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# IMPAX PASS Monitor



## Process Analysis and Sorting System

IMPAX PASS Monitor Manual, Revised for Code Version 2.10, October 2009  
Manual by Steven Noto

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Process Technologies Group, Inc. 30W106 Butterfield Road, Warrenville IL 60555  
630-393-4777 Fax: 630-393-4680  
<http://www.impaxptg.com> [impaxptg@aol.com](mailto:impaxptg@aol.com)

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## 1: Introduction

The IMPAX PASS (Process Analysis and Sorting System) is a device that measures the power used in each machine cycle. It uses a power sensor to measure the power signal used during each cycle. The monitor measures the peak and area under the curve of this power signal. By doing this, the monitor can detect broken tools, no-feeds, and many other problems.

### Feature List

- Touch Screen Operation
- Peak Power Monitoring and Area-Under-Curve Power Monitoring
- Monitoring via Automatically-Learned Limits
- Monitoring via Fixed Limits
- Adjustable Upper and Lower Monitoring Limits for Peak and Area
- Additional Crash Monitoring Limit
- Interactive Error Display
- Customizable Error Tolerance for Upper and Lower Limit Breaches
- Diverter Function / Diverter Gate Output
- Machine Stop Output
- Machine Crash Output
- Parts-Per-Minute display
- System Overview and Process Trending Displays
- Trend Data Log
- Order Counter
- Historical Error Log
- Password Protected Bypass Mode for Managers

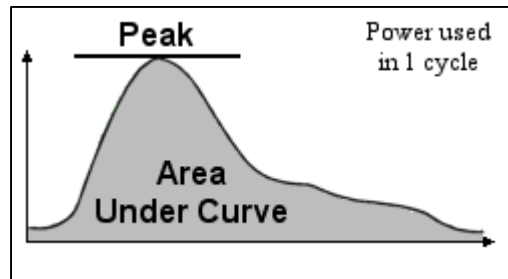
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## 2. Basic Operation

The IMPAX PASS Monitor measures the power signal of a machine process. It does this through a power sensor which normalizes the power usage as a number between 0 (no power) and 10 (maximum rated power).



For each cycle, the PASS measures the peak power and the area under the power curve. The peak power is the maximum power reading seen during the cycle, and the area under the curve is a summation of all the power readings (shown in grey in the figure), scaled by the cycle time.

The monitor “learns” a process to determine the power signature of a good cycle, and then calculates high and low limits based on this, and compares later cycles to the learned values, to ensure that the peak and area-under-curve stay within specified bounds. Limits can also be adjusted or entered manually.

If learned percentage limits are used, the monitor learns the process by observing a number of cycles, which are then averaged together to get learned values for the peak and area-under-curve. These learned values are multiplied by percentages to get upper and lower monitoring limits, which are then used to monitor each following cycle.

If fixed limits are used, the operator can specify upper and lower limits for monitoring. Then the monitor ensures that each cycle’s peak and area-under-curve fall within the chosen limits.

If a machine cycle is within the upper and lower limits, the cycle is considered good. Otherwise, it is considered bad, and an error is recorded. All limits can be adjusted in real time.

When a process error is detected, an error screen appears, the machine is stopped, and the monitor’s diverter output is activated. After this, an operator can choose to start over with new limits, or to continue with the current limits.

Additional features include crash detection, error tolerance, and trend analysis. Please refer to the sections below for information on these features and more.

### 3. Setup and Configuration

This chapter covers setting up the system to monitor a process, and fine-tuning the monitoring.

#### 3.1 Limits/Learn Button

The “Limits/Learn” button is available on most screens, and is the shortcut to setting limits for a process. Pressing it will go to either the percentage limits screen or the fixed limits screen, depending on which is currently being used. From that screen, the current limits can be viewed, adjusted, and a new learn can be started. Refer to the percentage limits and fixed limits sections below for more info.

#### 3.2 Setup Menu

The Setup Menu allows full access to monitoring setup, and can be shown by pressing “Setup Menu” on any screen. The sections below describe the Setup Menu’s features.

The monitor’s screen’s brightness can also be adjusted from this menu. Use the “Adjust Contrast” arrows to change the brightness/darkness.

MODE	IMPAX PASS MONITOR		PPM
READY TO MONITOR	SETUP MENU		22
SET PERCENTAGE LIMITS	ADJUST CONTRAST		
SET FIXED LIMITS	00		
ADJUST PEAK LIMITS	▲ ▼		
ADJUST AREA LIMITS	SYSTEM SETUP		
LIMITS/LEARN	SETUP MENU	DATA MENU	RUN SCREEN

#### 3.3 Setting Percentage Limits

To use percentage (learned) limits, press this button (or press “Limits/Learn” on any screen if the monitor is already in percentage limits mode).

It’s a good idea to use percentage limits when the ideal limits are unknown. For example, when a new part is started, or when a tool is changed, or when a machine adjustment is made that will affect power usage (air pressure, etc).

MODE	SET PERCENTAGE LIMITS		PPM
READY TO MONITOR			22
ENTER PERCENT LIMITS AND PRESS "LEARN"			
PEAK HIGH PERCENT:	10	AREA HIGH PERCENT:	10
PEAK LOW PERCENT:	10	AREA LOW PERCENT:	10
LEARN NOW			
LIMITS/LEARN	SETUP MENU	DATA MENU	RUN SCREEN

To enter a percentage, press it and enter a new value. The percentages entered on this screen will be multiplied by the learned values to determine the upper and lower limits of what will be considered a good cycle. For example, “Accept all cycles that are within +15% and -10% of the learned cycle.” Separate limits are used for peak and area-under-curve monitoring.

Pressing “Learn Now” starts the learn process, and jumps to the Learned Values screen, where the learned values will be updated as they are calculated. The “Learn Now” button can also be used for re-learning an existing process, in case some parameters have changed. The percentages can be changed without re-learning a process: see the sections on adjusting limits below.

### 3.4 Setting Fixed Limits

To use fixed limits, press this button (or press “Limits/Learn” on any screen if the monitor is already in fixed limits mode).

It’s a good idea to use fixed limits when ideal limits are known. For example, when starting a part that has been run many times before with the same limits each time, or on a machine that always makes the same part.



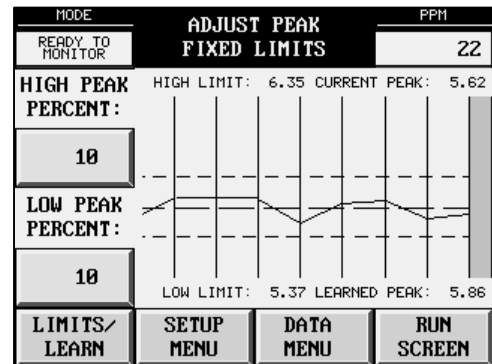
To enter a limit, press it and enter a new value. The limits that are entered in this screen will be used as-is to determine what will be considered a good cycle. Separate limits are used for peak and area-under-curve monitoring.

Press “Start Monitoring” to use the entered limits to monitor the process. If already in fixed limits mode, the limits can be changed on the fly and will be used as entered. Also see the sections on adjusting limits below.

### 3.5 Adjusting Peak and Area Limits

Limits can always be adjusted in real-time, to fine-tune the monitoring process. Limits can be adjusted through these screens, or through the Set Limits screens mentioned above.

There are separate adjust screens for peak and area-under-curve. Each shows a trend view of the peak/area, with its limits. Information such as the learned value, current value, and current high and low limits are shown in small text.



On the left of the adjust screens are fields where the upper and lower limits can be adjusted. If in percentage limits mode, these values will be the upper and lower percentages (that are multiplied by the learned value to get the limits). If in fixed limits mode, these values will be the actual limits themselves. In either mode, editing these values (by pressing one and entering a new number) will have an immediate effect on the limits, which will be used starting with the next cycle. The trend chart will also update in real time, showing the current value and the limits.

### 3.6 System Setup

The System Setup features are explained in a separate chapter. They include one-time setup tasks that are configured at the time of install.

## 4. Data and Monitoring Status

This chapter covers viewing the status of the process and of the monitoring.

### 4.1 Data Menu

The Data Menu can be shown by pressing “Data Menu” on any screen. The features in this menu display the monitor’s status and history.

MODE		IMPAX PASS MONITOR		PPM
READY TO MONITOR		DATA MENU		22
LEARNED VALUES		PEAK TRENDING		
OVERVIEW SCREEN		AREA TRENDING		
ERROR LOG		TRENDING DATA LOG		
ORDER COUNTER		USER NOTICE SCREENS		
LIMITS/LEARN	SETUP MENU	DATA MENU	RUN SCREEN	

### 4.2 Learned Values

This screen displays the learned values. It is automatically shown when the monitor is learning a process for percentage limits mode, but the process peak and area are also learned when in fixed limits mode (for calculating the crash limits).

MODE		LEARNED VALUES		PPM
READY TO MONITOR				22
CYCLES TO LEARN:	10	CYCLES LEARNED:	7	
CURRENT PEAK:	5.62	CURRENT AREA:	420	
LEARNED PEAK:	5.86	LEARNED AREA:	428	
CRASH PERCENT:	40	CRASH LIMIT:	8.20	
LIMITS/LEARN	SETUP MENU	DATA MENU	RUN SCREEN	

In addition to learning status and learned values, the current peak/area of the last cycle and the current crash settings are shown.

### 4.3 Overview Screen

This screen provides a quick overview of the current monitoring status. It displays values from the order counter (good parts, parts to go, bad parts, and the count of the last error), the current peak and area in bar graph form, and the current limits being used. If in percentage limits mode, the current percentages are shown as well.

MODE		OVERVIEW SCREEN			PPM
READY TO MONITOR					22
GOOD PARTS	CURRENT PEAK	HIGH PEAK LIMIT	CURRENT AREA	HIGH AREA LIMIT	
1500	10.00	VALUE	1000	VALUE	
PARTS TO GO	8.00	6.35	800	450	
0	6.00	LOW PEAK LIMIT	600	LOW AREA LIMIT	
BAD PARTS	4.00	VALUE	400	VALUE	
78	2.00	5.37	200	397	
LAST ERROR AT	0.00		0		
150	5.62		420		
LIMITS/LEARN	SETUP MENU	DATA MENU	RUN SCREEN		

### 4.4 Error Log

The monitor keeps extra information on the last eight errors, and this information is shown in the Error Log. Shown are error type (peak, area, or both), cycle count at which the error occurred, peak and its limits, and area-under-curve and its limits. The arrow keys move between the two pages of the log.

MODE		ERROR LOG PAGE 1					PPM
READY TO MONITOR							22
	COUNT	PEAKLO	PEAK	PEAKHI	AREALO	AREA	AREAH
PEAK	1482	3.00	4.11	4.00	300	450	500
AREA	1420	3.00	5.12	4.00	300	375	500
BOTH	1302	3.00	4.00	4.00	300	522	500
PEAK	1298	3.00	3.86	4.00	300	450	500
<	SETUP MENU	DATA MENU	>				

### 4.5 Order Counter

The Order Counter screen displays counts of good parts made and bad parts (errors). Learning cycles are counted as good parts as well. Pressing on the order quantity will allow entering a preset “goal” quantity, which will be counted up to.

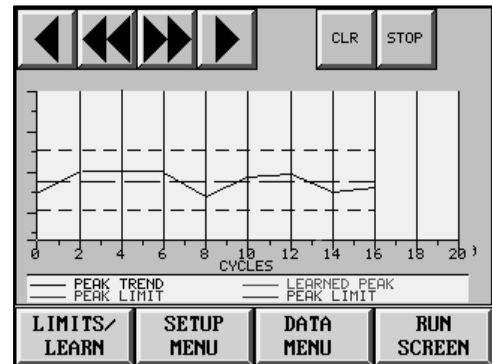
Pressing “Reset Counts” in the upper-right corner will clear all the counts in this screen.

MODE		ORDER COUNTER		RESET COUNTS
READY TO MONITOR				
ORDER QUANTITY:		15000		
GOOD PARTS MADE:		1500		
GOOD PARTS TO GO:		13500		
BAD PARTS DIVERTED:		78		
LIMITS/LEARN	SETUP MENU	DATA MENU	RUN SCREEN	

### 4.6 Trending

The trending screens display a rolling trend of the peak/area-under-curve of the last 200 cycles. Each cycle’s peak/area is shown, along with the upper and lower limits, and the learned value.

These screens are useful for examining the consistency of a process, to determine how tight the limits can be set without causing nuisance shutdowns. Trending can also reveal if the process power is drifting. For example, if the peak power is drifting up, it may mean that a tool is getting dull and needs replacement.



The arrow keys can be used to scroll through the 200-cycle buffer. The “CLR” button will clear the buffer, and the “STOP” button will pause the display.

### 4.7 Trend Data Log

This screen displays extra information on the last eight cycles displayed in the trending screens. Shown are the actual numeric values of the peak and its limits, and the area-under-curve and its limits. The arrow keys move between the two pages of the log.

MODE		TREND DATA PAGE 1:				PPM
READY TO MONITOR		MOST RECENT FIRST				22
1ST LAST CYCLE:	PEAKLO	PEAK	PEAKHI	AREALO	AREA	AREAHI
	3.00	4.11	5.50	300	450	600
2ND LAST CYCLE:	3.00	5.12	5.50	300	375	600
3RD LAST CYCLE:	3.00	4.00	5.50	300	522	600
4TH LAST CYCLE:	3.00	3.86	5.50	300	450	600
<	SETUP MENU	DATA MENU	>			

### 4.8 User Notice Screens

This series of three screens display information on the IMPAX PASS monitor, contact information for Process Technologies Group, Inc., and the user license agreement. The arrow keys move between the three pages.



## 5. Process Errors

This chapter covers what happens when a process error occurs.

### 5.1 Peak/Area Error

Whenever a cycle occurs that is outside the allowable peak or area limits, an error is recorded (See the section on Error Tolerances in the System Setup chapter for exceptions). The machine is stopped (via the machine stop relay) and the monitor’s diverter output is activated. Then this error screen is displayed, which shows what type of error occurred (peak, area, or both), along with the actual cycle values compared to the limits.

MODE		PPM	
PROCESS ERROR	PEAK ERROR DETECTED		22
PRESS CONTINUE TO USE EXISTING LIMITS. PRESS LIMITS/LEARN TO LEARN NEW LIMITS.			
HIGH PEAK LIMIT:	6.35	HIGH AREA LIMIT:	450
CURRENT PEAK:	3.42	CURRENT AREA:	420
LOW PEAK LIMIT:	5.37	LOW AREA LIMIT:	397
LIMITS/LEARN	SETUP MENU	DATA MENU	CONTINUE

When this screen is displayed, an operator should stop and determine the problem. They can then press “Continue,” which will resume monitoring with the current limits. Alternatively, they can press “Limits/Learn” to return to the screen with the current limits, and adjust the limits, and optionally re-learn the process. The Continue feature is intended for recovering from small one-time process faults, while re-learning the process is better for major changes to the process, such as using new tools or new material.

The operator can go to other screens when there is an error, but will need to either enter new limits or press “Continue” to allow the machine to run again. The operator can always return to the error screen from a button in the Setup Menu, which is visible when there is an error.

### 5.2 Crash Error

If crash limits are enabled, and the process power ever exceeds the crash limit, a crash error occurs (See the section on crash limits in the System Setup chapter for more info). Crash limits are enforced in real-time, unlike peak and area errors, which are not processed until the end of each cycle. As soon as the crash limit is exceeded, the machine is stopped.

MODE		PPM	
PROCESS ERROR	CRASH ERROR DETECTED		22
PRESS CONTINUE TO USE EXISTING LIMITS. PRESS LIMITS/LEARN TO LEARN NEW LIMITS.			
CRASH LIMIT PERCENT:		40	
CRASH LIMIT VALUE:		8.20	
PEAK CRASH VALUE:		8.37	
LIMITS/LEARN	SETUP MENU	DATA MENU	CONTINUE

Crash errors are handled in the same fashion as peak and area errors. When a crash error occurs, the machine is stopped (via the machine crash relay), and a crash error screen appears. This screen shows the crash limit and what the value was that passed the limit. After a crash, an operator has the same options to continue monitoring, or to enter new limits and/or re-learn the process.

## 6. System Setup

The System Setup pages can be reached by pressing “System Setup” in the Setup Menu. They are password-protected; the default password is 0 (zero). These screens let a manager change the monitor’s settings:

### Cycles to Learn:

This is the number of cycles the monitor will average together while learning, to calculate the learned peak and area-under-curve. Consistent processes can be learned in a few cycles, but it may take more cycles to get a good average of a less consistent process.

### Crash Limit Percent:

This is the percentage used to calculate the crash limit.

The limit works in the same way as an upper peak limit: the crash limit percent is multiplied by the learned peak to get the crash limit. If the limit is ever exceeded (at any point in a cycle), the machine is stopped. This feature can be turned off by entering zero for the crash limit percent.

### Processing Mode:

The monitor defaults to monitoring peak and area-under-curve, but it can be changed to only monitor one of these. Peaks and areas will still both be observed, but the monitor will only check for errors in the specified mode (peak, area, or both). Enter the appropriate number according to the key.

### Bypass Mode:

Pressing this will enable bypass mode: the monitor will not shut the machine down on an error or crash. This feature is only intended for short-term troubleshooting, and will disable itself every time the monitor reboots.

### High and Low Limit Tolerances:

These settings tell the monitor to not stop the machine until a certain number of consecutive errors occur. There are separate tolerances for the high and low limits.

This can be used for machines with feeding problems. For example, if the low limit tolerance is set to 3, up to 3 consecutive cycles that violate the low limits will be allowed. If a serious problem occurs that causes 4 or more consecutive errors, the monitor will then stop the machine and display the error.

The diverter output still activates on each error, so potentially bad parts can be diverted out even when using a tolerance. But by using tolerance values, nuisance shutdowns can be reduced.

Setting these to 0 will cause the monitor to stop the machine on every error.

MODE	SYSTEM SETUP PAGE 1		PPH
READY TO MONITOR			22
CYCLES TO LEARN	10	CRASH LIMIT PERCENT (0 = OFF)	40
PROCESSING MODE: 1 = AREA 2 = PEAK 3 = BOTH	3	BYPASS: ALLOWS MACHINE TO RUN EVEN IF ERROR	BYPASS MODE OFF
<	SETUP MENU	DATA MENU	>

MODE	SYSTEM SETUP PAGE 2		PPH
READY TO MONITOR			22
HIGH LIMIT TOLERANCE BEFORE STOPPING MACHINE	0	DIVERT GATE START DELAY (IN TENTHS OF A SECOND)	0
LOW LIMIT TOLERANCE BEFORE STOPPING MACHINE	3	DIVERT GATE STOP DELAY (IN TENTHS OF A SECOND)	10
<	SETUP MENU	DATA MENU	>

**Divert Gate Start and Stop Delays:**

These settings specify the time delays for the diverter output. After any bad cycle is detected, the monitor will start timers for the divert start and the divert stop. When the divert start time is reached, the diverter output will activate. When the divert stop time is reached, the diverter will deactivate. This is useful for properly catching parts as they are produced. These times are in tenths of a second. Setting both to 0 will disable the diverter output.

**System Password:**

A new system password can be entered. This password controls access to the System Settings.

**Clear Error Log:**

Pressing this will clear all the entries from the error log.

**Prox Polarity:**

This setting controls how the proximity sensor timing signal is interpreted. The default is positive polarity, which means the PASS will monitor the peak and the area-under-curve while the prox is on metal (activated). The alternative is negative polarity, which means that peak and area will be monitored while the prox is off metal (deactivated).

MODE	SYSTEM SETUP PAGE 3		PPM
READY TO MONITOR			22
SYSTEM PASSWORD	1234	CLEAR ERROR LOG	PRESS TO CLEAR
PROX POLARITY	POSITIVE	ANALOG CARD TYPE: VOLTAGE OR CURRENT (MUST RESTART MONITOR AFTER CHANGING)	ANALOG CARD: CURRENT
<	SETUP MENU	DATA MENU	>

**Analog Card Type:**

This should be set to match the type of analog card in the monitor. This information is provided with each monitor at time of install. The default is a current-based analog input card. Please contact PTG for assistance in changing this value.

**Default Run Screen:**

This setting controls which screen is displayed when the Run Screen button is pushed. This screen will also be shown after the process is successfully learned, and after the monitor resumes from an error. It can be used to designate a “home screen” for the monitor. Several options are available; enter the number of the desired screen from those available to the right.

MODE	SYSTEM SETUP PAGE 4		PPM
READY TO MONITOR			22
DEFAULT RUN SCREEN: GO TO THIS SCREEN WHEN RUNNING. USE VALUES ON RIGHT.	0	5 SETUP MENU 6 DATA MENU 20 OVERRUN SCREEN 37 ADJUST AREA LIMITS 38 ADJUST PEAK LIMITS 48 ORDER COUNTER 58 AREA TRENDING 59 PEAK TRENDING 55 TREND DATA LOG 68 ERROR LOG 72 LEARNED VALUES	
QUALIFYING INPUT: MONITOR ONLY WHEN X4 IS ON	QUAL. INPUT ON	NUMBER OF CYCLES TO IGNORE AFTER QUALIFYING INPUT (X4) COMES ON	1
<	SETUP MENU	DATA MENU	>

**Qualifying Input:**

A qualifying input is a signal that must be active in order for the PASS to monitor cycles. If this feature is enabled, the PASS will ignore all cycles, and will not check for crashes, while the qualifying input is off. When the qualifying input comes on, the next cycle will be monitored, and after that crash detection will resume. This is useful if the machine can be in a setup mode or a jog mode, and monitoring is not desired for these modes.

**Number of Cycles to Ignore After Qualifying Input Comes On:**

This setting tells the PASS to ignore several cycles after the qualifier turns on. This is useful if the first few cycles of continuous running need to be ignored for some reason. Setting this to zero will cause the PASS to immediately start monitoring when the qualifier comes back on.

**Max Prox Length Timer (For Tapping):**

This setting can be used for tapping or similar operations, to limit the maximum proximity sensor “on” time. If this setting is non-zero, the monitor will effectively turn off the prox and stop monitoring after the specified number of seconds. This can be useful for tapping machines with reversing drives: when the drive reverses to back out of a part, a large power surge can occur which throws off monitoring. By setting this value to a short enough time, the tapping can be monitored, and then the reverse and back-out will be ignored.

