

MSHA Course of Instruction

Certified Person; Sampling - CPDM

New Dust Rule Outline

- New Dust Rule Overview
- Certified Person; Sampling Overview
- Person Certified in Maintenance and Calibration Overview
- Excessive Concentration Value (ECV)
- Designated Work Positions (DWPs)
- Noncompliance
- Part 90 Miners
- Designated Occupations (DOs) and Other Designated Occupations (ODOs)
- Designated Areas (DAs)
- Mechanized Mining Units (MMUs)
- Quartz
- Normal Production Shift

Dates of Implementation

- Effective February 1, 2016
 - DOs, ODOs and Part 90 Miners must be sampled quarterly with a Continuous Personal Dust Monitor (CPDM)
 - 15 valid representative samples collected on consecutive normal production shifts required from each DO and ODO every calendar quarter. ODOs shall be sampled after DOs are completed and, if more than one type of ODO is present on the MMU, each is sampled during separate time periods
 - 5 valid representative samples on consecutive work days from each part 90 miner required each calendar quarter
 - The District Manager may require additional groups of 15 valid representative samples when information indicates the operator has not followed the approved ventilation plan for an MMU
- Effective August 1, 2016
 - Respirable coal mine dust standard for underground and surface - 1.5 mg/m^3
 - For a Part 90 Miner and Intake Air - 0.5 mg/m^3

General Sampling

- Sampling is full shift, portal-to-portal
- When sampling shifts longer than 12 hours, the CPDM must be switched out before the start of the 13th hour
- Miners expected to wear CPDM must be trained on CPDM prior to wearing it and retrained every 12 months
 - The importance of monitoring dust concentrations and properly wearing the CPDM
 - Clip-on sample inlet assembly should be attached to the miner's lapel or pocket
 - Inlet is not to be obstructed by clothing
 - How to display information screens and what the information is
 - How to start and stop second sampling runs
- Operator must keep record of the training for 24 months after completion of the training
 - Includes: date of training, name of miner, and subject trained

Duties – Certified Person; Sampling

- Program the CPDM for compliance sampling
- Ensure the miner(s) being sampled are properly wearing the CPDM at all times
- Monitor concentrations and status conditions at mid-shift or more frequently
 - Assure sampling device is in correct location
 - Assure CPDM is operating properly
 - Assure work environment remains in compliance with applicable standard
- Transmit compliance samples to MSHA electronically within 24 hours of the end of each sampling shift
 - Also note any samples that were not taken on a normal work shift

Duties – Certified Person; Sampling

(Continued)

- Shall provide each part 90 miner a paper record of the sample run within an hour after the start of the miner's next work shift
- Must check CPDM within 3 hours before the sampling shift to assure operational readiness
 - If not in proper working order, arrange for or conduct appropriate procedures to put CPDM into working condition
 - *In the event that a unit were to fail the preoperational check during the pre-shift warm-up period, the operator would either use another CPDM for sampling, or notify the District Manager orally and in writing that sampling will not occur because a CPDM is not available
- Checks Includes:
 - Required cleaning
 - Installation of a new filter

*** Responsibility of the operator which the certified person; sampling or maintenance and calibration can complete**

Duties – Certified Person; Sampling - CPDM

(Continued)

- Except for Part 90 Miners, within 12 hours of the end of a sampling shift post the dust data card with the mine ID number, shift length, location sampled, equivalent concentration reported, and status conditions encountered (if any are recorded by the CPDM)
 - Do not post dust data card for part 90
- Dust data card posted must remain posted until an MSHA report covering these respirable dust samples is received*
- The MSHA report must be kept posted for at least 31 days
- Ensure that the data transmitted to MSHA is kept for at least 12 months*

* Responsibility of the operator which the certified person; sampling or maintenance and calibration can complete

Duties – Certified Person; Sampling

(Continued)

- Upon request from the District Manager (DM), the operator must submit the date and time any sampling required by the rule is scheduled to start. This information must be submitted at least 48 hours before the scheduled sampling*
- Regarding the transmission of samples by the certified person to MSHA, all samples collected are to fulfill regulatory requirements unless the sample has been identified in writing to the District Manager prior to the sampling shift as a sample to be used for some other purpose

* Responsibility of the operator which the certified person; sampling or maintenance and calibration can complete

Duties – Certified Person; Sampling



Not permitted to perform calibrations
(is allowed to perform flow audit, not flow calibration)



Not permitted to open CPDM case



.msha file must not be altered in any way and shall be maintained for at least 12 months



Certification in sampling with the CPDM is required in order to collect samples with CPDM

Duties – Certified Person; Maintenance and Calibration - CPDM

(Continued)

- Performs maintenance and calibrations as recommended by the manufacturer
- Permitted to open CPDM case for maintenance



NOT permitted to perform sampling with the CPDM

Duties – 30 CFR

- To be certified in sampling or maintenance and calibration, you must complete the MSHA course of instruction and pass the exam for the respective certification
- Persons certified in sampling or maintenance and calibration must be recertified every 3 years by passing a MSHA examination
- MSHA may revoke the certification if there is a failure to properly carry out the required sampling procedures
- Both Sampling and Maintenance and Calibration certified persons may clean the CPDM including the flow line, grit pot, and mass transducer



This course DOES NOT certify for sampling using the Coal Mine Dust Personal Sampling Unit (CMDPSU)

ECV

(Excessive Concentration Value)

Accounts for margin of error between true dust concentration and observed dust concentration measurement. The appropriate chart for instrument, number of samples and standard must be utilized (Table 70-1 is one Example).

TABLE 70-1 - EXCESSIVE CONCENTRATION VALUES (ECV) BASED ON SINGLE, FULL SHIFT CMDPSU/CPDM CONCENTRATION VALUES

Applicable standard (mg/m ³)	ECV (mg/m ³)	
	CMDPSU	CPDM
2.0	2.33	2.26
1.9	2.22	2.15
1.8	2.12	2.04
1.7	2.01	1.92
1.6	1.90	1.81
1.5	1.79	1.70
1.4	1.69	1.58
1.3	1.59	1.47
1.2	1.47	1.36
1.1	1.37	1.25
1.0	1.26	1.13
0.9	1.16	1.02
0.8	1.05	0.91
0.7	0.95	0.79
0.6	0.85	0.68
0.5	0.74	0.57
0.4	0.65	0.46
0.3	0.54	0.34
0.2	0.44	0.23

DWP

(Designated Work Position)

- A position designated for sampling at a surface coal mine or a surface work area of an underground coal mine
- Samples must be taken for the entire shift (including travel to and from the DWP being sampled)
- If the DWP is assigned to a piece of equipment, the sampling unit's inlet must be maintained within 36 inches of the operator's normal working position
- Sample locations may be changed by the District Manager

DWP

(Continued)

- If notified by MSHA that any valid representative sample taken from a DWP exceeds the applicable standard, the operator must sample the DWP each normal work shift until 5 valid representative samples are taken
 - Within 15 calendar days of notification
 - Start the sampling on the first normal work shift after receipt of notification

DWP

(Continued)

- If a sample taken on a DWP meets or exceeds the ECV, the operator must take immediate corrective action to reduce exposure to at or below the applicable standard
- Upon notification of a citation for a violation due to sample(s) exceeding the ECV, the operator must begin sampling the environment of the affected DWP on consecutive normal work shifts within 8 calendar days after the date the citation is issued
 - Must collect 5 valid representative samples
 - All 5 samples must be \leq the applicable standard for termination of a citation

DWP

(Continued)

- If an MSHA sample exceeds 50% of the applicable standard in effect for a surface occupation, a new DWP may be established by the District Manager
- DWPs are assigned four-digit numbers by MSHA to identify the portion of the mine that is affected, followed by a three-digit occupation code describing the location to which a miner is assigned to perform his or her regular duties

Noncompliance

Operator Sampling

- Based on:
 - 2 or more of 5 valid respirable dust samples from a DWP, DA or Part 90 miner are \geq ECV
 - 3 or more of 15 valid respirable dust samples from a DO or ODO are \geq ECV
 - “Or” the average for all valid respirable dust samples in a sampling set are \geq ECV (average of 5 or 15)

MSHA Sampling

- A single valid respirable dust sample \geq ECV (single sample)

Part 90 Miners

- A representative sample collected on a part 90 miner should reflect typical dust concentrations in the miner's environment as he performs his normal work duties
- After the 20th calendar day following receipt of notification from MSHA that a part 90 miner is employed by the mine, the operator must take 5 valid representative dust samples for the part 90 miner within 15 days
- Part 90 Miner samples submitted must include the Part 90 Miner's MIIN

Part 90 Miners

(Continued)

- A citation for the overexposure of a part 90 miner will be terminated when a mine operator has complied with one of two conditions;
A: Reducing exposure, B: Transfer
 - A: If the operator chooses to reduce the exposure of the miner:
 - Implement proposed corrective action
 - Within 8 calendar days after the citation is issued, begin sampling consecutive work days until 5 valid respirable dust samples are collected
 - The equivalent concentration of each of the 5 valid respirable dust samples is at or below the applicable standard
 - B: If the operator chooses to transfer the miner:
 - Notify the District Manager and collect 5 valid representative samples within 15 calendar days
 - The equivalent concentration of each of the 5 valid respirable dust samples is at or below the applicable standard. These 5 respirable dust samples will be used for determination of citation abatement

DOs and ODOs

- DO and ODO identification numbers are four-digit numbers assigned by MSHA
 - Designated Occupations (DOs) are occupations on an MMU that have been determined to have the greatest respirable dust concentration
 - Other Designated Occupations (ODOs) are occupations on an MMU that are designated for sampling as required by 30CFR Part 70 in addition to DOs
- 15 valid representative samples are required every quarter for each DO and ODO
- Sampling of each ODO on an MMU with a CPDM must begin after fulfilling the sampling requirements for DO sampling
- When required to sample more than one ODO type, each ODO type must be sampled over separate time periods during the quarter

DOs and ODOs

(Continued)

- For each operator sample \geq ECV
 - Make approved respirators available
 - Immediately take corrective action to lower respirable dust levels to at or below the applicable standard
 - Make record of corrective actions taken
 - Certified by mine foreman or equivalent no later than the end of the mine foreman's or equivalent officials next regularly scheduled working shift
 - In secure book or electronically
 - Retained at a surface location at the mine for at least 1 year
 - Available for inspection by MSHA

DOs and ODOs

(Continued)

- For each MSHA sample \geq ECV
 - Actions same as with an operator's sample plus
 - Begin sampling within 8 calendar days, after the date of a citation being issued, the environment of the affected occupation in the MMU
 - Continue sampling on consecutive normal production shifts until 5 valid representative samples are taken
 - The citation shall be terminated when
 - Each of the 5 valid respirable dust samples are \leq the applicable standard
 - The operator has submitted revised dust control parameters as part of the ventilation plan applicable to the MMU in the citation and the changes have been approved by the district manager
 - The revised parameters shall reflect the control measures used by the operator to abate the violation

DAs

(Designated Area)

- Assigned a four-digit identification number by MSHA
- Samples are not based on the amount of material produced
- Each DA is sampled on consecutive production shifts until 5 valid respirable dust samples are collected
- For each sample \geq ECV (operator)
 - Make approved respirators available
 - Immediately take corrective action to lower respirable dust levels to at or below the applicable standard
 - Make record of corrective actions taken
 - Certified by mine foreman or equivalent no later than the end of the mine foreman's or equivalent officials next regularly scheduled working shift
 - In secure book or electronically
 - Retained at a surface location at the mine for at least 1 year
 - Available for inspection by MSHA

DAs

(Continued)

- Upon issuance of a citation for excessive dust – sequential actions to be taken:
 - Make approved respirators available
 - Immediately take corrective action to lower respirable dust levels to at or below the applicable standard
 - Make record of corrective actions taken
 - Certified by mine foreman or equivalent no later than the end of the mine foreman's or equivalent officials next regularly scheduled working shift
 - In secure book or electronically
 - Retained at a surface location at the mine for at least 1 year
 - Available for inspection by MSHA
- Within 8 calendar days after the date the citation is issued, sample the environment of the affected DA on consecutive normal production shifts until 5 valid respirable dust samples are collected

DAs

(Continued)

- The citation shall be terminated when
 - Each of the 5 valid respirable dust samples are \leq the applicable standard
 - The operator has submitted revised dust control parameters as part of the ventilation plan applicable to the DA in the citation and the changes have been approved by the district manager
 - The revised parameters shall reflect the control measures used by the operator to abate the violation

MMU Sampling

- DO and ODO sampling must be conducted on consecutive normal production shifts. A normal production shift is a shift during which the amount of material produced by an MMU is at least 80 percent of the average production recorded by the operator for the most recent 30 production shifts or all of the production shifts if fewer than 30 shifts of production data are available
 - The 30 shift average is a running average. The most recent production shift must be used in determining the 30 shift average
- Intake air for an MMU must meet the intake air standard anywhere within 200 feet outby the working faces of each section
- DOs on an MMU are required to be sampled before sampling ODOs

Quartz

- The maximum concentration of respirable quartz dust that a miner can be exposed to is 100 micrograms per cubic meters or ($100 \mu\text{g}/\text{m}^3$) as measured with an approved device and expressed in terms of equivalent concentration based on an MSHA sample
- A reduced standard will be established if respirable quartz dust exceeds $100 \mu\text{g}/\text{m}^3$ ($0.100 \text{ mg}/\text{m}^3$)
- A reduced respirable dust standard due to quartz overexposure is determined by dividing the number 10 by the percent quartz
 - Ex: Sample is 20% quartz, new reduced standard is $10/20$ or $0.5 \text{ mg}/\text{m}^3$
- When the dust standard is changed, the new standard becomes effective 7 calendar days after notification from MSHA

Normal Production Shift

A normal production shift is a shift on which the amount of material produced by an MMU is at least equal to 80% of the most recent 30-shift average production or all of the production shifts if fewer than 30 shifts of production data are available.

- Any sample, regardless of production, that exceeds the applicable standard by at least 0.1 mg/m^3 will be used for compliance determination



All samples are valid unless voided by MSHA

CPDM Outline

- PDM3700 Overview
- PDM3700 Features
- Charging
- Programming
- Sampling Screens
- Status Codes
- Troubleshooting
- Cleaning and Changing Filters
- Downloading and Transmitting Data
- Items to Remember

What is the PDM3700?

- An accurate, wearable personal dust monitor for miners that incorporates real-time particulate monitoring that measures respirable coal mine dust mass concentration, shift exposure, and accumulated exposure in real time. This real time measurement of respirable dust particles will permit the user to take actions to lower total dust exposure
- The mass measurement is a filter- based direct mass monitoring instrument using proprietary Tapered Element Oscillating Microbalance (TEOM) and momentum compensation technologies
- Approved by the Secretary of Labor and the Secretary of Health and Human Services to collect respirable coal mine dust samples

Description of PDM Operation

- Continuously draws air through a body mounted inlet and uses a cyclone to separate respirable fractions of dust which enter the instrument
- Dust is deposited on a tapered element oscillating microbalance (TEOM) filter that changes in frequency as more dust is accumulated on the filter. The change in frequency permits near real time measurement of the respirable dust concentration of the work environment of the miner wearing the unit
- Suitable for area monitoring of respirable dust in mg/m^3 . Reports cumulative information to the miner in numeric and graphical formats
- Provides end-of-shift exposure (shift-average exposure) and can help identify operations with highest dust generation

Features

- There are two types of primary programming
 - **Programming of the PDM with the use of a PC.** This programming is used for compliance sampling. This type of programming cannot be stopped or altered once the PDM starts up unless the PDM is reconnected to a PC
 - **Manual programming of the PDM.** This type of programming can be used for engineering or informational sampling purposes
- A primary sampling program entered manually into the PDM can be started and stopped at will for targeted measurements of respirable dust concentrations
- At the end of the sampling run, a person certified in sampling with the CPDM can download detailed respirable dust exposure and other environmental information to a PC for further analysis

Features

(Continued)

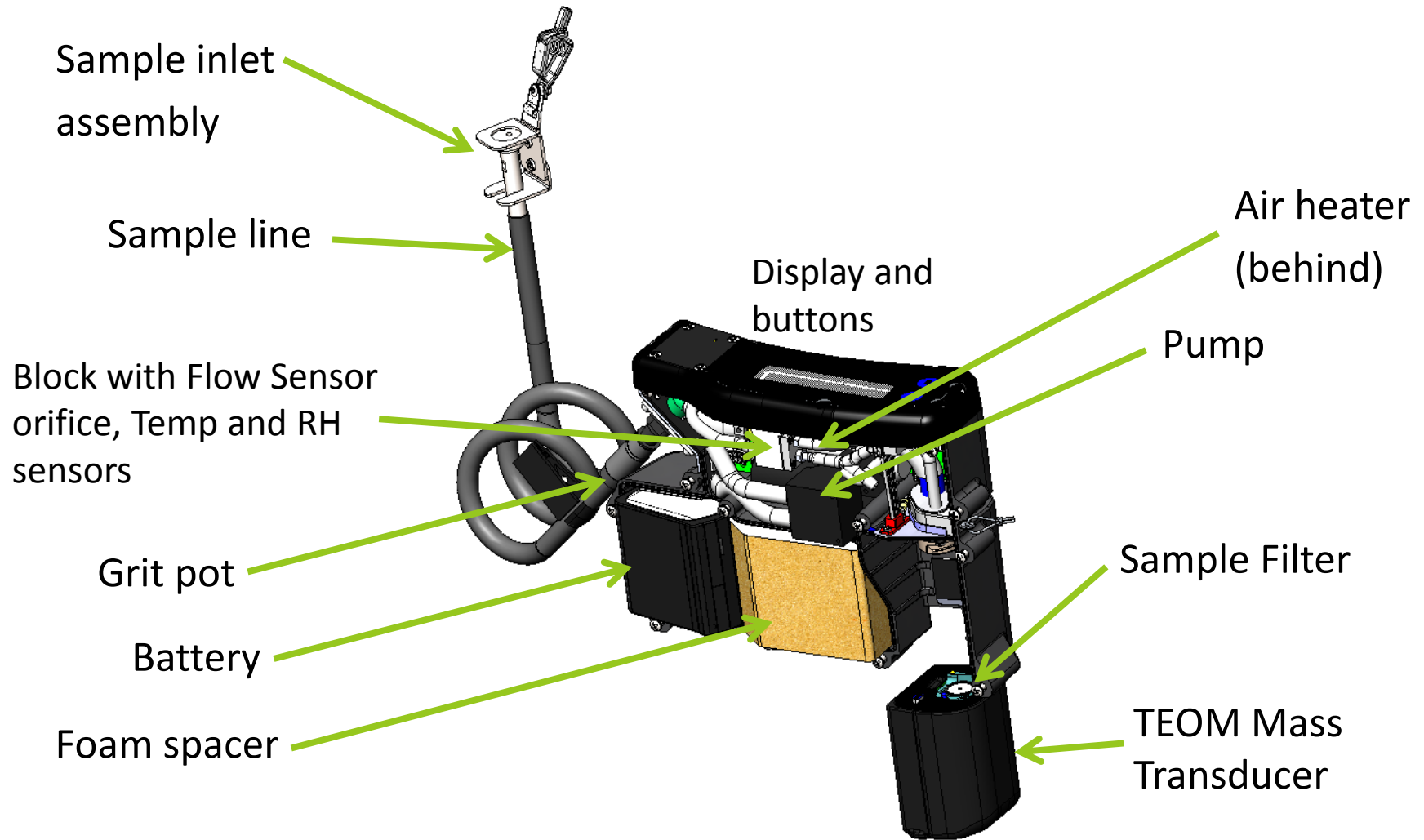
- Built-in sensors help detect possible tampering, track ambient pressure, temperature, humidity, filter differential pressure, and tilting
- Computer-controlled pump maintains volumetric flow rate at 2.2 liters per minute at mine temperature and pressure
- No miner intervention required to operate
- Certified intrinsically safe by MSHA

Features

(Continued)

- Run time of 12 hours - battery recharging time of 6 hours
- Heated internal sample line removes excess moisture
- Measures concentration of respirable dust without regard to composition
- Display has bright, large characters for easy readability

Main System Components



Purpose

- The CPDM unit is a device designed to provide a continuous readout of respirable coal mine dust concentrations during the work shift
- Only current approved CPDM unit is the PDM3700



General Information

- Provides near real-time analysis
 - Last 15-minute average for short samples
 - Last 30-minute average for full-shift samples
- Digital readout
 - Flow control system maintains operating flow at 2.2 lpm and total filter loading to 6 inches Hg (Uses Higgins Dewell instead of 10-mm Dohr-Oliver dust cyclone)
- Weighs approximately 4.4 lbs
- Stores sample data for future download and analysis
- Includes label certifying approval from MSHA/NIOSH

Advantages & Limitations

Advantages

- Immediate response
- Quick evaluation of dust control changes
- Ability to find dust generation problem areas quickly
- PDM unit MSHA approved as intrinsically safe
- Can be used as an engineering tool

Limitations

- Does not sample for quartz

Charging PDM Unit

Charger Lights

■ Red

- Solid: Charging
- Flashing: Problem with charger or connection

■ Green

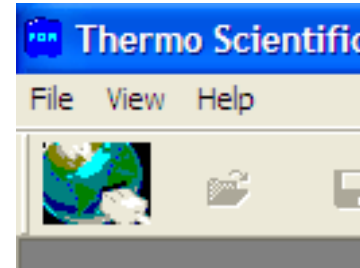
- Solid: Fully charged
- Flashing: 80% charged minimum



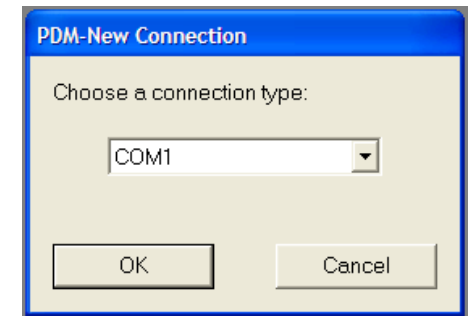
⚠ Keep PDM unit on charge when not in use. If PDM unit is not used within 3 months, run down PDM unit and recharge. Do not charge in environment below 32°F (0°C)

Opening WinPDM

- Use of WinPDM software requires Windows operating system



- Click button on top left corner of screen



- Choose connection type COM1 and click “OK”



Programming the PDM Unit

Computer-programmed Start

- Program PDM unit from computer:
 - 30 MIN CONC, CUM1, CUM2 measurements are available
 - **Required method for compliance sampling**
 - Can only be stopped by computer or when allotted sampling time ends



9-Pin RS232 port and
cable

PDM Unit and Computer Connections

- Connect PDM unit to charging unit



- Connect charging unit to serial port on computer with RS232 Cable or via a RS232/USB adapter



Information to Get Started

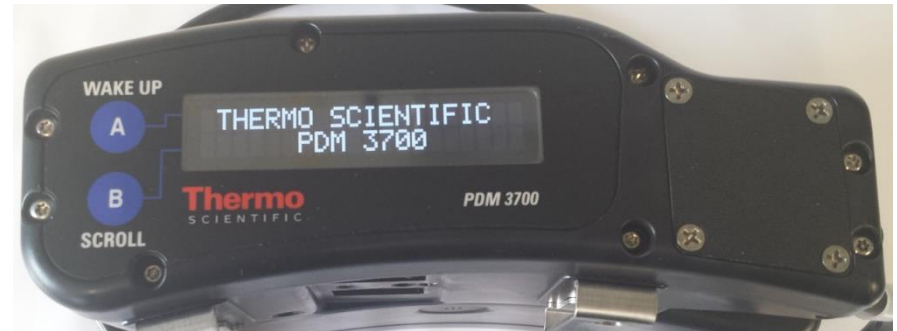
2 Buttons

A is the “wake up” button
(blank screen)

B is the “scroll” button



When not programmed the PDM displays idle screen: serial number and firmware version



Programming the PDM Unit

Manual Start

- Manual start from PDM unit:
 - 30 MIN CONC, CUM1, CUM2 measurements are available
 - Can be set to any amount of time in 15 minute increments
 - Can be stopped when desired

Warm-up Time

- PDM unit will automatically start a warm-up period of 35 minutes prior to ANY sampling type's start time
- During warm-up period, the PDM will display the time remaining until sampling starts

Program PDM Unit from Computer

- Connect PDM unit to charging unit
- Connect charging unit to personal computer
- Open WinPDM software
- Choose a connection type
 - Note “Connected To PDM” message and Serial #
- Click “**Program Shift**” in upper left



WinPDM will only run on a Windows operating system

Program PDM Unit from Computer

(Continued)

- Enter all data that can be filled in such as:
 - Wearer ID, Mine ID, Mine Name, Company Name, MMU DA/SA, etc.
- Click “OK”
- Click “Done”

Note: the Shift Concentration Limit is the applicable standard

The screenshot shows a software window titled "PDM - CDM4". It contains several input fields and checkboxes for data entry. The fields are organized into a grid-like structure. At the bottom, there is a "NOTICE" section and two buttons: "OK" and "Cancel".

Field	Value
Wearer ID	
Mine ID	
Contractor Code	
Mine Name	
Company Name	
MMU DA/SA	
Certification Officer	
Occupation Code	000 No occupation code
Current Time	10/12/2012, 14:52:38
Sample Start Time	10/12, 15:27
Warm-up Start Time	10/12/2012, 14:52:00
Sample Duration	12:00
Type of Sample (select one)	
Average Expected Temperature	73 - 85°F (23 - 29°C)
Shift Concentration Limit	2.0 mg/m³
Part 90 Miner Sampled (Employee Number)	
Auto Shift Setup	<input type="checkbox"/> Sunday <input type="checkbox"/> Monday <input type="checkbox"/> Tuesday <input type="checkbox"/> Wednesday <input type="checkbox"/> Thursday <input type="checkbox"/> Friday <input type="checkbox"/> Saturday

NOTICE - Knowingly making any false statement, representation, or certification on this document is a violation of the federal criminal code which may be punished by a fine or by imprisonment or both.

PDM Firmware Version: 7.10



PDM unit can now only be stopped by a computer or designated run time

Programming – Notes

- Expected temperatures must be reasonable but do not have to be exact
- By default the PDM reports dust concentrations as an MRE equivalent
- The wearer ID can be the miner's MIIN, company's employee number or whatever other means the mine has to identify the employee (The SSN MUST NOT be entered as the wearer ID)

Program PDM Unit Manually



Not to be used for compliance sampling

Start

- Press **A** and **B** together
- Press **A** to start sampling
- Press **B** to increase duration time
 - Initially 15 minutes on CPDM screen
 - Keep pressing **B** to increase duration time
- Press **A** to start sample

(A) START SAMPLING
(B) MORE OPTIONS...

Stop

- Press **A** and **B** together
- Press **A** to stop sampling



PDM unit can be turned off at any time.

First Sample Screen

(Default screen for programmed start)

30 MIN CONC	0.22
CUM1 CONC	1.21



30 Min Conc:

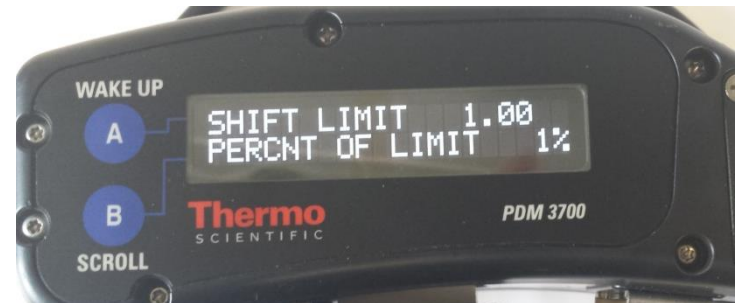
Average concentration for the past 30 minutes

Cum1 Conc:

Average concentration from the beginning of the shift (updated every minute)

Shift Concentration Limit

SHIFT LIMIT	2.00
PERCNT OF LIMIT	25%



Shift Limit: (applicable standard)

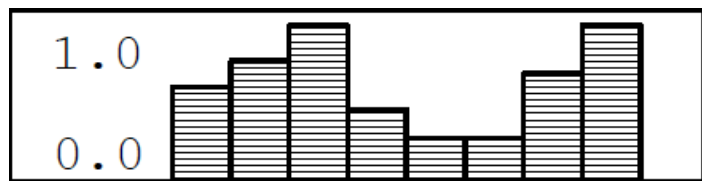
Shift concentration limit for the full-shift sample

Percent of Limit:

Percentage of exposure of the full-shift limit

Bar Graph Screen

(Press **B**)



- 30-minute average for each bar
- New bar added every 30 minutes



PDM must operate for 30 minutes before bar graphs are available

Sample Duration Screen

(Press **B**)

ELAPSED TIME: 001:15
PROGRAM TIME: 008:00



Elapsed Time:

From start of sample

Program Time:

For entire sample

Start Second Sample

(short term sample)

- Press **A** and **B** together

(A) RESET SAMPLE 2
(B) MORE OPTIONS...

- Then press **A** to begin second sample

Second Sample Screen

TIME	15 MIN	1.10
01:00	CUM2	0.37



- TIME:** Total time the second sample has been running
- 15 Min:** Average concentration from second sample for the past 15 minutes
- Cum2:** Average concentration from the beginning of the second sample

Blinking “S”

(Upper Right Corner)



Status Condition Encountered



Status Screen

- Indicates a status condition encountered
- “S” remains for sample duration
- “S” restarts blinking if new status condition is logged

View Status Codes

Press **A** and **B** together

(A) RESET SAMPLE 2
(B) MORE OPTIONS...



Press **B** until you see

(A) VIEW STATUS
(B) MORE OPTIONS...



Press **A** to view status

PDM3700 Firmware Status Codes

Status Code	Description
TE not detected	Mass transducer not detected
High filter load	Differential pressure approaching maximum
Flow out of range	Flow rate is out of allowable range
Mass offset error	The PDM3700 has gained or lost too much mass over a short period of time
CPU fault	A CPU fault was detected
Power low	Power remaining in the battery has reached a critically low level
TE Frequency	The TEOM frequency is out of range
CPDM CPU reset	The PDM3700's CPU was reset
Power low shutdown	The PDM3700 was shutdown due to insufficient power
TE Temp out of range	The difference between the mass transducer and the setpoint is greater than 1°C
Sample Start Time Missed	The programmed sample start time was missed

Troubleshooting

(Diagnostic Failure during Warm-Up Period)

- View cause of failure
 - Press **A** and **B** together
 - Press **B** twice to scroll until “View Failures” option is displayed
 - Press **A** to view failures
- Flashing “DIAGNOSTIC FAILURE” will stop if condition causing failure is corrected before end of warm-up period



PDM MUST NOT be operated in an area of the mine where permissible electrical equipment is required, if the case is cracked, one or more screws are missing or the MSHA approval label is missing or illegible

View Failures

Press **A** and **B** together

(A) RESET SAMPLE 2
(B) MORE OPTIONS...





Press **B** until you see



Press **A** to view failures

Troubleshooting

(Diagnostic Failure at end of Warm-Up Period)

- Sample run will not start
- Identify diagnostic failure
 - Press  to wake up
 - Press  to scroll and identify diagnostic failure
- Attach PDM unit to charger and start WinPDM program
- Start “Instrument Diagnostics”
 - First series of tests with pump and heaters off
 - Second series of tests with pump and heaters on

Troubleshooting

(Diagnostic Failures along with WinPDM Instrument Diagnostics)

PDM3700 Diagnostic Failure	WinPDM Instrument Diagnostics
AIR TEMP FAILURE	AIR TEMP
AMBIENT PRES FAILURE	AMBIENT PRES
AMBIENT TEMP FAILURE	AMBIENT TEMP
CLOCK FAILURE	CLOCK
DIFFERENTIAL PRESSURE	DIFFERENTIAL PRESSURE
FREQUENCY FAILURE	FREQUENCY
NO MASS TRANSDUCER	NO MASS TRANSDUCER
RH SENSOR FAILURE	RH SENSOR
RH TEMP FAILURE	RH TEMP
TE TEMP FAILURE	TE TEMP
FLOW RATE FAILURE	FLOW RATE (VOLTS)
TILT Z FAILURE	TILT Z DUTY CYCLE

Maintenance and Calibration

The following slides discuss procedures involved in verifying the calibration of the PDM3700 and maintaining the consistent operation of the hardware. In addition to regularly scheduled maintenance, the unit may require other maintenance as necessary, including replacing the battery, or other procedures.

- “Daily or after each use” - If a unit is not used on any given day the daily maintenance will not be required
- The term “or as necessary” refers to any condition that may occur that would require additional maintenance or calibrations to be conducted on the unit or any condition that would cause the mine operator to question the reliability of the unit to perform as approved;

Examples:

- Status codes referring to any potential maintenance or calibration issue
- Unit’s charge not lasting a full shift
- Unit is damaged

These are only a few examples of what might cause a mine operator to question the reliability of the unit. The mine operator must determine on a case by-case-basis whether a condition requires additional maintenance and/or calibration of the unit.

The manufacturers requirements for maintenance and calibration are minimums. The mine operator may conduct addition maintenance and calibrations any time there is a need.

Maintenance and Calibration

(continued)

Daily

- Charge the internal battery pack before each use, or as necessary
- Clean the grit pot after each use, or as necessary
- Clean the mass transducer area and sample flow lines after each use, or as necessary
- Replace the TEOM filter after each use, or as necessary



These maintenance procedures can be conducted by either a person certified in sampling or a person certified in maintenance and calibration

Maintenance and Calibration

(continued)

Monthly

- Perform a flow audit once per month, or as necessary
- Clean the cyclone and inlet tubing once per month, or as necessary



The flow audit may be performed by either a person certified in sampling or a person certified in maintenance and calibration. The cleaning of the cyclone and inlet tubing may **ONLY** be performed by a person certified in maintenance and calibration

Maintenance and Calibration

(continued)

Annual

- K0 audit once a year, or as necessary
- Tilt audit once a year, or as necessary



These audits must be conducted by a person certified in maintenance and calibration

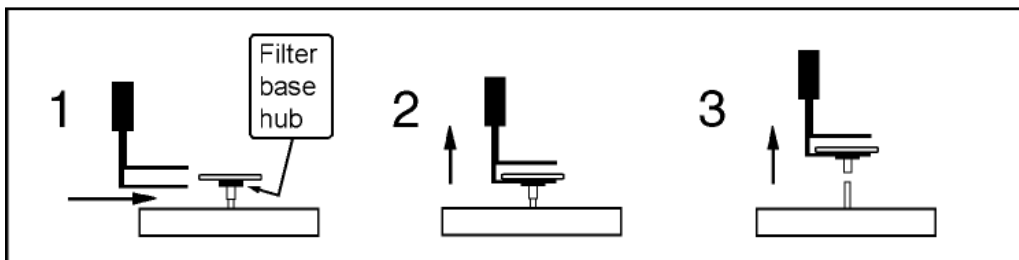
Changing Filters

(Removal)

1. Locate the TE handle on the left side of the PDM3700 and slide the handle all the way to the right to unlock the mass transducer and then pull the mass transducer out of the unit.
2. Carefully insert the lower fork of the filter exchange tool into the filter change notch so that the filter disk is between the lower fork and the upper tab of the filter exchange tool. The tines of the lower fork should straddle the hub of the filter base.
3. Gently pull straight up from the tapered element (TE) lifting the filter from the TE

Do not twist or tilt the filter exchange tool from side-to-side while removing the filter from the TE. This will damage the TE.

Filter change notch



Changing Filters

(Installation)

1. Clean the exchange tool with canned air or a clean cloth. Use it pick up a new TEOM filter from the box of filters, so that the filter disk lies between the fork and the upper tab of the tool, and the hub of the filter lies between the tines of the fork. Do not touch the filter with your fingers.
2. Lightly place the hub of the filter onto the tip of the tapered element, then slide the tool toward the notch and remove.
3. Turn the tool upside down, place the bottom of the spring loaded filter exchange tool on top of the filter and apply downward pressure until the filter tool stops. Lift the tool and rotate the mass transducer 90° and press down repeating this process a total of 4 times*.
4. Install the mass transducer back into the PDM3700 unit.



Cleaning PDM Unit

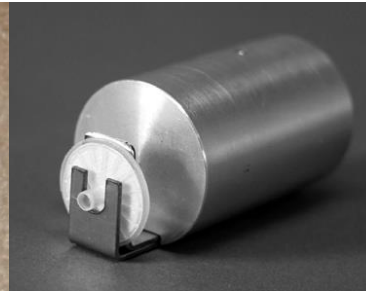
- The manufacturer requires the use of standard commercial canned air for cleaning a PDM
 - If using anything else, ensure the air is purified and free of any oil mist, such as compressor generated
- Isopropyl alcohol is suggested when cleaning anything that requires an alcohol swab

Cleaning PDM Unit

(Continued)

Remove

- Mass transducer
- TEOM filter
- Grit pot

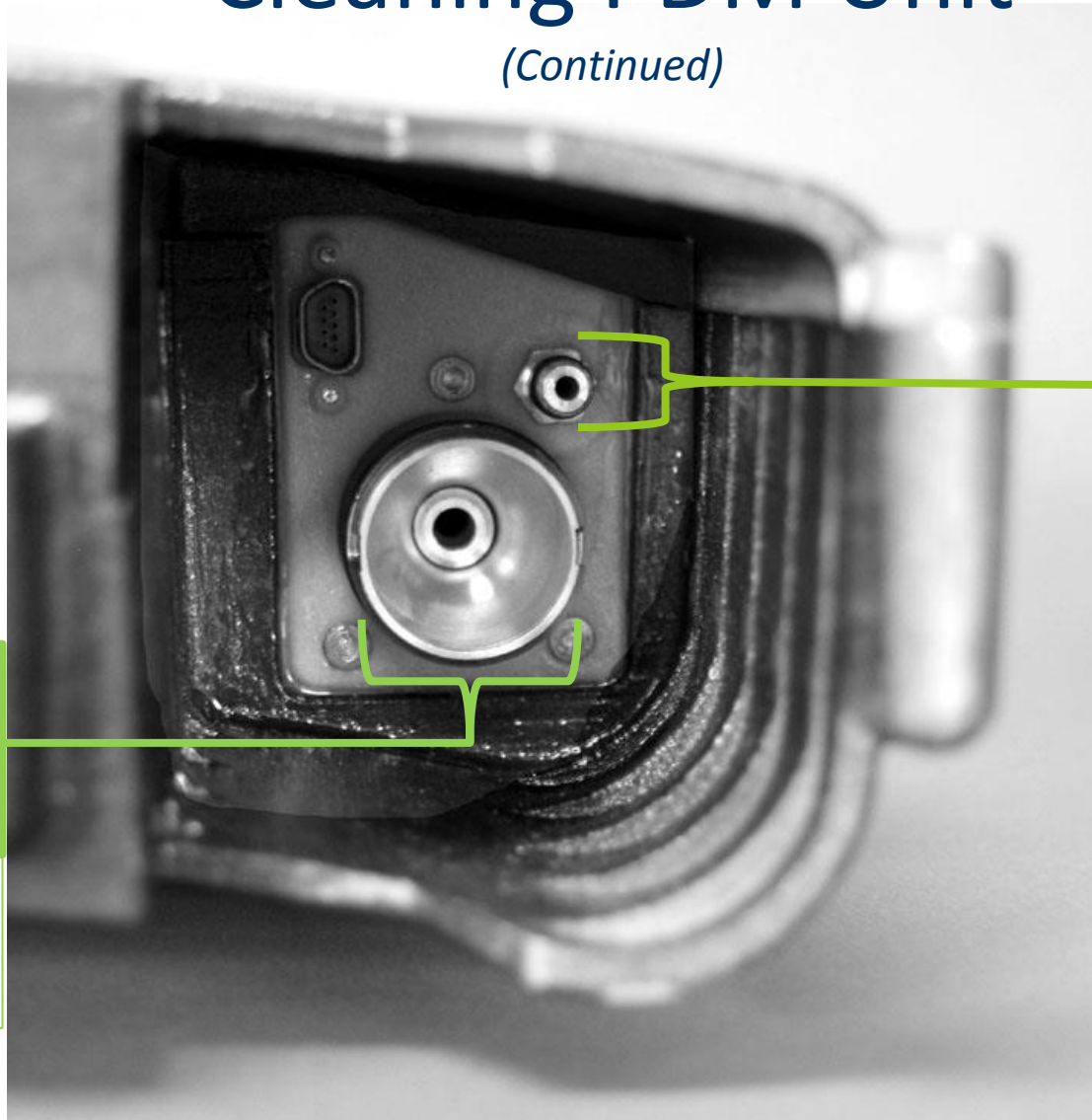


Spray compressed (canned) air inside (daily):

- Grit pot
- Sample inlet
- Plastic outlet (opposite direction from orifice)
- Housing of mass transducer, but not the connecting port
- Bell where mass transducer is installed (bell-shaped inlet)

Cleaning PDM Unit

(Continued)



Bell-shaped inlet

OK TO
SPRAY

Filter loading pressure sensor

DO NOT
SPRAY

This will damage the sensor and disable PDM

Cleaning CPDM Unit

(Continued)

Wipe with alcohol:

- Mass transducer
- Bell-shaped inlet
- Grit pot



Manufacturer requires that components listed above be cleaned daily or after each use

Cleaning the Sample Inlet Assembly, Sample Line, and Mass Transducer

(Daily)

1. Disconnect the sample line from the inlet assembly (inlet bracket).
2. Remove the mass transducer from the PDM3700 unit and remove the TEOM filter from the mass transducer.
3. Use canned air then an alcohol swab to clean all surfaces of the mass transducer.
4. Use canned air and an alcohol swab to clean the bell-shaped inlet inside the PDM3700 unit and then direct a stream of air through the bell-shaped inlet.

Disconnect
here

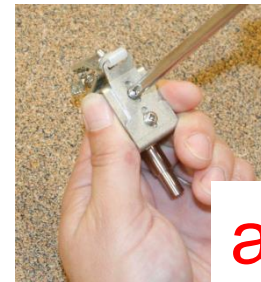
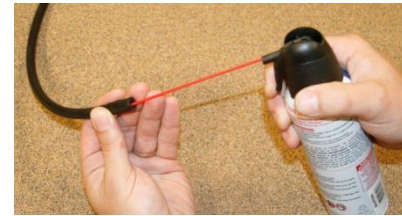


Cleaning the Sample Inlet Assembly, Sample Line, and Mass Transducer

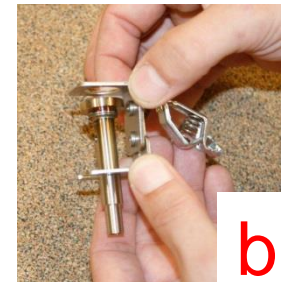
(continued)
(Daily)

5. Direct a stream of air through the end of the sample line removed from the sample inlet assembly (inlet bracket) and through the sample inlet on the sample inlet assembly (bracket).

- Disassembly of the sample inlet assembly
 - a. Loosen screws on rear of bracket
 - b. Open sample inlet assembly bracket
 - c. Slide out sample inlet assembly
 - d. Remove sample inlet cap using tool provided
 - e. Clean sample inlet



a



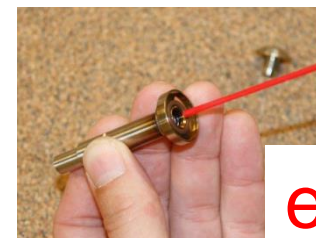
b



c



d



e

Cleaning the Sample Inlet Assembly, Sample Line, and Mass Transducer

(continued)
(Daily)

6. Install a new TEOM filter onto the mass transducer and install the mass transducer into the PDM3700 unit. Reassemble the sample inlet assembly*.
7. Install the sample line onto the base of the sample inlet assembly (sample inlet).



Make sure to inspect the O-ring in the top of inlet for damage

Flow Audit

- Flow Audits are to be performed once a month or as necessary
- Verifies the flow rate is within the accepted range
 - $2.2 \pm 2.5\%$ (2.145 – 2.255) lpm (Manufacturer's specification)
- 30 CFR Part 74 requires that a CPDM's flow rate be within 5% of the calibrated flow for 95% of samples up to 12 hours in duration

Flow Audit

(Continued)

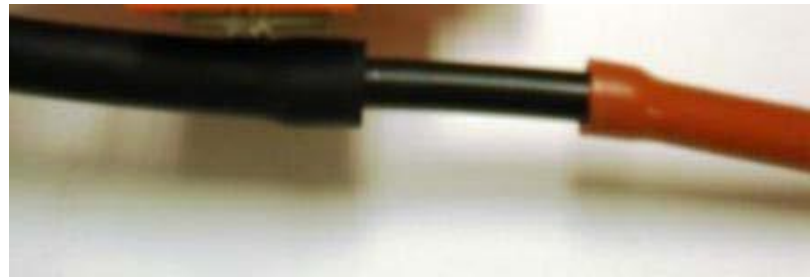
(Monthly)

- Materials needed for Flow Audit
 - Flow meter
 - Flow audit inlet tubing adapter (if necessary)

Flow Audit Steps

(Monthly)

1. Disconnect the sample line from the sample inlet assembly (inlet bracket).
2. Install one end of the tubing adapter (if necessary to connect) into the sample line from the inlet assembly (bracket) and the other end of the tubing adapter into the tubing that is attached to the flow meter.



3. Connect the PDM3700 unit to the charger and make sure the charger is connected to your PC.
4. Open the WinPDM software and connect to the instrument.

Flow Audit Steps

(Continued)

(Monthly)

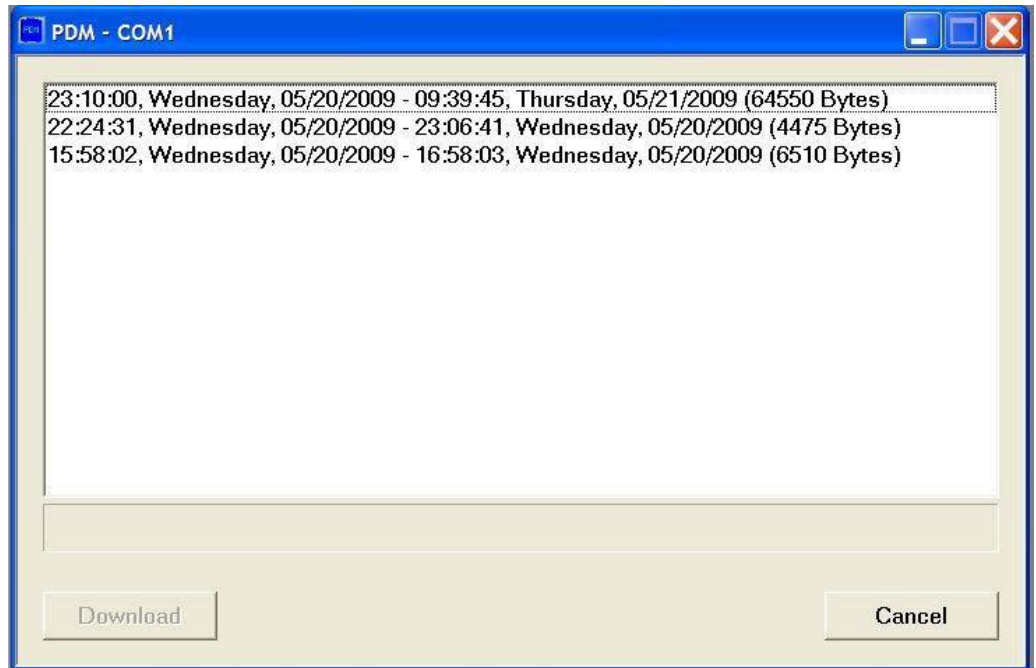
5. Start a primary sample run on the PDM3700 unit.
6. Wait 10 minutes to allow the flow rate to stabilize, then check the flow rate readings on the flow meter.
7. Ensure that this value matches the 2.2 lpm flow rate set point for the PDM3700 unit. If the flow meter reading is within your acceptance criteria end the sample run, remove the tubing adapter and reinstall the sample line. If the flow meter is not within your acceptance criteria, a flow calibration must be performed.



If flow is outside acceptable range, a person certified in maintenance and calibration must perform a flow calibration

Downloading Data

- Connect PDM unit to charging unit
- Connect charging unit to computer
- Open WinPDM software
- Choose a connection type
- Click “Download Sample”
- Highlight desired sample
- Click “Download”
- Save status file if available
- Save data file
- Click “Done”



Downloading Data – Notes

- The filename will contain the PDM's serial number, the date the sample was taken, the mine ID number, the word "STATUS" and the vendor instrument code
- **.msha** files are the only file extensions to be submitted for compliance
- Status code files do not need to be submitted. Status codes are included in the **.msha** file as well as **.csv** files (MSHA will evaluate status code entries to determine if the sample is valid – simply having a status code does not determine if sample is valid or not)

Downloading Data – Notes

- When the download Graph Screen appears, the Shift Tonnage dialog box will appear. You must enter tonnage for the shift along with the 30 shift average tonnage. WinPDM will not allow you to move forward without entering values for these two entries
- After entering tonnage, you can view various graphs of the logging parameters that were recorded during the sample run
- After you have viewed the data, select the “Print Dust Data Card” button. Select the “Print” button to print a paper record of the sample run
- To save the data from the sample run, select the “Save .csv” or “Save .msha” button as appropriate. The save as screen will display. Accept the file name that the software provides for that data. Select the “Save” button

Dust Data Card

Thermo Scientific WinPDM

Print | First Page | Prev Page | Next Page | Zoom In | Zoom Out | Close

Dust Data Card (Serial Number 000000)

Filter ID	Wing ID Number
Collector Code	Site Name
Company Name	Date Sampled
Sampling Time (minutes)	Type of Sample
Wing Code	Run Code
Per M Week (Employee Number)	Location (Room)
Results	Errors
MTT Exposure (Classical)	01-11-2009 08:47 - Success
Ball Load (Classical)	01-11-2009 08:47 - Success
MTA Feed Concentration (mg/m ³)	

20 Minute Mass Concentration (mg/m³)

01-10-2009 01-11-2009

01-10-2009 01-11-2009

Continuous Mass Concentration (mg/m³)

01-10-2009 01-11-2009

01-10-2009 01-11-2009

Notes

Transmitting Data

- Go to MSHA's website at www.msha.gov
- Go to the On-line Tools and click on CPDM Sample Transmission
 - Follow the instructions

Items to Remember

■ Use appropriate software

WinPDM 7.2 (or higher) software should be installed on the computer. Version 7.1 (or higher) firmware should be installed on the PDM unit. All computer versions (Software or Firmware) should be the most up-to-date, only the manufacturer can install or upgrade the firmware

■ Wipe down connectors

Always wipe down the connectors on the PDM unit and charging bracket to obtain a good connection. Using an alcohol swab is recommended

Items to Remember

(Continued)

- **Install mass transducer properly**

Firmly press the mass transducer into the unit while securing the latch and then check to make sure the mass transducer does not slide out of the PDM unit

- **Program accurate computer information**

Make sure your computer's date and time are accurate when programming the PDM unit by computer, since the PDM unit uses this information to start sampling (this is important when there are time zone changes and daylight savings time changes)

Items to Remember

(Continued)



Note the mass transducer has a separate serial number that should be recorded along with the date the K0 audit was performed on it. A K0 audit is recommended by the manufacturer to be performed at least annually

Items to Remember

(Continued)

- **Running a Manual Start**

(Manual start, instead of programming by computer)

- **PDM unit remembers last programmed information**

This can affect information such as time, temperature, etc. If information needs changed, program the PDM unit to run a sample ahead of time

- **Locked PDM unit screen**

Connect the PDM unit to charger and computer, and run the WinPDM software to unlock the PDM unit

Items to Remember

(Continued)


- If inlet is immersed in water
 - Remove and empty the mass transducer of water immediately.
Reinstall mass transducer
 - Run clean water through the PDM unit as soon as possible (Do not immerse the PDM unit into water). Running clean water through the inlet may not be possible when in a mine
 - Empty the mass transducer once again and reinstall
 - Next, let the PDM unit run for a long time (many hours) to work the water through and dry the PDM unit (the unit may run while on the charging unit)



As soon as possible use canned air to spray out the mass transducer and sample path

Items to Remember

(Continued)

- PDM Serial Number will be displayed on the top display panel by pressing the  button while the PDM is charging

MSHA Website

www.msha.gov