Lift Station Notification for Operations & Safety

Michael F. Zronek, Class III Operator WW3-1007286-83

Data-Command/SOS Integration

OTCO-S13493-X

Professional Experience

Currently working for Data-Command and SOS Integration in Akron Ohio for over 10 years providing support to Water/Wastewater entities.

Retired from the City of Solon Water Reclamation Department, Operations Manager, Safety Committee Chairman and Scada Manager for over 31 years.

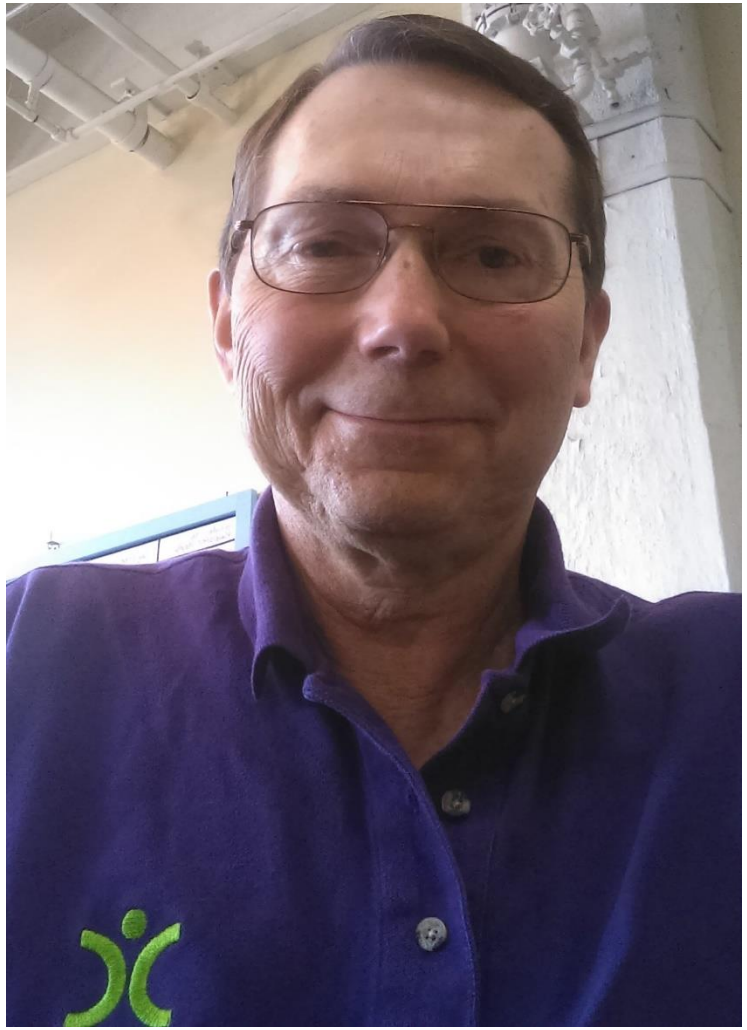
Teaching for Operator Training Committee of Ohio since 1990 for over 30 years, Basic, Intermediate and Advanced Wastewater courses.

Independent Contract Operator of Wastewater Class “C” plants for over 10 years.

Retired Part-time Firefighter/EMT for the City of Twinsburg for 19 years.

Retired from “United States Coast Guard Reserves” in 2002 of which most of my time was spent on the Great Lakes. When I joined in 1972 the Clean Water Act was enacted by Congress. I have seen the changes first hand.

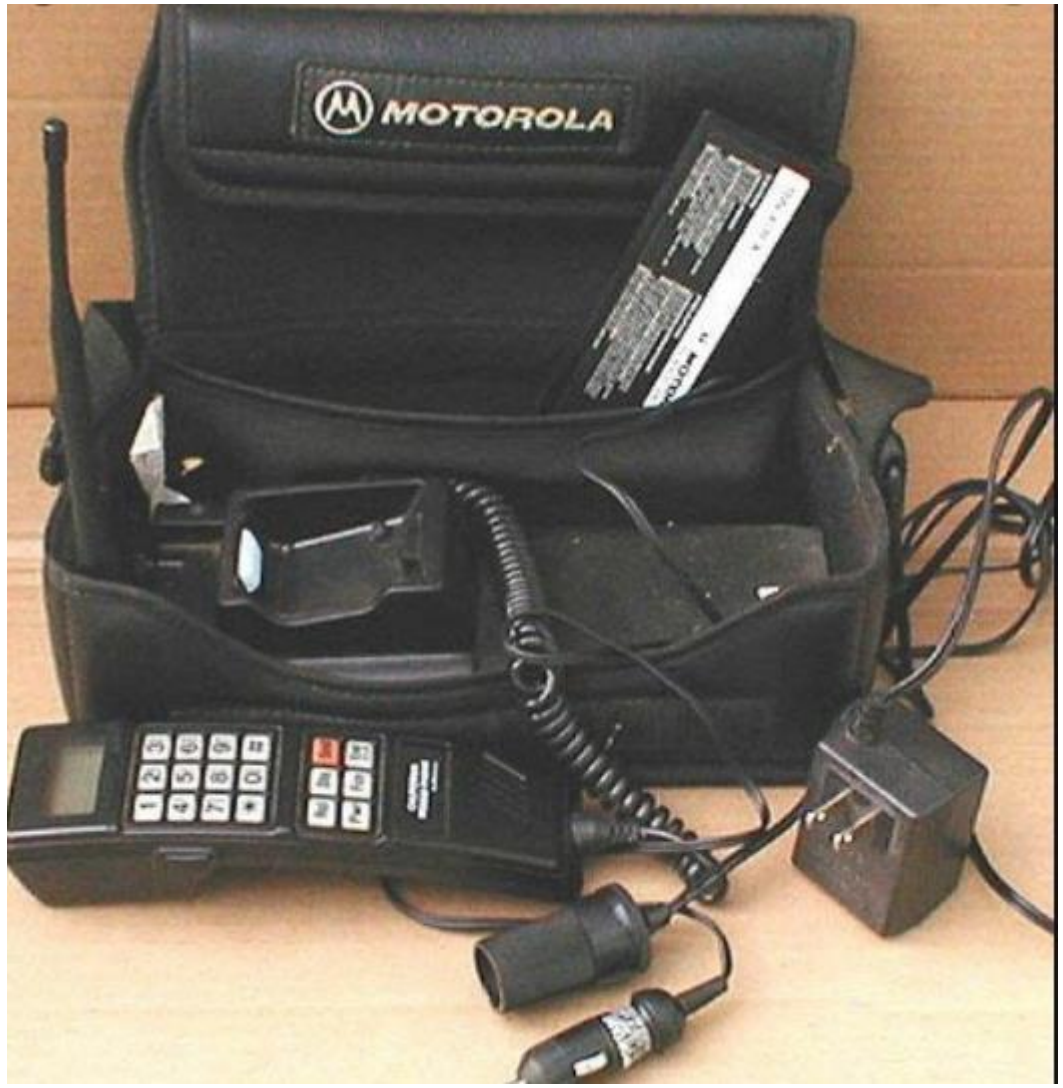
To say I’ve have some experience in many different job’s would be an understatement. Once thing for sure ***“Change happens and it is exciting and essential for growth”*** That is one thing you can count on “CHANGE”!



Remote Monitoring back in the day

If you are still using lease lines, dial up or maybe even your own radio system it may be time to think about your future. Remember "Change is exciting and essential for growth" Being proactive and plan your future. It can save you time and money.

SPECIFICATIONS		RS232	RS423	RS422	RS485
Mode of Operation		SINGLE -ENDED	SINGLE -ENDED	DIFFERENTIAL	DIFFERENTIAL
Total Number of Drivers and Receivers on One Line (One driver active at a time for RS485 networks)		1 DRIVER 1 RECVR	1 DRIVER 10 RECVR	1 DRIVER 10 RECVR	32 DRIVER 32 RECVR
Maximum Cable Length		50 FT.	4000 FT.	4000 FT.	4000 FT.
Maximum Data Rate (40ft. - 4000ft. for RS422/RS485)		20kb/s	100kb/s	10Mb/s-100Kb/s	10Mb/s-100Kb/s
Maximum Driver Output Voltage		+/-25V	+/-6V	-0.25V to +6V	-7V to +12V
Driver Output Signal Level (Loaded Min.)	Loaded	+/-5V to +/-15V	+/-3.6V	+/-2.0V	+/-1.5V
Driver Output Signal Level (Unloaded Max)	Unloaded	+/-25V	+/-6V	+/-6V	+/-6V
Driver Load Impedance (Ohms)		3k to 7k	>=450	100	54
Max. Driver Current in High Z State	Power On	N/A	N/A	N/A	+/-100uA
Max. Driver Current in High Z State	Power Off	+/-6mA @ +/-2v	+/-100uA	+/-100uA	+/-100uA
Slew Rate (Max.)		30V/uS	Adjustable	N/A	N/A
Receiver Input Voltage Range		+/-15V	+/-12V	-10V to +10V	-7V to +12V
Receiver Input Sensitivity		+/-3V	+/-200mV	+/-200mV	+/-200mV
Receiver Input Resistance (Ohms), (1 Standard Load for RS485)		3k to 7k	4k min.	4k min.	>=12k



Limitations of old technologies back in the day around 1979 Cell Phones were called Mobile Phones and they were big and not easily mobile. Would you still use this phone?

Communications has changed the way we operate each day

Basic communication

- Dial-up
- Leased Line (2-Wire & 4-Wire) & FSK Systems
- Licensed Radio (173, 450 & 952/928 MHz)
- Unlicensed Radio (Spread Spectrum)
- Wireless Ethernet
- Cellular (Newer technology)
- Cable, DSL, Fiber

Slow still around but not used much anymore.

Expensive and obsolete

Still used but very limited, point to point

Obsolete not used

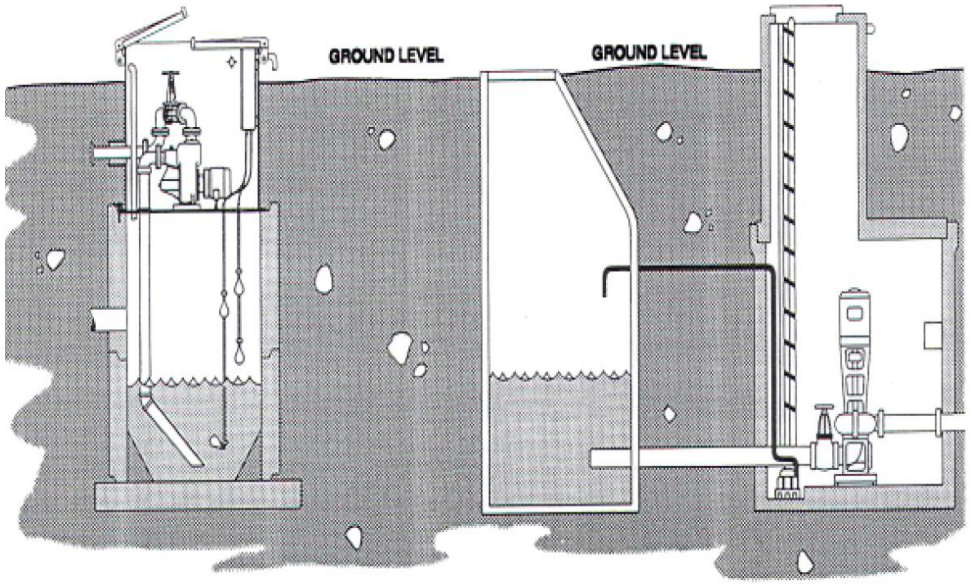
Hotspots, WIFI

Cellular Communications through private networks

Direct Comms through the Internet

Lift station Remote Monitoring & Safety

Lift stations are a key asset and sometimes overlooked in the Plant Process Monitoring. A lift station in theory should be your first priority your first line of defense. They come first in our sewer system. They protect our customers from flooding, environmental accidents due to overflows and protect us from lawsuits and claims. Lastly they protect us from writing those letters to the EPA about environmental accidents. In most cases we rarely think of them or they are an afterthought. We are always more concerned about our most "Costly Facility" the "Main Plant" where our employees spend most of their time and we tend to overlook our Remote Stations. In today's day and age of fast communication we need to have information as quickly as possible in real time to protect our most vital assets our "Employees, infrastructure and the environment" which should be our priority.



Wet Well Lift Station

Dry Well Lift Station

“Protection of the Environment”.

This is what we signed up for when we took the job at our local City, Village, County, Ohio EPA, US EPA or Private Company. “Protect” is the key work because it is all encompassing. We protect the environment, protect our infrastructure and protect our employees who manage our day to day Operations.

How well do you think you are doing in this area “Protection”?

Do you have an early warning system when it comes to your Remote Monitoring of the Lift Station? Is your building or site protected? Do you know what your wet well level is reading at a moment’s notice? Are your pumps being monitored for run times, pump failure, pump rotation or electrical current usage? Do you monitor the atmosphere in your building? If you answer no to any of these you are setting yourself up for costly failure at some point.

Our goal should be to prevent this……

You may think your system is protected but how do you really know?

You say you have regular Police presence and don't need door sensors and for you I say even if you had Police presence around the clock there will be times when they are not there and that is when someone or something will strike. My example is simple real case scenario happened at a local Lift station monitored by radio communication with a PLC on site. Communications went down one day around 4 pm. Seems this site was having radio problems from time to time due to conditions around the site. That time 4 pm is significant because most of the Plant personnel end their shift right around that time. The Operator reported the outage and the Supervisor who wanted to have someone check it out but that would cost a three hour call-in and overtime. It can wait until morning he thought. So the fact that the 3 hour call in of a Maintenance Person for $120.00 just cost you thousands of dollars does that make sense.

You say how or what?

Well a thief was watching and waiting for his opportunity. He knew the routine and he knew the area and he knew no one would notice him in his truck at the Remote Pump station around that time so he drove up, removed the lock on the gate and broke in to the station. You see most City vehicles are trucks and while many have a decal not all of them do. It was this thief that caused the Communication issue at this remote lift station. He removed everything of value and was in and out of the station all within 10 minutes. You may say well I don't not want my personnel confronting a "Thief" and I would agree with you on that but he or she could have called the Police or at least wrote down a License Plate number with a make or model of the vehicle. Or if you had Video monitoring with a motion detection you would have known before the Thief had even cut the lock off.

Criminals just blend into the surrounding area day or night. They have no color, they come in all sizes, shapes and gender. The only thing in common they wait for the right opportunity then they strike.

Now you see them now you don't…..

How much will this cost?

The PLC was the most expensive part of this theft. You can probably replace that that for around $2000.00 but then you need someone to program that, maybe an Electrician to wire everything back into the system because you know the thief took extra care when he/she removed the electronics out of your panel. If you're lucky you have the original program in which case you're one of only a handful that still have that or its so far out of date you will need a Integrator to write you a new one at a cost of about $100 dollars an hour for a simple program which could take around 10 to 15 hours to write. You can do the math and this does not even consider the communications cost associated with this problem. You say well we have insurance for these kinds of things but the cost of that just keeps going up and it's preventable.

It's safe to say many $$$$.$$

So my next question to you is <u>“Can you afford not to do some type of remote monitoring”?</u>

Your lift station know matter what type is a costly investment. It is vital to your daily operation. If it is not protected it can have a costly repercussion for you and your residents. It can affect downstream users and if your staff is not protected when they enter the Lift Station it can be devastating loss to their family and to your remaining staff. Round the clock monitoring is easier these days. You can still use your radios if you want but there are other options out there. Cell phone technology is cheaper and a great cost effective way to monitor your station. You may have a monthly fee but when you compare that to what you’re protecting is it really that much money. If you’re lucky perhaps you have internet access close by and can tap into this as an option again there may be a fee associated with the monthly monitoring but in a lot of situations City Governments have an agreement with local Internet providers.

You say well I'm doing my daily maintenance and we have a great preventative maintenance schedule so why would I need remote monitoring it won't fail and if it does I have a backup.

I would say I'm glad you have a Preventative Maintenance and if you do I applaud you. Not everyone does that. But while preventative maintenance helps keep your equipment operating at a high performance with the least amount of down time it does not always prevent accidents or equipment failure.

Preventive maintenance are you sure?

Let’s face it equipment fails eventually even the most expensive piece of machinery is made to last only so long. Due to our tight budgets are we ignoring the end date of each piece of our lift station equipment hoping for the best?

Newer equipment comes with sensors that can tell us if something is not right. VFD’s like Allen Bradley’s or Yaskawa Drives can keep you updated if something is not right. They have sensors associated with the drive that can give you a heads up when something is going wrong.

VFD equipment can also help us regulate flows on an hour by hour basis. Or better yet in a storm situation you can control flows at the source rather than handling all that storm flow at your main facility.

Analog and digital sensors can help us in so many ways too. Level sensors help us watch the well level and can assist us in running as efficiently as possible.

You say that’s just something else that can break or go wrong and I say well yes but if something does go wrong you will know about it right now before the equipment can fail. Thus saving you a lot of money on that pump. A sensor is much cheaper than a pump.

Flooding due to a storm flow

Invest in your future

Rebuild your old lift stations and plan for the future. The City of Solon had over 23 Lift Stations. You need to Plan and Budget when you have that many.

Include the latest technology for your employee safety and communication for your piece of mind. Not to mention you will sleep better at night knowing your protected and so is the environment.

Rebuilt Lift Station with new technology 5 years planning

So I've talked about Station security and Equipment but what about our Staff are we protecting them!

Today more than ever we should take the time to protect our employees. They are our most valuable asset so we can function on a day to day basis.

General Precautions at a Lift Station summed up as always avoid unsafe acts and correcting unsafe conditions. Apply and use as much instrumentation as you do in your Main Plants don't skimp on safety just because you're not there 24/7. There are electrical hazards, mechanical and pneumatic hazards, confine spaces, oxygen deficiency and enrichment, explosive gas mixtures and falls associated hazards. If possible perhaps you should have a "Dead Man switch" which in case of emergency it can summon help. These are used in Water and Wastewater Plants. If an Employee enters a lift station it triggers a timer through a door sensor that after so many minutes you must check in or a welfare check could be sent. Could save someone's life especially if they are working alone.

Old school but they were safe and went home every night after their shift

You should have <u>SOJP's</u> written for each situation an employee may encounter.

Standard Operating Job Procedures can help guide the employees on what to do if a certain situation occurs. This can prevent serious injuries and down time if they follow these guidelines.

We as Supervisors should want to protect our most vital resource our Staff. You can't just replace each of your staff as easily today as you could 15 years ago. Qualified people are hard to find especially if you have trained them. Let's protect them and prevent heartache.

Level 2

SOJP: Lift Station Power Failure under normal conditions:

1. During a power failure backup power/generator should switch over in (5) minutes or less.
2. If power does not return within the allotted time immediately Activate **"ALL PAGE"** for assistance from the off duty staff.
3. First two off duty persons that respond should respond to the main plant and will act as coordinator and Operator assistants.
    a. Pick up the backup generator hook to City truck.
    b. They will proceed to the Lift Station.
    c. Check out condition of site standby generator. If problem cannot be solved setup and initialize the portable generator to maintain the pumps and well levels.
    d. Monitor fuel as needed.
    e. Once Power is restored they are to disconnect and return all equipment to the main plant.
    f. Check all levels oil/fuel in the generator before storing.
4. Initialize report as to the main problem with site generator. Fill out maintenance request on generator issues.

Issues we may encounter?

Electrical issues are a hidden aspect of energized electrical equipment is that it looks normal until it's not. When working on electrical equipment you should always work in pairs and work on equipment you have been trained on. Part of this work should include Lock out/Tag out always de-energize your electrical equipment before working on it. When in doubt **"DO NOT TOUCH"**. Also when working on a remote station and you are using power tools only use them with an observer is on hand and **NEVER** use them when standing in water even if the tools are turned off you could still receive a shock.

One of the reasons for working in pairs is in case of electric shock the person receiving the shock may stop breathing due to the interruption of their breathing muscles in their chest. Within 2 minutes without oxygen a person may start to lose brain functions. Death could be imminent unless someone intervenes. Those employees who know CPR and are available and can start this life saving function. Remember the old saying "it will never happen to me until it does" First Aid Training should be a requirement for all of your staff and it should include CPR. Having performed CPR myself on a person not breathing it can mean life when done correctly.

Electrical Dangers

Lockout/Tagout

Air Monitoring

Air Monitoring Sensors come in all different applications. Do you have smoke detectors or CO2 detectors in your lift stations? Oxygen deficiency/enrichment sensors can prevent exposure to a life threatening situation. Having these types of alerts could prevent exposure to these types of atmospheres and cause illness or injury to one or more of your employees. Even if these areas are not considered to be a confine space the cost of a sensor is much less than the loss of one of your employees.

In addition you could have Methane, Hydrogen Sulfide, Radon, Carbon Dioxide or you may even have some chemical feeders like CL2 or Ferrous Chloride in which detectors may be needed. You will need some early warning if you spend significant hours at these sites.

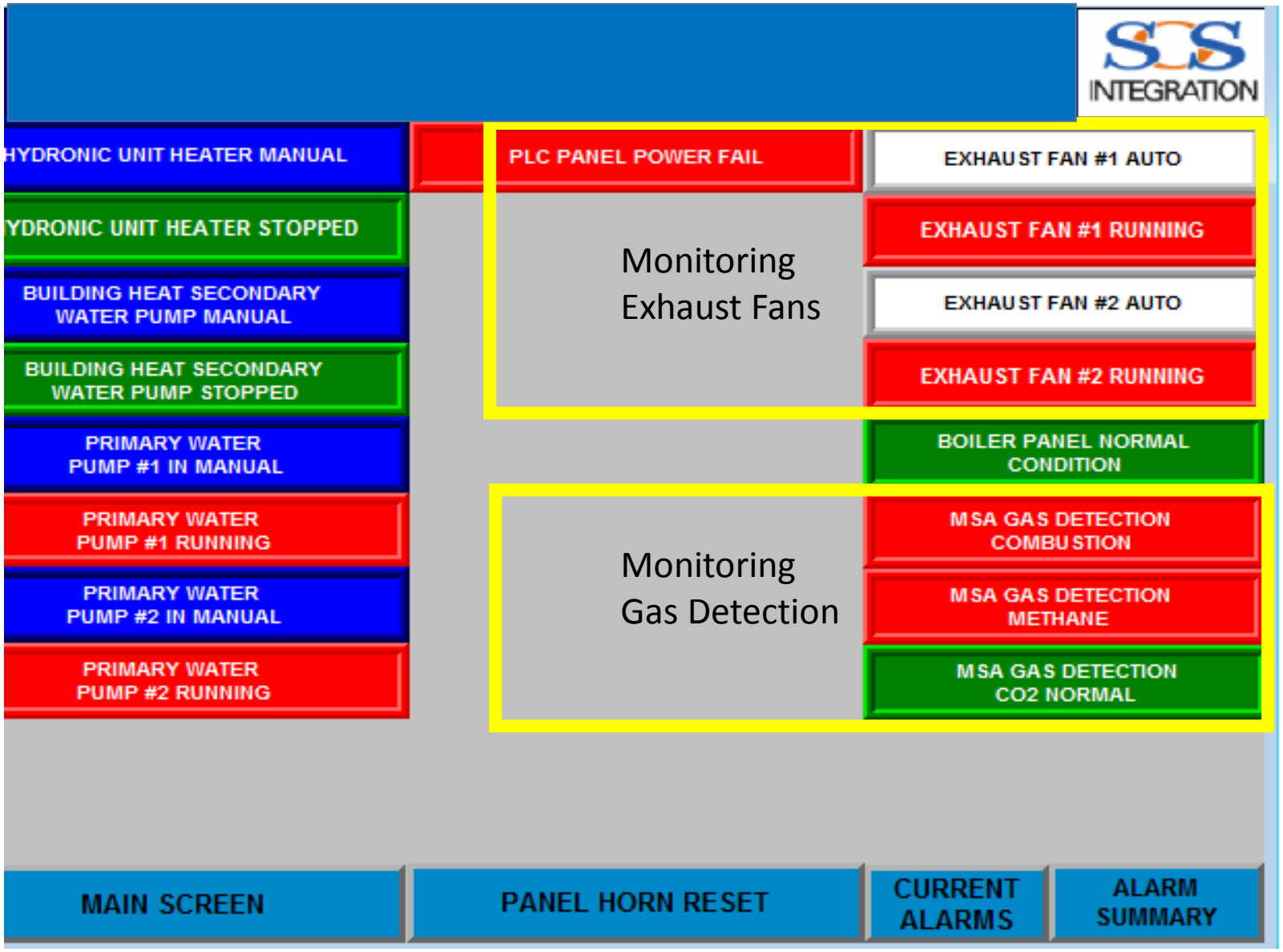
Each of these Gases have different Chemical properties. Explosion ranges from 5% LE to 15.0% UEL for Methane, 4.3% to 46.0% for Hydrogen Sulfide. That's a pretty wide range so safety if a must.

Smoke Detectors
For early warning

CO2 Detectors
For early warning
For Employees

One other thing

One other thing to consider if you have these gases present already and normally have issues then a forced air ventilation system could be your answer. A forced air system will exchange the air in the area and allow your staff to work in relative safety. Remember all areas are only safe if you are taking precautions and are always vigilant.



So I've talked about Remote Stations and the Safety of our employees.

I have not mentioned the one thing that guides us in the world of Safety when it comes to Waste Water and Remote Stations that would be OSHA. Occupation Safety and Health Laws and Regulations are the guide we use to help us do the things we do safely. I've have given you examples and how we look at the issues each of us face on a daily basis. So why wouldn't we want to go the extra yard and take steps to prevent loss or an accident.

Occupational Safety and Health Administration

Agency

osha.gov

The Occupational Safety and Health Administration is an agency of the United States Department of Labor. Congress established the agency under the Occupational Safety and Health Act, which President Richard M. Nixon signed into law on December 29, 1970. Wikipedia

Customer service: 1 (800) 321-6742

Founder: Richard Nixon

Founded: April 28, 1971, United States

Jurisdiction: United States

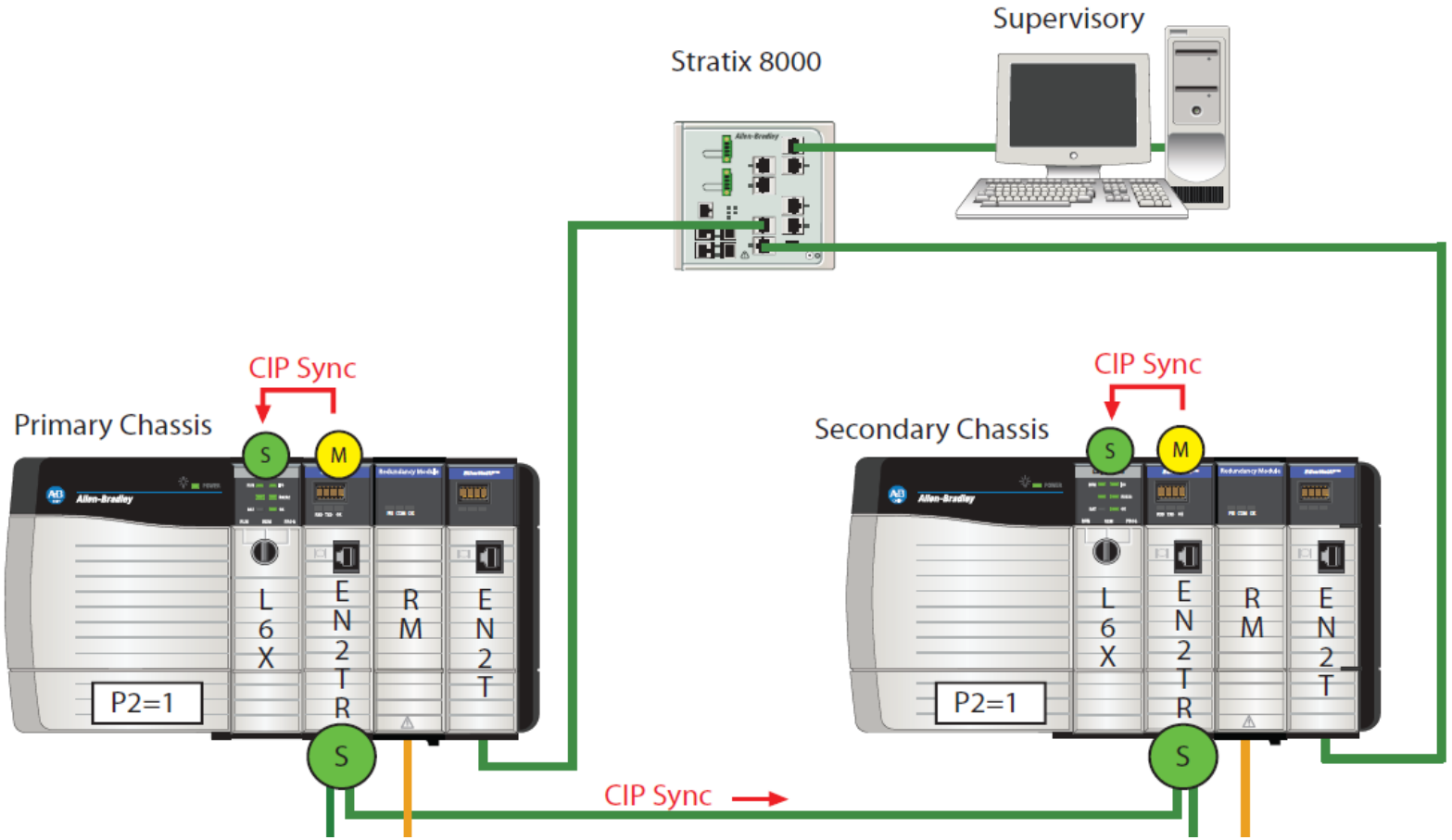
Number of employees: 2,265 (2015)

Employees: 2,265 (2015)

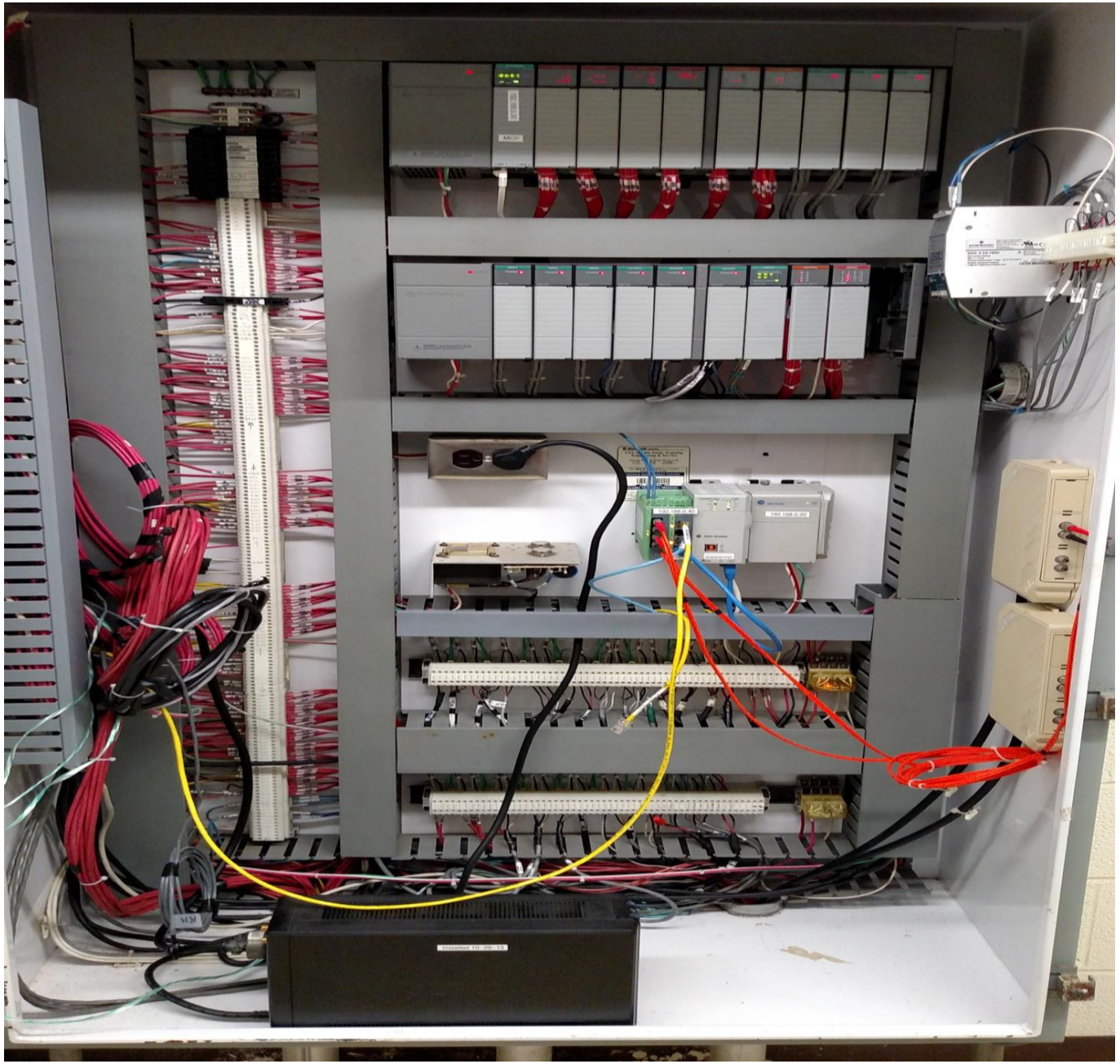
PLC's

So okay where do we start?

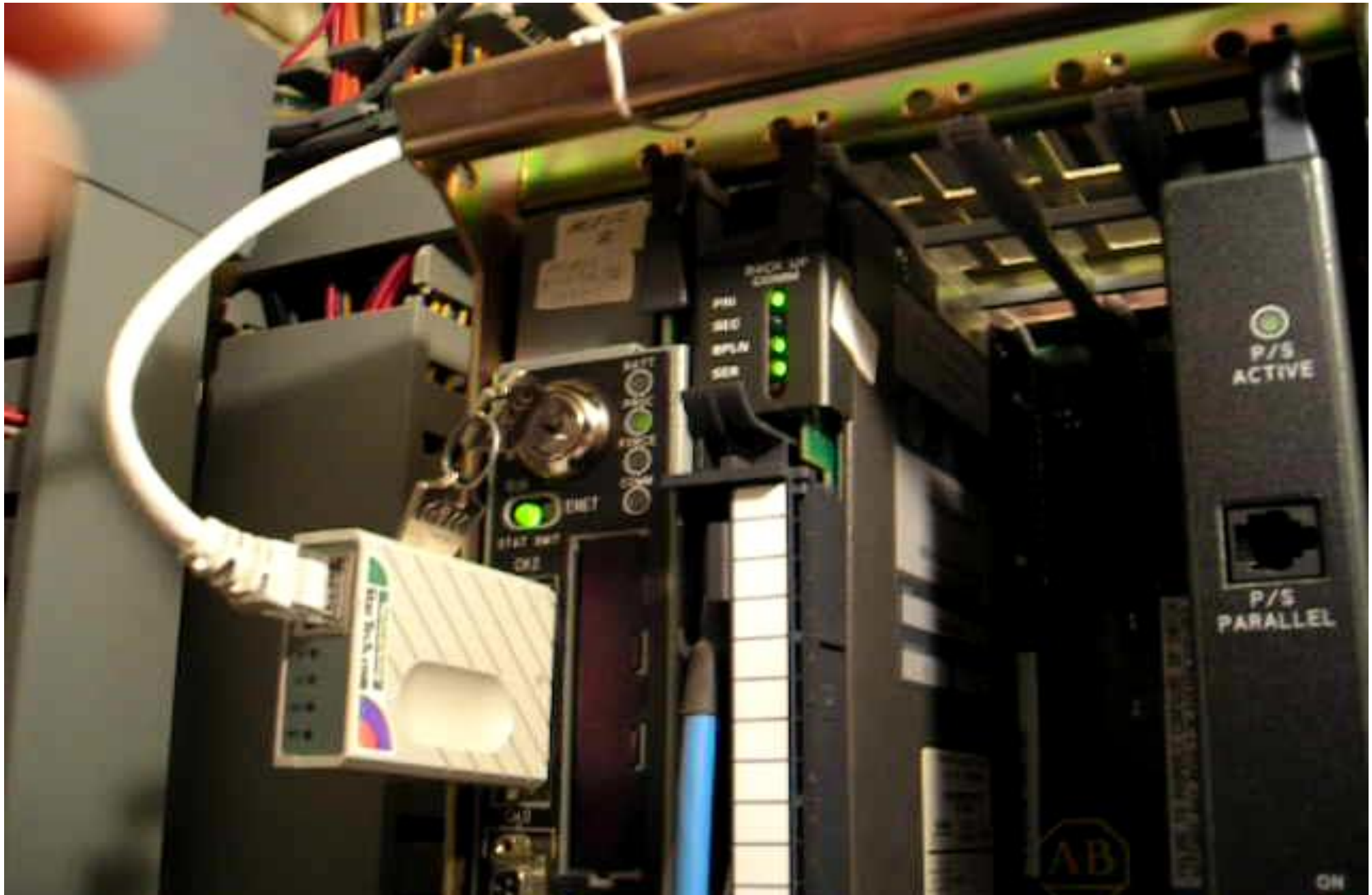
If you have a new PLC well then we can monitor the PLC Inputs and Outputs utilizing the Scada System or Remote Monitoring through the Cloud Based Systems.



If you have an older obsolete PLC then we can talk about replacement with a current model. Perhaps you can save some money by selling your old unit. There is always a market for old equipment. Modifying your program takes time but its worth the cost. Once this is done its on to Communications.



Old and obsolete PLC’s need constant attention



You say well I may not be able to afford expensive Remote Communications

You say well I may not be able to afford expensive Remote Communications, PLC's and sensors and I say there are other options out there that can help you do your job in a Safe and cost effective manner.

Devices that can just monitor digital inputs and analog inputs are available without programming and are cost effective. You can wire the door sensor which can tell you when the door is open at each of your stations. If you know your employee are not there at that time then you can alert the Police to a problem at your station. These devices just need to be wired into your system and through a radio, cell phone or a modem communication you can monitor these conditions from your computer, Scada system or a Website.

CELLULAR

CABLE

RADIO

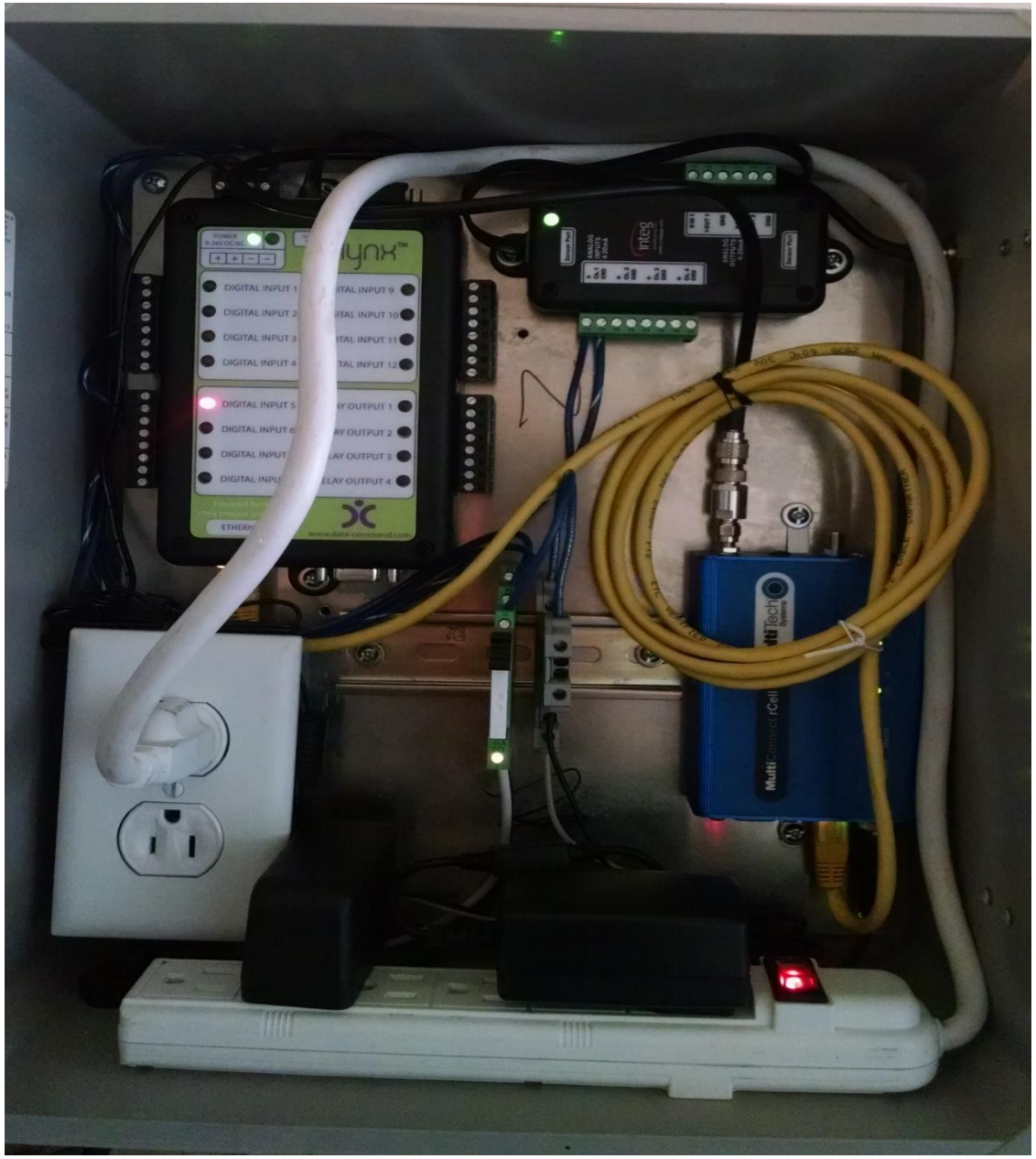
SATELLITE

DSL

If you don’t have a PLC then devices are available for you to just **monitor** your sites. These devices can be cost effective in the right applications.

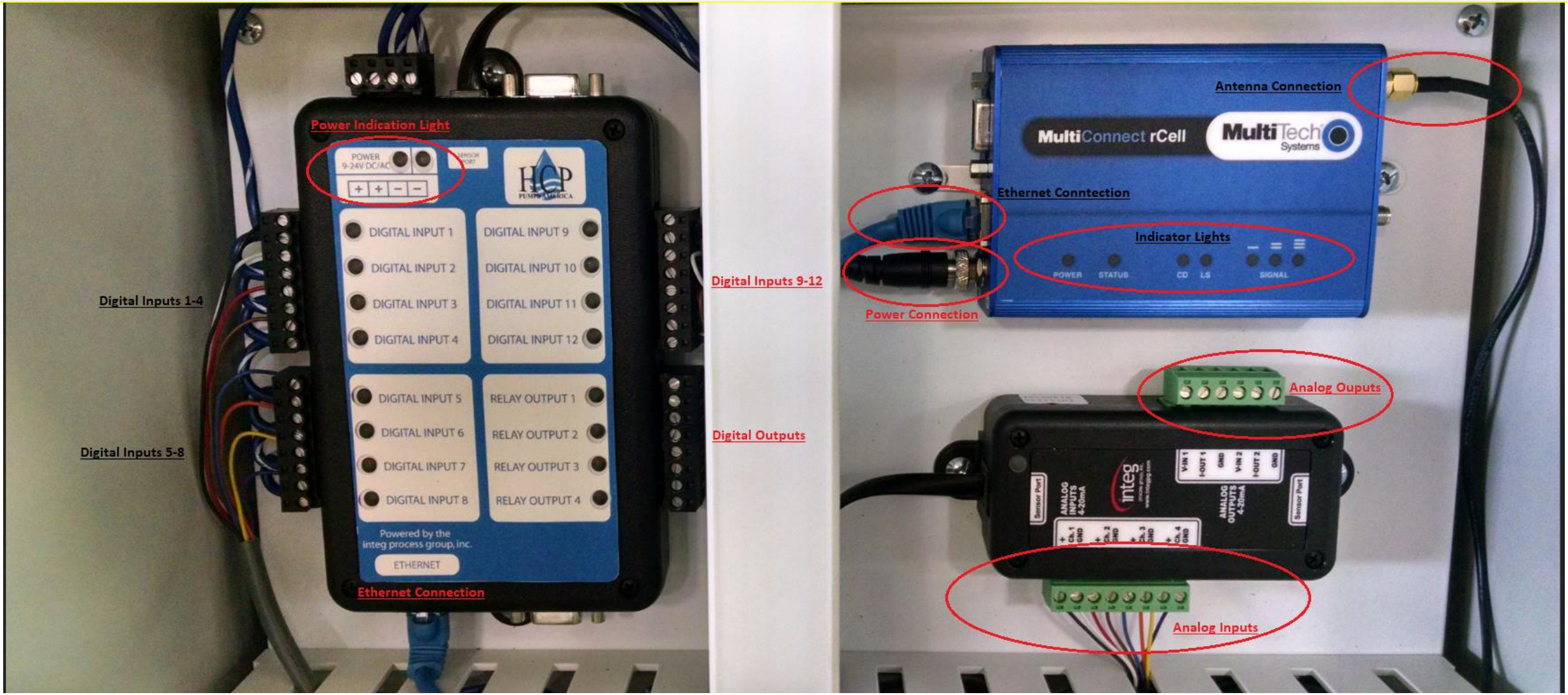
Direct wire these units to your pumps to monitor run status. Or perhaps you just want to monitor Pump fails.

Floats can be wired in for High Level or Low Level alerts. Can help save a pump from running dry or a bypass in an emergency.



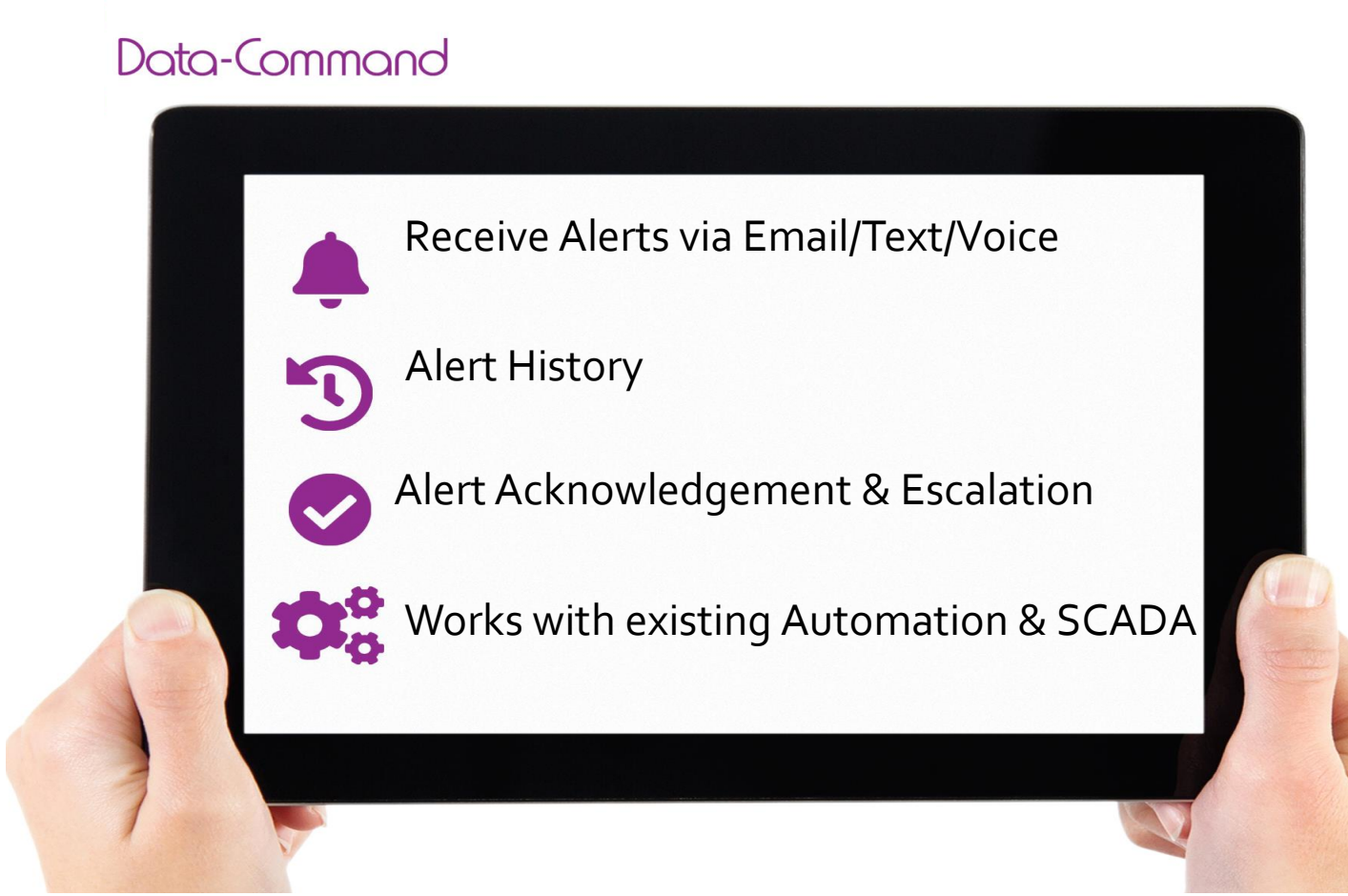
Devices like this unit are available, easy to install and easy to monitor

Typical Remote Monitoring Panel Setup with no PLC just direct wiring for monitoring 12 Digital Inputs and 4 Analog Inputs



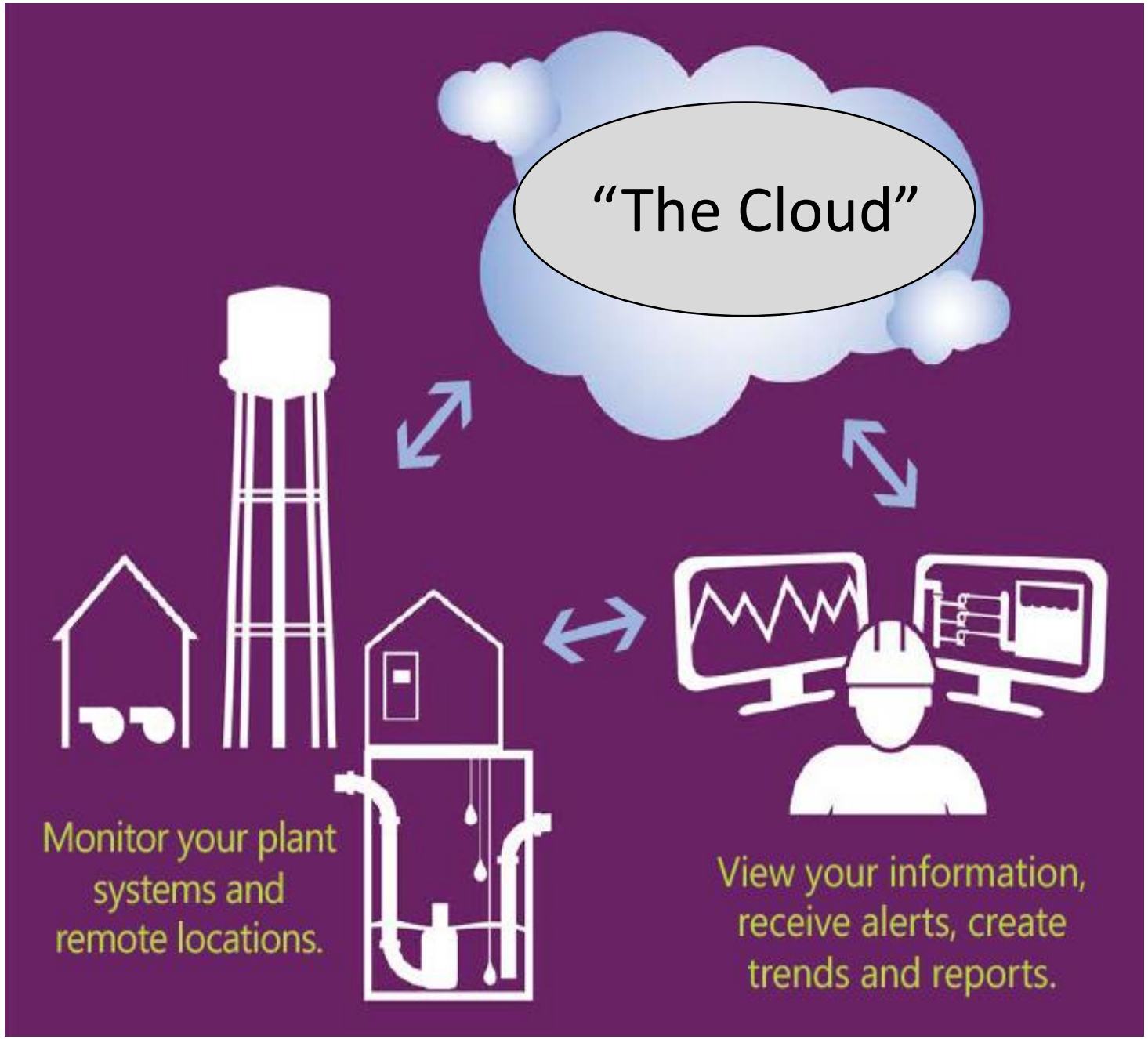
Or perhaps you want to monitor your sites at night or on the weekend well then remote monitoring with a **“Cloud Based system”** is available to monitor from your iPhone or Android. If the word the **“Cloud”** scares you like some of us in this digital age you just need to do your homework in this area we have come a long way in security. If you ask us “How can you protect us from Hackers?” Most reputable sites utilize multiple-authentication and there are multiple levels to prevent someone from accessing your site. In some cases these sites like **Data-Command**, **Mission, Win911** and others use a private networks which are protected through multiple sources. For example if you have Cell phone technology sending the information from your Remote site through the Cell Phone Company you must use the right protocols to even get that far. Then you have to authenticate at the company’s site that you are using to relay your information to you. Then you have to log into the site just to see your information. Layers upon layers of protection.

Cloud-Based Solution



“The Cloud”

Once all your data is safely transferred up to the cloud it can be displayed is a familiar way like you might see on your Scada systems. Screens can be generated to look just like your Scada or perhaps you just want to see the information laid out.



Private Networks are safe

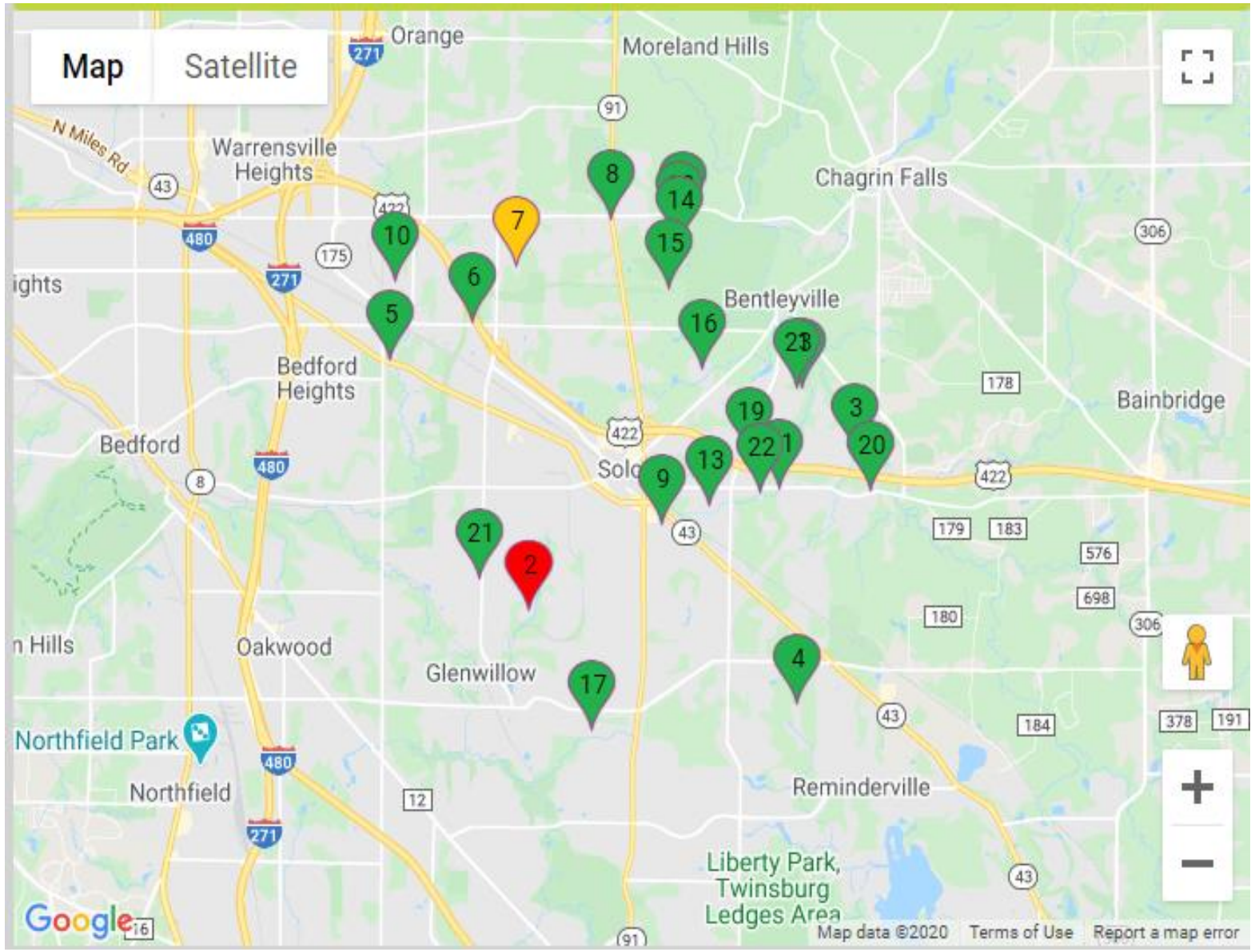
A private network is usually achieved through Local connectivity such as Ethernet (10/100BaseT). We at Data-Command utilize a System Administrator that determines the required static IP address through our Private network. This insures that your information is safe and secure. We also utilize Encryption in our system making it even harder to read. VPN (Virtual Private Networks) VPN Tunneling is a secure tunneling through and into a network. In networking, the Point-to Point protocol or PPP is a date link protocol commonly used in establishing a direct connection between two networking needs. It can provide connection authentication, transmission encryption privacy and compression of data.

Private Network Definition:

A private network is any connection within a specified network wherein restrictions are established to promote a secured environment. This type of network can be configured in such a way that devices outside the network cannot access it. Only a selected set of devices can access this type of network depending on the settings encoded in the network routers and access points. On the other hand a public network is defined as a network that anyone can freely connect to with little or no restriction

Webpage Monitoring

Monitoring your remote stations through a webpage on what is commonly known as the **“Web”** is a system of interlinked hypertext documents accessed via the Internet. A web browser can be displayed on a monitor on your computer or your mobile device like your phone. Using hyperlinks you can have easy access without many keystrokes and store this in your device as something called “cookies”. HTML short for Hypertext Transfer Protocol is a networking protocol. Using a private network that uses private IP address space these addresses are commonly used for home, office and enterprise local area networks also known as LAN’s. At a glance Green is good Communication.



Alerts-Alarming

Alerts can be set up to notify someone immediately or delayed if you prefer that there is an issue. A phone call, text or email can be generated and sent to multiple numbers. As I said earlier a Deadman setup can time out a digital alert to notify someone that there is something wrong. Each site can have its own administrator to handle Logins, phone numbers and email addresses.

Remember with Lift Stations you can never be to safe. Both the equipment and your Staff should be protected they are both very important resources.

Data-Command

Receive and acknowledge alerts remotely via:

Email

Text Message

Voice Call

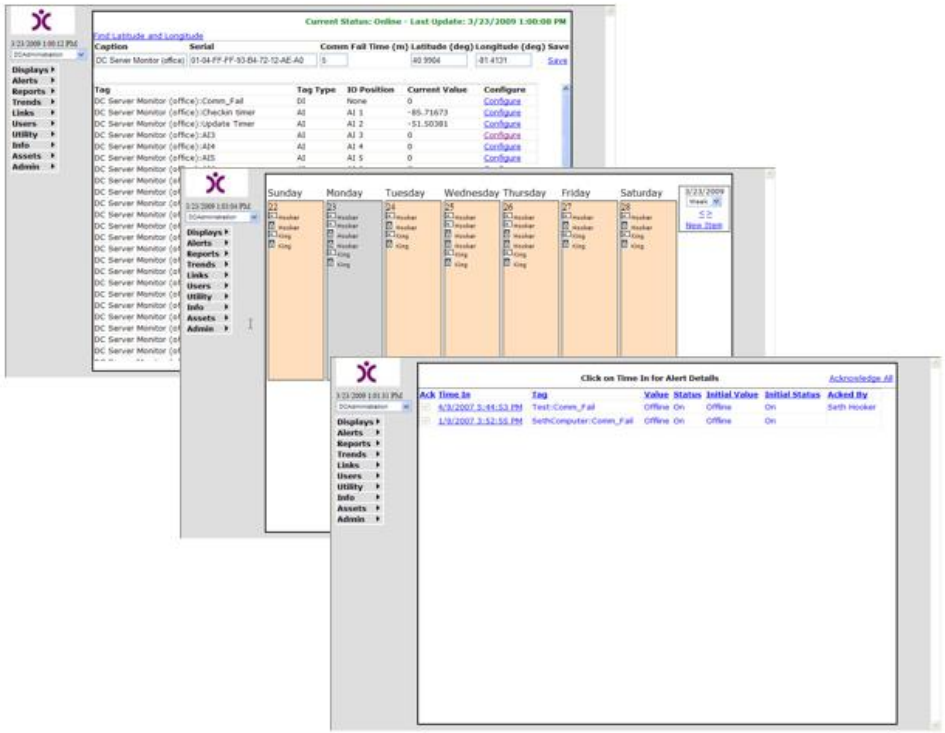
Page

Event Notification

Notifications can be sent through a variety of media, including voice calls, text messages, emails and alphanumeric pages WITHOUT special hardware or software (Dialogic card, Win911)

Data-Command

Event Notifications and Alarms Can Be Set Up By User



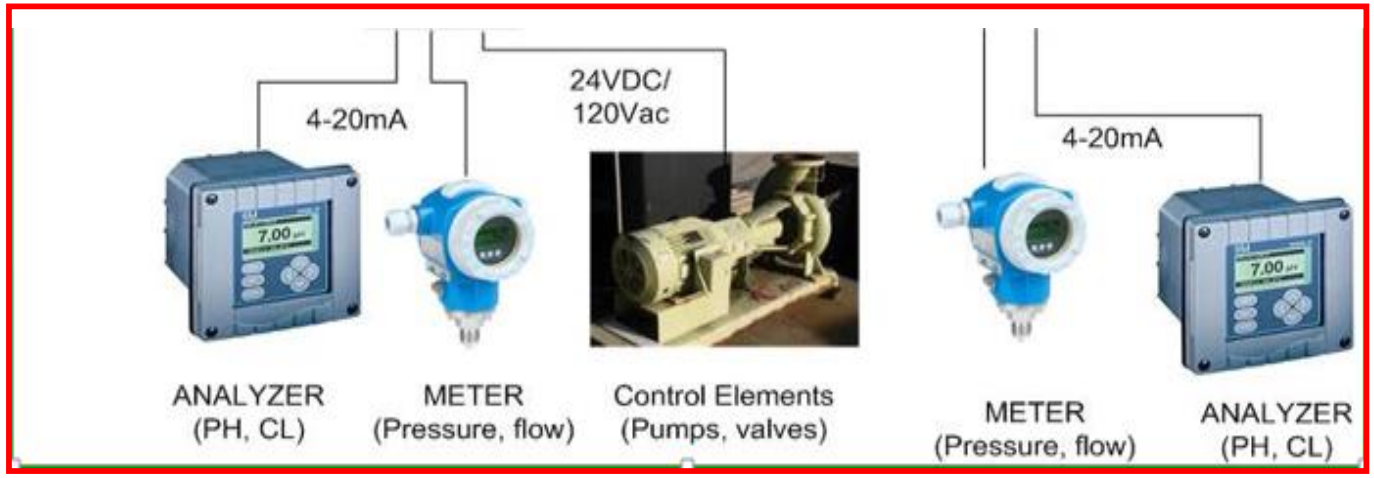
Data-Command

Remote Monitoring Features

- Works with existing infrastructure or as a standalone system
- Information can be viewed anywhere, WITHOUT special software (such as PC Anywhere)
- Notifications can be sent through a variety of media, including voice calls, text messages, emails and alphanumeric pages WITHOUT special hardware or software (Dialogic card, Win911)
- Information from an entire system can be aggregated and viewed in one central location
- No IT infrastructure or computer hardware is required
- Virtually any system can be connected

I have presented slides that depict our system but to be fair I have to mention that there are other systems also that can give you monitoring and safety for your employees. I would say check around do your homework. If someone can do something for a price I'm sure you can find others that can do something similar. Check around verify the system fits your needs and your budget.

Remember if you want to monitor your remote sites and do it safely you need Remote Monitoring.



Data-Command

526 South Main Street
Suite #412
Akron, Ohio 44311
Phone: 330-294-4477
Website: www.data-command.com

Thank you

Questions/Answers