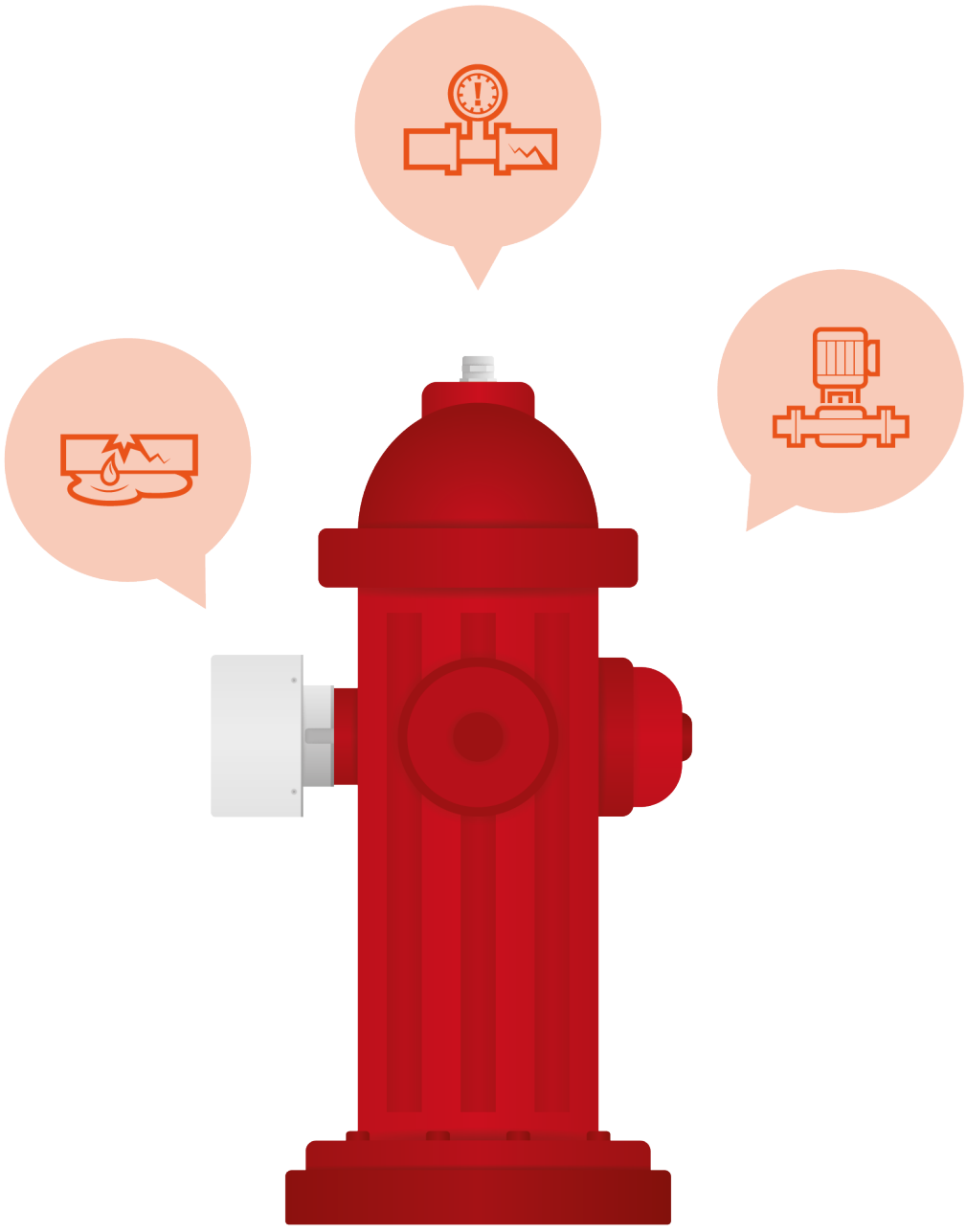
PIPEMINDER H



PRODUCT MANUAL

Content

Please note this manual is for guidance only. Any user must ensure any deployment, access, signage and guidance is consistent with all applicable regulations and requirements including without limitation the requirements of relevant fire authorities. If any queries arise please do not hesitate to contact Syrinix for further assistance.

1 Safe Usage of PIPEMINDER-H

1. Please read these instructions thoroughly before attempting to use PIPEMINDER-H.
2. Retain the instructions and make them available to others who may use PIPEMINDER-H.
3. Follow the instructions when deploying PIPEMINDER-H.
4. Take care when handling PIPEMINDER-H. If it is dropped or damaged, please contact Syrinix for technical support
5. If PIPEMINDER-H is used outside the manner stated in this manual, then the safety of the product may be impaired.
6. There are no user serviceable components inside PIPEMINDER-H. In the event of failure, do not attempt to use the instrument and contact Syrinix for guidance.
7. Use only electrical attachments and accessories supplied by Syrinix. Syrinix cannot be responsible for the performance of the instrument when used with non-approved parts.
8. Do not place PIPEMINDER-H or accessories on or near a heat source.
9. Do not incinerate.

Syrinix hereby declare that this product is in compliance with the requirements of IEC 61010-1:2010 and UL 61010-1:2012, FCC CFR 47 Part 15B and UN38.3.

2 Revision History

Document Number	Date	Changes	Sign off
10XXXX	12th March 2019	Draft	
300023	29th July 2019	First Release	
300023 /1 /2 /3	21st August 2019	Timing Ch 8, Emergency Services Ch 12	S Allen 25-9-19
300023	5th May 2020	Standards information added	PWL

3 Introduction

3.1 Primary Functions

The primary function of PIPEMINDER-H is to continuously measure pressure accurately and with very little noise at a high sample rate. From this continuous data stream, high sample rate event data, 15 minute and 1-minute summary data are derived.

The following outputs are available:

- Continuous high sample rate data at 128 S/s (pressure) and 1 S/s (flow)[1];
- Pressure transient event data at 128 S/s (data leading up-to and following a transient event);
- Burst event data at 128 S/s (pressure) and 1 S/s (flow)
- Daily summary data at 1 S/15 minutes or 1 S/minute for minimum, mean, maximum and S3 score computed from the 128 S/s history.

Each of these outputs can be (see figure 1,):

- stored internally to 2GB of Flash storage; and/or
- sent to Syrinix RADAR using the 4G modem.

For the daily summary data, the minimum, mean and maximum streams are calculated using every sample (at 128 S/s for pressure and 1 S/s for flow) in the time window.

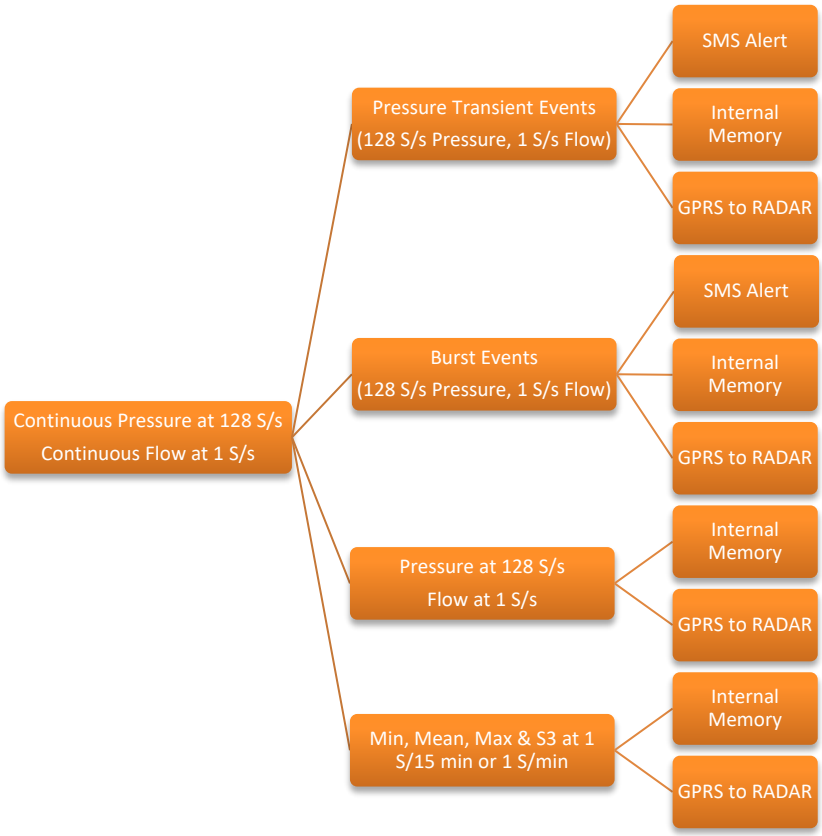


Figure 1 : PIPEMINDER-H Data Flow

3.2 Syrinix Severity Score (S3)

The S3 score is a non-dimensional measure (a Severity Score) of pressure transient activity calculated within PIPEMINDER-H itself. Large changes which happen quickly, or oscillatory changes result in a high score, small changes over a longer period result in a lower score and a continuously stable pressure results in a score of zero.

Tracking and profiling S3 for a particular site over time is a good measure of the pipeline's transient activity and readily indicates if the activity level has increased or if mitigation work has been successful in reducing it.

3.3 Timekeeping

PIPEMINDER-H contains a very low drift clock which is used to time stamp data. This clock is set on deployment using an internal GPS receiver and then disciplined (kept in time) by regular time checks over the cellular network. Syrinix operates Network Time Protocol servers (NTP servers) in each major territory to enable the regular NTP time checks.

Using this combined GPS and NTP method the clock inside PM-H is maintained to within 50 to 100 milliseconds of UTC

NTP requires a reliable cellular signal, in situations where a poor cellular signal is affecting the accuracy of NTP please follow chapter 8.2 Manual GPS Time Synchronisation.

3.4 Specification

PIPEMINDER-H: Part Number: 101903	
Functions	• Real time pressure transient monitoring • Burst event data (in conjunction with Flow meter)
Interface	• Remote managed alerts (SMS, Email)
SIM Card	• Internal chip SIM (Emnify) • Full size removeable SIM
Cellular	• 4G Cat1/GPRS • 2G/3G fall back
Sample rates	• Pressure 128S/s • Summary data 1 s/min or 1 s/15 min • Flow 1 S/s
Pressure Range	• 0-20 Bar absolute
Pressure accuracy	• 0.25%
Temperature Range	• -20°C to +65°C (See Frost Protection Chap 3.5)
Enclosure	• Housing: 316L Stainless Steel and Acetal (plastic).
Dimensions	• Diameter 160mm, Height 120mm (Device only), Anti-Tamper cover Diameter 175mm, Height 150mm.

[1] Although it is electrically possible to attach a pulse-signal type flow meter to PIPEMINDER-H, the location of its deployment on a fire hydrant means this is impractical but is mentioned here for completeness.

Weight	• 3.7kg
Environmental rating	• IP68
Antenna	• Internal 4G • Internal GPS
12.8V 11.4AHr Rechargeable Battery (internal)	
Type	• Rechargeable Lithium iron phosphate
Voltage	• 12.8 V
Maximum charge current	• 4A

Table 2: PIPEMINDER-H Specification

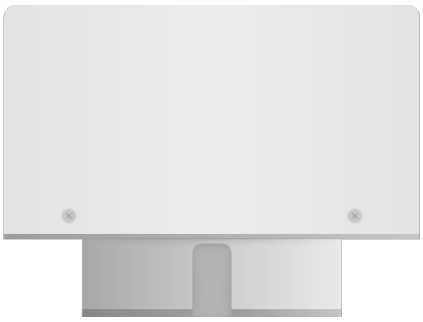
3.5 Frost Protection

It is possible to permanently damage the pressure transducer if the water in the hydrant freezes. Under these conditions the pressures exerted by the expansion of freezing water can exceed the maximum burst pressure of the transducer. As it may also burst the hydrant this is not a situation, we anticipate PIPEMINDER-H finding itself in.

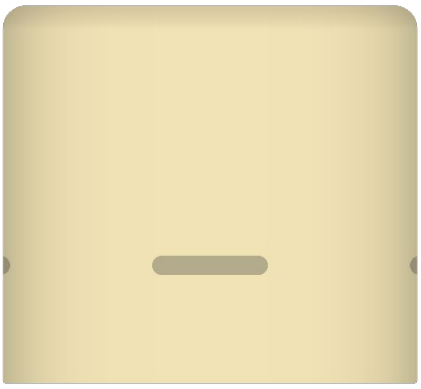
- Local procedure for prevention of freezing within the Hydrant should be followed

Devices damaged due to overpressure events, whether due to the expansion of freezing water or very high-water pressures (above 40bar, 580psi), will not be replaced under warranty.

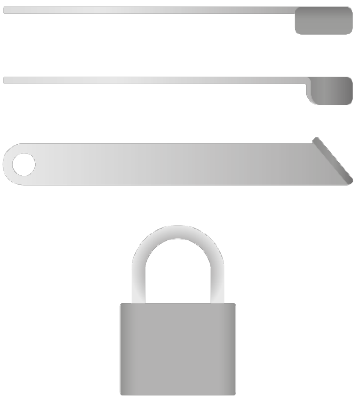
4 System Components



PM-H Unit



Anti-tamper cover



Locking bars and (optional) padlock

4.1 Accessories

Hand-held Activator Unit.

Part no. 101590
12V 4A Battery charger

5 SIM Installation and Configuration

PM-H comes with a pre-installed chip SIM for use with the Emnify network. If a customer provided SIM is to be used it can only be installed by Syrinix technical staff or those trained by Syrinix.

6 PIPEMINDER-H Deployment

6.1 PIPEMINDER-H Site Selection – Pressure Transients

In residential and industrial areas where multiple routes can be taken across the network the devices should be deployed approximately every 1.5 km.

On long pipelines, with few service connections and take-offs, the devices can be spaced more widely apart along the length. Every 3 to 5 km works well, longer is possible dependant on pipeline topology.

When investigating a known or suspected transient event source the devices should be placed upstream and downstream so that the source identification procedure in section 8 can be followed.

For DMA areas Syrinix can offer an optimal placement procedure – please contact us if you need to make use of this service.

6.2 PIPEMINDER-H Site Selection – Burst Monitoring

PIPEMINDER-H requires an external flow meter for burst detection. When both flow and pressure signals are available it continuously monitors them for changes characteristic of a burst. Upon detection of a burst:

- An SMS alert is sent to the configured mobile number;
- A section of flow and pressure data containing the event is sent to Syrinix servers.

PIPEMINDER-H can indicate whether the burst is upstream or downstream of the installed location. For fast burst events, which cause pressure transients, a more accurate location may be possible by following the procedure in section 8, Event Source Identification.

Connecting a flow meter to a PM-H requires special installation and as such, Syrinix would recommend using one of our PM-S projects at the flow meter point.

6.3 Cellular and GPS Signal

Hydrant selection can have an impact on the cellular signal strength and/or the availability of GPS signals:

- Selecting a hydrant close to or under a bridge may compromise both signal types
- Hydrants which are in narrow “canyons” formed by close, high-rise buildings may have compromised GPS
- Positioning the unit on hydrant such that the front face is directly in front of a wall may create signal issues.

6.4 Hydraulic Connection

The hydraulic connection from the PIPEMINDER-H to the hydrant should not leak or drip. It is important that the rubber sealing ring is positioned correctly within the PIPEMINDER-H connection and that it is not damaged in any way.

The PIPEMINDER-H should be offered up to the hydrant and gently screwed on. Once the unit becomes tight, use a hydrant tool to tighten the PIPEMINDER-H onto the hydrant. Once tight, the hydrant can be opened and the hydrant body filled. Syrinix recommends, if possible, to crack one of the other hydrant ports prior to

opening the hydrant to allow as much air as possible to escape. Once only water is leaving the cracked port it can be tightened and sealed. See Annex X for further information on fitting the unit.

If the PIPEMINDER-H leaks or drips, then the procedure must be reversed, and the connection attempted again. A new seal may help and/or taping the hydrant threads with PTFE tape.

Note that the height difference between the PIPEMINDER-H and the pipeline being monitored will result in a pressure offset (10m height difference = 1 bar, 14.5psi).

6.5 At the Deployment Site

1. The intended fire hydrant should be inspected to ensure it is not leaking and the unit is sound.
2. PIPEMINDER-H can be activated on the hydrant or before mounting on the hydrant. A better GPS fix of the hydrant is formed if it is activated on the hydrant.
3. Plug the activator unit (see Section 10, Annex1 for activation details) into the port on the back of the PIPEMINDER-H – note that this connector is keyed. Once connected the red lamp to the far right on the activator battery indicator section will illuminate. This tells you that the plug has been correctly inserted, and the activator is powered. There should be no other LED lamps illuminated at this point – if there are, press the RED off button.
    - At this point it is good practise to perform a battery level test. Press the orange button on the end of the activator and, whilst holding it, observe the level indicator lamps. If the lamps illuminate to: -
        - Blue – the battery is fully charged and has come off charge recently
        - Green – the battery is fully charged, and deployment should go ahead
        - Yellow – the battery is partially discharged - deployment can go ahead but a return visit for battery recharge will be needed sooner.
        - Orange – the battery is depleted and should be charged.
        - Red – the battery is fully depleted and must be charged.
    - Release the orange switch.
4. To continue deployment,
    - Press and release the green switch – this applies power to the internal electronics of the PIPEMINDER-H and success is indicated by the red LED lamp near the green switch coming on.
    - At this point the status indicator lamp may also illuminate – probably yellow. Ignore this until it starts flashing.
    - The status lamp will give two short flashes close together and followed by a longer pause before repeating:
        - First flash is the status of the GPS receiver; Yellow = obtaining fix; Green = successful; Red = Failed.
        - Second flash is the cellular radio connection to Syrinix RADAR. Yellow = attempting to connect; Green = successful; Red = Failed.
    - It could take up to 20 minutes to obtain two greens. The PIPEMINDER-H should not be left deployed unless two greens are seen. If the unit repeatedly gives a red failed indication, then Syrinix technical help should be contacted.
    - Once two greens are obtained, disconnect the activator unit. DO NOT press the red off switch!
    - Protect the connector port with the plastic cover.
    - Log on to RADAR and confirm the unit is functioning.

6.6 Signal Strength

The signal strength reported during start-up comes straight from the 4G modem within PIPEMINDER-H. It is necessary to access the unit's dashboard page on RADAR and look at the Signal panel. If the unit is reporting low signal then improved performance and longer battery life could be obtained by moving the device, perhaps to the next hydrant along the main.

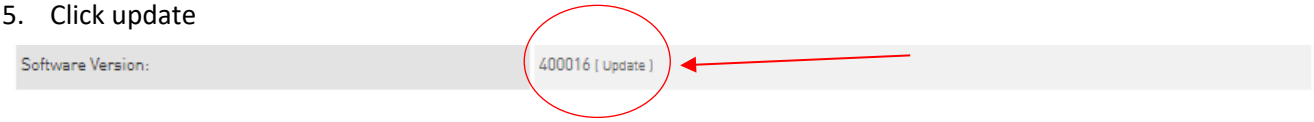
6.7 USB Data Removal and Upload

Only a Syrinix technician or a Syrinix trained technician can take data from a PIPEMINDER-H using a USB connection.

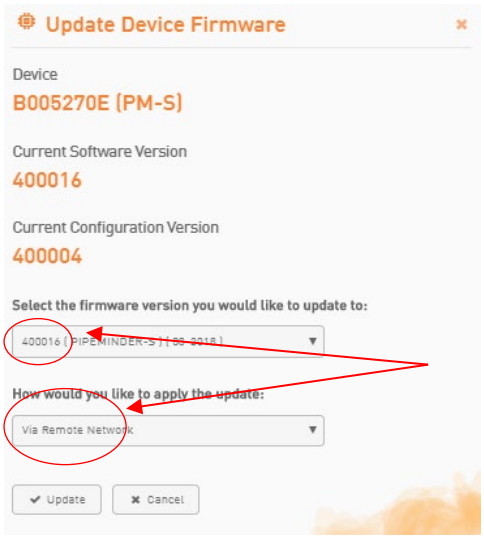
6.8 Remote Software Update

When cellular signal is available PIPEMINDER-H has the capability to remotely update system software via cellular network.

1. Open https://radar.syrinix.com
2. Select device to update.
3. Click on the manage tab.
4. Under edit PIPEMINDER settings check the current software version.
5. Click update



6. Select firmware version and update via Remote Network from the dropdown box.



7. Click update.
8. A new device configuration file will be generated.
9. Set configuration file to required parameters.
10. Click save configuration.

Note:

- Remote software updates will take effect next time the device checks for configuration changes which it will do at the next data summary upload.
- Only one attempt will be made to update software, failed updates will cause device to remain on the existing firmware version.
- Updates can be confirmed by checking the configuration history for successful download of new configuration settings.

6.9 Manual Software Update

Only a Syrinix technician or a Syrinix trained technician can perform a manual USB firmware update on a PIPEMINDER-H. Refer to PIPEMINDER-H USB firmware update procedure, document 100XXXX.

6.10 Battery Life

Battery life is designed to meet 6 – 9 months based on an ambient temperature greater than 5°C, a combined signal quality score (CSQ) of 8 and standard operating use transmitting summary data and 2 transients per day (3-minute events).

The device can be configured to set the number of “event” and “daily log” retries should communication fail on the first attempt. This will shorten the life of the battery and is therefore the utilities decision of data availability versus battery performance. Please note that, setting a high level of resends, or requesting a very sensitive level of transient alert communications will impact battery life. The S3 sensitivity score should be configured by the utility once the unit has been installed for a few days and the background S3 score has been evaluated. Setting the S3 score too low may result in small transients being continuously detected and transmitted resulting in a significant reduction in battery life.

Battery performance will also be reduced in areas of poor signal strength, a CSQ score of below 8. Battery life will also be impacted if the device is subjected to low ambient temperatures for extended periods of time, 0°C< or lower.

7 RADAR

7.1 RADAR Address

The RADAR (RADAR) can be found at:

https://radar.syrinix.com

You will need the username and password issued to you by Syrinix.

7.2 Devices, Sites and Groups

RADAR has a hierarchical structure of devices, sites and groups.

A device is an individual PIPEMINDER-H.

A site is a fixed location containing a PIPEMINDER-H device. The intention is that sites remain static and that devices are registered to them for periods of time. Plotting is done by site so several devices installed, one after the other, may be used to generate a continuous stream of data for that site. Conversely, several sites may be visited by one PIPEMINDER-H; in this case the data would be split across sites.

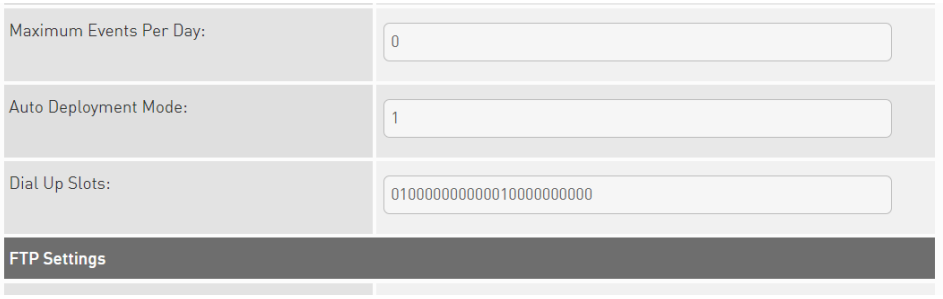
Each site should be a member of a group to make multiple site plotting faster and other analysis functions possible.

The “Manage” menu on RADAR can be used to manage devices, sites and groups.

7.3 Remote Device Configurations

Once the SIM card is correctly configured, all device configuration changes can be made via RADAR and downloaded to the PIPEMINDER-H over the cellular network. The PIPEMINDER-H will check daily at midnight for configuration changes or when it boots during deployment.

Parameters which may be edited on the “Manage Device” page are listed in Table 7: Configuration Parameters. It should also be noted that for the unit to deploy correctly on detection of a pressure rise (i.e. the hydrant being turned ‘on’) the auto deployment flag needs to be set in the configuration file:



Auto Deployment flag has been set (=1) for this unit.

Parameter	Function	Default	Impact on Battery Life	Flash / Modem Data Usage
S3 Sensitivity	Adjusts the visibility on RADAR of transient data from the 128 S/s data stored on the device.	130	Significant if > 7 events per week	
Modem Delay	Setting no longer used.	20		
Transient Detection	Turns the transient detection on / off.	On		
Get leap second	Force the GPS to stay on at startup to update the leap second information.	On		
Retrieve Software Update	To manage the deployment of updated embedded software.	Off	Minimal	
Measure Clock Drift	Re-fix the GPS and compare it against the internal clock.	Off	Minimal	
Deployment Marker Count	Number of 64 second blocks of 128S/s data to send after deployment	15	Minimal	
Daily Log Retries	Number of re-transmission attempts for 15-minute data	3	High	
Event Retries	Number of re-transmission attempts for 128S/s event data	3	High	
Reporting Hour	UTC hour to send summary data	8	Minimal unless regular retries due to congestion	
Resend Hour	UTC hour to retry failed comms	17	Minimal unless regular retries due to congestion	
Save Event Data	Save all transient events to the internal storage.	On	Minimal	Approximately 150 KB per event.
Send Event Data	Send all transient events to the RADAR.	On	Significant if > 15 events per week	Approximately 150 KB per event.
Save Daily Summary Data	Save all 15-minute data to the internal storage.	On	Minimal	2KB per day.
Send Daily Summary Data	Send all 15-minute data to the RADAR.	On	Minimal unless lots of retries due to poor signal	2KB per day.
Save High Sample Data	Save all high sample rate data to the internal 30-day loop	Off	Minimal	21 MB per day.
Send High Sample Data	Send all high sample rate data to the RADAR waking up every 768 seconds	Off	Very High	21 MB per day.
Burst Pressure Change	Burst detection configuration parameter	0.5	Significant if > 15 events per week	
Minimum Pressure Drop	Burst detection configuration parameter	1	Significant if > 15 events per week	
Gain	Flow meter gain, default gives pulses / second	0.00152592		
Offset	Flow meter offset.	0		

Burst Flow Change	Burst detection configuration parameter	0.2	Significant if > 15 events per week
Flow Mode	See Table 1: Flow Meter Modes.	0	Significant if > 15 events per week
SMS Transient Alerts	Send an SMS when a pressure transient is detected.	On	Minimal
SMS Burst Alerts	Send an SMS alert when a burst is detected.	On	Minimal
CSQ SMS Messages	Send 20 SMS messages at 2-minute intervals after deployment reporting signal strength		Minimal
Mobile Number	Used for SMS transient alerts and signal strength reporting at deployment.		
APN Address	APN for data communications on cellular network.		
Username	Username for APN.		
Password	Password for APN.		

Table 7: Configuration Parameters

7.4 Transient Sensitivity Adjustment

When initially manufactured, the devices are configured with an S3 Sensitivity of 130. This setting is deliberately conservative to avoid the situation where the devices continually detect transient events on active pipes.

Once PIPEMINDER-H has been installed for a few days the background S3 score may be evaluated using the "S3 Value" plot in the graph on RADAR. In most cases a clear background S3 value can be identified with occasional event spikes; the S3 sensitivity should be set midway between these two.

The resulting number of transient events identified per day can vary significantly between pipelines but the situation where transients are continuously detected should be avoided.

When relocating a device, it is important to re-set the S3 Sensitivity back to 130 until the background knowledge at the new location is developed.

7.5 Flow Metering

Metering of flow can be achieved with additional hardware, please consult your Syrinix Account Manager for this requirement.

7.6 Plotting Data

The “Graph” menu on RADAR brings up the standard plotting window.

To generate a plot, select from the sidebar:

1. the “Data Channels” to be plotted;
2. the “Timescale” to be plotted (date ranges can be entered);
3. the “Group” to be plotted.

Providing data is available, a plot will appear.

Zooming: Clicking and dragging in the plot area will zoom into the data (very small selections are ignored). A zoom history is available in the top right allowing previous “zooms” to be retrieved.

Data Markers: Hovering on the data and clicking on the data will place a marker. A summary of markers is shown on the right.

Data Tags: Once two markers have been placed the “Tag Selection” box appears in the pane on the right. Tagged events are highlighted by a small bar along the bottom edge of the plotting window.

Plotting suggestions:

- Plot the S3 Value for a long period to look for significant events.
- Plot the “Min Pressure”, “Max Pressure” and “High Sample Pressure” for a period where high sample data is available.
- Plot the “High Sample Pressure” for an event captured by multiple devices.

Note:

- The URL for a plot can be copy / pasted as a link to the plot (x1 zoom version).
- Links can be opened in a new tab (ctrl + click) allowing the graph and map to be open at the same time.

7.7 Data Download

High sample rate data and the 15-minute mean / minimum / maximum / S3 data can all be downloaded from the RADAR as CSV files. The instructions on the Download menu should be followed.

The time and date information in the CSV files is in a Unix epoch format which is the number of seconds since midnight January 1, 1970. There is more information on this format here:

http://spreadsheetpage.com/index.php/tip/converting_unix_timestamps

The CSV files can be loaded into excel and the epoch time converted into an excel format. From the above link, and assuming that the epoch time is in cell A2:

1. In a different cell, perhaps F2, enter the following formula:

   =(((A2/60)/60)/24)+DATE(1970,1,1)

2. Change the format of cell F2 to a date:
   a. Right click on cell F2;
   b. Select “Format Cells…”;
   c. Select the “Number” tab;
      Select you preferred time / date format either from Date, Time or Custom;
   d. If choosing Custom, entering “dd/mm/yyyy hh:mm:ss.000” in the type results in a format which includes decimal seconds.
3. Drag the formula down the sheet.

8 Event Source Identification

8.1 PIPEMINDER-H Deployment

When using two or more PIPEMINDER-H devices to infer the source of an event it is important to ensure that their clocks are closely synchronised. The first step in achieving this is to deploy them all on the same day following the procedure in section 6.5. The devices should be deployed between 1km and 5km apart bridging the suspected transient source.

The device contains Network Timing Protocol (NTP) software, therefore if the devices cellular signal is poor it will prohibit the effectiveness of NTP please follow chapter 9 below.

8.2 Source Identification

If PIPEMINDER-H devices have been deployed to hydraulically surround the suspected event source (making it “in bracket”) then the following analysis may be applied.

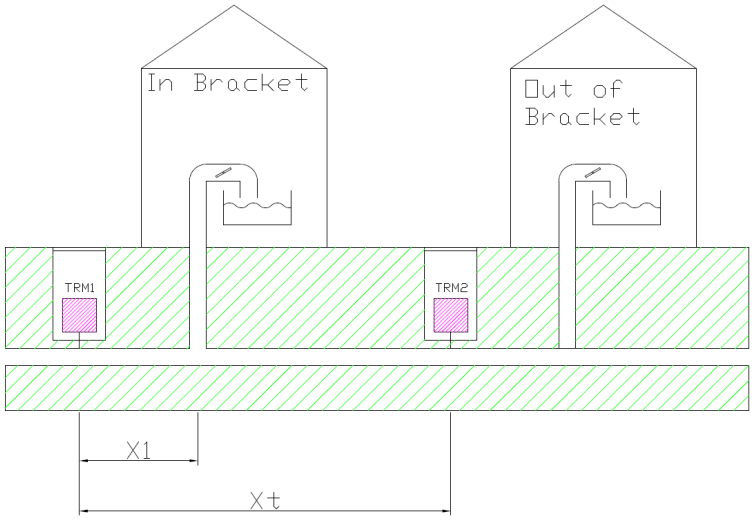


Figure 2: Example Deployment

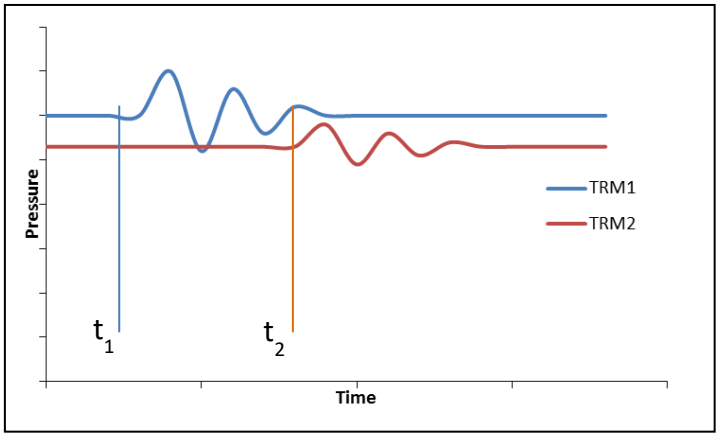


Figure 3: Captured Transient Events

$$x_1 = \frac{(t_1 - t_2)C + x_t}{2}$$

Equation 1: Transient Source Identification

Where:

X_t = Total distance between a pair of PIPEMINDER-H devices (m)
X_1 = Position of transient source (m)
C = Pressure wave velocity (m/s)
$(t_1 - t_2)$ = Time difference between two transient edges (s), see Figure 3

Pressure wave velocity is dependant primarily upon pipe diameter and material. Correct determination of the pressure wave velocity in the pipe is very important and can be achieved in two ways. The first is to use "out of bracket" events, which pass both PIPEMINDER-H devices, to estimate the wave speed. The second is to use a look up table. Table 2 shows how wave velocities vary with both pipe material and diameter (the reason for the range in each case).

Pipe Material	Pressure Wave Velocity
Steel	910 to 1390 m/s
Cast Iron	1050 to 1280 m/s
Asbestos Cement	900 to 1080 m/s
MDPE	340 to 380 m/s

Table 1: Example Wave Speeds

There are many technical papers, presentations and discussions on source identification and the user is encouraged to contact Syrinix directly for further guidance.

9 Common Problems

9.1 GPS Failure

- If a green indicator for the GPS is not achieved (the indicator shows red) the most likely issue is the location of the hydrant. The only solution is to select a hydrant in a more GPS-friendly location. Selecting an alternative port on the hydrant, if one is available, may also be successful because it rotates the unit to point in a different direction. If there is a large metal object (a car, perhaps) close to the hydrant and blocking the PIPEMINDER-H's view towards the sky, this could also be the reason for the failure. Trying again after removing the obstruction could be successful.

10 Annex 1 – Activation

The PM-H unit is shipped to you with batteries partially charged but otherwise ready to be deployed.

The first action, therefore, is to fully charge the battery – see section (13.1).

PipeMinder-H can only be activated and deployed with a PM-H Activation Unit, a number of which will have been supplied to you by your Syrinix sales contact. Usually a working ratio of 1 activator to 20 PM-H units gives good flexibility without unduly adding to costs.

The Activator appears as Figure 4.

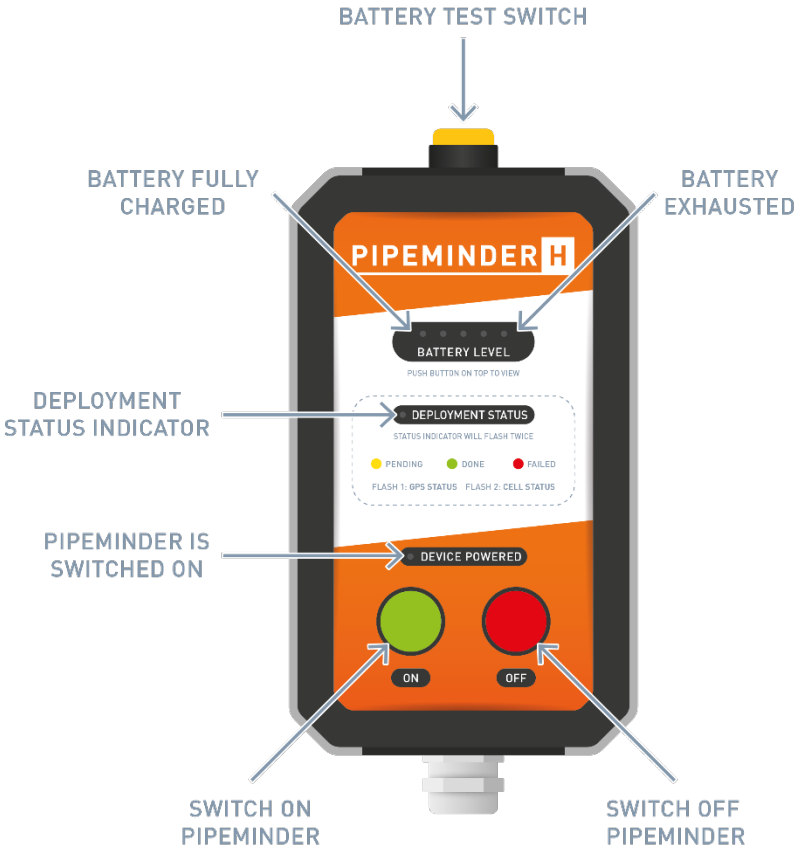


Figure 4.

10.1 Activation Steps

Please use the following procedure to activate a PM-H unit.

10.2 Location

The PM-H unit must be able to access a cellular network and a GPS signal for initial activation. If the unit is being activated whilst attached to a fire hydrant then this usually gives very good result.

If the unit is being activated at the depot or in a service vehicle as part of a multi-unit deployment, then it may be necessary to move outdoors, or perhaps in the shelter of a large doorway to successfully access the GPS signal.

The PM-H can be placed face down on a non-metallic surface (like a workbench) such as shown in Figure YY with good results but if this fails, an upright location out of doors may be necessary. Support the PM-H on a wood block to avoid breaking the Activation Unit's electrical connector.

10.3 Connection

Remove the black plastic cover from the electrical port on the back of the PM-H unit. You may need a broad flat screwdriver or a small coin to do this. *Do not lose the cover!*

Connect the cable from the Activation unit as shown in Figure 5

Figure 5

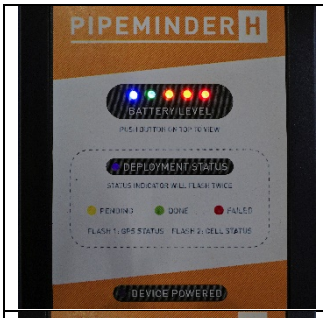
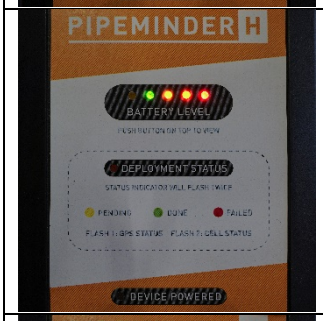
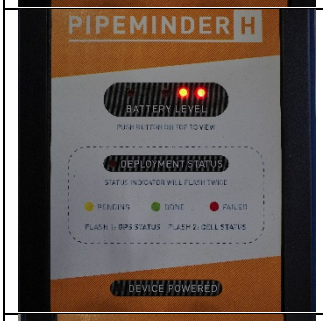
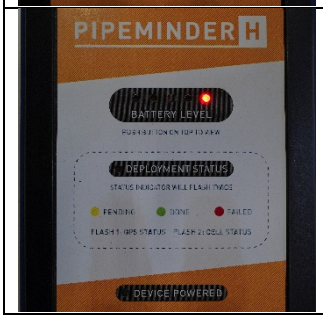
It is important to note the LED indicators on the Activation unit:

Battery level	Only the (right) RED lamp is showing. In this situation, where the orange battery test button has *not* been pressed, this lamp is acting as an indicator to inform you that connection to the PM-H has been made and power is available.
Deployment Status	OFF
Device Powered	OFF

If the Deployment Status lamp and/or the Device Powered lamp is illuminated then the PM-H is already running – in this case, press the RED button on the Activation Unit to power it down. Now, only the red lamp on the right of the battery indicator array should be illuminated. If not, please contact Syrinix support.

10.4 Perform a battery level test

Press the ORANGE battery test switch on the top of the Activation Unit, holding it down to observe the reading.

	All the LED lamps are illuminated, including the blue lamp far left. This unit's battery has a complete charge and most likely only came off charging recently. The unit is ready to Activate.
	The LED lamps are illuminated to the green indicator. This unit's battery has a full charge and is ready to Activate.
	The LED lamps are illuminated to the yellow indicator. This unit's battery has approximately a half-charge. It can be Activated in this condition, but the deployed battery life will proportionately less than a full charge. We recommend changing before deployment.
	The LED lamps are illuminated to the orange indicator. This unit's battery is depleted and is nearing full discharge. The unit should not be deployed in this state. We strongly recommend charging before deployment.
	Only the red LED lamp is illuminated (apparently nothing changes when the orange switch is pressed). The battery is exhausted. This unit must be not be deployed until the battery is fully recharged.

Assuming the battery test produces a “green” or a “blue”, move on to activation.

10.5 Activate the unit

Press the green ON button on the Activation Unit.

The LED indicators will show:

Battery level	The (right) RED lamp is showing confirming connection to the PM-H and that power is available.
Deployment Status	Either OFF or SOLID YELLOW
Device Powered	ON

On pressing the ON button, the Device Powered indicator, coloured RED, should immediately illuminate. If this does not happen, and the battery test was good, then (1) Press the red OFF button and (2) contact Syrinix support.

Depending on the PM-H internal state, the Deployment Status lamp may illuminate at this point, or it may remain off. Figure 6 shows the expected status lamps.

Figure 6

10.6 Achieving GPS lock and Cellular connection.

The Deployment Status lamp, after a short delay, will start to flash. There are two short flashes followed by a longer delay, like this:

FLASH = FALSH ======== FLASH = FLASH ======== FLASH = FLASH == etc

The first flash is the status of the GPS receiver.

The second flash is the status of the cellular connection.

Initially both flashes will be yellow (pending), turning green (success) or red (failure) after a few minutes. Note that for a new PM-H on first deployment, GPS lock could take 20 minutes due to the need to acquire the leap-seconds information from the satellites. You are looking for two green flashes. If you obtain a red flash, try

moving the unit to a better position for radio reception and trying again. If you have no success, call Syrinix support.

1st GPS	2nd 4G	Status
		GPS pending: Cellular pending
		GPS pending: Cellular success
		GPS pending: Cellular failed (no connection possible)
		GPS success (locked): Cellular pending
		GPS failed (no lock possible): Cellular pending
		GPS failed (no lock possible): Cellular failed (no connection)
		GPS success: Cellular success

Once the PM-H has achieved "two greens" (or reds) it will continue to report this, via the Activation Unit, for about 15 minutes before reverting to a solid yellow.

10.7 Completing deployment

Once "two greens" are achieved, the Activation Unit cable should be removed from the PM-H and the black plastic cover replaced. It just needs to be nipped up, not over-tightened and broken. Failure to replace the cover will compromise the IP rating of the unit and invalidate the warranty.

TAKE CARE NOT TO PRESS THE RED BUTTON ON THE ACTIVATOR when removing it – this will turn off the PM-H. If you accidently do this, start the deployment sequence from the beginning.

If the PM-H has been deployed whilst attached to the hydrant it is now functioning and can be left. The anti-tamper cover should be fitted if required.

If the PM-H is being activated at the depot, then it can now be packed for travelling to the deployment site. At site it only needs fitting to the hydrant in the normal way, the hydrant charged, and the anti-tamper cover fitted, if required. The PM-H will automatically detect the rise in pressure when the hydrant is charged and complete the deployment sequence on its own. As you have deployed the PM-H in a different location to where you initially went through the activation sequence, there is a possibility that the unit may fail to connect to a cellular network. You can check that it has done by:

a. Noting the time at which you charged the hydrant
b. Accessing the PM-H unit on RADAR and checking the import logs
c. If you see files being successfully uploaded just after the time you noted in (a) then the unit is working correctly.

10.8 De-activating a PM-H

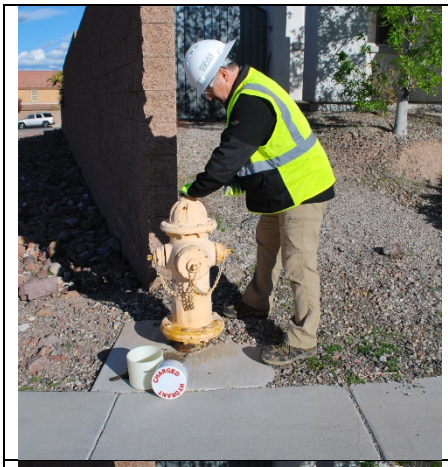
You can de-activate a unit either on the hydrant before removal or after it has been removed from the hydrant. See section 11.2 for removal.

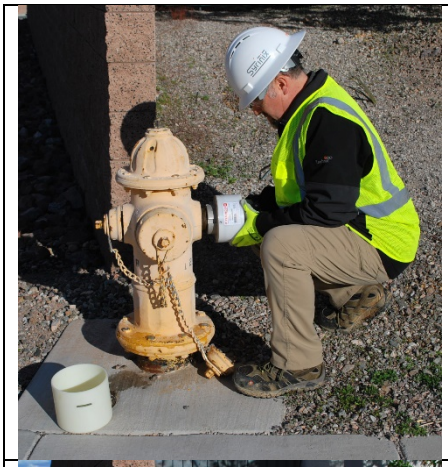
1. Remove the black cover from the electrical port and attach the Activation Unit. You will note the LED lamps as shown in 10.5, Figure VVV
2. Press the red OFF button – the unit will deactivate, and the DEVICE POWERED LED will turn off.

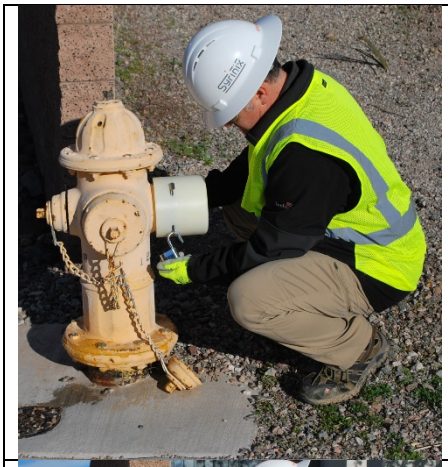
3. Remove the Activation unit and replace the black cover.

11 Annex 2 – Fitting the PM-H on a hydrant

11.1 Fitting

	STEP 1: Ensure the hydrant is turned OFF.
	STEP 2: Remove the cap.
	STEP 3: Secure the cap

		STEP 4: Fit the PipeMinder-H unit. Ensure the pressure cavity and fitting thread on the PM-H are clean and that the seal is in place. Hand tighten the unit. NOTE: For sanitary reasons, Syrinix recommends that the internal pressure cavity of the PM-H is sprayed with a chlorine wash immediately before fitting. Your local work practise requirements may also include chlorine washing the hydrant internals as well
		STEP 5: Tighten the PM-H using the appropriate tool and the slots on the PM-H base.
		STEP 6: Charge the hydrant. Observe the PM-H and check there are no leaks or drips. If there are, start the deployment again, perhaps cleaning the hydrant fitting or possibly adding some thread seal.
		STEP 7: Fit the anti-tamper cover.

		STEP 8: Secure with the locking-bars and padlock.
		STEP 9: Fitting complete.

11.2 Removal

Removal of a PM-H from a hydrant is essentially the reverse of fitting to the hydrant (See section 11.1).

	1. Turn the hydrant off.
	2. Unlock the padlock and remove the locking bars
	3. Remove the anti-tamper cover
	4. Using an appropriate tool, remove the PM-H. If the hydrant still contains main pressure, it will be tight for the first part-turn, due to the internal stored pressure. Note that some water will flow out as you remove the PM-H.

	5. Place the PM-H on the ground or in its shipping container. 6. Replace the hydrant port cap, checking it is clean first.

12 Annex 3 – Emergency Services Removal of PM-H

EMERGENCY SERVICES ONLY

	1. Ensure the Hydrant is turned off
	**2. <u>Cut the padlock</u>**
	3. Remove the locking bars
	4. Remove the anti-tamper cover

		5.Using a hydrant tool spin off the PM-H, engaging the tool in the lock ring of the PM-H.
		5. Set PM-H aside and continue

WHILST SYRINIX HAS MADE EVERY EFFORT TO ENSURE THIS UNIT IS EASY TO DEPLOY AND REMOVE, INCLUDING IN AN EMERGENCY, THE END USER MUST EXPRESSLY ENSURE THE DEPLOYMENT OF AND METHOD OF REMOVING THIS EQUIPMENT IS ACCEPTABLE TO LOCAL FIRE FIGHTING AUTHORITIES. IF ANY QUERIES OR ISSUES ARISE PLEASE CONTACT SYRINIX FOR FURTHER ASSISTANCE.

13 Battery charging

The following procedure must be used for charging a PM-H unit.

Use the charger supplied by Syrinix, part number 101590, to charge a PIPEMINDER-H. Use of any other unit may compromise the safety of the unit and invalidate the warranty. You will have been supplied with a mains power cord appropriate for your country. If you cannot locate this, or think you have an incorrect cord, please contact Syrinix customer support and we will send you a new power cord.

It is strongly recommended that the PM-H unit be turned “off” whilst charging. This can be checked by attaching the Activation unit (see section 10) and pressing the RED button. If the unit’s internal batteries are very depleted it may not be possible to turn the unit “off” or you may be unsure of its on/off status. In this case:

1. Put the unit on charge (see below)
2. Allow 1 hour of charging
3. Remove the charger, attach the Activation unit and press the RED button
4. Re-start the charge cycle from the beginning (section 12.1).

13.1 Charging

Place the PM-H in a dry location on a clean bench and placed top-down such that the pressure cavity is pointing upwards. Ensure that there is no foreign object that might drop into the pressure cavity.

The charger should be placed in a well-ventilated area adjacent to the PM-H about to be charged and connected to a source of mains electrical power. The mains connection must be equipped with an isolating switch so that the charger unit can be disconnected from the mains in case of a fault and for correct control of the charge cycle.

Procedure:

1. Ensure that the charger is turned off at the mains.
2. Remove the black plastic cover from the port on the back of the PM-H
3. Attach the charger cable to the port
4. Turn the charger on – observe that the indicator on the charger is RED.
5. A full charge takes about four hours, but the charger can be left charging the unit for as long as necessary, there will be no damage to the PM-H unit. The indicator on the charger will turn GREEN on full charge.
6. Turn off the charger once full charge has been achieved.
7. Remove the cable from the PM-H
8. Replace the black plastic protective cover on the port. Note that the warranty on the unit is affected if the cover is not replaced.

The unit is now ready for deployment.