

# The PMAC 2000

## Operator's Manual 7.6

This manual covers operating version 7.6 of the PMAC 2000.

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Sensor Developments Inc  
1050 W. Silver Bell Road  
Orion, MI 48359  
1 (800) 997-3676  
(248) 391-3000  
Fax: (248) 391-0107  
[www.sendev.com](http://www.sendev.com)

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# Introduction

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## System Overview

The PMAC 2000 is a multi-function **Process Monitor And Control** instrument, designed to operate with SDI Auto-ID transducers. Model 90222 has been enhanced to support torque sensors with quadrature encoders. This functionality is supported via Auto-ID and third party sensor programming. The PMAC version 7.6 will have an encoder chip and new software installed. For easy verification of version 7.6, if a torque sensor with encoder is attached at power up, an "E" will be displayed at the end of the line of the sensor data.

Additional features of the PMAC 2000 model 90222 are additional options under the menu items:

- Settings
- Transducer

Model 90222 is a portable instrument, and comes with the following:

- Carrying Case
- Shoulder Strap
- 12 V 600 mA Power Supply, and
- This Manual

If any of these items are missing, call SDI customer support number, 1 (800) 997-3676. Model 90227 is a fixed instrument housed in a NEMA-12 enclosure.

## Features

The PMAC 2000 features:

- Six process monitoring functions, including:
  - A continuous tracking function
  - 3 peak logging functions
  - 2 waveform recording functions (with multiple record rates)
- 3 process control output signals (for High, Low and Target occurrences)
- Programmable setpoints for Threshold, Target, High and Low Limits
- Analog output
- Storage capability for up to 8,000 peak readings
- 3 [peak] data logging operations
- Automatic calibration with SDI's strain gage based Auto-ID sensors,
- Collects absolute values or values relative to a user defined zero point
- Scaling adjustment for transducers
- Multiple unit capability and automatic units conversion
- Menu locking
- Automatic power-down
- Rechargeable Ni-Cad batteries, and
- Support for third party transducers

## Process Monitoring Functions

The PMAC 2000 provides six process monitoring functions:

- Track
- - Peak
- + Peak
- +/- Peak
- Auto Record, and
- Manual Record

Track is always available by pressing the TRACK button. The FUNC button can be programmed for any one of the other five functions.

### Track

Track provides continuous monitoring of a process. The instrument takes readings at 5 kHz (without an encoder), 2kHz (with an encoder in deg mode), or 20Hz (with an encoder in rpm mode) averages them, and updates the display 4 times/second. In the Track function, re-taring zeros the encoder. (Track is designed for slowly changing processes.)

### Peak

The Peak functions (-, +, +/-) sample data at a rate of 5 kHz. However, if the encoder is enabled and in deg mode, the sample rate is 2kHz. If the encoder is in rpm mode, the sample rate is 20 kHz.

In all Peak functions when readings drop below 80% of the user-defined Threshold Value, the PMAC engages a 100 msec timer. If readings rise above threshold within that time, the process cycle continues. If not, the process cycle ends and readings are evaluated with respect to the limits. This timer is reset every time readings drop below threshold.

### Record

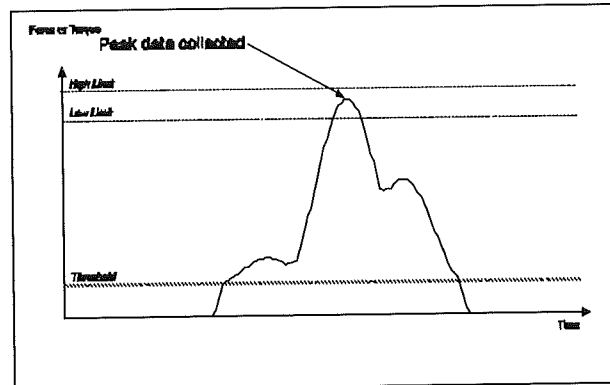
All functions except Manual record enable the encoder at the threshold for deg mode, or immediately for rpm mode. Manual record enables the encoder at the manual trigger for deg mode. The Auto and Manual Record functions have programmable record rates.

The Record functions will only allow 10kHz and 5kHz rates without an encoder. All other rates are allowed with an encoder. The encoder is sampled at the record rate for deg or rpm mode.

The Record and Peak functions are limited to a total of 8,000 readings with or without an encoder.

### + Peak

+Peak collects, displays and evaluates the highest [positive] peak value above the user-defined threshold.

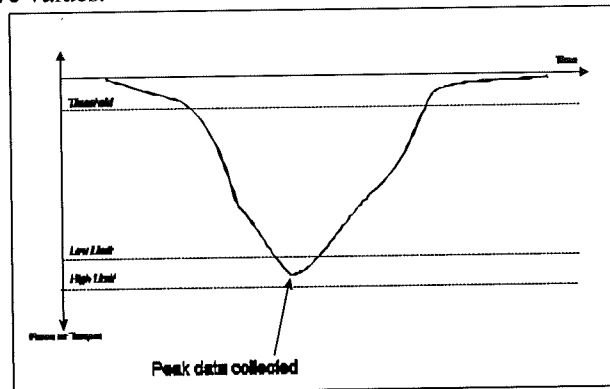


+ Peak ignores negative values.

### -Peak

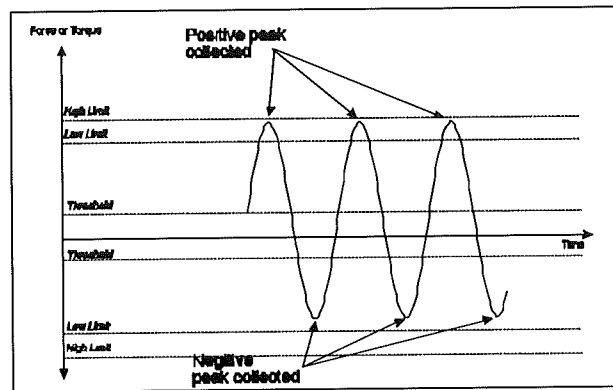
-Peak collects, displays and evaluates the lowest [negative] peak value below the user-defined threshold.

- Peak ignores positive values.



### +/- Peak

+/- Peak collects, displays and evaluates the greatest positive or negative values.



All setpoints are symmetrical about the x-axis.

Note: The PMAC 2000 collects only one reading per process cycle. If readings rise from negative to positive values within a process cycle, (this happens if readings are between the positive and negative Threshold for less than 100 msec.) the instrument records the peak with the greatest absolute value.

#### Auto and Manual Waveform Recording

Auto and Manual waveform recording are data recording functions that digitize incoming signals. Up to 16,000 data points can be stored. Neither function displays readings, or evaluates them with regard to the limits. The following update rates are available: 10, 5, 2, and 1 kHz, and 500, 200, 100, 50, 20, 10, 5, 2, and 1 Hz. For the 10 kHz\* scanning rate, data is sampled and stored; the instrument does not average the data. For the 5 kHz\* scanning rate, data is sampled at 5 kHz and continuously averaged to store readings. For each of the other scanning rates, data is sampled at a rate of 6 kHz and continuously averaged to store readings at the selected rate.

*\*10kHz and 5kHz rates are only available when the encoder is not used.*

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#### The Process Control Output Signals

The PMAC 2000 has three open collector, process control output signals:

- High Condition Signal
- Low Condition Signal, and
- Target Signal

When a Peak function is selected, the Target Signal is a real-time signal transmitted when a reading equal to, or greater than, the Target Value is detected. The High Condition and Low Condition Signals are post-process signals transmitted after readings drop below threshold, and the peak value is evaluated. These readings are also evaluated with respect to the encoder limits and target value.

When Track is selected, all signals are transmitted in real-time. When a waveform recording function is selected, all signals are disabled.

All three signals are TTL compatible and are transmitted through the I/O connector on the back of the unit. (See the chapter on Connecting the PMAC for more information.)

### **Programming Setpoints**

When each *type* of sensor (i.e., force, torque or displacement) is first connected to the PMAC, the instrument sets all of the setpoints to their default values.

Threshold Value = 5% of sensor's Full Scale

High Limit = Sensor's Full Scale

Low Limit = 5% of Sensor's Full Scale

Target Value = Sensor's Full Scale

Each of these values may be changed by the operator. (See the Basic Operation and Applications chapters.) The PMAC 2000 retains the most recent setpoint values for all three types of sensors; i.e., when you disconnect a torque sensor and connect a force sensor, the setpoints are reset to the values used with the last force sensor connected to the instrument.

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### **The Analog Output**

The analog output is the signal from the transducer, amplified and relayed through a low pass filter. The instrument provides an excitation of 7 V. The amplifier has a gain factor of 76 for a nominal output of 1 V at 2 mV/V. This signal is transmitted through the I/O connector. (See the Appendix for wiring diagrams.)

### **Data Logging**

The peak functions log all peak values automatically. The PMAC 2000 provides for:

- Viewing [peak] readings on the PMAC 2000 screen (one at a time)
- Uploading the readings to a PC
- Transmitting the readings directly to a serial printer, or
- Erasing the readings

The PMAC 2000 can store up to 8,000 [maximum] peak readings.

Note: The data is stored in blocks, and each block contains a header. Each time you change transducer types or units, the instrument must store an additional heading which reduces the memory available for storing peak values. Leaving a waveform stored in memory will also reduce the memory available for storing peak values.

No data logging occurs when the Track or waveform recording functions are selected. Data collected by the waveform recording functions must be uploaded to a PC or erased. It cannot be viewed on the PMAC 2000 screen.

### **Data Transmission**

The PMAC 2000 transmits data in ASCII format with the following parameters:

Baud Rate = 9600  
Parity = None  
Data Bits = 8  
Stop Bits = 1  
Flow Control = None or Xon/Xoff

### Automatic Calibration

The PMAC 2000 is designed to support SDI's Auto-ID sensors. SDI's Auto-ID sensors are equipped with an EPROM that stores the sensor's Full Scale value, the mV/V output, and engineering units. The PMAC 2000 automatically reads these values when:

- The sensor is initially connected
- When the instrument is powered up, and
- When the operator exits the menu structure

The PMAC 2000 automatically recalibrates to the sensor when it detects a change in these values.

### Absolute and Relative Modes

The PMAC 2000 uses an internal reference bridge to define absolute zero. In Absolute mode, readings are taken with respect to this value. In Relative mode readings are taken with respect to a tare value from the transducer.

**Important:** When using Absolute mode, it is important that the user-defined threshold be at least 25% greater than sensor's offset from zero.

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### Scaling

The PMAC 2000 multiplies **all new** readings by the scaling factor before storing or displaying the data. Changing the scale factor does not affect previously stored readings. With a scale factor of 1.0, the instrument stores and displays readings exactly as taken.

The instrument retains the most recent scale factor for all three types of sensors. (Same as the setpoints for the limit values. See page 4.)

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### Units

The PMAC 2000 provides automatic unit conversion. The Full Scale value for all SDI's Auto-ID sensors are specified in engineering units. When the operator selects a different set of units, the PMAC 2000 converts the Full Scale value, the High and Low limits, the Threshold and Target values, and all readings [taken from that point on] to the new units. The following units are available:

Force:	oz, lbs, Tons, g, kg, N
Torque:	inoz, inlbs, ftlbs, kgcm, kgm, NM
Displacement:	mils, in, mm, cm
Absolute numbers:	None



Note: The PMAC 2000 will only allow the operator to select units that are consistent with the type of transducer connected, i.e., torque units for a torque transducer.

### **Menu Locking**

All of the above mentioned features are accessed through the PMAC 2000's menu system. Each of the four menus (see the Basic Operations chapter) can be locked to prevent accidental changes.

### **Automatic Power-Down**

The PMAC 2000 will automatically power-down 12 minutes after the transducer is disconnected (unless the instrument is in the menu system).

### **Manual Power-Down**

To power-down the instrument manually, hold the OFF key for five seconds and release.



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### **AC Outlet or Battery Operation**

The PMAC 2000 can operate from an AC outlet or from the internal Ni-Cad batteries. When completely charged, the batteries should last for approximately 8 hours.

To completely charge the batteries, the instrument must be plugged into an outlet for 16 hours. There is no danger of over-charging the batteries if left plugged in for longer than 16 hours.

Note: If the instrument is left charging for "several weeks", the batteries' charge life will be severely diminished. (This is a property of all Ni-Cad rechargeable batteries.) SDI recommends completely discharging the batteries on occasion to maintain their charge life.

Note: When shipped from SDI's factory, the batteries will be completely discharged.

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### **Support for Third Party Transducers**

Third party transducers may be connected to the PMAC 2000 using a standard 15 pin D-sub connector, or SDI's Auto-ID connector (Model 90144). In either case, when the sensor is first connected to the PMAC 2000, the instrument will prompt you for the sensor's calibration data. (See the Applications chapter.)

When using sensors with a standard 15 pin connector, the data is stored in RAM so that it is not necessary to reenter the calibration data if the sensor is disconnected and immediately reconnected. But it must be reentered if another sensor is connected in the interim. These sensors are identified as "Raw".

When using sensors with SDI's Auto-ID connector, the instrument writes the calibration data to the connector's EPROM and retrieves it each time the sensor is connected. The PMAC 2000 programs these connectors with the transducer type, Full Scale value, the mV/V output, and the engineering units. This

provides automatic calibration every time the sensor is connected to the instrument. These sensors are identified as "Cus".

Note: Transducers that are programmed at SDI's factory include a "write protect" code. The PMAC 2000 will never overwrite the values stored in these connectors. These sensors are identified by "SDI".

## Basic Operation

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### Initial Power-up

Press any key to turn on the PMAC 2000.

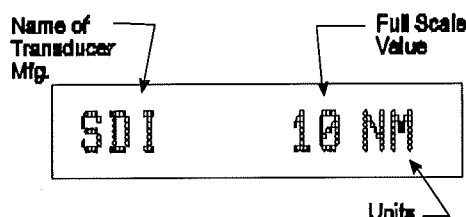
### Initial Self Checks

On powering up, the instrument briefly displays "PMAC 2000 V7.6", indicating the software revision number.

If no transducer is connected, the PMAC 2000 displays,  
"Check transducer".

Once a transducer is connected, the instrument displays:  
"SDI 10 lb",  
"Relative Mode or Absolute Mode  
Counting . . ."

The first message is a description of the transducer.



Note: When a third party transducer is connected, "Cus" or "Raw" will replace "SDI". The second message indicates if the instrument is in Absolute or Relative Mode. The last message is displayed while the instrument determines how much RAM is currently available for storing new readings.

### Ready to Collect Data

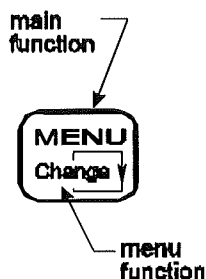
When the instrument is ready to collect data it displays one of the following messages:

"R0000 Ready"	if a peak function was selected and there is no data stored
"R0001 202.01b"	if a peak function was selected and there is data stored
"Ready to record"	for auto trigger recording, or
"Accept to record"	for manual trigger recording

Note: If the screen goes blank, the instrument is set to Auto-record and readings may already be above the threshold. Press ESC to cancel the data sampling.

## Key Definitions

The PMAC 2000 has four keys. Each key has multiple functions, and is labeled with its main function and its menu-navigation function.



The main functions are as follows:



Enters the menu system.



Selects the Track function.



Programmable key-- can be set to select any one of the five following functions: +Peak, -Peak, +/-Peak, A-Record, or M-Record.



Hold for 5 sec. and release to turn off the PMAC 2000. (The "OFF" feature is always available.)

Each key's additional functions are described in the following sections.

## The Menu System

The PMAC 2000 is configured through a menu system.

There are four menus:

1. Log Operations
2. Settings
3. Transducer Setup, and
4. Menu locking

You enter the menu system by pressing MENU.

Note: The PMAC 2000 does not collect data while in the menus.

The menu system is as follows:

Log Operations	Settings	Transducer Setup*	Menu Locking
View log	Func: <current>	Type: <current>	L-Menu: <current>
Upload log	R-rate: <current>	Unit: <current>	S-Menu: <current>
Print log	Unit: <current>	FS: <current>	T-Menu: <current>
Erase log	ZMode: <current>	mV/V: <current>	
	Thrshld: <current>	EPPR: <current>	
	LLimit: <current>	Write to Auto-ID	
	Target: <current>		
	HLimit: <current>		
	Scale: <current>		
	Emode: <current>		
	ELLimit: <current>		
	ETarget: <current>		
	EHLimit : <current>		
	Echo: <current>		

\*Note: The "Transducer Setup" menu is only available when "Cus" or "Raw" sensors are connected to the instrument. (i.e. no Auto-ID - See page 7.)

In the menu system, the keys perform the following functions:



Selects displayed menu items for change.



Scrolls through menu or submenu choices.



Accepts changes and exits submenu./Performs displayed operation.



Discards changes, exits submenu and returns to higher menu.

### Log Operations Menu

To execute any log operations, press Accept. While uploading or printing, the PMAC 2000 displays the data on screen as it is sent; while erasing data, the PMAC 2000 will display "Erasing". When Viewing Data the keys perform the following functions:



-No Function



Scrolls to the next reading.



Scrolls to the previous reading.



Exits the subroutine and returns to the "Log Operations" submenu.

The "Erase log" command requires confirmation. To confirm the "Erase log" command, press Next and Accept.

### Settings Menu

The "Settings" menu contains four multiple choice items:

Function, R-rate, Unit, and ZMode.  
and nine numeric items:

Threshold, High Limit, Target, Low Limit, Scale, Encoder Low Limit, Encoder Target, Encoder High Limit, and Echo.

When changing a multiple choice item:



Selects the currently displayed item for changing and enters the submenu containing the available choices.



Scrolls to the next available choice in a submenu.



Accepts the currently displayed item, and returns to the "Settings" menu.  
Exits the submenu and returns to the "Settings" menu.

When changing numeric items:



Selects the currently displayed item for changing and accesses the numeric entry subroutine.  
/Changes the value of the current digit position.

Scrolls to the next digit.



Accepts the currently displayed value, and returns to the "Settings" menu.

Discards the new value. / Press twice to exit the subroutine and return to the Settings" menu.

See the Applications Chapter for examples of setting up the PMAC 2000 for various tasks.

### Transducer Settings Menu

The "Transducer settings" menu is for entering calibration data into the Model 90144 connector, and for changing the data for raw sensors. This menu is only available when a Model 90144 or a standard 15 pin connector is connected to the PMAC, and is never available when an SDI sensor is connected to the instrument.

This menu contains three multiple choice items:

Transducer Type (Force, Torque or Displacement)  
Units,  
Encoder (y/n)

Three numeric items:

Full Scale Value  
mV/V Output, and  
Encoder Pulses Per Rev (EPPR)

and the command "Write to Auto-ID".

The keys work the same in this menu as they do in the "Settings" menu. And the "Write to Auto-ID" requires confirmation (the same as the "Erase Log" command).

Note: The "Transducer Settings" comes up automatically when a connector [that has never been programmed] is first connected to the instrument. At that time it is not necessary to press the Next key to go from one menu item to the next. But when accessing this menu from the menu system you must press the Next key to go from one menu item to the next.

### Menu Locking

The Locking Menu is used to protect menu selections from accidental change. Each of the three submenus can be individually locked.



The PMAC 2000 requires a password to access the "Menu Locking" menu. The password is "290". (See the section on entering numeric values above for further instructions.) **Note, unplug sensor, cycle power and enter "911" under Menu Locking to reset the PMAC in the event of a lock-up.**

When a menu is locked, you will be able to enter it and view the currently selected item or values, but you

will not be able to change them.

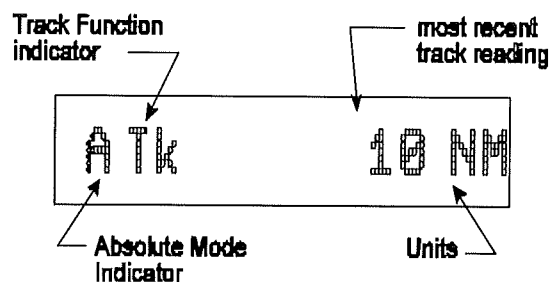
When the menus are locked:

- The "Settings" and "Transducer setup" submenus CNext will scroll through the values, but Change and Accept will not function. Esc will exit the submenu.
- In the "Log operations" submenu Cthe View Data, Upload Data, and Print Data will function normally, but you will not be able to Erase Data. Esc will exit the submenu.

If you attempt to change a locked item, the PMAC 2000 will respond by flashing the message "\*\*\* LOCKED \*\*\*" for one second.

### Using the Track Function

When the Track function is selected, the instrument displays:



The keys perform the following functions:



Enters the menu system.



Tares the sensor.



Selects the programmed function.



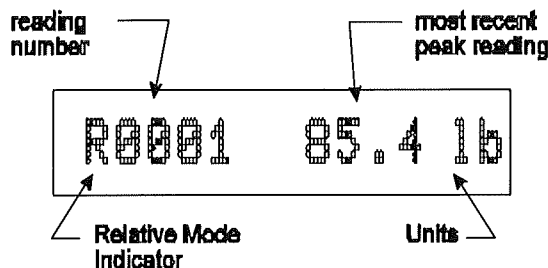
Tares the sensor.

Note: The PMAC 2000 does not log readings when the Track function is selected. With the encoder function, no limits are displayed with the angle function.

### Using the Peak Functions

When any of the three peak functions are selected, the instrument displays the reading number, the most recent peak reading, and the units as shown:





Readings are logged, and the display is updated after each loading cycle; i.e., after readings rise above and then drop below the Threshold Value.

The keys perform the following functions:



Enters the menu system.



Selects the Track function.



Will decrement the reading number, allowing the last reading to be re-taken.

Toggles between Absolute and Relative Modes.

## Using the Auto and Manual Record Functions

The Auto and Manual Record functions are identical except for the initial trigger. The Auto Record function uses the Threshold Value as its signal to begin recording data. The Manual Record function requires pressing the Accept key to begin recording data.

The PMAC 2000 stops recording when either of the following occur:

- The memory is full, or
- The ESC key is pressed

Before recording data, the instrument displays "Ready to record". While the instrument is recording, the screen will be blank and the green indicator light will flash at the recording rate. (Refer to the section on the menu system for information on selecting the scanning rate.)

When the instrument is done recording, it displays "Accept to upload". Pressing the Accept key uploads the data to a computer via the RS-232 port.

Only one digitized curve can be stored in memory at a time. The instrument retains all data when you enter the menu system or turn off the PMAC 2000. Recorded data must be manually erased.

To Erase data:

1. Press ESC to initiate the "Erase data" command.
2. Press Next to scroll to "Yes".
3. Press Accept to confirm the "Erase data" command.

The keys perform the following functions:



Enters the menu system.



Selects the Track function./Scrolls from "No" to "Yes" when confirming the "Erase data" command.



Begins recording in Manual./Uploads data./Confirms the Erase command.



Stops data recording./Initiates "Erase Data" command

# Applications

## Monitoring Continuous Change

Use the Track function to monitor continuous changes. Select the Track function by pressing the TRACK key. (Outside of the menus.) The instrument will monitor the sensor and update the display four times per second (4 Hz).

Readings may be taken in either Relative or Absolute mode. In Relative mode the instrument tares the sensor and readings are relative to the sensor's offset. In Absolute mode, readings are taken with respect to absolute zero; defined by the instrument's internal reference bridge.





## Recording Peak Readings



The PMAC 2000 can collect and store peak readings from any force, torque or displacement. The instrument can also automatically convert readings from one unit to another as the readings are collected. (The instrument will not convert the units of readings already stored.)

### Example






Suppose you have a 50 kg load cell (with a 0.05 kg offset) and you want to record peak readings in pounds.

To set up the PMAC 2000, do the following:







Step	Action	Instrument Displays:
1	Connect the sensor and power-up the instrument	PMAC 2000 V7.6 Transducer check SDI 50 kg Absolute mode A0000 Ready
Enter the menu system.		
2	 To enter the menu system	Log operations
Assign a Peak function to the FUNC key.		
3	 To scroll to the "Settings" menu	Settings
4	 To enter the "Settings" menu	Func: +peak Indicates the current function.
5	 To enter the "Function" submenu	New Fn: +peak



6		(Twice) to scroll through the function choices	New Fn: -peak New Fn: +/-peak
7		To select the currently displayed function	Func: +/-peak

Select the units.

8		(Twice) to scroll to the "Units" submenu	Unit: kg
9		To enter the "Units" submenu	New Unit: kg
10		(4 times) to scroll to lbs	New Unit: lb
11		To select the displayed units	Unit: lb
12		To exit the "Settings" menu	Settings

[Optional] Erase any previously recorded data.

13		(Twice if using an SDI sensor, three times if using a third party sensor) to scroll to the "Log operations" menu	Log operations
14		To enter the "log operations" menu	View log
15		(3 times) to scroll to "Erase log"	Erase log
16		To erase the log	Erase log: No The instrument asks for confirmation.
17	 	And To confirm the erase log command	Erase log: Yes Erasing Erase log Note: if the log only contains a few entries, "Erasing" may be displayed too quickly to be seen.

18	 To exit the "Log operations" menu	Log operations
Exit the menu system.		
19	 To exit the menu system	Transducer check A0000 Ready

The instrument is now set up to collect peak reading.

### Uploading Logged Peak Readings to a Computer or Printer

To calculate any statistics from collected peak data, it is necessary to upload the collected data to a computer. The readings may also be sent directly to a printer.

There are three steps to uploading the data:

- Step 1: Connect the PMAC to either the computer or the printer. Use the RS-232 port on the back of the PMAC 2000, and the serial port on the computer or printer.

To connect to a printer, use a standard IBM serial printer cable.

To connect to a PC, use a standard IBM null modem cable.

- Step 2: Prepare the PC to receive the data.

1. Launch a terminal emulation application such as Windows Terminal or Hyperterminal.

2. Set the communications settings to:

Baud Rate	=	9600
Parity	=	None
Data Bits	=	8
Stop Bits	=	1
Flow Control	=	None

Note: Since data is in raw ASCII format, it is not necessary to set the terminal emulation.





3. Select "Receive Text File" from the data transfer options.

You will be prompted for a file name. (Depending on the program, this may occur before or after the data transfer.) All the data transmitted to the computer will be stored in this file.

4. Enter a file name.





Step 3: Upload the data.



To upload peak readings to PC do the following:

Step	Action	Instrument Displays:
Enter the menu system.		
1	 To enter the menu system	Log operations
2	 To enter the "Log operations" menu	View log
3	 (Once) to scroll to "Upload Log." or (twice) to scroll to "Print Log"	Upload log or Print log
4	 To upload or print the data	The instrument will scroll through the readings as it uploads or prints them. Note: Uploading is faster than printing.

[Optional] Erase Readings.

Note: Peak readings are not automatically erased, and can be downloaded to a computer or printer as many times as desired.






5	 To scroll to "Erase Log"	Erase log
6	 To erase the peak readings	Erase log: No The instrument asks for confirmation.
7	 And  To confirm "Erase log" command	Erase log: Yes Erasing Erase Log Note: if the log only contains a few entries, "Erasing" may be displayed too quickly to be








		seen.
8	 To exit "Log operations" menu	Log operations
Exit menu system.		
9	 To exit the menu system	Transducer Check R0000 Ready

### Digitizing a Force-Time Curve

The PMAC 2000 provides two functions for digitizing waveforms, the A-record function and the M-record function. To capture a force-time curve with the M-record function, follow this procedure:

To set up the PMAC 2000:

Step	Action	Instrument Displays:
1	Connect the sensor and power-up the instrument	PMAC 2000 V7.6 Transducer Check SDI 50 kg Absolute mode A0000 Ready
Enter the menu system.		
2	 To enter the menu system	Log operations
Assign a record function to the FUNC key.		
3	 To scroll to the "Settings" menu	Settings
4	 To enter the "Settings" menu	Func: +/-peak
5	 To enter the "Function" submenu	New Fn: +/-peak
6	 To scroll to the desired function (in this case M-record)	New Fn: M-record

7		To assign the displayed function to the FUNC key	Func: M-record
Select the Recording Rate.			
8		To scroll to "R-rate"	R-rate: 10kHz
9		To enter the "R-rate" submenu	New rate: 10kHz
10		To scroll to the desired recording rate (in this case, 500Hz.)	New rate: 500Hz
11		To select the displayed recording rate	R-rate: 500Hz
12		To exit the "Settings" menu	Settings
Exit the menu system.			
13		To exit the menu system	Transducer check Accept to record

To record the force-time curve:

1. Press Accept to begin recording data.
2. Apply loads to the sensor.
3. When you are done applying loads, Press ESC to stop recording.
4. Press Accept to upload the data to a computer, or

Press ESC to erase the data. The instrument will ask for confirmation. Press Next and Accept to confirm the erase command.

## Using the Output Signals

### Example

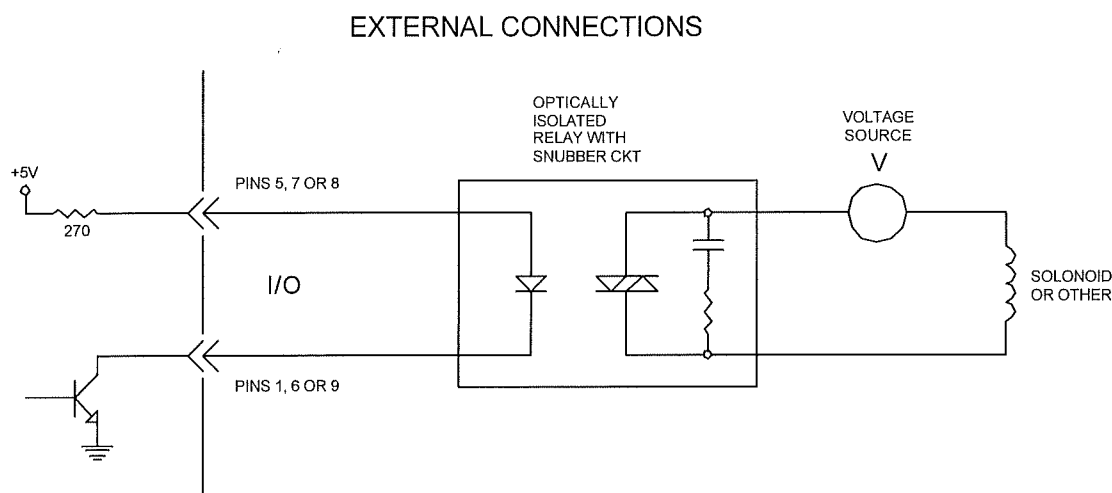
Suppose you are fastening bolts with a nut runner. The application requires that torque be between 90-100 in-lbs. You want the PMAC to turn off the nut runner when it detects a torque of 92 in-lbs; and you want to trigger an audible alarm if the actual peak torque is not within the specified range.

To set up the PMAC 2000, do the following:



Step 1: Purchase a standard 9 pin D-sub male connector.



Step 2: Wire the connector to each of the alarms according to the following diagram.







Note: In some cases you can connect the load directly to the instrument, but most cases do require a buffer as shown.












Pins 5 and 1 are for the Target Signal; 7 and 6 are for the High Condition Signal; and 8 and 9 are for the Low Condition Signal.



Step 3: Program the PMAC to trigger the signals according to the following procedure:

Step	Action	Instrument Displays:
1	Connect the sensor and power-up the instrument	PMAC 2000 V7.6 Transducer Check SDI 50 kg Absolute mode A0000 Ready
Enter the menu system.		
2	 To enter the menu system	Log operations
Assign a Peak function to the FUNC key.		
3	 To scroll to the "Settings" menu	Settings

4		To enter the "Settings" menu	Func: +peak indicates the current function
5		To enter the "Function" submenu	New Fn: +peak
6		(Twice) to scroll to the +/- peak function.	New Fn: -peak New Fn: +/-peak
7		To select the currently displayed function	Func: +/-peak

Set the High and Low Limits for acceptable Peak Values; and the Target Value.

8		(Four times) to scroll to the Low Limit	LLimit:: 10.00
9		To change the Low Limit	New LL: The underline indicates the currently selected digit
10		(11 times) to change the first digit to "9"	New LL: <u>9</u>
11		To move to the second digit	New LL: 9 <u>  </u>
12		(Twice) to change the second digit to "0"	New LL: 90 <u>  </u>
13		To scroll to the third digit	New LL: 90 <u>  </u>
14		To change the third digit to "."	New LL: 90. <u>  </u>
15		To scroll to the fourth digit.	New LL: 90. <u>  </u>
16		Repeat step 12	New LL: 90. <u>0</u>
17		To accept the displayed value	LLimit: 90.0
18		To scroll to the Target Value	Target: 200.0
19		Repeat Steps 10-18, entering 92.0 for the Target Value	Target: 92.0
20		To scroll to the High Limit	HLimit: 200.0
21		Repeat Steps 9-17, entering 100.0 for the High Limit	HLimit: 100.0

22		To exit the "Settings" menu	Settings
Exit the menu system.			
23		To exit the menu system	A0000 Ready

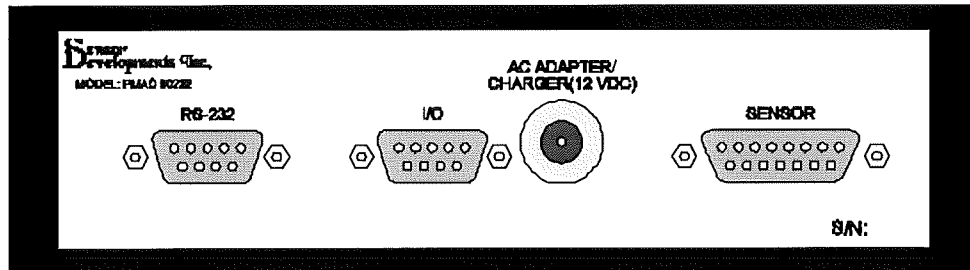
To operate the instrument, apply torque to the sensor. When the instrument detects a torque equal to the Target Value, it will send the Target Signal.

After each loading cycle is completed, the instrument will display the peak value and evaluate it relative to the High and Low Limits. If the peak value falls above the High Limit, the instrument will send the High Condition Signal. If the peak value falls below the Low Limit, the instrument will send the Low Condition Signal.

# Appendix

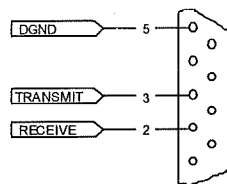
## Connecting the PMAC 2000

There are four connectors on the back of the PMAC 2000.



### RS-232

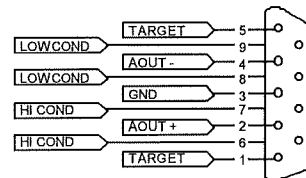
The RS-232 connector is used to upload and print data.



### I/O

The I/O connector is used for:

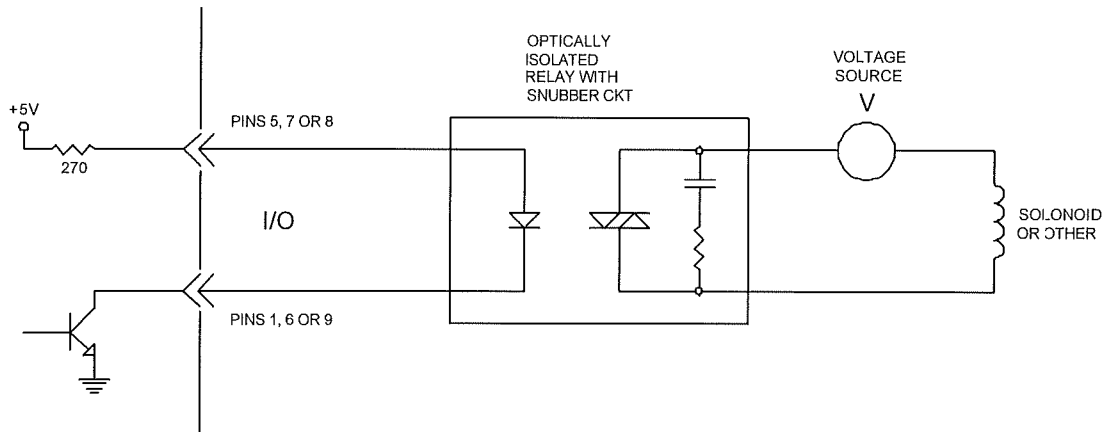
- Analog Output
- High Condition Signal
- Low Condition Signal, and
- Target Signal



The analog output is a differential output across AOUT+ and AOUT-. It has a common mode voltage of 2.5 V with respect to chassis ground. AOUT- is the reference and AOUT+ is driven positive or negative with respect to it. The Output impedance of each is 620 ohms and the output voltage is +1.0 V nominal for 2 mV/V full scale sensor.

Wire the connections for the output signals according to the following diagram.

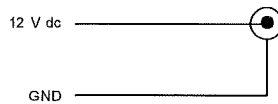
### EXTERNAL CONNECTIONS



Pins: 5 and 1	Target Signal
6 and 7	High Condition Signal
9 and 8	Low Condition Signal

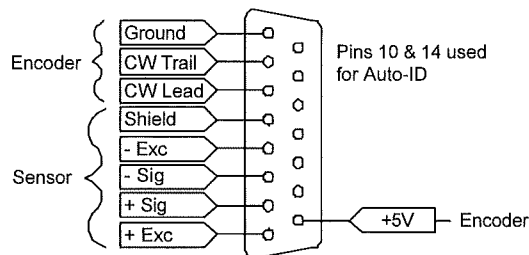
### AC Adapter/Charger (12V DC)

The AC adapter is used to power the instrument, and charge the battery.



### Transducer Wiring

The standard 15-pin D sub Connector and the Model 90144 Connector are wired according to the following diagram:



### Battery Replacement

The PMAC 2000 uses two types of batteries:

- A 9.6 V Rechargeable Ni-Cad Battery Pack, and
- One 3 V Lithium Coin Battery

The rechargeable Ni-Cad batteries power the instrument when it is not plugged into a wall socket. If the "charge life" of these batteries decreases significantly, or if the instrument refuses to work unless plugged into a wall socket, the Ni-Cad batteries need to be replaced. This must be done at SDI's factory. Contact our service department at 1 (800) 997-3676 for shipping instructions.

The coin battery supplies power to the RAM when the instrument is turned off. This protects the collected data from being erased when the instrument powers down. When this battery needs replacement, the instrument will display the message: "Low Coin Battery". Replace this battery with a Duracell DL2025 or equivalent 3 V lithium coin battery.

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## **Specifications**

### **Sampling Rates**

#### **Peak and Track Functions 5 kHz**

With Encoder ..... 2 kHz

**Record Functions** ..... Selectable up to 10 kHz

With Encoder..... Selectable up to 2 kHz

**Frequency Response**..... (-3 dB) at 1000 Hz

**Accuracy** ..... Max Error = 0.05% of Full Scale

### **Sensor Interface**

Max Input at Full Scale .....  $\pm 4.5$  mV/V

Polarity..... Bipolar

Bridge Excitation..... 7 V Supplied

Min Bridge Impedance..... 120  $\Omega$

**Data Output** ..... RS-232 Port

..... ASCII

..... 9600 Baud

..... 8-N-1

### **Power**

AC Adapter..... 115 VAC/12 VDC

Batteries ..... 9.6 V Internal/Rechargeable

### **Physical Dimensions**

Height..... 1.75 in

Width ..... 6 in

Depth ..... 8 in

Weight ..... 2.4 lbs

### **Environment**

Operating Temperature Range ..... 0 – 50 deg C / 32 – 122 deg F

## **NEMA PMAC Addendum**

The NEMA PMAC 2000 is an industrially hardened version of the standard portable PMAC 2000. Everything about the user interface is the same as the standard portable unit. The standard NEMA PMAC 2000 differs from the standard portable PMAC 2000 in the following ways:

- Large character (.5") alphanumeric display is readable from up to 20' away.
- Large (.2" square) limit indicators for high, accept and low conditions
- Dry contact closures (up to 24VDC, .5 amp max.) for high, target, and low conditions. Terminal block wiring connections for these are located inside the enclosure near the bottom and are labeled as such
- An internal 12-volt DC, 2-amp power supply. This supplies power to the PMAC 2000 circuitry and can also be used to power accessories such as lights, solenoids, buzzers, etc. Terminal block wiring connections for this are located inside the enclosure near the top and are labeled as such
- Site mountable. Operates on 120VAC directly, does not require AC adapter or internal batteries

NEMA PMAC 2000 Options include:

- Internal 15 or 24-volt power supplies (2 amp or 1.4 amp respectively). These can be used to power accessories such as lights, solenoids, buzzers, etc, where the standard 12-volt supply is not enough. The supplies can also be factory configured to provide a high pull in voltage followed by a lower hold voltage for operation in some solenoid control application.
- Jumbo (.5") limit indicators, are visible from 50' away
- Factory configurable to operate go/no go LED (or low voltage incandescent) indicators built into other equipment