7
Off	On	Off	Off	Off	8
Off	On	Off	Off	On	9
Off	On	Off	On	Off	10
Off	On	Off	On	On	11
Off	On	On	Off	Off	12
Off	On	On	Off	On	13
Off	On	On	On	Off	14
Off	On	On	On	On	15
On	Off	Off	Off	Off	16
On	Off	Off	Off	On	17
On	Off	Off	On	Off	18
On	Off	Off	On	On	19
On	Off	On	Off	Off	20
On	Off	On	Off	On	21
On	Off	On	On	Off	22
On	Off	On	On	On	23
On	On	Off	Off	Off	24
On	On	Off	Off	On	25
On	On	Off	On	Off	26
On	On	Off	On	On	27
On	On	On	Off	Off	28
On	On	On	Off	On	29
On	On	On	On	Off	30
On	On	On	On	On	31

Appendix F-Panel Cut-Out Profile

