Syrinix

A Badger Meter® Brand

A Proposal for

CITY OF APPLETON

for the supply of

PipeMinder-One Internal Monitoring Solution

Technology Overview

Thank you for your interest in this Syrinix solution. As you will see, Syrinix's focus is on providing high resolution insights to allow users to optimize their activities, with advanced customizable data filtering functionality also incorporated.

Pressure surges, or transients, in pipelines are a contributing factor for network strain and resulting failures. By identifying the source of these transients, Syrinix promotes 'calming of the network' to reduce leaks and breaks and reduce any operational inefficiencies. Syrinix PIPEMINDER ONE devices are deployed in optimal areas of the system to conduct high-resolution pressure monitoring to locate transient sources.

The devices measure pressure at 128 samples per second (constantly) and summarize this into a 1-minute timeseries dataset containing minimum, mean and maximum pressures. This allows transients to be captured and also provides useful insights into overall pressure trends in the system.

Transmission of high sample rate (128 sample/second) transient data is triggered by a significant pressure change, measured by the Syrinix Severity Score (S3). Calculated every minute, the S3 score is a measure of pressure transient activity calculated within the device itself. Large changes which happen quickly result in a high score, and small changes over a longer period result in a lower score. Continuously stable pressure results in a score of zero. S3 is a broad measure of transient severity and is related to the energy of the transient event and potential damage to the pipe.

Designed to be installed on supply pipelines of all diameters for permanent or temporary monitoring, this innovative solution provides network operators with the tools they need to minimize risk, save time, reduce operational costs and dramatically improve the resilience and life of assets. PIPEMINDER ONE provides:

Automated alerts including location	Immediate notification of a burst including* its location and size estimate to reduce response times and save money.
High resolution pressure data for network calming	Always-on 128 samples per second with precision timing auto-maintained without GPS identifying a broad range of damaging pressure events and their causes.*
Easy Total / Static Head analysis	Review events on a standardized basis without distortions from total head differences.
Sophisticated "zone"/ "threshold" alerting	Configurable for individual data feeds including immediate alerts to notify users when an upper/ lower threshold (e.g. pressure, water quality) is breached.
Automated status alerts and remote upgrading	View, manage and update units easily and remotely.
7-day diurnal reporting	Compare pressures against a rolling 7-day average with automated alerts for deviations e.g. due to leakage.

* With GIS integration

With data and alerts displayed via the RADAR user platform, PIPEMINDER ONE units can also be connected to:

- water quality sensors;
- flow meters; and
- other third party data sources.

With its extensive data export/import functionality, PIPEMINDER ONE units can also be linked to SCADA platforms to show corresponding pump/valve event displays via RADAR and/or to provide notifications to SCADA.

PIPEMINDER ONE has been designed for flexibility and longevity, with rechargeable batteries and alternative battery options available, antenna options and over the air remote firmware upgrades to ensure that, once deployed, units can remain in-situ.

RADAR

Paired with RADAR, Syrinix's secure cloud-based platform, PIPEMINDER ONE reporting has been designed to focus on key information while avoiding data-overload for users by transmitting:

- immediate notifications of potentially damaging events, with high resolution data immediately uploaded for user viewing from the period before, during and after the event;
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- up to 96x daily uploads of the maximum, minimum and mean pressures and maximum S3 score (for each 1-minute or 15-minute period as required) all calculated from the pressure continuously recorded at 128 samples/second.

The RADAR system also allows for the full interactive management of devices including remote configuration, location tracking via Google Maps, multi-unit visualization, status alerts and updates, and advanced data analysis.

Powerful highly intuitive "RADAR" user interface	See what you want and need in detail without lengthy training and roll-out programs.
Third party data import and display	Easily import third-party data into RADAR for a "single screen view" including water quality, pressure, flow and SCADA pump / valve status changes
Configurable automated filtering and alerts	Avoid data-overload and focus easily on what you need to with customizable alerts to highlight when important changes occur.
Secure cloud-based platform	See what you need to see from wherever you need to see it, auto-scaled for your device.
Customer API and simple data integration / export tools	Easily integrate your network data with simple to use tools and APIs for importing and exporting data sets and alarms.
Advanced GIS and Google Maps integration	Including street and satellite views and GIS overlay options to see your network as it actually is.

Technical

General

Functions	• Real time pressure transient monitoring • Burst event data (in conjunction with Flow meter) • Analytic functions when used with Syrinix RADAR
Interface (Via RADAR)	• Web based tools including viewing live/historic data and device configuration • Remote managed alerts (SMS, Email) • SCADA integration with API (optional, chargeable) • FTP push (optional, chargeable)
SIM Card	• Integral eSIM • Mini-SIM back up available
Cellular	• 4G Cat1 LTE Worldwide • 3G/2G Fallback
Sample rates	• Pressure 128S/s • Up to 96x daily summary reporting of minimum, maximum and mean pressures, and maximum S3 score, over 1 minute or 15 minute periods
Pressure Transducer Type	Internal
Pressure Range	0-300 psi absolute range, ±0.25% accuracy
Pressure accuracy	0.25%
Temperature Range	-4°F to +140°F (see frost protection below)
Connection	• 21KA male connection with ¼" NPT adapter (see frost protection below). • Adaptors can be provided on request. • NB use single hose only, not multiple, to reduce attenuation.

Control Unit

Enclosure	Housing: Acetal
Dimensions	105mm x 40mm / 4.1in x 1.6in
Weight	0.4kg / 0.8lbs
Environmental rating	IP68
Antenna (varying lengths available)	• External 4G with SMA connection (various options available) • Internal GPS

12.8V 22.2AHr Rechargeable Battery (Optional)

Type	Rechargeable Lithium Iron Phosphate
Voltage / Capacity	12.8V 22.2AHr
Enclosure	Enclosure: ABS
Environmental Rating	IP68
Dimensions	206mm x x89mm x 115mm / 8.1in x 3.5in x 4.5in
Weight	3kg / 6.6lbs

Batteries

Please note that battery life between charges / replacement is dependent on the ambient temperature, cellular signal quality and standard operating use. PIPEMINDER ONE can be configured to undertake a number of “event” and “daily log” retries should communication fail on the first attempt. Please note that these will reduce the battery life between charges as will setting a high level of resends or requesting a very sensitive level for event communications.

The S3 sensitivity score should be configured once the PIPEMINDER ONE has been installed for a few days. Setting the S3 too low may result in transients being continuously detected each day, with high sample data reported, which can significantly reduce battery life between charges.

Battery performance will also be reduced in areas of poor signal strength, a CSQ score of below 8, or if the unit is left powered on with a damaged or disconnected antenna as the device will by default use more power to achieve successful communication. Battery life between charges will also be impacted if the device is subjected to more extreme environmental temperatures for extended periods of time, such as < 32°F or > 104°F.

In case of any doubt as to the impact of specific actions on battery life please contact Syrinix for further information.

Data

Data is collected and stored under the following conditions:

- High sample rate pressure data (128 S/s): collected continuously and transmitted by exception. The pressure and (if applicable) flow data uploaded to RADAR is stored for a period of 3 years unless otherwise agreed. Data is locally stored on device for 30 days.

- 15 minute and 1 minute summary data: collected continuously and transmitted up to 96 times a day.The pressure and (if applicable) flow data uploaded to RADAR is stored for a period of 3 years unless otherwise agreed.

Please note that Syrinix reserves the right to delete data if there is a failure to maintain RADAR subscriptions. Current practice, which may be subject to change, allows 15 months before data deletion is enforced.

Installation

Please always refer to the technical guidance on installation for detailed information and instructions on siting, installing, commissioning and operating PIPEMINDER ONE units.

Avoid installing the device in a location where the water against the pressure sensor may freeze as an expansion of freezing water will damage the pressure sensor (and void warranty cover). Where a risk exists of the water column freezing, including where installation is undertaken by Syrinix, it is the responsibility of the user to review the need for additional insultation / disconnection. Where a freezing risk exists please consider use of the PIPEMINDER ONE with an external digital sensor.

It is recommended to use a cellular signal tester to survey potential site locations prior to deployment. See the cellular signal guide for help troubleshooting signal issues.

PIPEMINDER ONE requires a GPS lock upon initial deployment for geo-positioning and to set the device internal clock. For applications that require continuous high accuracy time synchronization PIPEMINDER ONE firmware contains a Network Time Protocol that maintains the time drift to within 50 milliseconds (continuous cellular signal required).

Please read all safety measures and instructions listed in the product manual.

Use only electrical attachments and accessories supplied by Syrinix.

Do not place devices, accessories, or batteries on or near a heat source.

Apply care handling devices and batteries and if dropped or damaged please contact Syrinix.

Warranty and Exclusions

Each unit, software and service is provided in conjunction with the applicable standard Terms and Conditions (referenced above which are to be read in conjunction with this section.

All Syrinix units are to be installed in accordance with the technical installation documentation and other guidance separately provided. An electronic copy of applicable operating and installation documentation will be made available via the Syrinix RADAR platform.

Please note that this proposal does not include the provision of any of the following by Syrinix unless expressly agreed otherwise in writing:

- site access and preparation including any connection, valves and tappings required for the connection of each unit;
- field work including unit preparation, connection, testing and operation unless agreed otherwise in writing;
- local duties and taxes;
- all applicable/required permits, licenses and analogous fees;
- civil, structural, architectural and design work of any kind;
- interconnections, pipes, valves and fittings which are not part of the supplied equipment;
- all testing and system verifications other than to Syrinix standards;
- painting or special finishes; and
- all items not specifically listed.

Battery life is exempt from the product warranty but if used in areas of good signal and in accordance with our standard operating instructions will deliver the battery life between charges as indicated.

Any warranty claims must be made by contacting Syrinix to obtain a return authorization and then returning the unit back to Syrinix for inspection and testing. It is the client's responsibility to cover the costs of the return carriage. Syrinix reserves the right to charge for costs incurred where any fault is a result of a breach by the user.

Please note that this warranty does not cover:

- any excluded matter detailed above, communications interruptions due to third party intervention and/or failure including but not limited to communications network provider, unauthorized access and/or tampering or other form of interference, whether related to hardware, communications and/or software;
- failures interruptions and damage resulting directly or indirectly from Acts of God, war, terrorism, civil, disobedience, theft, extreme weather, floods, storms, lightning, tornado, hurricane, fire, combustion, explosion, landslip, volcano and earthquake, extreme temperature, external electrical irregularity including surge and failure, acoustic interference,
- damage from water borne materials, corrosion from unanticipated liquids and materials and external electromagnetic interference and all and any external events analogous to any of the above;
- theft, vandalism, or other damaging acts whether intentional or accidental;
- battery failure beyond that level of warranty provided by the manufacturer (please see above)

- installation, commissioning, use and/or removal (temporary or permanent), tampering, and unapproved opening;
- intentional or accidental abuse, interference, misuse or neglect of the hardware
- failures resulting from the negligence to perform preventative maintenance
- damages or defects in the product which are caused by initial start-up, repairs or attempted repairs performed by anyone other than a Syrinix authorized service provider or appropriately qualified individual in strict accordance with Syrinix's installation guidance;
- unavailability of GPS or communications networks;
- customer in default of any payment obligations to Syrinix;
- abuse by abnormal system conditions including but not limited to temperature, chemical or debris;
- goods that have been improperly stored by owner or its representative prior to installation and start-up;
- equipment/programming which has been revised or altered by others.

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