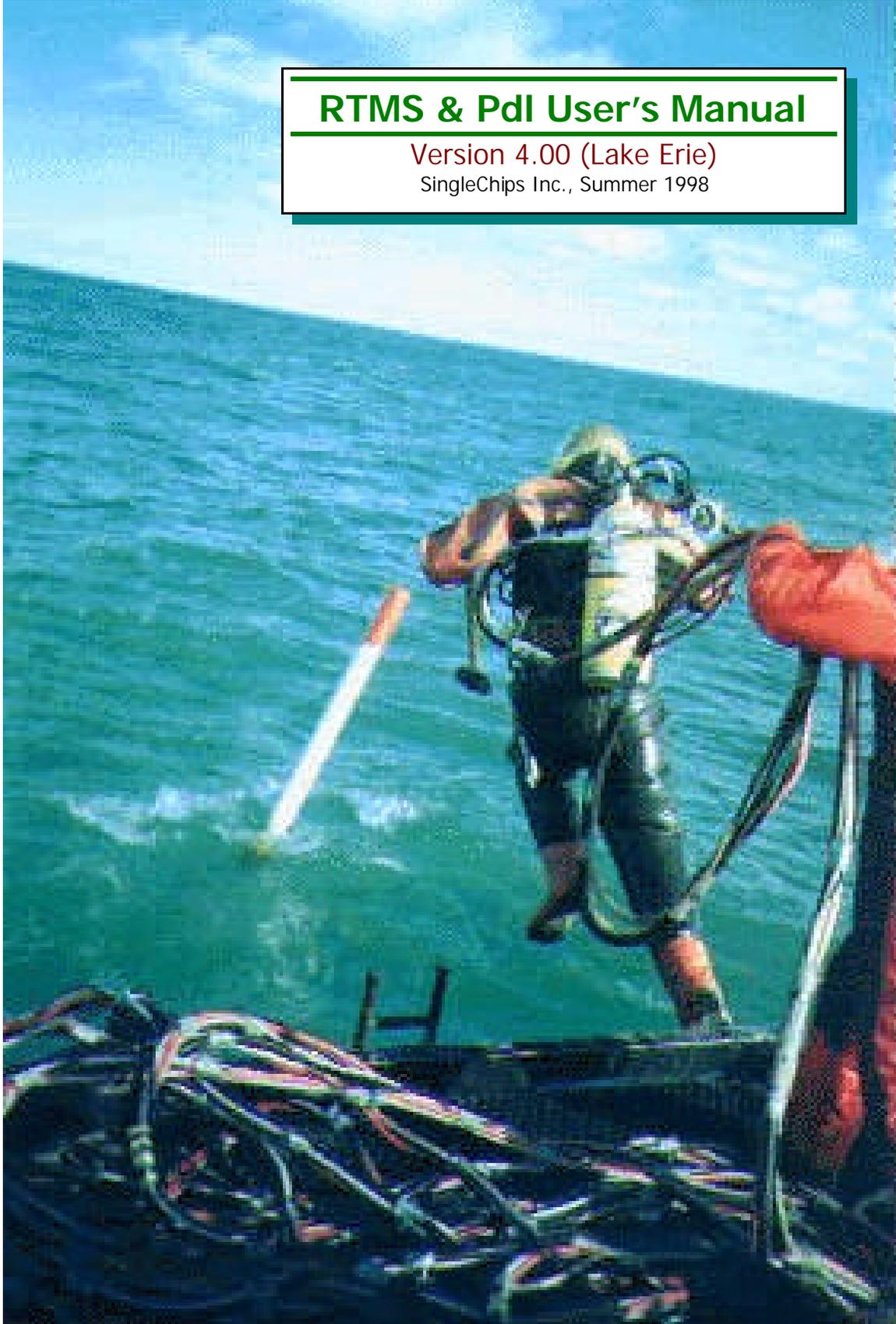


# RTMS & Pdl User's Manual

Version 4.00 (Lake Erie)  
SingleChips Inc., Summer 1998



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## Preface

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We take a leap forward with this edition of the PDL and RTMS. The changes and improvements were designed to further simplify system use as well as increase functionality. Some duplication of information from previous versions is unavoidable, but we do attempt to describe only new features and anything that is likely to enhance understanding.

### What's new

- { **Site file elimination.** As you may recall, site files contain site-specific variables and calibration data for each PDL. Site files were necessary to ensure that if for whatever reason the PDL had lost its setup parameters, they could be reset to original values easily. It is no longer necessary to keep track of site files, as the calibration variables and other setup information is stored in the PDL. Upon communication, RTMS "interrogates" the PDL and if it is firmware version 4000 and later it proceeds to download setup info from the PDL. If the PDL is an earlier version it will prompt the user for the appropriate site file.
- { **Log file elimination.** These files have outlived their usefulness as well. RTMS versions 4.00 and later, do not create log files.
- { **Smart intermitter and plungerlift modes.** "Smart" may be a misnomer here. It really means pressure and/or flow based switching. It is still up to the operator to choose the switching criteria.
- { **Realtime calculation and display of liquid volume in tubing.** This is shown only in the plungerlift mode, when there is a casing transmitter. Liquid volume is calculated based on pressure difference between casing and tubing, and approximate specific gravity of the fluid.
- { **RTMS and PdlPlot integration.** The installation utility automatically installs all needed software. RTMS is now invoked from within the PdlPlot screen.

### About the year 2000 issue

Much has been written lately about what will happen to computers when the year "rolls over" to 2000. The issue is further complicated by the fact that the year 2000 is a leap year. This is because the year 2000 is evenly divisible by 4, 100, and 400. Everyone knows the four year rule: if the year is evenly divisible by 4, it is a leap year. The exception to this rule is that if the year is also evenly divisible by 100, it is not a leap. Which brings us to the next exception which states that if the year is also divisible by 400, it is a leap. All this brings about the following statement:

The PDL depends on two chips for its timing functions. The Dallas DS1386 RTC and the Harris CP82C54 programmable counter. Date and time information is used only as a "tag" to recorded data. All recording and switching functions are controlled by the 82C54, which contains three, independent, free-running counters. When a counter times-out, the unit "wakes up" and does something (records). The timebase or clock for the 82C54 is supplied by the DS1386 "watchdog" circuit. In other words, the date/time has nothing to do with the PDL primary functions (record, switch).

It is therefore evident that the PDL simply cannot fail in the year 2000 because it simply does not care what the year is. Even if the wrong date is supplied by the operator, it will still work. Naturally, if the date supplied is wrong, it will be wrong in the recorded data and subsequent reports. The operator however is prevented from manually entering the date, as it is supplied by the host computer operating system. Incoming and outgoing year information is shown in four digits. The operator can immediately verify that the PDL date is correct, via the "Get Status" command.

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# 1. PDL System Overview

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## 1.1 Introduction

As the acronym PDL (Production DataLogger) implies, the primary job of the device is to record production related quantities such as pressure and flow. The system has been devised to support decision making related to offshore natural gas production in Lake Erie and also to record long-term production information. It does this by recording flow pressures across a machined orifice, called the meter or camco. Pressure data is later mathematically manipulated to produce flow values. Recently, the PDL has evolved into a production controller as well, its main task being the removal of fluids either from the well bore (plungerlift), or the gathering system (intermitter).

## 1.2 PDL background

The gas industry has had access to gadgetry of all sorts for years. The economics involved have promoted the development of systems that provide production information and related data to the engineer at the office. There are literally thousands of remote monitoring systems in today's marketplace. Most of these are based on a known "platform" such as a DOS computer with some additional plug-in boards. Since you can't easily use your laptop at the bottom of Lake Erie, the solution to our problem required the use of an embedded system.

### 1.2.1 Embedded systems

An embedded system differs from one's desktop or laptop PC, and for all intents and purposes must be thought of as a "black box". When something goes wrong, there are no error messages to inform of the trouble. The program simply "crashes" and it is up to the programmer to figure out the problem. In any case, things get worse in our application because when things go wrong, it is very difficult for someone to press the reset button at the bottom of Lake Erie.

### 1.2.2 Power consumption

There are two very different varieties of embedded systems. Those that are optimized for control are usually "single-chip" based, which means that most system resources such as CPU, serial port, memory, input and output ports, are all built into one chip. The mouse or the microwave are examples of systems that use single-chip devices. Some advantages are price, low power, relatively simple to develop. Their major disadvantage is that they just can't address a large memory space. The other variety is optimized for number crunching, speed, and memory size, but these systems are a lot more complex, take longer to develop, and generally consume more power. Power consumption is directly proportional to CPU clock speed. Ever wonder why 100Mhz+ Pentiums have little fans attached to the chip? Power is not a problem for most applications, as solar panels, wind generators, car batteries and wall adapters are routinely used to provide it. This is the reason why most of the systems of either kind are powered up constantly.

### 1.2.3 PDL development goals

So here is the challenge: build something for the bottom of Lake Erie, make it last for a year without recharge, have it store thousands of readings of accurate pressures, download all that to the boat PC in a couple of minutes, and make sure there are no communication errors. The simple-sounding answer to this problem was to use the second variety of system above, and have external hardware operate the system in "totally on, totally off" mode. Since the duty cycle is usually very small (read twice an hour), a relatively huge amount of power could be saved.

### 1.3 PDL highlights

The development goals listed above, and about three years of work, have produced a rather robust field recorder and controller. Its main attributes are listed below:

#### 1.3.1 Hardware

- { **1 Megabyte data storage area.** One month, four channels @ 30 minutes = 20Kbytes. PDL maximum capacity is 1024 Kb. Then  $1024/20 = 51$  months at above settings.
- { **Low Power.** Record as per settings above for at least a year without recharge, on a single 6 Volt, 12AmpHour battery.
- { **8 programmable, differential, input channels.** Designed for use with voltage output pressure transmitters, but can be used with current output.
- { **15 bit resolution.** The PDL can now break down a particular pressure range to 30,000 steps. When 500psi transmitters are used, we get a resolution step of 0.02psi.
- { **Intermitter PDL.** The PDL is capable of controlling two latch valves (solenoids). The usual industry names ("A valve" and "B valve") have been dropped in favor of the more descriptive names, "bypass valve" and "meter valve". Three modes of operation are possible: Shutin, Bypass and Meter. These are invoked in the order listed, the bypass mode being used to allow free passage of fluids.
- { **Binary download (fast).** Memory image download. No translation takes place in the PDL. Up to 15 times faster than ASCII-based data.
- { **Programmable recording interval from one minute to fourteen days with one minute resolution.** Set the recording interval and the intermitter times to anything from minutes to days.
- { **Flow meter capability, math built-in.**
- { **Power-ready.** Convert PDL data to Power data by hitting a couple of keys.

#### 1.3.2 Firmware

- { **Bulletproof, bi-directional communications protocol.** Over 40 individual commands are combined in many ways, to produce a master-slave communications link. Error checking is accomplished by the redundant nature of the Xmodem protocol.
- { **Field Upgradeable.** When it is time to upgrade or change the firmware, simply upload the supplied binary file to the unit.

#### 1.3.3 Software

- { **Comprehensive realtime display in RTMS.** When the PDL is in realtime mode, all pressures are displayed in realtime (every two seconds or so), including flow, meter/plate combination, "C" prime, and WC".
- { **Remote calibration.** This means there are no potentiometers to turn. Record the minimum and maximum values for a particular input pressure range, and the PDL takes care of the rest.
- { **Built-in smarts.** The PDL is now capable of acting in the event a low battery condition is detected. If more than 10 consecutive bad battery readings are sensed, the PDL will extend its recording interval to 60 minutes and if in intermitter mode, will return the well/junction to bypass and stop intermitter operation.
- { **PdIPlot charting.** Powerful plotting utility, displays and prints PDL recorded data.

## 2. Hardware

### 2.1 General

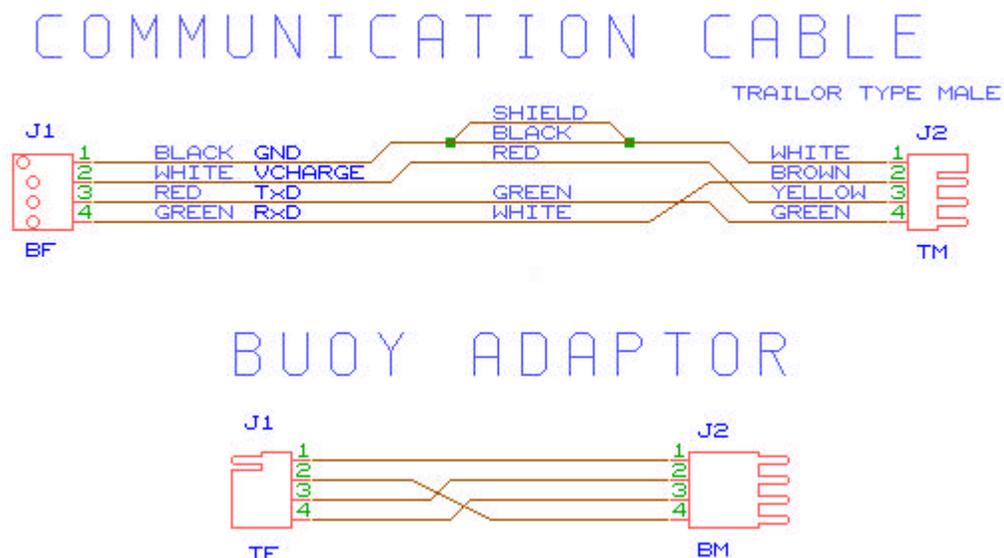
The PDL design allows it to mount directly on the camco. This is possible because of submersible pressure transmitters. This allows us to completely seal the case with silicone potting compound, to eliminate any possibility of water leaks.

### 2.2 Pressure transmitters

Two models of Viatran supplied transmitters are used. These are the 570 and 770 series and output current and voltage respectively. The 570-770 series have proved to be accurate to better than 0.1%FSO. This translates to a maximum error of 0.5 psi for a 500psi transmitter over its entire operating range.

### 2.3 Communication cable

This four conductor cable is used for communication and battery charging. Three wires are needed for communication, the fourth one being claimed by the battery charger positive. Charger power ground and communication ground connect to the same wire. The connections for both the communication cable and wired buoy are identical and are shown below.



### 2.4 Battery charger

The PDL was designed for use with an inline battery charger. The communication cable is routed from the computer, through the charger, and on to the PDL. The charger box has ten LED's on the face, used to indicate the amount of current drawn by the PDL battery. The charging current is limited to about an Ampere by internal circuitry. In normal operation, four or five lights will be on, indicating a current of about 500mA. If the PDL battery is in good shape, the charging current will drop after a few minutes to perhaps two lights. No lights indicates a fully charged battery, ten lights indicates a badly discharged battery. The operator is expected to get in the habit of checking battery performance during connection and subsequent communication with the PDL. The actual battery voltage is shown in the PDL status box, in the RTMS communications screen.

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## 3. Software - RTMS

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### 3.1 Introduction

The computer communicates with the PDL through RTMS (Remote Testing & Monitoring Software). RTMS provides the following:

- { Interface between PDL and user.
- { Realtime flow calculation and display.
- { A means of remote PDL calibration.
- { Data translation.
- { Screen plotting.

Although RTMS is a DOS program, it gets along well with the Windows environment. If the host machine is configured correctly and RTMS uses a serial port that no other application is using at the same time, there are no problems. The program has a minimum three year background in this application, and is currently undergoing the necessary changes to bring it to the Windows environment. Pending field testing of plungerlift operation this summer, a beta version should be expected around the end of 1998.

#### 3.1.1 Operation - general

Individual commands are sent to the PDL, which is expected to interpret them and act upon them. Some commands always generate a response, while others only generate a response if an error occurred in reception. In this scheme, the computer is always the "master" and the PDL is always the "slave".

All communication between the PDL and RTMS takes place through an augmented implementation of the popular Xmodem protocol. This assures error-free communication and is particularly important due to the binary download, where an error can seriously corrupt data.

#### 3.1.2 About Xmodem

The Xmodem file-transfer protocol (also referred to as the Christensen protocol), was introduced to the public domain by Ward Christensen in 1977. This is a send-and-wait protocol, using a fixed-length data field. It has been chosen for PDL communications because of its redundant nature. The transmitter assembles the data as shown above while adding all 128 bytes, and sending this checksum along with it. The receiver does the same while receiving, and if the checksum values, or the block numbers don't agree, does not acknowledge the block. The transmitter then resends the block until it is acknowledged. If more than ten rejections occur, communication stops. This happens in a bi-directional fashion in PDL communications, assuring the best performance to security ratio.

### 3.2 RTMS files

The program needs and/or creates several files, the extensions of which are significant. All files reside in the RTMS directory (usually C:\PDL\). These are:

- { **RTMS4.INI**. This is an ASCII file which must exist, or the program will not start. Contains general program defaults such as the RTMS files directory, the currently selected site file, baud rate, and communications port. Here is an example of the contents of a typical file:

```
[Sci-RTMS]                ; Heading, significant to the program
password=                  ; Master password
version=4.20               ; RTMS version
error=Top                  ; Show errors at top line
path=c:\pdl                ; Directory
current=J121A1E.TMP       ; Current temporary site file
comport=COM2               ; Communication port
baudrate=9600              ; Baud rate
```

- { **SITENAME.TMP**. "SITENAME" is actually replaced by the well or junction name. The contents of the site file describing W-39-Y-3 is shown below:

```
[Sci-RTMS Setup]          ; Heading, significant to the program
description=PDL-4 Logger #60, Installed 06/04/1998, at W-39-Y-3 ; Description
password1=                 ; User passwords
password2=
TempCo= +65.00, 0.00      ; Temperature compensation
siteid=039Y3,36           ; Site ID and logger number
powarnum=3902530          ; The Well number in Powar
powarname=PM39Y3          ; The Junction name in Powar
loggertype=PDL-4          ; Logger type
meterrun=2.067            ; Size of meter
orifice=1.000             ; Size of plate
wet/dry=Wet               ; Gas specific gravity approximation
sour/sweet=Sweet          ; Gas type
samplerate=30             ; The recording interval in minutes
flow=1440                  ; The flow period in minutes
shutin=30                  ; The shutin period in minutes
bypass=30                  ; The bypass period in minutes
diffzmin=+00060           ; Differential channel calibration values
diffzmax=+00038
```

```
[Sci-RTMS Channels]      ; Normal channel calibration values
Inp,      Temp,      DegF, +00005, +27952, +0.000, +200.0, Yes
Inp,      U/S,       PsiG, +00864, +28255, +0.000, +478.3, Yes
Inp,      D/S,       PsiG, +00827, +28177, +0.000, +478.2, Yes
Inp,      Diff,      PsiD, +00001, +05003, +0.000, +86.3, Yes
```

- { **SITENAME.001**. Created by the program at download time. Contains PDL data in binary form and thus is not human-readable. If more than one download is made, a second file will be created, and the extension will be "002". Up to 99 files of the same SITENAME are allowed.

### 3.3 Conversions

When the PDL downloads its memory contents, it purposely does not "translate" its binary files to a human-readable format. If it did, the download time would be up to 15 times longer, and the resulting files would be huge. The most efficient way to store PDL information then, is in its native format. This allows subsequent conversion at any time, and ensures that the original data stays intact.

#### 3.3.1 WinPlot conversion

Winplot is the name given to the file format that PdlPlot can interpret. Once a PDL has been downloaded, the "Convert to WinPlot" command can be issued to convert the PDL data to WinPlot data. When this is done, the data can be plotted by PdlPlot. The steps required to accomplish this are:

- { Download the unit
- { Leave the communication screen by pressing ESCAPE
- { Click on the "Convert to WinPlot" command in the main menu.
- { Open the generated file in PdlPlot

#### 3.3.2 POWAR conversion

Power is a special database of daily average production values for each location. The RtmPower utility reads the "PDL.ASC" file, crunches the numbers, and produces a file with extension "pw2" or "pw3". This file is later imported into the power database. To start the program click on DOS Programs/RtmPower menu in PdlPlot. Here is an example of the typical power file format:

```
286d2,,286d2,19971212,,24,,,,,163.8,106.2,43.0,,0.875,19.2,,,0
286d2,,286d2,19971213,,24,,,,,171.9,104.5,42.5,,0.875,19.3,,,0
```

#### 3.3.3 ASCII conversion

Ascii files are used to convert PDL data to Power data. These are created by RTMS when a PDL to ASCII translation is requested. To create an Ascii file, repeat as in Winplot above, but click on "Convert to Ascii" instead. Here is a chunk of a typical file:

```
[PDLASC_ID]
User=Susan Michelle
Date=1998-02-10
Time=12:15:43
Readings=3940
Interval=30
Power Number=0000000
Power Id=0000000
Site Name=286D2
[PDLASC_DATA]
1997-11-20,12:11:39,2.067,0.5000, +46.8,+350.0,+336.0, +13.8,+586.0
1997-11-20,12:41:39,2.067,0.5000, +46.9,+195.9,+159.4, +36.1,+720.7
1997-11-20,13:11:39,2.067,0.5000, +46.9,+185.1,+148.1, +36.8,+708.7
```

## 4. Calibration

### 4.1 Introduction

When the PDL “reads” a pressure transmitter, it actually “sees” a number anywhere in the range of -30000 to +30000. These numbers must be converted to pressure in Psi, temperature in degrees, or any other unit. This is accomplished by the calibration process. All calibration is done through communications, eliminating the need to turn trimmers. Included since the PDL-3, is a special temperature compensation scheme, applied to the differential channel only. Recall that the differential channel is an independent, hardware implemented differential, and not the arithmetic difference between upstream and downstream.

### 4.2 Calibration and temperature compensation

An explanation is required of the fields pertinent to calibration. Access to the calibration screen is through the communication menu. Three fields in the header section must be entered, prior to calibrating anything else. Identify these in the screen shot below:

The screenshot shows the RTMS4 calibration screen with the following data:

Site File Header Info							
Comment...	NodeDescription						
Password1..	Site Numb..	123456789	Gas Comp.....	Met			
Password2..	Power ID..	POWNAME	Gas Type.....	Sweet			
TempCo.....	55.00,0.00	Logger....	PDL-4				
Filename...	0001.tmp	Meter Run..	6.0650				
Site ID....	0001,32	Orifice....	0.2500				
Diff Min..	169	Diff Max..	10				
			Bypass Mins..	1			

Chan	Type	Label	Unit	Imin	Imax	Rmin	Rmax	On?
0001	Inp	Temp	DegF	00065	11514	0000.00	0084.00	Yes
0002	Inp	U/S	PsiG	00353	19016	0000.00	0500.00	Yes
0003	Inp	D/S	PsiG	00221	19023	0000.00	0500.00	Yes
0004	Inp	Diff	PsiD	00008	17000	0000.00	0400.00	Yes

ENTER:Edit chan	INS:Add Before	ALT-A:Add After	DEL:Delete				
Inp Temp	DegF	00065	11514	0000.00	0084.00 Yes		
F1: Help	F2: Edit Header Info	ESC: Exit					

Last message: Received ok

- { TempCo in the header section
- { Diff Min and Diff Max in the header section.
- { Imin, Imax, Rmin, Rmax in the channels section.

#### 4.2.1 Temperature compensation

Before commencing the calibration process, do a realtime and mentally record the ambient temperature. Enter this number in the TempCo field, as shown above. In this example the temperature is 55.00 degrees. The second number is the drift, either negative or positive, in counts per degree. This number should be very small, usually less than one. Enter a zero, as shown above. At some later time, the second number can be changed so that the differential channel is zeroed at some other temperature. Proceed as follows:

- { In the communications menu select “Change..”, then “Change Header”.
- { Go to the TempCo field and enter the temperature you noted above, followed by zero (ex. 55.00,0.00).
- { Press “ESCAPE” a couple of times, and reset the unit as usual.

### 4.2.2 The differential channel

Due to slight differences in component tolerance in the analogue section of the PDL, calibration of the differential channel is required prior to calibrating the other channels. To calibrate the differential channel proceed as follows:

- { In the communications menu, select "Calibrate".
- { Press the "F2" key to edit the header section.
- { Expose both Upstream and Downstream transmitters to the minimum expected pressure range. (This is usually 0 PsiG).
- { Go to the Diff Min field and press ENTER. The PDL will respond with a value that will replace the previous value shown in the field.
- { Increase the pressure input to the maximum intended pressure. (usually 500PsiG).
- { Go to the Diff Max field and press ENTER. The PDL will respond with the new value.
- { Press ESCAPE to exit the header section.
- { Press ESCAPE again to return to the communications menu.
- { Select "Erase Memory", and "Send Setup" in that order. The new values will be sent to the PDL. You now need to return to the "Calibrate", to complete calibration of the remaining channels.

### 4.2.3 All other channels

Assuming that the previous step has been completed successfully, proceed as follows to calibrate any other channel:

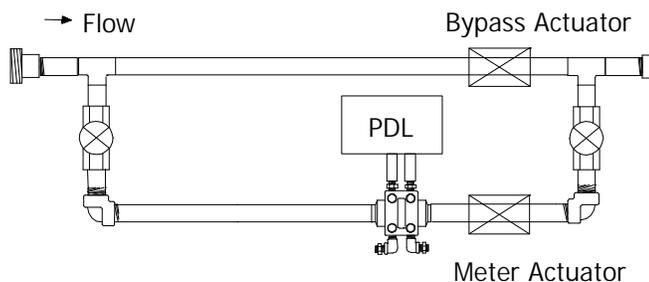
- { Highlight the desired channel and press ENTER.
- { Apply the minimum intended pressure. (for this example minimum = 0PsiG)
- { Go to the Imin field and press ENTER. The PDL will respond with a new value.
- { Go to the Rmin field and manually enter zero.
- { Apply the maximum intended pressure. (for this example maximum = 500PsiG).
- { Go to the Imax field and press ENTER. The PDL will respond with a new value.
- { Go to the Rmax field and manually enter 500.
- { Repeat this procedure for all other channels.
- { Exit this screen, (after the changes are saved) and select "Send Setup" from the communications menu

## 5. Intermittent-Plungerlift

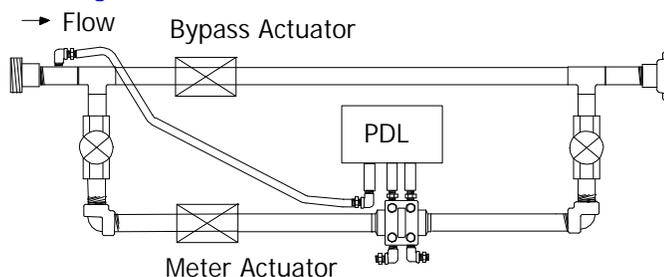
### 5.1 Introduction

Intermittent capability is extended with the inclusion of several new operating modes, in addition to the standard time based modes. This makes possible seven operating modes, listed below:

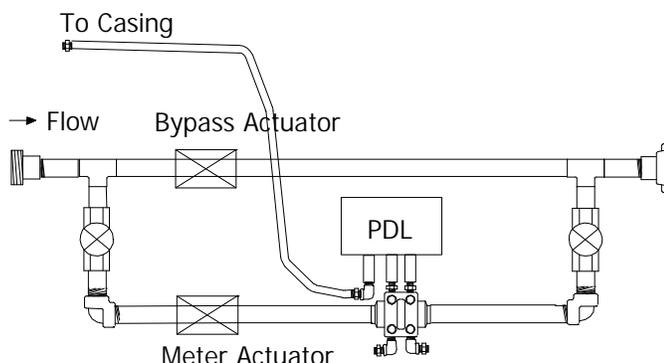
- { **Datalogger only.** This is the default mode after an "Erase Memory" command has been sent to the PDL.
- { **Datalogger with ESD (Emergency Shut Down).** This mode is intended for use on wells that may require it. If the shutdown criteria (low line pressure) is ever encountered, the PDL will switch production off. The unit will, intentionally, not recover from this condition on its own. This mode may be activated on flow runs with one or two actuators.
- { **Timed Intermittent - two cycle.** If the shutin time is set to zero minutes, the unit will not switch to shutin. In this case the cycle consists of repeated bypass and meter periods.
- { **Timed Intermittent - three cycle.** This is the expected and rather familiar three cycle intermittent. The PDL will switch between shutin, bypass and meter indefinitely (or until the battery is low).
- { **Flow based Intermittent - two transmitter.** This is the minimum possible configuration for a "smart", two transmitter intermittent and the standard timed intermittent. Its drawback is that line pressure (D/S), can not be determined, since the actuators are after the meter. Its advantage is that a third pressure transmitter is not required since the U/S pressure is the buildup pressure. This configuration is shown below:



- { **Flow based Intermittent - three transmitter.** In this configuration, a third pressure transmitter is used to measure the buildup pressure when the flow run is in shutin. Since the line pressure is always known to the PDL, this is a better configuration than the one described above.



- { **Pressure based Plungerlift - three transmitter.** This operating mode requires three transmitters and looks much like the three transmitter intermitter described above. The difference is that the third transmitter is connected to measure casing pressure, and the switch to shutin condition is dictated by the pressure difference between casing and tubing. The flow run is shown below:



## 5.2 "Smart" mode operation

Assuming that the flow run is currently in shutin mode, and the unit has been initialized, operation proceeds as follows:

- { When the recording interval has expired, the PDL will "wake up", and read all channels. If the buildup pressure (intermitter), or casing-to-open pressure (plungerlift), has been reached, it will switch to bypass. If the "open" condition has not been met, it will remain in shutin and check again at the next recording time.
- { It will remain in bypass until the bypass time expires, at which time it will switch to meter.
- { The unit will remain in meter mode as long as the flow condition (intermitter), or casing-to-tubing pressure differential (plungerlift), is met.
- { If the flow condition is not met, it will start the cycle over by switching to shutin.

**IMPORTANT:** "Smart" modes share the following operating attributes:

- ✓ The PDL switches ONLY when it is time to take a reading. If the recording interval is set to 30 minutes, and it has just switched to meter, it will stay in meter for at least 30 minutes.
- ✓ The time spent in bypass must be programmed.

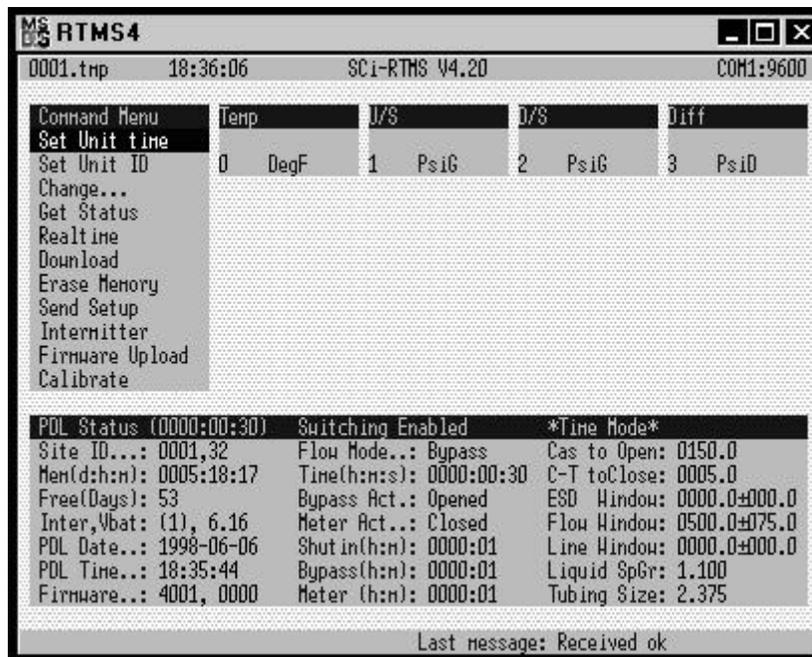
### 5.2.1 Time modes vs. "smart" modes

There are some operational differences between time and "smart" modes. These are:

- { There is no need to reset the unit when changing the "smart" parameters. In time mode, after setting the intervals, you must reset the hardware timers by issuing the "Set Unit Time" command.
- { For obvious reasons, the meter and shutin counters are not used in "smart" modes. Set these to 1440 minutes, prior to starting the unit in any "smart" mode.

### 5.3 Understanding “smart” switching criteria

The values responsible for “smart” switching are listed at the lower right of the screen. Identify these in the following screen shot.

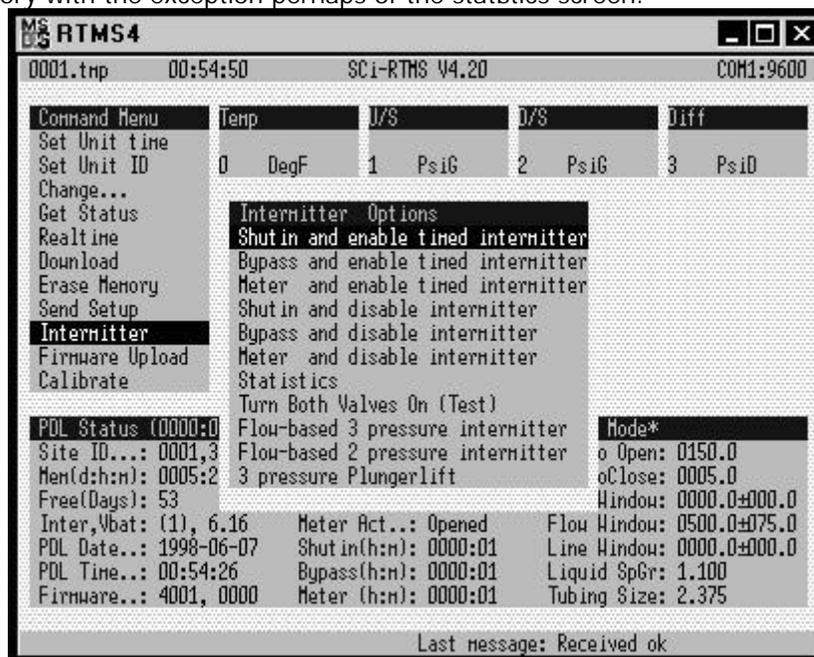


**IMPORTANT:** The ESD Window and Line Window pressure values, are optional. To disable, set to zero. If anything but zero values are entered, they will be part of the decision making. Note that zero is the default value for both.

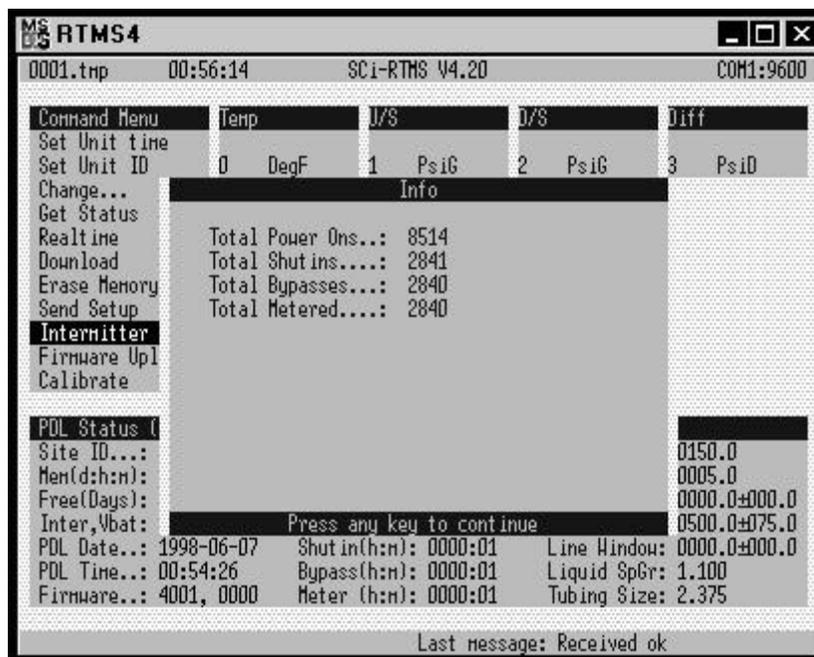
- { **Casing-to-Open.** In the case of plungerlift this is the minimum pressure required to cause the PDL to switch to bypass. This is also the minimum buildup pressure required to open when in intermitter mode.
- { **Casing-to-Tubing differential to close.** This is the maximum differential (C-T) pressure required to keep the unit in meter. If this value is exceeded, the unit will switch to shutin. This number is significant only in plungerlift operation.
- { **ESD Window.** This number specifies the normal line pressure window. If the line pressure drops below the lower limit, the unit will switch production off, and will remain shutin until it is reset manually.
- { **Flow Window.** Used in intermitter mode to specify a range of acceptable flow values. Anything above the minimum is interpreted as normal.
- { **Line Window.** There is no point of “opening” the flow run when the line pressure is too high. This value, if enabled, will prevent the unit from opening unless the line pressure is within the window.
- { **Liquid Specific Gravity.** Used to calculate the liquid volume in the tubing.
- { **Tubing Size.** There is a little popup menu attached to this field, used to specify tubing size.

### 5.4 Intermittent options

The intermitter may be started and stopped in any mode. All intermitter options are shown on the next screen, and are self-explanatory with the exception perhaps of the statistics screen.



The statistics screen is nothing more than a count of PDL actions. The example screen below, shows that this PDL has recorded 8415 readings, and has completed 2840 full cycles.



## 6. Using the system

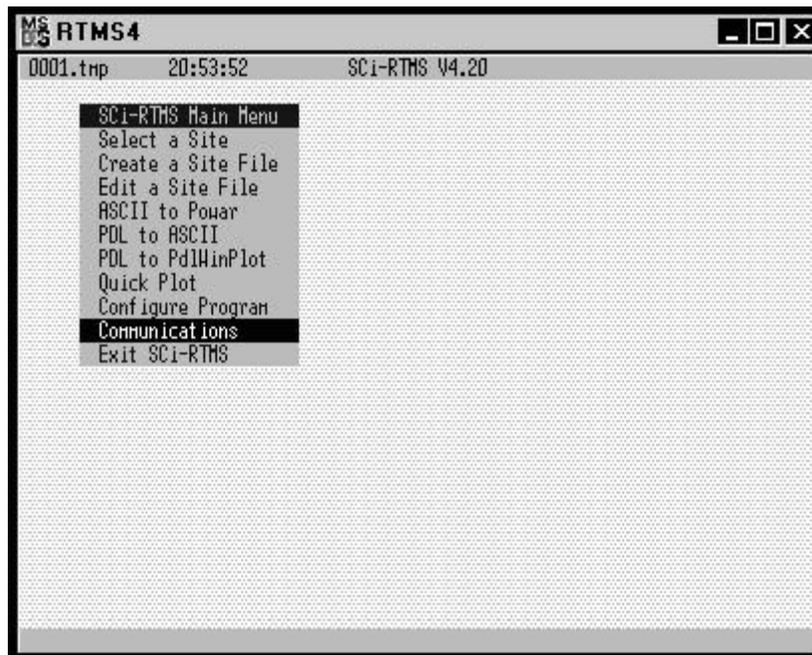
### 6.1 General

The program is started by selecting DOS Programs/RTMS4 within PdlPlot. Once the program is started, an introduction screen is displayed, with the message "Press any key to continue". Respond by hitting any key or pressing the RIGHT mouse button. The mouse can be used to emulate keyboard keys as shown below:

- { Right button. Emulates pressing the ESCAPE key.
- { Left button. Emulates pressing the ENTER key.

### 6.3 The main menu

After boat selection, the main menu is shown. Note that choices pertaining to site files are now obsolete, and are listed here only for compatibility reasons.



- { **Select a Site.** Allows selection of a new site file.
- { **Create a Site File.** Creates a new site file.
- { **Edit a Site File.** Allows editing (changing) of parameters in a site file that already exists.
- { **ASCII to Power.** Converts a previously created PDL.ASC file into Power format.
- { **PDL to ASCII.** This option is used or should be used immediately after download. Allows creation of the PDL.ASC file.
- { **PDL to WinPlot.** We had intended to use this command to convert PDL data to Trend data, for plotting purposes. It is not active in this version.
- { **Quick Plot.**
- { **Configure Program.** Allows setting-up of general program defaults. Select the communication port, baud rate, master password, and program main directory.
- { **Communications.** Allows access to the communication menu.
- { **Exit Sci-RTMS.** Exit the program and return to Windows.

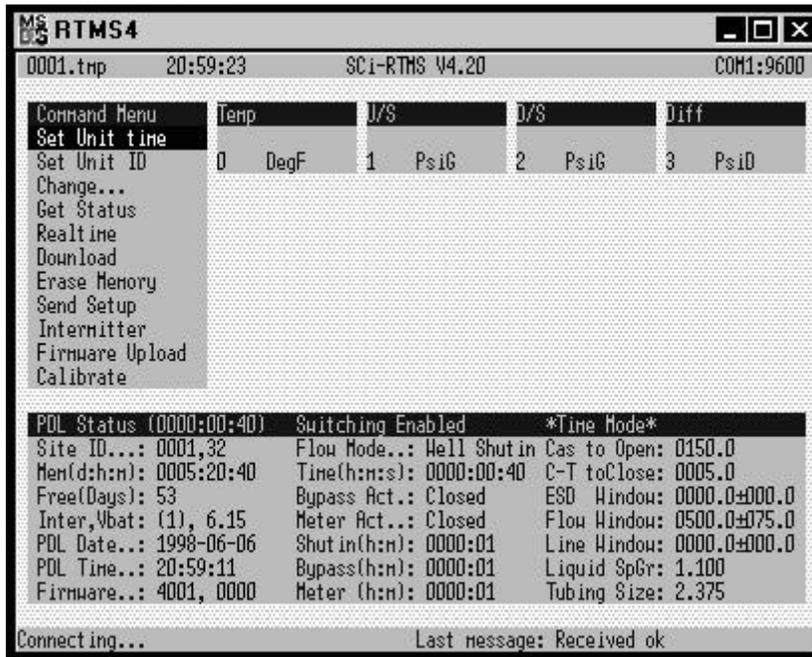
Once "Communications" is selected from the main menu, RTMS attempts to connect to the PDL. If the PDL is a "3" and earlier, RTMS prompts for site file selection. If it is a "4", the following screen is displayed:



Note that the system still makes use of site files, although they now reside in the PDL itself. This information is downloaded to the PC and stored in a temporary file.

### 6.4 The communications screen

All communication between PDL and PC is handled through the options in this menu. Note the following attributes of the communications screen:



- { Communication port and current baud rate at the top right.
- { Individual channel boxes and their descriptions to the right of the command menu.
- { Session clock in the bottom right of the flow calculator box.

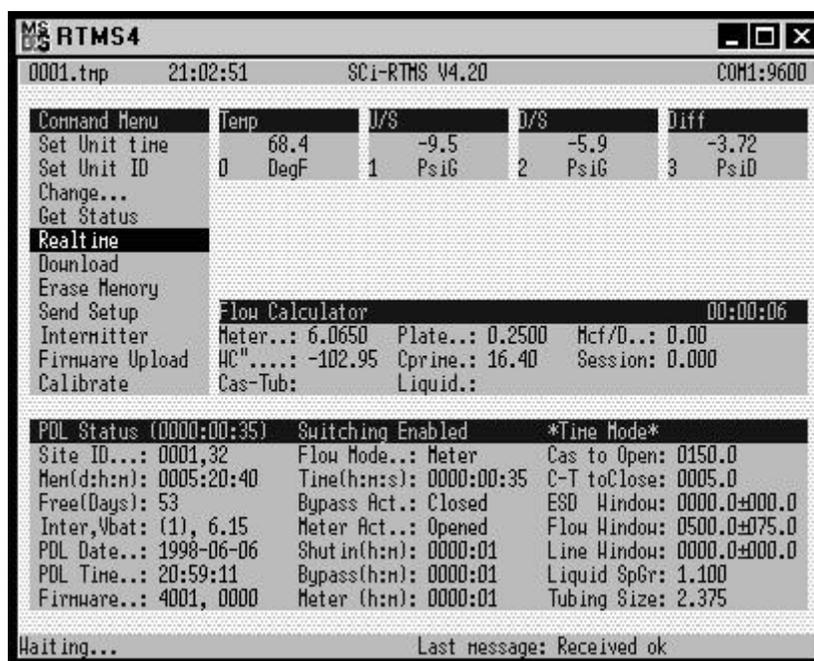
- { PDL status information at the box at screen bottom.
- { Messages such as "waiting" in the last line.
- { Flow calculator box in the centre. (Only appears during realtime).

### 6.4.1 New info in RTMS4

Note that several things have been added to the communications screen. These are:

- { Plungerlift and "smart" intermitter criteria at the bottom right.
- { Estimated remaining recording days, just below the used memory line in status
- { Time remaining until the next reading, next to the "PDL Status" line.
- { Casing to Tubing difference and Liquid in Tubing (gallons), in the Flow Calculator box

The screen shot below shows a typical PDL realtime screen.



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## 7. Quick Guide

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### 7.1 Introduction

This chapter contains step-by-step instructions on how to do specific things in a question-answer format.

#### 7.1.1 Erase memory - reset

{ How do I reset the PDL and how often should I do it?

It is not necessary to reset the PDL every time you download. What is important to remember is that if you choose to Erase Memory (reset), you must do some additional things. These are, (make sure to download first):

1. Select "Erase Memory" from the menu and press "Y" when asked "Sure?(Y/N)"
2. Select "Send Setup" from the menu and press "Y" when asked "Sure?(Y/N)"
3. If the PDL is an intermitter, select "Intermitter", then any of the "start" choices
4. Select "Set Unit Time" and click the LEFT mouse button or press "ENTER"
5. Select "Set Unit Id" and click the LEFT mouse button or press "ENTER"

#### 7.1.2 Change plate, meter, recording interval

{ How do I change the plate size in the program?

Select "Change.." then "Change Plate Size" in the Communications menu. Do this after you have physically changed plate in the camco. A drop list will appear, allowing a choice. Use the cursor keys to see more choices in the popup menu. A few realtime commands after a plate change will verify that you have actually changed it. The correct plate size must always be sent to the PDL, as it is recorded and used to calculate flow.

{ How do I change the recording interval?

Repeat the procedure above, but pick "Change Interval" instead. The recording interval must be entered in integral minutes.

#### 7.1.3 Files

{ What files do I mail to the office?

RTMS names the download file(s) for you. If for example you have just downloaded the logger at J040K1 for the first time, the data will be in a file called J040K1.001. Subsequent downloads will be named the same, except that the numbered filename extension will keep increasing. You should mail-in the files with a numbered extension.

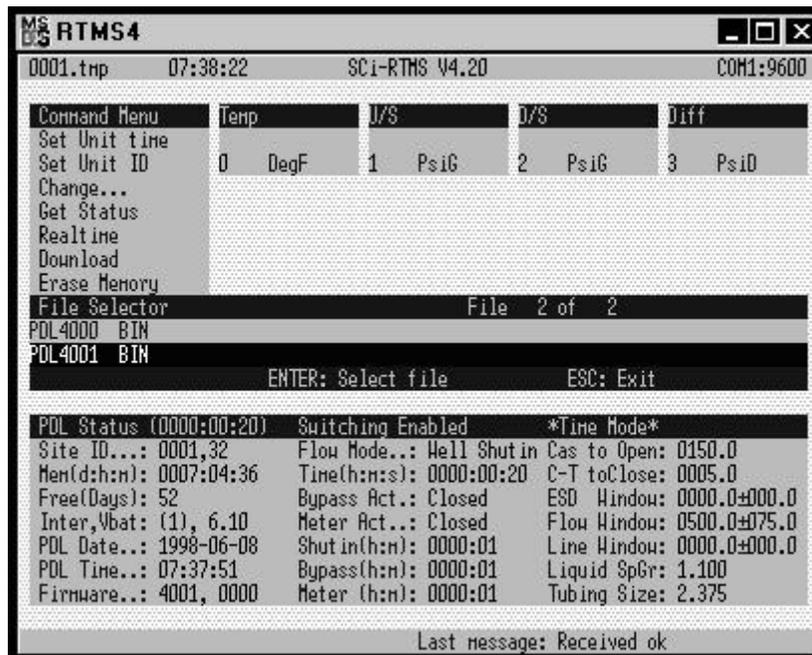
#### 7.1.4 Upgrading the firmware

{ How do I upgrade a PDL-3 into a PDL-4?

The PDL firmware can be upgraded or changed in the field. Starting with firmware version 4000, this process cannot fail, unless there is a serious hardware problem in the PDL. Upgrading a PDL-3 to a PDL-4 can be tricky, because a communication problem during the program send can result in trash written into the program chip. Make sure the communication cable is connected firmly before attempting this. Again: if there is a communication failure during the upload, PDL removal may be necessary. This situation has been corrected in the 4xxx series firmware. The necessary steps are:

- { From the communications menu, select "Firmware Upgrade"
- { Select the binary file from the list of choices and press "ENTER" when the message window appears
- { Type "Y" at the (Y/N) prompt and wait for the upload process to end
- { Wait about 10 seconds and reset the unit in the usual manner
- { Make sure that the version number in the status box has changed. If not, repeat the process

The following screen is produced after the "Firmware Upload" command has been issued. The BIN extension indicates PDL binary program files. In this example, there are two files in the directory, and the user has selected the Pdl4001.bin file.



The following screen contains information about the selected binary file to upload (Pdl4001.bin). In this case, the binary file contains 27,939 bytes, it is 219 xmodem blocks long, and the checksum is 7ab6 in hexadecimal. This information is also sent to PDL, which uses it to make sure that the process of rewriting its own program is carried out without errors.

