

This document is presenting a solution for
Online remote Pipe Line GAS Pressure
Monitoring

Smart Pressure Monitoring (SPM System)

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DIGITEC SYSTEM:

INTRODUCTION

The company was registered as DIGITEC SYSTEMS in 1992 with sole proprietorship with a view to concentrate more on HIGHTECH PRODUCTS, SYSTEM & SOLUTIONS . From the beginning DIGITEC endeavors and strives for high-end technological implement and its uses throughout the country. We successfully fulfill the genuine needs of the Industry's standard test, measuring & calibration equipment & latest technological tools. Basically, DIGITEC is providing a wide range of Office automation, Data communication, Network Services, Security systems to Govt. Semi Government, financial & research organizations, private and corporate sectors as well.

The head office of the company is located at Karachi with representative in Islamabad & Lahore, which covers the Punjab and N.W.F.P area. The company has well equipped maintenance shop both in Karachi and up-country to provide after sales service and support facilities. The company is registered supplier to all government, semi-government public corporation and private industries.

DIGITEC GROUPS:

Associated firms and sister concern of DIGITEC Group are as under:

DIGITEC SYSTEMS

178 Sector 24, Korangi Industrial area Karachi

DIGITEC SYSTEMS Sales/Marketing

29E Kyaban-e-jami.DHA Phase II Ext.

OUR PROFILE AND CATALOG:

PROFILE LINK:

<http://digitecsystems.com/brochure/profile.pdf>

CATALOG LINK:

<http://digitecsystems.com/brochure/catalog.pdf>

Need:

Pakistan is fortunate of having a very Large Gas Reserves. Gas being the cheapest form of Energy is meeting the bulk of the country energy requirement and all major industries are dependent on it. GAS distribution is based on a huge PIPE line Network that is distributed all over the country. In order to keep these PIPE line working there are some major technologies that come into Place Like a SCADA network that is meant to monitor the Flow Meter along the Line Also there is a Cathodic Protection System that make sure that the PIPEs are not corroded over a period of Time. Another important issue is to maintain PIPE line pressure to the required levels as The Network is very interconnected there are chance that due to excessive demand the Line pressure drop and the user are unable to receive the required quantity of GAS .Maintain the required level of Pressure is imperative for the utility of the GAS supply and the SPM system will play a key role in this regard as it will be able to provide the following important Data that will enable the Network Engineer to Plan the future up gradation and Run the system to provide the specified Quality of Service to the users.

- 1) Identify the area effected by LOW/High Pressure.
- 2) Find the Time of Day when the pressure irregularities occur
- 3) Identify The Piping Network that are Underutilized or Over Loaded.



SPM System Description :

Ever since its inception Digitec has worked to provide low cost innovation to meet the customer requirements. With the same spirit we have developed the SPM Solution for SSGC so that it can monitor the operations of the Pipe Network more efficiently and provide reliable service to the customers. Digitec has been providing GSM based solutions for more than 10 years and has already developed a GSM based Tracking system with its own Web Server, Online Energy Monitoring System for KElectric, Online Generator Fuel and Temperature Monitoring units. Using this experience Digitec has developed the SPM Solution for SSGC.

The SPM System is housed in a Water Proof, Rugged Metallic casing so it can be installed on any Pipe Line without requiring any additional casing or BOX. The Unit is self-contained with a two-line 8 Char Alpha Numeric Display. The Display is normally OFF and Pressure Level reading can be viewed by pressing a switch

The Micro Controller in the SPM is in Sleep mode with current

consumption of only 6uA. The Software System design is event based. There are three types of events that are present.

1) Tamper Pulse: When the casing is opened it will cause a tamper interrupt to wake up the controller so that it can send a signal to the server that it has been tampered.

2) LCD Wake : The LCD display is in off state. If it is required to activate the display a push switch has to be pressed on the display. The controller will wake up as a result of the switch update the LCD and start a LCD off timer. When the timer expires the microcontroller will wake up again and turn off the LCD.

3) House keep: This is a regular timer that will wake up the controller to perform different tasks like recording the pressure values, update the daily hourly reading, upload the daily reading of pressure. Check if the pressure levels have exceeded any of the high low threshold levels set. Record the time of the alert. The alert can be set to either immediate alert in this case it will send an SMS to the preset number and upload the server. The default setting is that alerts are uploaded along with the pressure registers once /day. So for installations that are critical they can be set to immediate alert (IA Mode). The only negative aspect is that the battery time would be less for such units.

The entire design philosophy of the system is to consider the battery a precious resource and use it most efficiently.

LCD Display :

The unit has an 8 char x 2 line LCD that is activated when the push switch is pressed. The display ON time is programmable and the default is 8 Sec. It can be set to a range from 3 to 12 Sec through start up commands

21.12 PSI
3 5.9 19

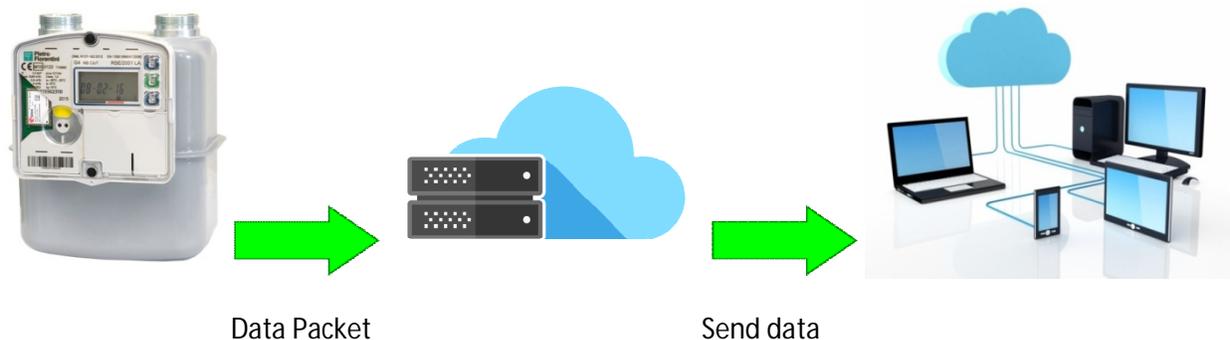
The First line Show the current Pipe Pressure Level . In the Second line The first Number is the GSM signal Level of the Last transmission it can be from 1-9 in this case it is 3, It will Show "E" if there is error because of SIM not active or that last transmission did not Succeed. The Second parameter is the Battery Level which is show as 5.9 Voltage the Battery is 6.8 at the start and can operate till 4.2V. The Next Parameter is the Average Gas pressure (Based on Last 10 reading) which is Shown as 19PS I if it is less the 10 it will show to one fraction place like 4.1

SVC Server Communication Description :

Gas Meter with Hardware

Socket Server

Control Station



Socket Server:

Normally, server sockets may accept multiple client connections. A server socket listens on a known PORT number . When an incoming connection arrives at the assigned port number it will serve the message. The socket server listen request from client ,The Sever can be local or on the cloud.

Monitoring System:

For monitoring gas Pressure reading uses Server Machine having an Static IP , The Communication between the SPM unit and the server is through TCP/IP socket at a predefined Port number. The SPM pressure reading are sent over GPRS link to the Socket server. The Stored Data can be viewed in various formats. like hourly, day wise, monthly wise, yearly wise and specific area, distinct and city wise on search, and also can see its reports on different formats like PDF format, Microsoft Excel format and hard copy can also printed. Big advantage is that, its database is Microsoft SQL Server, it is strong and powerful database for store data, Data of Microsoft SQL Server has always normalized form, it makes proper data for manipulating when its occurs in this software and user authentication and authorization, it is also feature of this software, on the main screen alerts are shows on datagridview when event wise occurs, application control panel is also available in this software which user can be set easily.

Report for specific Unit ID , date wise .

The screenshot shows the 'MeterReading' application window with the following sections:

- Customer Type:**
 - All Customer Status
 - Specific Customer Status
 - District Wise
 - Area Wise
 - Customer ID:
 - District:
 - Area:
- DateTime Wise:**
 - Date Wise
 - 24 Hours
 - Specific Hours
 - Month Wise
 - Year Wise
 - From: To:
 - From: To:
 - From: To:

Additional filters and a 'View' button:

- Reading Type:**
 - Gas Reading
 - Pressure Reading
 - Both
- Gas Flow Type:**
 - Normal Gas Flow
 - Over Gas Flow
- Gas Reading Range:**
 - All Gas Reading Range
 - Specific Gas Reading Range
 - Range From:
 - Range To:
- Pressure Reading Range:**
 - All Gas Reading Range
 - Specific Gas Reading Range
 - Range From:
 - Range To:

A 'View' button is located in the center-right area of the form.

Reading	Pressure	Month	Time
10443	1.63	12/25/2017 12:00:00 AM	00:02:08
10379	2.82	12/25/2017 12:00:00 AM	01:02:10
10245	1.82	12/25/2017 12:00:00 AM	03:02:06
11257	1.28	12/25/2017 12:00:00 AM	04:02:02
10325	2.17	12/25/2017 12:00:00 AM	05:02:49
10525	1.52	12/25/2017 12:00:00 AM	06:02:16
10324	1.48	12/25/2017 12:00:00 AM	07:02:55
12011	2.27	12/25/2017 12:00:00 AM	08:02:27
12125	1.59	12/25/2017 12:00:00 AM	09:02:40
13257	3.27	12/25/2017 12:00:00 AM	10:02:42
11242	2.52	12/25/2017 12:00:00 AM	11:02:12



Report for district wise, included with related Unit ID according to specific time duration from 7am to 3 pm.

The screenshot shows the MeterReading application interface with the following sections:

- Customer Type:**
 - All Customer Status
 - Specific Customer Status
 - District Wise
 - Area Wise
- DateTime Wise:**
 - Date Wise
 - 24 Hours
 - Specific Hours
 - Month Wise
 - Year Wise
- Reading:**
 - Gas Reading
 - Pressure Reading
 - Both
- Gas Flow Type:**
 - Normal Gas Flow
 - Over Gas Flow
- Gas Reading Range:**
 - All Gas Reading Range
 - Specific Gas Reading Range
- Pressure Reading Range:**
 - All Gas Reading Range
 - Specific Gas Reading Range

Additional fields include Customer ID, District (dropdown), Area (dropdown), and From/To date and time pickers. A 'View' button is located at the bottom right of the filter section.

District Name	CustomerID	Reading	Pressure	Date	Time
Korangi	1225450000	10375	0.25	12/25/2017 12:00:00 AM	00:02:06
Korangi	1354789500	10444	0.34	12/25/2017 12:00:00 AM	01:02:12
Korangi	1024141400	10542	0.54	12/25/2017 12:00:00 AM	02:02:03
Korangi	1320514000	12422	0.36	12/25/2017 12:00:00 AM	03:02:11
Korangi	1032515500	20144	0.43	12/25/2017 12:00:00 AM	04:02:09
Korangi	1201221121	30215	0.67	12/25/2017 12:00:00 AM	05:02:02
Korangi	1420502220	20212	0.52	12/25/2017 12:00:00 AM	06:02:16
Korangi	1254242114	10244	0.85	12/25/2017 12:00:00 AM	07:02:09
Korangi	1202115000	10324	0.92	12/25/2017 12:00:00 AM	08:02:02
Korangi	2012115400	15414	0.69	12/25/2017 12:00:00 AM	09:02:14

Report for district wise according to month January 2017 to December 2017 with specific time duration and its shows pressure reading which are over gas flow.

Customer Type

All Customer Status Specific Customer Status
 District Wise Area Wise

Customer ID :

District :

Area :

DateTime Wise

Date Wise 24 Hours Specific Hours
 From : From :
 To : To :

Month Wise Year Wise
 From : From :
 To : To :

Reading Type

Gas Reading
 Pressure Reading
 Both

Gas Flow Type

Normal Gas Flow
 Over Gas Flow

Gas Reading Range

All Gas Reading Range
 Specific Gas Reading Range
 Range From :
 Range To :

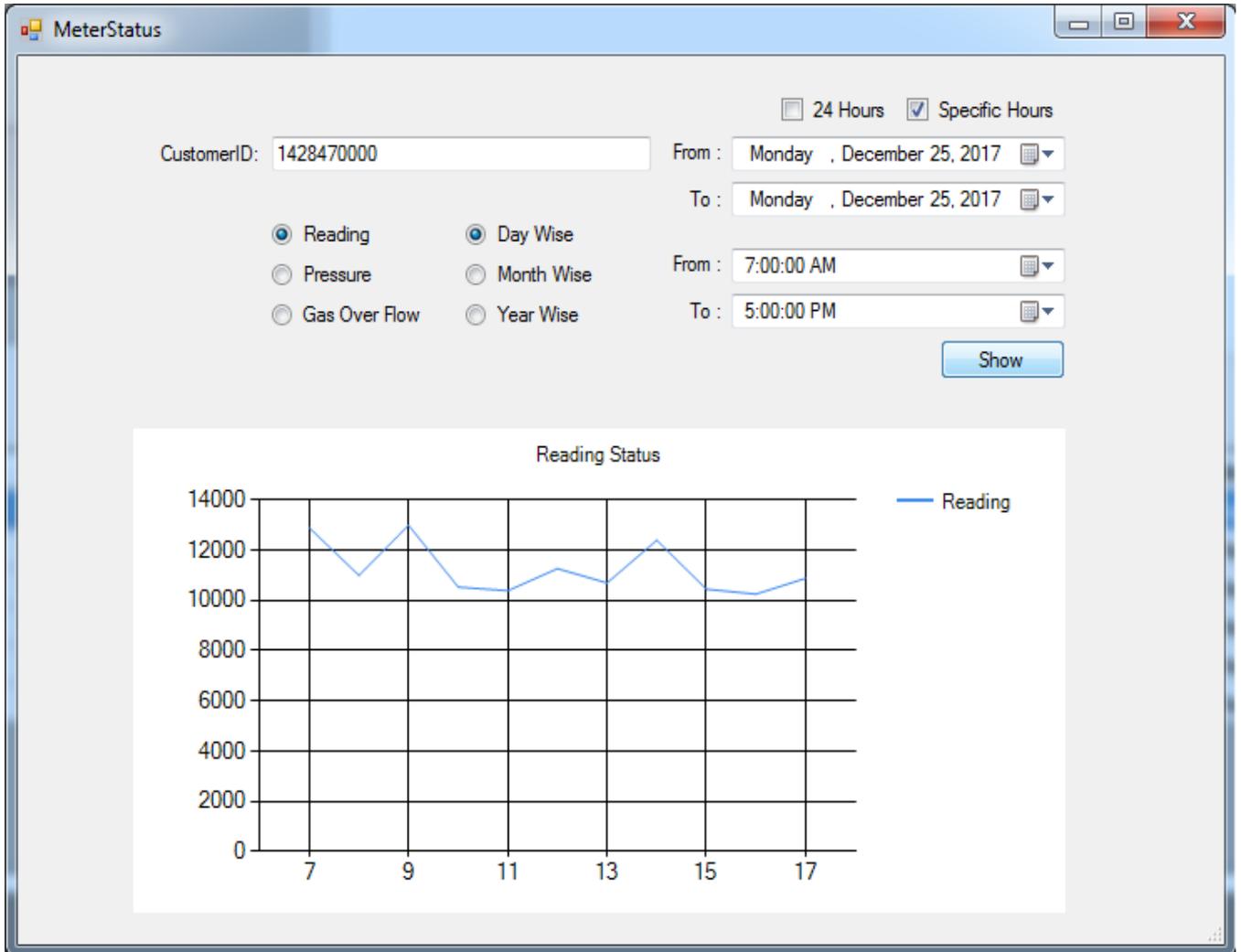
Pressure Reading Range

All Gas Reading Range
 Specific Gas Reading Range
 Range From :
 Range To :

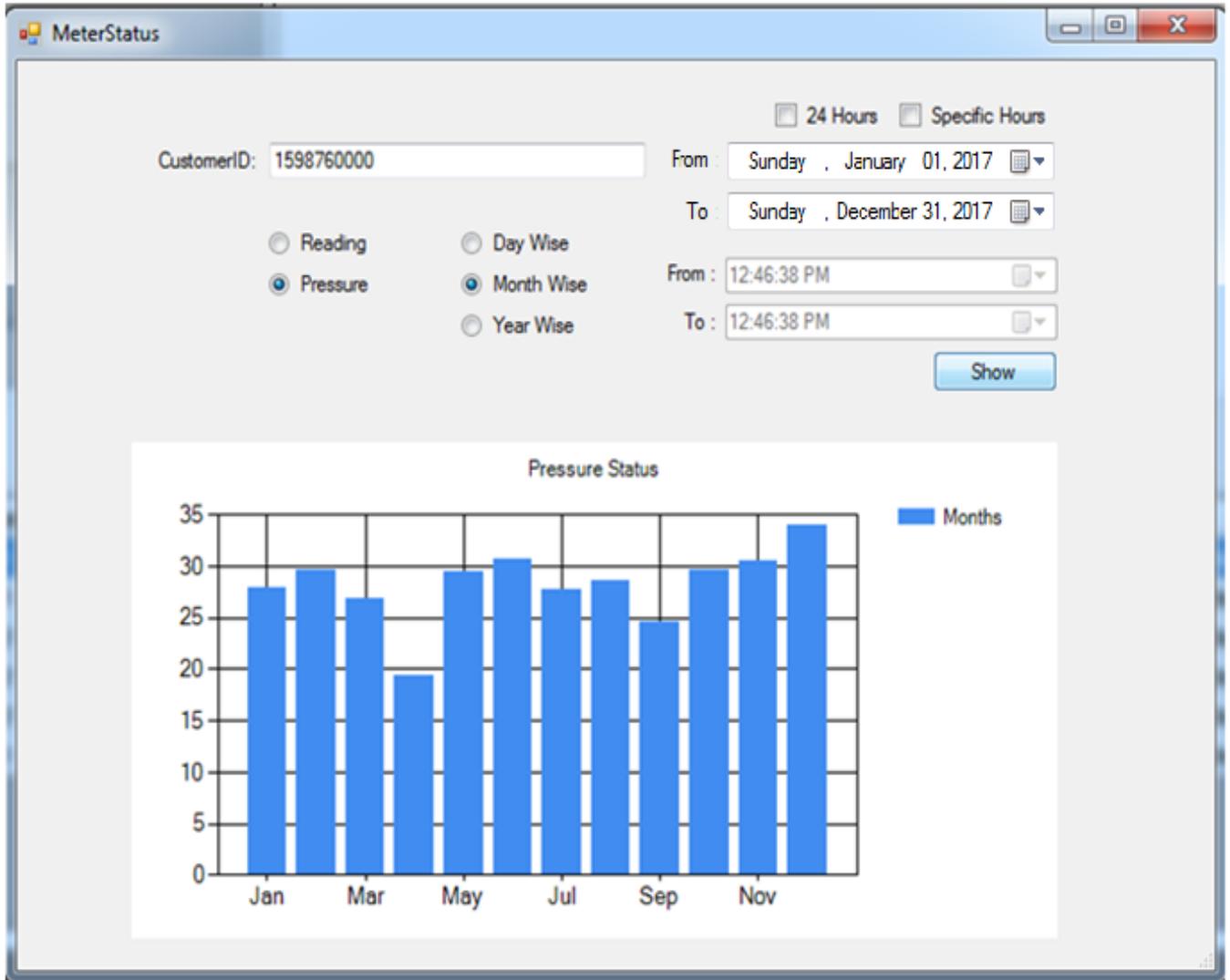
District Name	CustomerID	Pressure	Month	Time
Malir	1023256400	1.63	01/04/2017 12:00:00 AM	07:01:08
Malir	1123654020	2.82	01/20/2017 12:00:00 AM	07:01:10
Malir	1212521000	1.82	01/25/2017 12:00:00 AM	07:01:48
Malir	1320214560	1.28	02/15/2017 12:00:00 AM	07:02:02
Malir	1454213021	2.17	02/27/2017 12:00:00 AM	07:02:49
Malir	1254652310	1.52	02/28/2017 12:00:00 AM	07:03:16
Malir	1232154000	1.48	03/13/2017 12:00:00 AM	07:03:55
Malir	1123542300	2.27	03/16/2017 12:00:00 AM	07:04:27
Malir	1013212450	1.59	04/02/2017 12:00:00 AM	07:04:40
Malir	1324563210	3.27	04/25/2017 12:00:00 AM	07:05:42

Graph

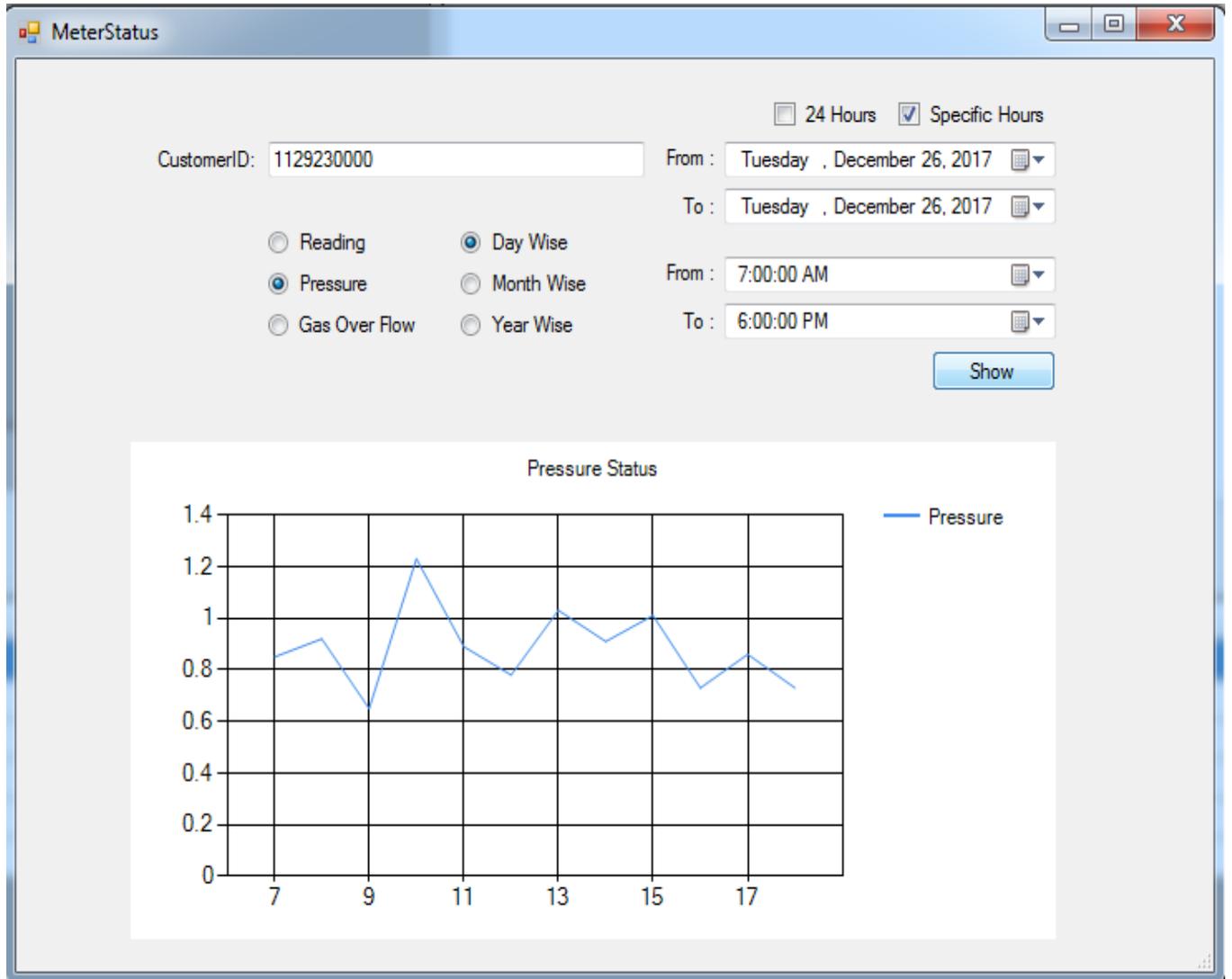
Its shows graph of day wise reading with specific hours from customer ID.



Its shows graph of month wise pressure from January 2017 to December 2017 from customer ID.



Its shows graph of day wise pressure with specific hours from customer ID.



Peak Detection Report(as a output)

CustomerID	ReadingPeak	Month	TimeFrom	TimeTo
112427000	16	12/04/2017	08:08:10	08:42:23
112427000	21	12/05/2017	09:07:14	10:13:07
112427000	17	12/08/2017	20:18:17	21:24:11
112427000	19	12/09/2017	08:15:32	09:17:26
112427000	13	12/10/2017	18:54:15	19:24:02

SPM module Tampering

Meter Serial	Time Stamp	Alarm Label
26086244	05/21/2017 12:45:54 AM	on
27458956	04/12/2017 04:10:04 AM	on
24566298	08/14/2017 02:07:05 AM	on
14697592	08/13/2017 11:15:40 PM	on
24616846	10/21/2017 01:24:06 AM	on

SPM Operation Description :

The SPM does not have any command or user interface apart for the LCD Switch. The entire working is server based and it is also controlled through the Server. The communication ID for the Server is the IMEI number of the GSM module which is fixed and can not be changed in any way .So the Unit ID can not be alerted. The Assignment of the IMEI to the User Number is done at the server End. The Server command can alter the following Setting of the Meter

1)Upload Rate

The Upload rate is the time after which the Meter upload its memory counter to the Server (Having a Static IP) using GPRS connectivity . The SPM keep hourly Pressure registers which is uploaded once Daily. There is also an SMS mode in which it will report through SMS at a presentable interval or When the threshold has Exceeded. On the basis of (one packet/Day) Daily reporting the expected Battery Live is 6 years and above. If the Upload rate is reduced then batter duration will also be less (Detail in Battery Section).The Bulk of the power consumed is when the Packets are uploaded.

2)Threshold Settings:

Different Threshold levels Like Min/Max Pressure Level can be set through Server.It is import to note that the Settings will only take effect when the SPM unit access the server. So if Daily report Time is changed it will take effect after the next reporting time .

SPM Power Up Settings :

There are some parameters that have to be set at the time of Power When Battery is connected for the first Time. The Unit will remain awake for 5 Min so that the necessary task can be performed. During this time the important parameters listed below are set through SMS commands.

- 1) Server IP: The Static IP to which the SPM will report.
- 2) Server Port : The Server Port number on Which it will report.
- 3) APN : Access Point Number Each Network has its own APN.
- 4) SMS Command Number ,Some responses can be received by SMS on any particular Number. For testing purpose. The following are the List of SMS Commands that the Unit will serve.

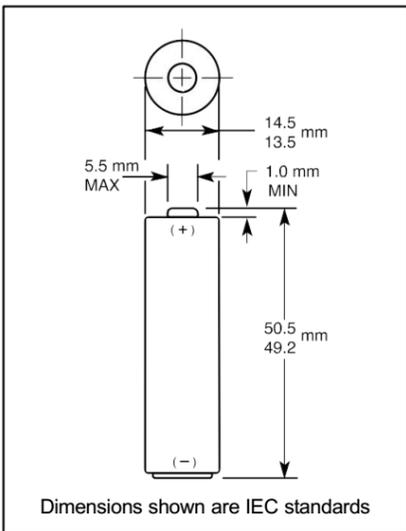
Command	Code	Explanation	Response
Set Alert	#A <Hi> <Lo> <Typ>	Set Alert and define how the system will respond to it Hi : High Level Threshold e.g 25.2 Lo : Low Threshold e.g 10. <Typ> 0 normal Send the alert state to Server 1: Send to Sever immediately 2:Send SMS and Send to Server :Activate Relay add 10 to any of the type to Pulse the Alarm Relay for 30 Sec	
Generate SMS	#G <number> <Msg>	Generate SMS. This command will cause the device to send a SMS to the given number and send the message to that number. e.g.#G 03112233445 Test Message. The device sends SMS to number03112233445 containing text "Test Message". This command can be used to Test the GSM or activate the SMS package etc.	The given number will receive the response.
Get Tower Location	#I	The Device will send a link to the Nearest Mobile tower .	www.goftrack.com/lbs2.aspx?p="); //21036@59918@410@22@Google
Change Password	#P <password>	Changes the device Password e.g. #P 1234ABC will set the device password as 1234ABC. The default is 12345. It is recommended that the User number be set first with the default password before changing the password so that the device can be set by the user if password is misplaced.	Command Served
Get Status	#S	Get The Current Device Status .The Device will respond with the following information User1 Number If programmed Internal Battery Voltage (IBat) GSM ok 22 (22 is Power Level max 33) Meter Value Pressure Value	U1 0300876543 U2 0312456789 IBat=4.2v GSM Ok 22 PW 123abc 00123789 0.32

		Pressure High Threshold Pressure Low Threshold Flow Rate Max Password 123abc	0.44 0.25 1.5
Set Users	#U <usr1><usr2><usr3>	Set Mobile number of the user of the device. Usr1 is the first usr2 and usr3 are the other two user numbers Only One space should be given between each number Usr1 will receive all alerts and location messages. Following examples will explain the settings 1)#U 03001122334 03003344553 03001122345 //set user1 user2 and user3 numbers 2)#U 03001122334 03003344552 //set only user1 and user2 . 3)#U 030012345678 //will set only user1, user2 and user3 are not set 4)#U 03001122334 11 //delete usr2 5)#U 03001122334 11 11 //delete both user2 and user3	Command Served
GPRS Setting	@44 < APN >< ID>< PW>	GPRS setting command APN is the operator provided Access Point Name .ID is the user ID to be used to connect with the network .PW is the password provided by the Network provider e.g @44 internet Telenor Telenor @44 net2.APN.com If no user name or Password is required then leave the field as empty	"Command Served"
Device ID	@02 <My Name>	The device Name can be assign .It can be any 10 digit Alpha numeric value without space. This ID is used when the device is to viewed online e.g @02 TestUnit1 It is important that the ID by the same name exist on the web server in order to view the track	"Command Served"

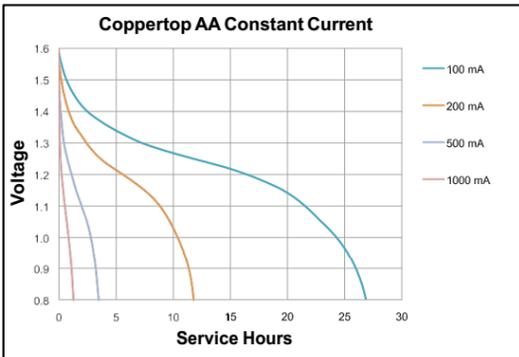
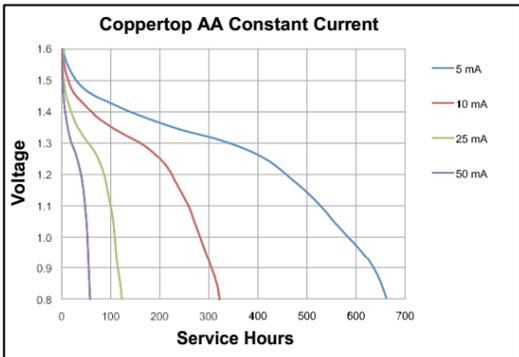


MN1500
Size: AA (LR6)
 Alkaline-Manganese Dioxide Battery

Zn/MnO₂



Nominal voltage	1.5 V
Impedance	120 m-ohm @ 1 kHz
Typical weight	24 g (0.8 oz)
Typical volume	8.4 cm ³ (0.5 in ³)
Terminals	Flat
Storage temperature range	5°C to 30°C (41°F to 86°F)
Operating temperature range	-20°C to 54°C (-4°F to 130°F)
Designation	ANSI: 15A IEC: LR6



Berkshire Corporate Park
 Bethel, CT. 06801 U.S.A.
 Telephone: Toll-free 1-800-544-5454
 www.duracell.com

Delivered capacity is dependent on the applied load, operating temperature and cut-off voltage. Please refer to the charts and discharge data shown for examples of the energy/service life that the battery will provide for various load conditions.

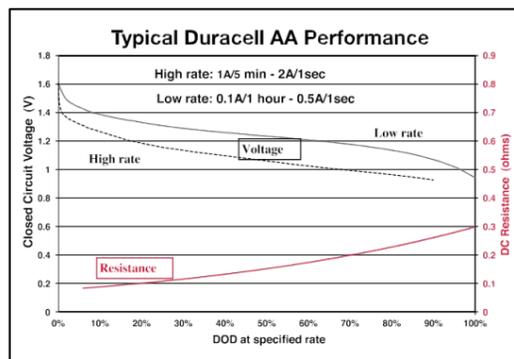
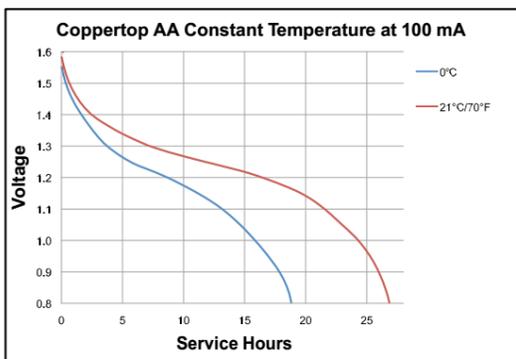
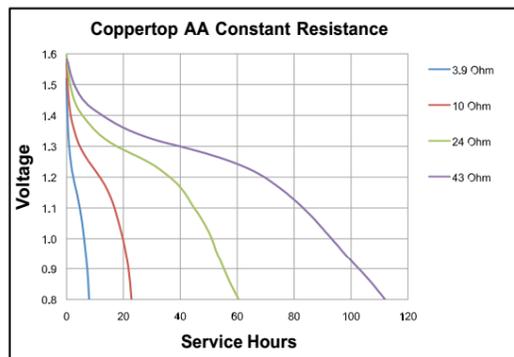
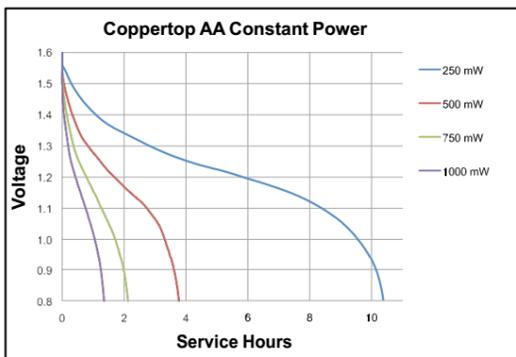
This data is subject to change. Performance information is typical. Contact Duracell for the latest information.

MN15CTUS0413



MN1500
Size: AA (LR6)
 Alkaline-Manganese Dioxide Battery

Zn/MnO₂



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MN15CTUS0413

Pressure Sensor:

The Pressure Sensor is MEMs based device with a very rugged construction

**Specifications:**

Working Voltage: 5VDC

Output Voltage: 0.5-4.5 VDC

Sensor material: Carbon steel alloy

Working Current: ≤ 10 mA

Working Pressure Range: 0-30psi

The Maximum Pressure: 2.4 MPa

Working TEMP. Range: 0-85 degrees

Storage Temperature Range: 0-100 degrees

Measuring Error: ± 1.5 %FSO

Temperature Range Error: ± 3.5 %FSO

Response Time: ≤ 2.0 ms

Cycle Life: 500,000 pcs

Application: non-corrosive gas liquid measurement

Features:

Easy removal, carbon steel connection more firmly.

Stainless steel is durable, sealed waterproof line

Wiring: red +, black -, yellow output

SPM Specification

Description	Value
Working Voltage	3.8v-8v DC
Battery	Alkaline Battery 1.5 x 4 2600mAH
Battery Life	10Years
Operating Current in Sleep	6uA
Operating Current LCD Active	20mA
Operating Current GSM Active	80-100mA
Operating Temperature	-5degC to 70 Deg C
Charging Time (Secondary battery used)	3-5hrs
Battery Duration	5 Year (One Pac/Day)

CONCLUSION

This SPM system if introduced will bring about a major change in term of Network Quality of service as the Entire system will be monitored for Pressure Variation and Critical Pipe Lines /Load area can be indentified and New network design on concrete data can be planned.