ABSOLUTE PROCESS INSTRUMENTS

CECOMP®

Sensors to Solutions

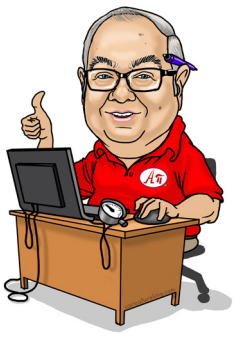
A HANDBOOK OF INSTRUMENTATION AND PROCESS APPLICATIONS




- AC Input
- AC Power
- DC Input
- Frequency, Speed
- Position, Valve
- Potentiometer Input
- Pressure & Vacuum Gauges
- Strain Gauge, Load Cell Input
- Temperature Input


1220 American Way, Libertyville IL 60048 USA | api-usa.com | 800-942-0315 · 847-918-3510 | 800-949-7502

Table of Contents



Order of App Notes

KEY: **TS:** Tech Support **C:** Cecomp **A:** API **B:** All other product lines

Cat	#	Product	Application
TS	1001	API 3200 G M01	Calibration Tech Support
TS	1002	Gauges	Why choose digital gauges? Analog vs Digital gauges
TS	1003	DPG1000B	Calibrating DPG1000 series gauges with a 760TORRA range
TS	1004	Signal conditioners, Gauges	Ohm's Law
TS	1005	Signal conditioners, Gauges	What is a ground loop?
TS	1006	Signal conditioners	Functions of a signal conditioner
TS	1007	Signal conditioners, Gauges	Single-ended vs. differential inputs
TS	1008	Signal conditioners, Gauges	Sink & source
TS	1009	Signal conditioners, Gauges	Total system error band
TS	1010	Signal conditioners, Gauges	Definitions of temperature effects on accuracy
TS	1011	Signal conditioners, Gauges	Instrument calibration requirements
TS	1012	Signal conditioners, Gauges	Environmental factors affecting instrument accuracy
TS	1013	Gauges	Absolute reference & gauge reference defined
TS	1014	Gauges	Cecomp gauge accuracy
TS	1015	Gauges	Analog vs. Digital pressure gauges: An important distinction
TS	1016	Signal conditioners	Testing an analog control loop using API/APD module features
TS	1017	Signal conditioners	Using the built-in 4-20 mA loop power supply
TS	1018	Signal conditioners, Gauges	Terms & Definitions
TS	1019	Signal conditioners, Gauges	What is deadband?
TS	1020	Signal conditioners, Gauges	RFI & EMI
TS	1021	Signal conditioners	Relay protection & EMI suppression
TS	1022	Signal conditioners	Common thermocouple sensor types

Cat	#	Product	Application
A	101	API 4001GL,1000G,4300G	Monitor and control a dam bubbler system
A	102	APD HV-DC	Monitoring voltage on SCR motor drives
A	103	APD2208	Monitoring blower speed and vent position
A	104	APD 2000	Monitoring station battery current and voltage
A	105	API 1000 G	Automatically select pH transmitter
A	106	API 3200 G	Automatically control air damper position
A	107	API 4300 G	Controlling SCRs for supplemental heat
C	108	DPG1000B	Monitor pressure on an autoclave
C	109	F16ADA	Controlling water level in a tank
C	110	F4B	Monitor hydrostatic test on tanks
C	111	F16ADA	Monitoring flow on pumps
C	112	DPG2000B	Monitoring pressure on tube trailers
A	113	API Special	Monitor high-speed strain gauge pressure sensors
C	114	DPG1000B	Accurately monitoring hydrostatic pressure testing in a gas pipeline
A	115	API 6010 G 5A	De-icing aircraft
A	116	APD HV-DC, APD 4300	Monitoring power usage on DC motor

Cat	#	Product	Application
C	117	DPG1000B	Monitor pressure on a vacuum chamber
A	118	APD 4393	Split signals for separate monitoring and control
C	119	DPG2000B	Monitoring vacuum in chemical tanks
C	120	F16DR	Local and remote monitoring of test chambers
A	121	API 4130 G	Monitoring flare stack burnout
C	122	DPG1000B	Leak detection on a life raft
C	123	DPG2000B	Monitoring aircraft tire pressure
C	124	DPG1000L	Monitoring vacuum on pump motors
A	125	API 4059 G M02	Monitor and control the melt pressure in an extruder
A	126	APD 2000	Monitoring water level in a tank
C	127	F16L	Monitoring vacuum on diesel engines
A	128	APD 4380	Interface level transmitter with PLC
C	129	F16B	Monitor pressure on large refrigeration units
C	130	F4B	Certifying boiler pressure
C	131	ARM760AD	Monitor negative pressure on fume hood
C	132	F16B	Accurately monitoring pressure in a gas pipeline
A	133	APD 2000	Monitoring water quality using pH and ORP
A	134	API 4003 G I	Controlling water level in a tower
B	135	Kinax 2W2	Monitoring drainage doors
B	136	A210	Monitoring power usage on motors and compressors
C	137	ARM760B	Monitoring vacuum pump motors
C	138	F4B	Monitor pressure on a boiler
A	139	API 4058 G	Monitor load cells for weighing containers
B	140	A230S	Monitoring power usage on pumps
A	141	API 4300 G D	Monitor engine RPM to control engine torque
A	142	API 4003 G	Manual boiler control during testing
A	143	APD 4393	Splitting signals
A	144	APD 4380	Monitoring motor current on DC motors
A	145	APD 1430	Separate monitoring and control system functions
A	146	API 1600 G	Monitoring critical heater operation
A	147	APD 1500	Monitor load cells for weighing material
A	148	APD 4393	Split flowmeter signals for alarming and monitoring
C	150	DPG1000L	Monitoring level of chemical in tank
A	151	API 4300 G	Controlling limestone added to ash on conveyor
C	152	F16ADA	Monitoring natural gas pressure in piping systems
A	153	API 1600 G	Monitoring AC current on railroad crossings
C	154	DPG1000L	Monitor vacuum on kiln
A	155	API 1220 G	Separate monitoring and control system functions
C	156	DSGL1	Maintain line pressure for water lines
C	157	DPG1000B	Monitor QC pressure test on soccer balls
C	158	DPG1000B	Monitor elasticity and leak test
A	159	API 3200 G M420	Control valves with no potentiometer feedback
A	160	APD 4393	Splitting a signal to both a PLC and a controller
A	161	API 4380 G	Isolating signals with a hot swappable unit
C	162	DPG1000B	Monitor flow and pressure on DI water equipment
C	163	DPG1000DR	Monitor regulated air flow leak tests
A	164	APD 1090	Monitoring current in DC motor

Cat	#	Product	Application
A	165	API 1200 G	Hardware shutdown for furnace over temperature alarm
C	166	F16L	Monitoring inlet pressure for potable water
A	167	API 7010 G	Isolating and converting a flow meter output
C	168	DPG1000B	Monitor methane gas pressure in a production well
A	169	API 4385 G	Isolate and control the signal to a hydraulic control valve
C	170	DPG2000B	Pressure test leak detection for explosion protection
A	171	API 7010 G	Isolate and convert the signal from a positive displacement gas meter
C	172	DPG1000B	Monitoring turbine engine testing
C	173	DPG1000DR	Calibrate valves for operation
A	174	API 1420 G	Over temperature alarm for motor bearings
A	175	API 7500, API 7580	Monitoring water level in a tank
C	176	F16L	Monitor autoclave vacuum to PLC
A	177	APD 4393	Isolate and split the signal for furnace SCR control
C	178	DPG2000B	Monitor OTR tire pressure in mines
A	179	APD4380	Monitoring wind speed
C	180	F20B	Pressure check on turbine engine exhaust gas
C	181	F16B	Test and calibrate diesel engine governors on locomotives
C	182	F16B	Test and check calibration of in-place analog gauges
A	183	API 7010 G	Monitoring hydro-electric generator speed
A	184	APD 4059	Monitoring pressure transducer
C	185	F16B	Test engine compression for wear
A	186	API 1420 G	Over temperature alarm for motor operation
C	187	F16DAR	Monitor vacuum pressure for printing press pickups
A	188	APD 1080 D	Monitor hydrogen sulfide (H2S) gas for oil wells
C	189	ARM760B	Monitor deep vacuum for food packaging machine
A	190	APD 1000, APD 4003	Monitoring a steam condensate line
C	191	DPG1000B	Monitor pressure on tires during dynamometer testing
C	192	F16ADA	Monitor vacuum on a CNC machine
A	193	APD 4059, APD 1090	Monitoring pressure transducer
A	194	API 1220 G	Over temperature alarm for motor bearings
C	195	DPG1000B	Monitor fluid pressure on dispensing system
C	196	DPG1000L	Monitor flow through water filtering systems
A	197	API 4059 G	Monitor load pins on winch system
C	198	DPG2000B-D4	Monitor gas flow for testing of production capability
A	199	APD 4300	Shaft speed simulator for diesel engine training
C	200	DPG2000B	Monitor gas pressure for cleaning and testing of pipeline
A	201	APD 4300 D	Isolating and converting a moisture sensor output
C	202	DPG1000DR	Test and check hyperbaric chamber operation
A	203	APD 7500, APD 1720	Testing and activating a tornado siren
C	204	F4L	Acid washing for printed circuit boards
A	205	APD 7580	Control for an HVAC system
C	206	F16B	Testing concrete beams for flexural strength
A	207	APD 1080	Load limiting device on hoist
A	208	APD 4930	Split flowmeter signals for separate display/control and chart recording
B	209	Kinax 3W2	Positioning of fire extinguishing gun in tank farms
B	210	Sineax 604S	Using 604S as input card for videographic recorder
B	211	Rheintacho Alarm	Monitor wind turbine operation

Cat	#	Product	Application
A	212	APD 7010	Monitoring hydro-electric generator speed
A	213	APD 3280	Automatically control air damper position
C	214	F16DR	Monitor flow through water filtration systems
C	215	DSGA4	Monitor slurry pressure in pipe
C	216	F22B	Monitor pressure on a vacuum chamber
C	217	F16B	Monitor pressure in public water system distribution system
A	218	APD 4059	Monitor and control the melt pressure in an extruder
C	219	F16ADA	Pump control of steam heating system
C	220	DPG1000L	Improving automotive vacuum systems efficiency
C	221	F16LSC	Safe monitoring of inactive loops

App Notes by Industry

Aircraft Services

Application Note	Item	Application
C108	DPG1000B	Monitor pressure on an autoclave
C117	DPG1000B	Monitor pressure on a vacuum chamber
C122	DPG1000B	Leak detection on a life raft
C123	DPG2000B	Monitoring aircraft tire pressure
C172	DPG2000B	Monitoring turbine engine testing
C176	F16L	Monitor autoclave vacuum to PLC
C180	F20B	Pressure check on turbine engine exhaust gas
C192	F16ADA	Monitor vacuum on a CNC machine
C195	DPG1000B	Monitor fluid on dispensing systems
C216	F22B	Monitor pressure on a vacuum chamber
A115	API 6010 G 5A	De-Icing aircraft
A213	APD 3280	Automatically control air damper position

Automotive

Application Note	Item	Application
C108	DPG1000B	Monitor Pressure on an autoclave
C112	DPG2000B	Monitoring pressure on tube trailers
C176	F16L	Monitor Autoclave vacuum to PLC
C178	DPG2000B	Monitor OTR pressure in mines
C180	F20B	Pressure check on turbine engine exhaust gas
C192	F16ADA	Monitor vacuum on a CNC machine
C206	F16B	Testing concrete beams for flexural strength
C220	DPG1000L	Improving Automotive vacuum systems efficiency
A115	API 6010 G 5A	De-icing aircraft
A144	APD 4380	Monitoring motor current on DC motors
A205	APD 7580	Control for an HVAC system
A213	APD 3280	Automatically control air damper position

Chemical

Application Note	Item	Application
C110	F4B	Monitor hydrostatic test on tanks
C111	F16ADA	Monitoring flow on pumps
C117	DPG1000B	Monitor pressure on a vacuum chamber
C119	DPG2000B	Monitoring vacuum in chemical tanks
C120	DPG1000DR	Local & remote monitoring of chambers

Chemical (cont'd)

Application Note	Item	Application
o C131	ARM760AD	Monitor negative pressure on fume hood
o C150	DPG1000L	Monitoring level of chemical in tank
o C156	F4L	Maintain line pressure for water lines
o C163	DPG1000DR	Monitor regulated air flow leak tests
o C170	DPG2000B	Pressure test leak detection for explosion protection
o C173	DPG1000DR	Calibrate valves for operation
o C195	DPG1000B	Monitor fluid pressure on dispensing system
o C196	DPG1000L	Monitor flow through water filtering systems
o C200	DPG2000B	Monitor gas pressure for cleaning and testing of pipeline
o C204	F4L	Acid washing for printed circuit boards
o C221	F16LSC	Safe Monitoring of Inactive Loops
o A105	API 1000G	Automatically select pH transmitter
o A106	API 3200G	Automatically control air damper position
o A115	API 6010 G 5A	De-icing aircraft
o A118	APD 4393	Split signals for separate monitoring & control
o A133	APD 2000	Monitoring water quality using pH and ORP
o A146	API 1600 G	Monitoring critical heater operation
o A147	APD 1500	Monitor load cells for weighing material
o A151	API 4300 G	Controlling limestone added to ash on conveyor
o A160	APD 4393	Splitting a signal to both a PLC and a controller
o A165	API 1200 G	Hardware shutdown for furnace over temperature alarm
o A169	API 4385 G	Isolate and control the signal to a hydraulic control valve
o A188	APD 1080 D	Monitor hydrogen sulfide (H2S) gas for oil wells
o A208	APD 4930	Split signals from flowmeters for different applications
o A213	APD 3280	Automatically control air damper position
o B209	Kinax 3W2	Positioning of fire extinguishing gun in tank farms

Food & Beverage

Application Note	Item	Application
o C129	F16B	Monitor pressure on large refrigeration units
o C137	ARM760B	Monitoring vacuum pump motors
o C158	DPG1000B	Monitor elasticity and leak test
o C163	DPG1000DR	Monitor regulated air flow leak tests
o C173	DPG1000DR	Calibrate valves for operation
o C189	DPG1000B	Monitor deep vacuum for food packaging machine
o C196	DPG100L	Monitor flow through water filtering systems
o C214	F16DR	Monitor flow through water filtration systems
o C215	DSGA4	Monitor slurry pressure in pipe
o C217	F16B	Monitor pressure in public water system pipes

Food & Beverage (cont'd)

Application Note	Item	Application
o A113	API Special	Monitor high speed strain gauge pressure sensors
o A164	APD 1090	Monitoring current in DC motor

HVAC

Application Note	Item	Application
o C131	ARM760AD	Monitor negative pressure on fume hood
o A103	APD 2208	Monitoring blow speed and vent position
o A107	API 4300 G	Controlling SCRs for supplemental heat
o A142	API 4003 G	Manual boiler control during testing
o A143	APD 4393	Splitting signals
o A155	API 1220G	Separate monitoring and control system functions

Iron, Steel, Metals

Application Note	Item	Application
o C170	DPG2000B	Pressure test leak detection for explosion protection
o C178	DPG2000B	Monitor OTR tire pressure in mines
o C192	F16ADA	Monitor vacuum on a CNC machine
o C204	F4L	Acid washing for printed circuit boards
o C206	F16B	Testing concrete beams for flexural strength
o A116	APD HV-DC/APD 4300	Monitoring power usage on a DC motor
o A142	API 4003 G	Manual boiler control during testing
o A144	APD 4380	Monitoring motor current on DC motors
o A151	API 4300 G	Controlling limestone added to ash on conveyor
o A177	APD 4393	Isolate and split the signal for furnace SCR control
o A179	APD 4380	Monitoring Wind speed
o A203	APD 7500/APD 1720	Testing and activating a tornado siren
o B136	A210	Monitor power usage on motors & compressors

Military

Application Note	Item	Application
o C110	F4B	Monitor hydrostatic tests on tanks
o C123	DPG2000B	Monitoring aircraft tire pressure
o C170	DPG2000B	Pressure test leak detection for explosion protection
o C176	F16L	Monitor autoclave vacuum to PLC
o C178	DPG2000B	Monitor OTR tire pressure in mines
o C180	F20B	Pressure check on turbine engine exhaust gas
o C206	F16B	Testing concrete beams for flexural strength
o C216	F22B	Monitor pressure on a vacuum chamber

Military (cont'd)

Application Note	Item	Application
o A101	API 4001GL/1000G	Monitor and control a dam bubbler system
o A107	API 4300 G	Controlling SCRs for supplemental heat
o A199	APD 4300	Shaft speed simulator for diesel engine training
o B209	Kinax 3W2	Positioning of fire extinguishing gun in tank farms

Oil & Gas

Application Note	Item	Application
o C112	DPG2000B	Monitoring pressure on tube trailers
o C114	DPG1000B	Monitoring hydrostatic pressure testing in a gas pipeline
o C132	F16B	Monitoring pressure in a pipeline
o C152	F16ADA	Monitoring natural gas pressure in piping systems
o C163	DPG1000DR	Monitor regulated air flow leak tests
o C168	DPG1000B	Monitor methane gas pressure in a production well
o C170	DPG2000B	Pressure test leak detection for explosion protection
o C173	DPG1000DR	Calibrate valves for operation
o C178	DPG2000B	Monitor OTR tire pressure in mines
o C182	F16B	Test & check calibration of in-place analog gauges
o C192	F16ADA	Monitor vacuum on a CNC machine
o C198	DPG1000B	Monitor gas flow for testing of production capability
o C200	DPG2000B	Monitor gas pressure for cleaning & testing of pipeline
o C221	F16LSC	Safe Monitoring of Inactive Loops
o A102	APD HV-DC	Monitoring voltage on SCR motor drives
o A106	API 3200 G	Automatically control air damper position
o A121	API 4130 G	Monitoring flare stack burnout
o A142	API 4003 G	Manual boiler control during testing
o A148	APD 4393	Split flowmeter signals for alarming & monitoring
o A165	API 1200 G	Hardware shutdown for furnace over temperature alarm
o A169	API 4385 G	Isolate & control the signal to a hydraulic control valve
o A171	API 7010 G	Isolate & convert the signal from a positive displacement gas meter
o A188	APD 1080 D	Monitor hydrogen sulfide (H2S) gas for oil wells
o A213	APD 3280	Automatically control air damper position
o B140	A230S	Monitoring power usage on pumps
o B209	Kinax 3W2	Positioning of fire extinguishing gun in tank farms

Medical & Pharma

Application Note	Item	Application
o C110	F4B	Monitor hydrostatic test on tank
o C119	DPG2000B	Monitoring vacuum in chemical tanks

Medical & Pharma (cont'd)

Application Note	Item	Application
o C131	ARM760AD	Monitor negative pressure on fume hood
o C150	DPG1000L	Monitoring of chemical level in tank
o C156	F4L	Maintain line pressure for water lines
o C158	DPG1000B	Monitor elasticity and leak test
o C162	DPG1000B	Monitor flow & pressure on DI water equipment
o C202	DPG1000DR	Test & check hyperbaric chamber operation
o A113	API Special	Monitor high-speed strain gauge pressure sensors
o A134	APD 4393	Splitting signals
o A145	APD 1430	Separate monitoring & control system functions
o A155	API 1220 G	Separate monitoring & control system functions
o A205	APD 7580	Control for an HVAC system

Plastics

Application Note	Item	Application
o C108	DPG1000B	Monitor pressure on an autoclave
o C117	DPG1000B	Monitor pressure on a vacuum chamber
o C120	DPG1000DR	Local & remote monitoring of test chambers
o C137	ARM760B	Monitoring vacuum pump motors
o C170	DPG2000B	Pressure test leak detection for explosion protection
o C176	F16L	Monitor autoclave vacuum to PLC
o C192	F16ADA	Monitor vacuum on a CNC machine
o C195	DPG1000B	Monitor fluid pressure on dispensing system
o C204	F4L	Acid washing for printed circuit boards
o C216	F22B	Monitor pressure on a vacuum chamber
o A105	API 1000 G	Automatically select pH transmitter
o A113	API Special	Monitor high-speed strain gauge pressure sensors
o A118	APD 4393	Split signals for separate monitoring & control
o A125	API 4059 G M02	Monitor and control the melt pressure in an extruder
o A146	API 1600 G	Monitoring critical heater operation
o A147	APD 1500	Monitor load cells for weighing material
o A165	API 1200 G	Hardware shutdown for furnace over temperature alarm
o A184	APD 4059	Monitoring pressure transducer
o A218	APD 4059	Monitor & control the pressure in an extruder

Pulp & Paper

Application Note	Item	Application
o C150	DPG1000L	Monitoring level of chemical in tank
o C154	DPG1000L	Monitor vacuum on kiln

Pulp & Paper (cont'd)

Application Note	Item	Application
o A128	APD 4380	Interface level transmitter with PLC
o A141	API 4300 G D	Monitor engine RPM to control engine torque
o A207	APD 1080	Load limiting device on hoist

Semiconductor

Application Note	Item	Application
o C204	F4L	Acid washing for printed circuit boards

Alternative Energy

Application Note	Item	Application
o B211	Rheintacho Alarm	Monitor Wind turbine operation

Transportation

Application Note	Item	Application
o C112	DPG2000B	Monitoring pressure on tube trailers
o C181	F16B	Test & calibrate diesel engine governors on locomotives
o C206	F16B	Testing concrete beams for flexural strength
o A106	API 3200 G	Automatically control air damper position
o A116	APD HV-DC/APD 4300	Monitoring power usage on DC motor
o A139	API 4058 G	Monitor load cells for weighing containers
o A153	API 1600 G	Monitor AC current on railroad crossings
o A207	APD 1080	Load limiting device on hoist
o A213	APD 3280	Automatically control air damper position

Utilities

Application Note	Item	Application
o C109	F16ADA	Controlling water level in a tank
o C111	F16ADA	Monitoring flow on pumps
o C112	DPG2000B	Monitoring pressure on tube trailers
o C114	DPG1000B	Accurately monitoring hydrostatic pressure testing in gas pipeline
o C120	DPG1000DR	Local & remote monitoring of test chambers
o C124	DPG1000L	Monitoring vacuum on pump motors
o C127	F16L	Monitoring vacuum on diesel engines
o C130	F4B	Certifying boiler pressure
o C132	F16B	Accurately monitoring pressure in a gas pipeline
o C138	F4B	Monitor pressure on a boiler
o C150	DPG1000L	Monitoring level of chemical in tank
o C152	F16ADA	Monitoring natural gas pressure in piping systems

Utilities (Cont'd)

Application Note	Item	Application
C166	F16L	Monitoring inlet pressure for potable water
C168	DPG1000B	Monitor methane gas pressure in a production well
C178	DPG2000B	Monitor OTR pressure in mines
C182	F16B	Test & check calibration of in-place analog gauges
C196	DPG1000L	Monitor flow through water filtering systems
C198	DPG1000B	Monitor gas flow for testing of production capability
C200	DPG2000B	Monitor gas pressure for cleaning and testing of pipeline
C206	F16B	Testing concrete beams for flexural strength
C214	F16DR	Monitor flow through water filtration systems
C217	F16B	Monitor pressure in public water system pipes
A101	API 4001GL, 1000G	Monitor and control a dam bubbler system
A104	APD 2000	Monitoring station battery current and voltage
A106	API 3200 G	Automatically control air damper position
A107	API 4300 G	Controlling SCRs for supplemental heat
A121	API 4130 G	Monitoring flare stack burnout
A126	APD 2000	Monitoring water level in a tank
A134	API 4003 G I	Controlling water level in a tower
A142	API 4003 G	Manual boiler control during testing
A148	APD 4393	Split flowmeter signals for alarming and monitoring
A151	API 4300 G	Controlling limestone added to ash on conveyor
A159	API 3200 G M420	Control valves with no potentiometer feedback
A161	API 4380 G	Isolating signals with a hot swappable unit
A164	APD 1090	Monitoring current in DC motor
A167	API 7010 G	Isolating and converting a flow meter output
A169	API 4385 G	Isolate & control the signal to a hydraulic control valve
A171	API 7010 G	Isolate & convert the signal from a positive displacement gas meter
A174	API 1420	Over temperature alarm for motor bearings
A175	API 7500/API 7580	Monitoring water level in a tank
A179	APD 4380	Monitoring wind speed
A183	API 7010 G	Monitoring hydro-electric generator speed
A186	API 1420 G	Over temperature alarm for motor operation
A190	APD 1000/APD 4003	Monitoring a steam condensate line
A194	API 1220 G	Over temperature alarm for motor bearings
A201	APD 4300 D	Isolating and converting a moisture sensor output
A203	APD 7500/APD 1720	Testing and activating a tornado siren
A212	APD 7010	Monitoring hydro-electric generator speed
A213	APD 3280	Automatically control air damper position
B135	Kinax 2W2	Monitoring drainage doors
B140	A230S	Monitoring power usage on pumps

Utilities (Cont'd)

Application Note	Item	Application
o B209	Kinax 3W2	Positioning of fire extinguishing gun in tank farms
o B210	Sineax 604S	Using 604S as input card for video graphic recorder
o B211	Rheintacho Alarm	Monitor wind turbine operation

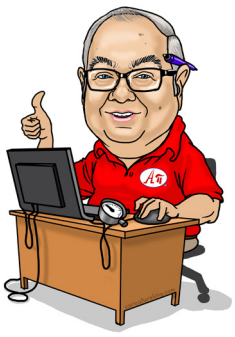
Water/Wastewater

Application Note	Item	Application
o C109	F16ADA	Controlling water level in a tank
o C111	F16ADA	Monitoring flow on pumps
o C124	DPG1000L	Monitoring vacuum on pump motors
o C127	F16L	Monitoring vacuum on diesel engines
o C130	F4B	Certifying boiler pressure
o C150	DPG1000L	Monitoring level of chemical in tank
o C156	F4L	Maintain line pressure for water lines
o C162	DPG1000B	Monitor flow and pressure on DI water equipment
o C166	F16L	Monitoring inlet pressure for potable water
o C168	DPG1000B	Monitor methane gas pressure in a production well
o C196	DPG1000L	Monitor flow through water filtering systems
o C214	F16DR	Monitor flow through water filtration systems
o C217	F16B	Monitor pressure in public water system pipes
o A101	API 4001GL/1000G	Monitor and control a dam bubbler system
o A126	APD 2000	Monitoring water level in a tank
o A133	APD 2000	Monitoring water quality using pH and ORP
o A134	API 4003 G I	Controlling water level in a tower
o A159	API 3200 G M420	Control valves with no potentiometer feedback
o A167	API 7010 G	Isolating & converting a flow meter output
o A169	API 4385 G	Isolate and control the signal to a hydraulic control valve
o A174	API 1420 G	Over temperature alarm for motor bearings
o A175	API 7500/ API 7580	Monitoring water level in a tank
o A183	API 7010 G	Monitoring hydro-electric generator speed
o A186	API 1420 G	Over temperature alarm for motor operation
o A212	APD 7010	Monitor hydro-electric generator speed
o B135	Kinax 2W2	Monitoring drainage doors
o B140	A230S	Monitoring power usage on pumps
o B209	Kinax 3W2	Positioning of fire extinguishing gun in tank farms
o B210	Sineax 604S	Using 604S as input card for videographic recorder

App Notes by Product

	Product	Aircraft Services	Automotive	Chemical	Food & Beverage	HVAC	Iron, Steel, Metals	Military	Oil & Gas	Medical & Pharma	Plastics	Pulp & Paper	Semiconductor	Alternative Energy	Transportation	Utilties	Water Wastewater
Cecomp																	
	ARM760AD																
	ARM760B																
	DPG1000B																
	DPG1000L																
	DPG1000R																
	DPG1000DR																
	DPG2000B																
	DSGA4																
	F4B																
	F4L																
	F16DR																
	F16L																
	F16ADA																
	F16B																
	F16LSC																
	F20B																
	F22B																
API																	
	API Special																
	APD HV-DC																
	APD 1000																
	API 1000G																
	APD 1080																
	APD 1080 D																
	APD 1090																
	API 1200 G																
	API 1220 G																
	API 1420																
	API 1420 G																
	APD 1430																
	APD 1500																
	API 1600 G																
	APD 1720																
	APD 2000																
	APD 2208																
	API 3200 G M420																
	API 3200G																
	APD 3280																
	API 4001GL																
	APD 4003																
	API 4003 G I																
	APD 4003 G																
	API 4058 G																
	APD 4059																
	API 4059 G M02																
	API 4130 G																
	APD 4300																
	APD 4300 D																
	API 4300 G																
	API 4300 G D																
	API 4380 G																
	APD 4380																
	API 4385 G																
	APD 4393																
	APD 4930																
	API 6010 G 5A																
	APD 7010																
	API 7010 G																
	API 7500																
	API 7580																
	APD 7500																
	APD 7580																
Camille Bauer																	
	Kinax 3W2																
	A210																
	A230S																
	Kinax 2W2																
	Sineax 604S																
RheinTacho																	
	Alarm																

Tech Support



 | www.api-usa.com | www.cecomp.com

Calibration: Valve positioner/actuator/controller (API 3200 G M420)

API TECH SUPPORT - TS1001

Calibration procedure:

1. Equipment required:
    a) API 3200 G M420
    b) Proper power supply for the unit (115VAC, 230 VAC or 24VDC as specified on label)
    c) Two (2) NIST traceable calibrator/simulator (Fluke Model 787 or equivalent)
    d) Relay load visual indicator to verify relay open and close action
    e) Connecting cables and socket
2. Allow a minimum of 30 minutes of equipment warm up time for equipment temperature stabilization.
3. Observing proper polarity connect one Calibrator/Simulator to the control input terminals (terminals 4 & 5) for the API 3200 G M420 and the other calibrator/simulator to the feedback input terminals (terminals 6 & 7) for the API 3200 G M420 and set the output from both Calibrator/Simulators for a 4.0 mA output.
4. Preset the API 3200 G M420 deadband to the minimum position (potentiometer to its fully CCW position).
    Note: The deadband potentiometer is a twelve-turn potentiometer, so turn it 13 turns in the specified direction and ensure that there is no "bounce back" from the potentiometer end of travel as this potentiometer have no "positive" end stops.
5. Turn the zero potentiometer on the side of the unit to its mid position.
    Note: Since the zero potentiometer is a twelve turn potentiometer that has no "positive" end stops turn it 13 turns in a CW direction and then turn it 6 complete turns in a CCW direction to ensure that it is in the mid position.
6. Turn the zero potentiometer three complete turns in each direction from its mid position and observe that the Relay Bi-Color LED goes from green (open) to no color to red (close).
7. Verify that the relay load visual indicator indicates that the relay output goes from open to close.
8. Adjust the zero potentiometer so that the Relay Bi-Color LED is out and the zero potentiometer is at the mid-point of travel between the Relay Bi-Color LED going from green to red.
9. Adjust the output from both Calibrator/Simulator to the API 3200 G M420 so that it applies 20.0 mA to both the control input terminals and the feedback input terminals.
10. Turn the span potentiometer on the side of the unit to its mid position.
    Note: Since the span potentiometer is a twelve turn potentiometer that has no "positive" end stops turn it 13 turns in a CW direction and then turn it 6 complete turns in a CCW direction to ensure that it is in the mid position.
11. Turn the span potentiometer three complete turns in each direction from its mid position and observe that the Relay Bi-Color LED goes from green (open) to no color to red (close).
12. Verify that the relay load visual indicator indicates that the relay output goes from open to close.
13. Adjust the span potentiometer so that the Relay Bi-Color LED is out and the span potentiometer is at the mid-point of travel between the Relay Bi-Color LED going from green to red.
14. Calibration is complete. Return API 3200 G M420 to service.

The API 3200 G M420 controls the position of a valve or linear actuator by comparing a DC input control signal (typically 4-20 mA) to that of a current feedback signal (typically 4-20 mA). An SPDT relay provides bi-directional (open-close) signals to drive a motor to open or close a valve.

Why choose digital gauges? Analog vs. Digital

API TECH SUPPORT - TS1002

Accuracy **Digital pressure gauges are far more accurate than analog gauges**.

- Analog gauges-The rule of thumb with analog pressure gauges is that when the operating pressure of the system is normal, the needle should be pointing straight up or in the "twelve o'clock" position. So since the accuracy of most dial pressure gauges is best in the middle third of a gauge, you have to always select a gauge with a range that is about twice your normal operating pressure.
- Digital gauges – The rule of thumb with digital pressure gauges is that you match the maximum pressure that you are measuring to the pressure of the gauge. Standard accuracy for Cecomp digital pressure gauges is 0.25% of the full scale of the gauge but most ranges are available at 0.1% accuracy so you will automatically have better accuracy since the range is only what you are measuring NOT twice the normal operating pressure.

Readability Analog gauges **are often misread** due to a parallax issue (the phenomenon whereby a gauge dial appears to the user to be in one position from one angle and a different position from a different angle)

- Digital gauges have a digital readout so there are no parallax problems and no counting hashes when taking a reading.

Repairability Should a digital gauge be physically damaged (ie, punctured display or faceplate/keypad) the calibration is typically not affected and they can be repaired at a nominal cost.

Durability Due to the solid state design, **digital pressure gauges can be used in high vibration applications**. The display will hold steady while an analog gauge needle may bounce around and make it difficult to take an accurate reading.

Engineering units Analog gauge engineering units are not changeable in the field. The dial face must be reprinted and replaced to change engineering units. Cecomp digital pressure gauges are available with microprocessors that **allow the user to change engineering units**, set the battery on/off time, as well as digitally calibrate the gauge.

Calibration

- **Digital gauges will withstand considerable shock, vibration, and abuse without losing calibration**. Analog gauges are most often "out of calibration" after the first time they are dropped or banged around.
- Digital pressure gauges, due to the superior accuracy, are often used as "gauge standards" to test analog gauges to determine that they are in calibration and if they are operating properly. The rule of thumb for checking instruments is a 4:1 ratio. Since analog gauges are most often 2% (or worse) accuracies, a 0.25% digital gauge is more than accurate enough for this purpose.

Cost

- Analog gauges are less expensive initially; however, analog gauges fail often and are unreliable when subjected to shock and normal abuse. It is often necessary to buy several gauges per year. **Digital gauges, if properly maintained, will last several years.**

Cecomp Digital pressure gauges are more resistant to withstanding overpressure spikes without sustaining damage and can withstand 2X overpressure without affecting the calibration. Special engineering units or custom scales are no problem for Cecomp gauges.

 | www.api-usa.com | www.cecomp.com

Calibrating DPG1000 series gauges with a 760TORRA range

API TECH SUPPORT - TS1003

Precautions

- Install or remove gauge using wrench on hex fitting only. Do not attempt to tighten or loosen by turning housing or any other part of the gauge.
- Use fittings appropriate for the pressure range of the gauge as indicated on the rear label.
- Due to the hardness of 316 stainless steel, we recommend using a thread sealant to ensure leak-free operation.
- NEVER insert objects into the gauge port or blow out with compressed air. Permanent damage not covered by warranty will result to the sensor.
- These products do not contain user-serviceable parts except for replaceable batteries as specified in the instructions. Contact us for repairs, service, or refurbishment.

Preparation

1. Please refer to the data sheet for specifications, installation, wiring, and complete operating instructions. Data sheets are available at www.cecomp.com.
2. Calibration should only be performed by qualified individuals using appropriate calibration standards and procedures.
3. The calibration equipment should be at least four times more accurate than the gauge being calibrated. The calibration system must be able to generate and measure pressure/vacuum over the full range of the gauge. For zero calibration of absolute gauges, a vacuum pump is required that is able to produce a vacuum of 100 microns (0.1 torr or 100 millitorr) or lower.
4. It is good practice to install fresh batteries before calibrating battery-powered gauges.
5. Allow gauge to equalize to normal room temperature for at least 20 min before calibration.

Calibration Potentiometer Access

- Access the calibration potentiometers as indicated in the product data sheet.
- Remove the black plastic caps to expose the calibration potentiometers.
- Contact Customer Service to purchase replacement potentiometer covers if needed.

Calibration Procedure

1. Apply full vacuum to the gauge. Adjust the Zero potentiometer for a display indication of zero.
2. Apply full-scale pressure. Set the pressure to obtain a calibrator reading of approximately 760 torr and adjust the Span potentiometer for a display indication equal to your calibrator's pressure reading. You may use atmospheric pressure for span calibration, provided your calibration equipment can read it accurately.
   - **Note**: As stated on the data sheet (where applicable), atmospheric pressure constantly changes as it is affected by high and low pressure weather systems and how high the measuring station is above sea level.
3. Verify pressure indications at 0%, 25%, 50%, 75%, and 100% of full scale and repeat calibration steps 1 and 2 as needed to achieve best accuracy over desired operating range.

Absolute Reference gauges use absolute vacuum as a zero reference and thus will read zero at high vacuum and atmospheric pressure with the gauge port open to ambient. The gauge's reading will vary with barometric pressure and altitude. Since barometric pressure is constantly changing, the gauge's reading will continuously change when the gauge port is open to atmosphere, or if the system to which it is attached changes in volume or pressure with response to atmospheric pressure changes.

Ohm's Law

API TECH SUPPORT - TS1004

OHM'S LAW is the relationship between current, voltage and resistance. It states that current varies directly with voltage and inversely with resistance.

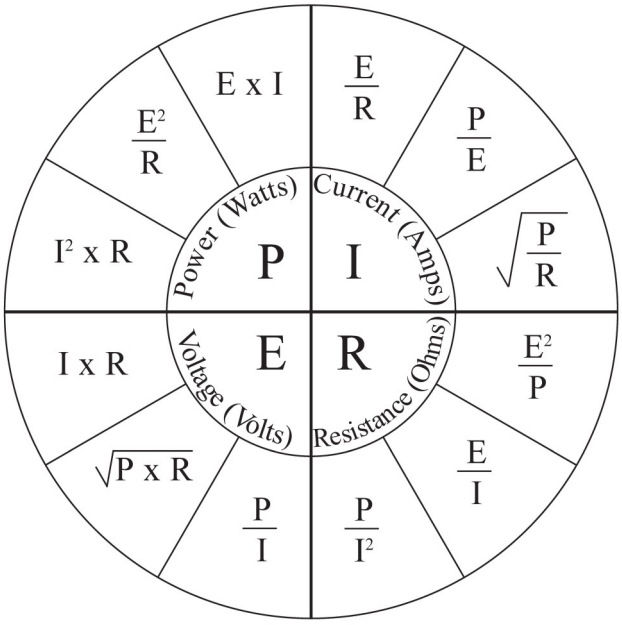
$$E = I \times R$$

E (Electromotive Force or **Voltage)** is the electrical potential that exists between two points and is capable of producing a flow of current when a closed circuit is connected between the two points. The unit of measure for Electromotive Force or Voltage is the volt (V). One volt will send one ampere of current through a resistance of one ohm.

I (current) is the flow of electrons past a point in a specified period of time, usually one second. The unit of measure for current is the ampere (A). One ampere of current is 6.24 x 1018 electrons passing a point in one second. Ampere is often shortened to amp.

R (resistance) is the opposition to current flow offered by a resistive component. The unit of measure for resistance is the ohm. One ohm is the resistance through which a current of one ampere will flow when a voltage of one volt is applied.

Ohm's and Watt's Laws



 | www.api-usa.com | www.cecomp.com

What is a ground loop?

API TECH SUPPORT - TS1005

Some Background: Today's modern process plants are highly dependent upon their electrical instrumentation loops for the quality of the end product. The information supplied by the process sensors (pressure sensors, flow sensors, thermocouples, RTDs, and other temperature sensors, etc.) is used by manufacturing instrumentation not only for control purposes but also to prevent runaway reactions. As such, maintaining accurate instrumentation output is critical to safety as well control. Any equipment used to implement an instrumentation loop makes use of a common signal ground as a reference for analog signals. A facility rarely has just one instrumentation loop; it may have hundreds or even thousands. Many are packaged together in vendor-supplied instrumentation system cabinets. Generally, these cabinets contain a DC signal common bus and a power supply common bus; these busses normally are tied together within the cabinets at a master ground bus. Further complicating the picture is the fact that the cabinet ground is a safety ground that protects equipment and personnel from accidental shock hazards while providing a direct drain line for any static charges or electromagnetic interference (EMI) that may affect the cabinets. This cabinet ground remains separate from the DC signal ground until it terminates at the master ground bus. Ground loops are particularly troublesome, since they are capable of serious signal disruption and their effect can be intermittent.

A ground loop usually refers to a current, generally unwanted, in a conductor connecting two points that are supposed to be at the same voltage potential, often ground, but are actually at different potentials. For a ground loop to occur, there must be at least two different grounds that are at different potentials, and a circuit path must be established between those grounds. Usually the circuit is completed when the process signal wire is connected from the sensor (which is typically at one ground potential) to the receiving I/O device (which can be at a different ground potential). **Figure A:** Ground loops cause problems by adding or subtracting small currents (or voltage levels) to the process signal. The I/O point receiving the signal can't differentiate between the desired process signal and the corrupted signal, so the programmable logic controllers (PLC) or distributed control systems (DCS) will not reflect true process conditions.

The probability of establishing multiple grounds and ground loops is especially high when you install new PLCs or DCSs. With so many connections referenced to ground within a facility, the likelihood of establishing more than one point is almost unavoidable. Since eliminating all but one ground is not feasible, the most cost effective solution is to use API's signal conditioning isolators (API or APD series). Signal conditioners break the current path, or DC continuity, between grounds that are at different earth potentials (**See Figure B**). Without this path, there is no way for any stray current or voltage to reach the receiving device. Moreover, an isolator also eliminates another problem: AC continuity noise, otherwise known as common mode voltage. Isolators, like most other transmitters, come in 2- and 4-wire versions. The 4-wire type requires a separate power source and is partially suited for back-of-panel mounting. You can power the 2-wire type from either the input or output loops. API isolators can also be used as signal repeaters or for scaling functions—i.e. 2-12 mA input to 4-20 mA output.

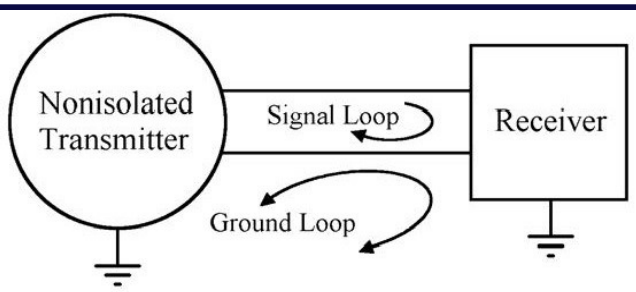


Figure A

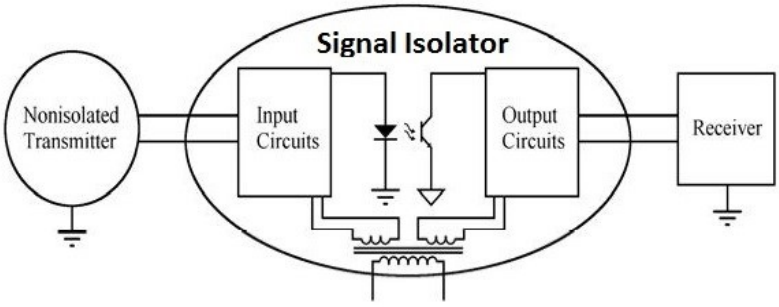


Figure B

Functions of a signal conditioner

API TECH SUPPORT - TS1006

While there are many different types of signal conditioners, their basic function is to change or alter signals so that different process devices can communicate with each other accurately. Signal conditioners are most commonly needed to link temperature, pressure, weighing, level and flow devices with indicators, recorders, and computerized process monitoring and control systems. Signal conditioners (isolators) can also perform some other tasks for you, as listed below:

***SIGNAL CONVERSION*:** A signal isolator can change an analog signal from one form to another allowing equipment with dissimilar signals to communicate. For instance, if a piece of field equipment outputs a 4-20 mA signal and the control system needs a ±10 V input signal, the signal from the field equipment must be converted. A signal isolator that accepts a 4-20 mA input and produces a ±10 V output solves the problem.

SIGNAL BOOSTING: A signal isolator can increase the load drive capability in the loop. This works because the input impedance of most isolators is much less the total load resistance of a loop. Therefore adding an isolator to the loop boosts the loop's net load drive capability. This is especially useful when it becomes necessary to add additional devices to an existing overloaded loop.

SIGNAL SPLITTING: Signal splitters receive a process signal input and provide two isolated process output signals. Each channel operates independently and is isolated from the others to prevent interaction between channels.

SIGNAL ALARMING: Warns of trouble if a process signal reaches a too high or too low level. A signal conditioner that accepts an analog signal (4-20 mA, 1-5 V, etc.) and produces a relay output is an inexpensive way of providing a redundant hardwire safety net in the event of a system failure.

***SIGNAL ISOLATION*:** Stops ground loops from affecting the accuracy of a process signal. Ground loops are a common complaint at system startup and can be eliminated by installing isolated signal conditioners, or isolators, on the process loop between a nonisolated device and a control system.

***LINEARIZATION*:** Many sensors output a signal that is not linearly related to the engineering value being measured. For example, a thermocouple used to measure temperature has a nonlinear millivolt output. A thermocouple input signal isolator translates this to a standard, robust, linear signal such as 4-20mA that is linear to temperature.

NOISE FILTERING: Isolators typically incorporate low pass filters that eliminate high frequency EMI/RFI and unwanted signals from power lines, generators and motors that induce errors in a process loop. An isolator filters this "noise" and produces a clean process signal.

When you need to isolate, convert, share, split, boost, protect, step down, or linearize process signals, look to the versatile workhorses of the process instrumentation world... API and APD signal isolators, alarm trips or converters.

 | www.api-usa.com | www.cecomp.com

Single-ended vs. differential inputs

API TECH SUPPORT - TS1007

When connecting analog current (such as 4-20 mA) signals to a PLC, data acquisition system or measuring instrument, you can often choose between single-ended or differential inputs. What is the difference between these and which should you use? When choosing it is important to keep three things in mind:

- **POWER -** Which device is providing power to the loop?
- **SIGNAL -** What is the signal path? It must be connected correctly and be the right type of signal for the circuit to operate.
- **GROUND -** Where are the ground connections? Is there a potential for a ground loop?

Single-Ended Inputs

Typically, single ended inputs come from a two-wire transmitter: one wire is connected to a power source, and the other wire from each signal source is connected to the PLC or receiving device. This assumes the sensor ground, power source ground and the PLC or measuring device ground will all have the same value. In reality, earth ground can vary in different locations. These earth ground potential differences can create current paths or ground loops leading to measurement errors. The errors generally increase as distance between earth grounds increases, and also increases with more electrical equipment in the vicinity.

Differential Inputs

Typically differential inputs have two signal wires run from each signal source to the PLC or receiving device. One goes to the + input and one to the - input. This allows the PLC or receiving device to measure each of the wires in reference to its own ground, eliminating grounding differential errors. Noise immunity is improved since the pair of wires pick up interference equally. When using differential inputs, the sensor may "float" or have no ground connection. It may be preferable to connect the negative (-) signal wire to the PLC terminal marked 0V, REF or GND.

An API or APD signal conditioner can provide solutions to the above issues. It can power a loop or be passive, convert incompatible signals, and provide isolation to break ground loops. Every Absolute Process Instruments APD signal conditioner gives you the ability to selectively wire in the field for either a differential or single-ended input/output device.

 | www.api-usa.com | www.cecomp.com

Sink vs. Source

API TECH SUPPORT - TS1008

When using transmitters and signal conditioners to connect to a PLC, data acquisition system or measuring instrument, you must choose between sinking or sourcing inputs and outputs (I/O). **What is the difference between these and which should you use?** A 2-wire transmitter is a passive device (provides no power) and thus "sinks" current. A 4-wire transmitter operates on an external power source (provides power) and thus "sources" or provides power to the circuit. Sinking and sourcing refer to the way that any external power load is connected to any electronic device such as a PLC, data acquisition systems, measuring instrument, or of course, our signal conditioners. See
It is important to keep three things in mind:

1. **POWER** - Which device is providing power to the loop?

2. **SIGNAL** - What is the signal path? It must be connected correctly (sink to source, never source to source or sink to sink) and be the right type of signal (mA) for the circuit to operate.

3. **GROUND** - Where are the ground connections? Is there a potential for a ground loop?

SINKING INPUT

The device receiving the input signal does not provide power to that signal (device acts as a resistive load). In order for the circuit to have power, this device must be either:
A) Connected to a device that powers the loop / sources its output signal **(Ex 1, Ex 2)**; or
B) If it is connected to a sinking output, there must also be a loop power supply in the circuit **(Ex 3)**.

SOURCING INPUT

The device receiving the signal provides power to that signal. It must be connected to a passive device / one that sinks its output signal, such as a 2-wire transmitter that uses the power from the receiving device. **(Ex 1, Ex 2)**

SINKING OUTPUT

The device's output signal does not provide power to the circuit (device acts as a resistive load). In order for the circuit to have power, this device must be either:
A) Connected to a device that powers the loop / sources its output signal **(Ex 1, Ex 2)**; or
B) If it is connected to a sinking input, there must also be a loop power supply in the circuit **(Ex 3)**.

SOURCING OUTPUT

The device's output signal powers the output circuit. It must be connected to a receiving device that provides no power to the signal (is passive / acts as a resistive load). **(Ex 1, Ex 2)**

Note that sinking-sourcing and sourcing-sinking pairing is always used, and never sourcing-sourcing or sinking-sinking.

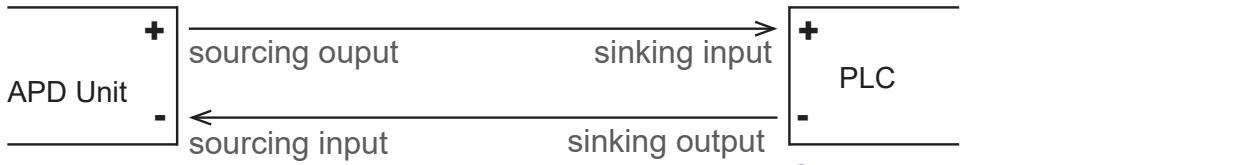
(ctd., p2 contains diagrams)

Sink vs. Source (ctd.)

API TECH SUPPORT - TS1008

Ex 1

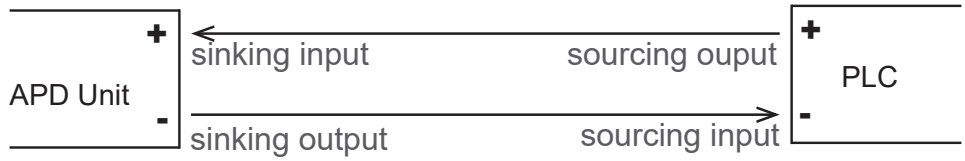
Source (Provides power to the loop)



Sink (Passive / Resistive load)

Ex 2

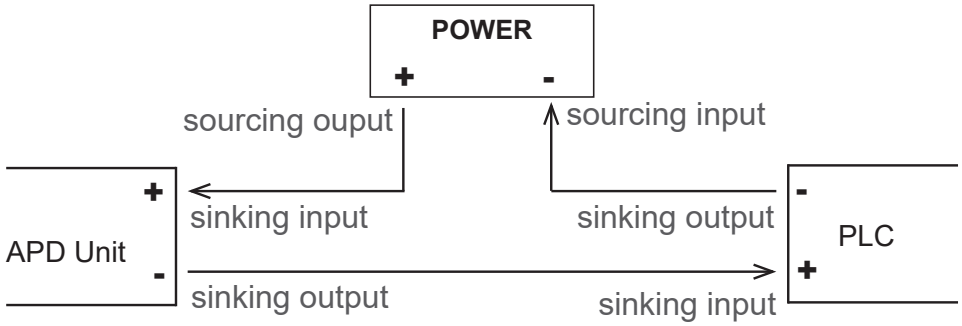
Source (Provides power to the loop)



Sink (Passive / Resistive load)

Ex 3

Source (Provides power to the loop)



Sink (Passive / Resistive load) **Sink (Passive / Resistive load)**

We build solutions to sinking/sourcing problems into our signal conditioners. APD units can power a loop or be passive, convert incompatible signals and provide isolation to break ground loops. Standard on Absolute Process Instruments' APD series of signal conditioners is a 20 VDC loop excitation supply for the milliamp output and a +15 VDC ±10%, regulated input loop power supply. You can thus selectively wire the input and the output in the field for either sinking or sourcing.

 | www.api-usa.com | www.cecomp.com

Total system error band

API TECH SUPPORT - TS1009

Total System Error Band

When determining the "accuracy" of any measurement/conversion system, one must consider the performance criteria for each relevant component. The total "system" error (typically referred to as "total system error band") is the algebraic sum of the errors for each part of the system. Therefore, the total error band must be considered when determining if a "system" is within specifications, i.e. "Is it operating within specified performance tolerance."
For example, assume the following accuracies:

- Sensor/conversion instrument ±0.15%
- Signal conditioners ±0.1%
- Conversion hardware ±0.05%

So the system accuracy tolerance (total system error band) for the above example will be ±0.3% when measured at a static operating temperature.
Nothing can be done to eliminate the compounding of the errors in a system because, as noted above, in order to ascertain the effectiveness of any measurement system, one must consider the performance criteria for each relevant component. Other factors that influence the "total system error band" are environmental conditions such as temperature, humidity, air flow, mechanical vibration, RFI and EMI. Unlike mechanical parts, ALL analog active and passive type circuits tend to "DRIFT" out of their initial calibration specifications over time. For this reason, the calibration of any instruments affecting production must be performed periodically either on site or in a laboratory. There is no simple method for assigning calibration intervals; however, documentary standards such as ANSI/NCSL Z540 and ISO/IEC 17025 prescribe that measuring and test equipment need to be recalibrated at regular intervals as part of a quality assurance program. The most frequently used calibration interval is one year.

Temperature Effects on Total System Error Band

Many companies continue to ignore the single largest cause of precision measurement error: temperature. If a system is calibrated at one temperature and then operated at a significantly different temperature, the temperature-induced error will affect the system's accuracy. The temperature coefficient of the relevant components (system sub-assemblies) must be added to the general accuracy specification for each component. It is calculated by the following manner:

> The temperature coefficient specification is commonly defined as percent per degree. This means that, for each degree outside of the normal operating temperature, this percentage is added to the normal accuracy specification. In general, the temperature coefficient is much less than the normal accuracy. The normal operating temperature is typically 23 to 25°C.

Example:

Temperature Coefficient = 0.04% of span per °C.
Accuracy = ±0.1% of span.
Now consider that the component is operating at 33°C temperature but was calibrated at 25°C. Since this is 8°C above the calibration temperature (normal operating temperature), the temperature coefficient is going to apply to the normal specification, so the accuracy tolerance for this component will now be as follows:

±0.1% + (±0.04% x 8) = ±0.42% of span

The ability to depend on accurate monitoring and control signals is literally priceless. Inaccuracies can lead to process inefficiencies, process upsets and even very costly plant shutdowns. Whether you call them signal isolators, signal converters or signal interfaces, these useful process instruments are indispensable tools that enhance measurement accuracy and protect signals from damaging conditions, thereby saving time, effort, and money.

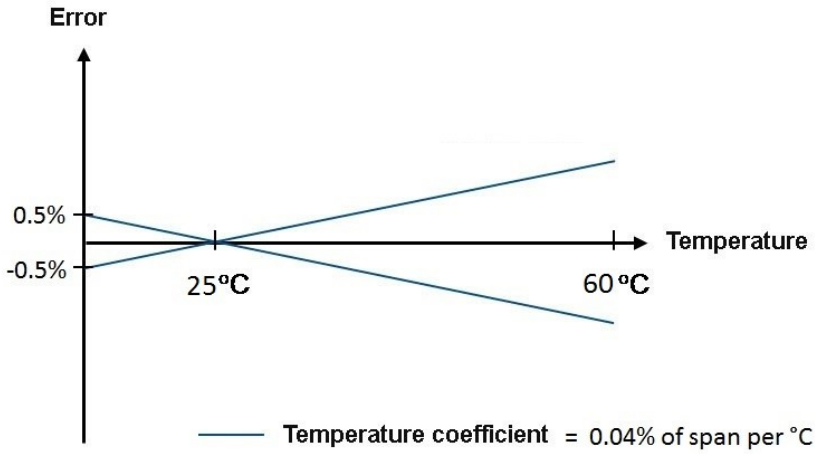
 | www.api-usa.com | www.cecomp.com

Definitions of temperature effects on accuracy

API TECH SUPPORT - TS1010

One of the most important considerations for accurate calibration procedures is ensuri that the calibration conditions of the instrument approximate actual operating temperature conditions as closely as possible. Components used in an instrument are affected by changes in operating temperature. If an instrument is calibrated at one temperature and then operated at a different temperature, the temperature-induced error can degrade the instrument accuracy.

- **Operating Temperature Range** - This is the temperature range over which the instrument can be safely operated without consideration of accuracy. The "ambient operating temperature range" is from the minimum operating temperature to the maximum operating temperature. Outside of this range, components may become damaged and the instrument may fail.
- **Temperature Coefficient** - A temperature coefficient describes the relative change of output that is associated with a given change in temperature. Since temperature affects the measuring accuracy of an instrument, there always remains a small temperature error in the rated temperature range despite a wide range of compensation measures. Accordingly, the temperature error at the calibration point is zero and increases with increasing difference of the temperature from the calibration temperature with the specified coefficient in linear fashion (see figure below).



- **Temperature Error Effect on Span -** This error specifies the effect of temperature on the full-scale value (rated output) as the ambient operating temperature increases and decreases. This is usually expressed as a percentage change in rated output per degree C change in ambient operating temperature, over the compensated temperature range.

Calibration is a means to an end and defines the accuracy and quality of measurements recorded using a piece of equipment. Most calibrated instruments eventually drift over time due to age or due to temperature cycling. To be confident in the results being measured, there is an ongoing need to service and maintain the calibration of equipment throughout its lifetime for reliable, accurate and repeatable measurements.

 | www.api-usa.com | www.cecomp.com

Instrument calibration requirements

API TECH SUPPORT - TS1011

Calibration is one exercise that is often taken for granted within an industrial plant. Even the most important and high quality industrial instrumentation will become useless if not calibrated regularly. Through the process of calibration, adjustments are made to an instrument to ensure that it performs as expected to deliver predictable, accurate and reliable results that meet quality standards within a specified accuracy. The most easily understood definition of calibration is that it is the process of adjusting an instrument to meet the manufacturer's design specifications.

Instrument Calibration can be called for:

- With a new instrument
- When a specified time period is elapsed (**Standard:** every 12 months)
- When a specified usage (operating hours) has elapsed
- After system maintenance has been performed
- When an instrument has undergone an event such as an electrical fault, a fall, a shock or a vibration that may have created the potential to put it out of calibration
- With sudden changes in environmental conditions (temperature is the most common)
- Whenever observations appear questionable

Calibration of an instrument must be performed using the correct values, reliable NIST-traceable calibrators with the correct tolerance, and the correct manufacturers preparation technique. Errors can still result from environmental factors, like the temperature of the surroundings, which can have a huge impact on the results of the calibration, therefore:

- Instruments should be calibrated in an environment where factors that can affect the performance, like temperature, pressure and humidity, are closest to those of the surroundings it is operated in.
- Instruments calibrated at one particular temperature, or in fluctuating temperatures, may be prone to temperature-induced errors if they are operated in a significantly different environment. These conditions can degrade the accuracy of the calibration results.

A signal conditioner should be capable of measurements that are "within the manufacturer's accuracy specifications" when used within the stated environmental conditions over some reasonable period of time. Minimizing, or altogether eliminating, environmental factors that could cause inconsistencies and errors are a fundamental part of instrument calibration/operation philosophy.

Environmental factors affecting instrument accuracy

API TECH SUPPORT - TS1012

1. ***Temperature***

   Temperature can have a significant effect on calibration of electronic instruments like signal conditioners and transmitters. Calibration accuracy degrades rapidly when temperature strays either way from “ambient.” Both the International Society of Automation (ISA) and NCSL International recommend that the temperature for calibrations (ambient calibration temperature) be 23°C ± 1.5° C. Most instrumentation specifications provide a "temperature coefficient (an adder)" to determine accuracy specifications if the ambient operating temperature differs from the ambient calibration temperature. For example if a signal conditioner/transmitter is exposed to varying outdoor temperature fluctuations, annual field calibrations may not be sufficient. Instead calibration may have to be done weekly, monthly, quarterly, etc. in order to maximize critical instrument performance under a wide variety of weather conditions. Even with this diligence, it is desirable to keep all instrumentation from experiencing temperature variations whenever possible.

   - NCSL Recommended Practice RP-14 - *Guide to selecting standards-laboratory environments.*
   - ISA Recommended Practice ISA-TR52 - *Recommended environments for standards laboratories*.

2. ***Humidity***

   Humidity can influence instrument operation and calibration. If the circuit boards inside the instrument are sealed with conformal coatings, high humidity shouldn’t really affect the instrument. If the boards are not sealed with conformal coatings, high humidity will typically affect cross track resistance and can cause internal shorts. Most API and Cecomp products have affordable conformal coating options. The most common recommended humidity range for calibration is 20% minimum to 55% maximum at 23°C.

3. ***Dryness***

   The issue with very dry air is that ambient static can’t bleed off. When the quantity of ambient static gets high enough, it can flash over and typically causes damage to components.

3. ***Vibration***

   Vibration from other process equipment or other sources transmitted to the instrument can cause substantial effects on instrument calibration. It is desirable to reduce or prevent vibration effects on all instrumentation.

4. ***Air current/pressure differential***

   Air currents or changes in air pressure from ceiling fans, air conditioners, and open windows and doors can also cause an instrument to show incorrect measurements. It is desirable to keep all instrumentation from experiencing pressure variations whenever possible.

Our engineering team has had decades of experience in assisting customers with a wide variety of environmental conditions. Many customers’ solutions have come out of brainstorming sessions with our team. If you have a problem you can’t solve, give us a call and we are happy to help with your application.

 | www.api-usa.com | www.cecomp.com

Absolute reference & gauge reference defined

API TECH SUPPORT - TS1013

What is "Gauge Reference"?

One of the most common pressure references is "gauge reference," which is pressure measured relative to atmospheric pressure. This means that the gauge will read zero with no pressure applied and continue to read zero as atmospheric pressure changes. It is typically signified by a (g) after the pressure unit (e.g. 100 psi g). One common reason for using gauge reference when monitoring pressure is to ensure that, with any location throughout the world, the sensor will always reference zero with no pressure applied. A pressure measurement higher than ambient pressure is referred to as positive pressure. If the measured pressure is below atmospheric pressure, it is called vacuum gauge pressure (negative pressure). Gauges built to measure 1000 psi and above use sealed reference transducers which are referenced to a fixed value of 14.7 psi (normal atmospheric pressure). At these higher pressures, slight atmospheric changes cause no noticeable operational differences.

What is "Absolute Reference"?

Absolute reference gauges use absolute vacuum as a zero reference and thus will read zero at high vacuum and atmospheric pressure with the gauge port open to ambient pressure. It is signified by an (a) after the pressure unit (e.g. 100 psi a). The gauge's reading will vary with barometric pressure and altitude. As locations change, the reference point can change because of atmospheric pressure differences. (The most common reason for this effect is changing elevation.) As vacuum is applied, the readings will decrease, eventually reaching zero when full vacuum is applied. Absolute reference gauges are not available in ranges below 15 psi because the transducer would always be in an over-range condition at normal atmospheric pressures.

A note about atmospheric pressure:

Atmospheric pressure is affected by high and low pressure weather systems and how high the measuring station is located above sea level. For weather barometer readings to make sense, it is desirable to remove the effect of weather station altitude. A weather barometer reading is corrected to a hypothetical sea level reading by taking into account the altitude, pressure reading and temperature. An altimeter reading is corrected by taking into account the altitude and pressure reading.

- **Gauge pressure** is zero-referenced against ambient air pressure, so it subtracts atmospheric pressure from the pressure measurement equation.
- **Absolute pressure** is zero-referenced against a perfect vacuum, so it adds atmospheric pressure into the pressure measurement equation.

 | www.api-usa.com | www.cecomp.com

Cecomp gauge accuracy

API TECH SUPPORT - TS1014

How is accuracy calculated for Cecomp gauges?

The accuracy of a measurement is determined by how close a result comes to the true value. Determining the accuracy of a pressure gauge requires calibration with a known standard.

Accuracy calculations are based on the characteristics (linearity, hysteresis, repeatability) of the transducer and supporting electronics, range of the transducer, and display resolution. These calculations are expressed as a percent of full scale of the transducer plus the round-off error of the rightmost least significant digit (LSD). This round-off error has to do with the fact that the analog output of the pressure transducer needs to be rounded up or down when it is converted to a digital readout. This produces a 1 digit uncertainty in the right-most digit in the display which cannot be ignored. Sometime the "±1 LSD" is left off from the specifications, but it is safe to assume it is there.
The Cecomp accuracy specifications typically state ±0.25% FS ±1LSD.

For example, an F16B100PSIG gauge will have an overall accuracy of ±0.4 PSI. To calculate the accuracy of this gauge :

- First calculate the 0.25% accuracy of the gauge: ±0.0025 X 100psi = ±0.25 psi
- Since this gauge has a digital display resolution of 0.1, we round the 0.25 error up to ±0.3. This is the round off error for the transducer analog output signal being converted to a digital readout.
- Then we add a display last digit uncertainty of ±0.1 to get a calculated accuracy of ±0.4 psi. This is the digit uncertainty for the right-most digit in the display.

Our gauges are conservatively rated and operate well within the stated accuracy limits. Cecomp uses the "terminal point" specifications method during gauge calibration instead of "best-fit straight line" specifications. This type of calibration procedure is more stringent and means that the zero pressure point and the 100 percent pressure point are "terminals" (sometimes referred to as end points) to which the actual performance of the transducer is fixed. Since the "terminal-based" specification is based on stated accuracy at zero and full scale, the worst possible case, usually at midrange, will never have the unit exceed specified nonlinearity.

It is possible to scale and calibrate a Cecomp gauge over part of the transducer range, but accuracy will always be determined by the full range of the transducer. Our digital gauges can generally withstand 2 times their rated pressure without incurring damage.

 | www.api-usa.com | www.cecomp.com

Analog vs. Digital pressure gauges: An important distinction

API TECH SUPPORT - TS1015

We are often asked why one might require a digital gauge when their analog (dial) gauge is working just fine. The short answer is, it may not be working fine at all and you may never know.

The long answer is...

- Analog gauges are less expensive initially; however, analog gauges fail often and are unreliable when subjected to shock and normal abuse. It is often necessary to buy several gauges per year. Digital gauges, if properly maintained, will last several years.
- Digital gauges will withstand considerable shock, vibration, and abuse without losing calibration. Analog gauges are most often “out of calibration” after the first time they are dropped or banged around.
- Should a digital gauge be physically damaged (ie, punctured display or faceplate/keypad) they can be repaired at a nominal cost. They also often continue to function when damaged. Cecomp gauges also come with a one year warranty.
- Digital gauges can be NIST certified.
- Due to the digital readout, there are no parallax problems reading a digital gauge. Analog gauges are often misread due to the parallax issue.
- Digital pressure gauges are far more accurate than analog gauges. Standard accuracy for Cecomp is 0.25% but most ranges are available at 0.1% accuracy.
- Cecomp’s gauges can withstand 2X overpressure without it affecting the calibration.
- Cecomp’s gauges are available with microprocessors that allow the user to change engineering units, set the battery on/off time, as well as digitally calibrate the gauge.

  Cecomp’s gauges have much higher resolution that analog gauges.
- Cecomp’s gagues are available with min/max memory for monitoring peak and valley pressures.
- Cecomp’s gauges are available with a backlit display for use in dark areas.
- Due to the solid state design, digital pressure gauges can be used in high vibration applications. The display will hold steady while an analog gauge needle may bounce around and make it difficult to take an accurate reading.
- Digital pressure gauges, due to inherent superior accuracy, are often used as “gauge standards” for testing analog gauges. The rule of thumb for checking instruments is a 4:1 ration. Since analog gauges a most often 2% (or worse) accuracies, a 0.25% digital gauge is more than accurate enough for this purpose.

There is a reason why our Cecomp digital pressure gauges are often used as “gauge standards.” Due to superior accuracy, companies test them against analog gauges to determine the analogs’ accuracy and to ensure they are operating properly. If running a whole plant on digital is impossible, having ‘test gauges’ on hand for can guarantee an entire system’s accuracy.

 | www.api-usa.com | www.cecomp.com

Testing an analog control loop using API/APD module features

API TECH SUPPORT - TS1016

The customers who use these features swear by them.

The API **LoopTracker® LEDs** indicate the level of the input and/or output signal by varying signal intensity proprotionally. In other words, as the process signal increases, the brightness of the LED increases, and as the signal decreases the LED brightness decreases. Should a problem develop in the current loop, such as a faulty device in the loop causing an incomplete path for current flow, the Loop LEDs detect this and cease to illuminate. This function works on both the input and output loops, allowing the technician to diagnose the cause of the problem quickly and efficiently, minimizing system down time.

The **Functional Test Switch** will, when pressed, output its own constant, preset output test signal independent of the input signal. This signal is factory set at 50% (±1%) and allows the technician to temporarily inject a test or preset calibration signal into the output loop without manipulating the input signal. This manual output is field-adjustable via a potentiometer on top of the module. This feature allows the technician to check loop status (LoopTracker LEDs should be ON), downstream display operation, downstream alarm operation, etc. using only a pencil or pen.

Scenarios

1. Customer states system is not operating correctly. **The input LED is out and the output LED is lit dimly.** When Test Switch is pressed, both input and output LEDs illuminate at approx. 50% brightness. The input LED illuminating when the Test Switch is pressed indicates that the problem is the input signal to the module: the input signal to the module is either open or shorted-to-ground.

2. Customer states system is not operating correctly. **The input LED is out and the output LED is lit dimly.** When Test Switch is pressed, the output LEDs illuminates at approximately 50% brightness but the input LED stays out and he has verified that the input signal is correct at the socket. Since the input LED is out, this indicates that there is no signal from the module input amplifier so the module needs to either be replaced and/or repaired by the API factory.

3. Customer states system is not operating correctly. **The input LED seems to be varying in brightness with the input signal but the output LED is out.** When the customer presses the Test Switch, only the input LED illuminates: the output LED stays out. We had the customer place a jumper across the output terminals, and the output LED illuminates. This indicates that the output circuit is open.

4. Customer states system is not operating correctly. **The input LED is seems to be varying in brightness with the input signal but the output LED is out.** When customer presses the Test Switch, only the input LED illuminates: the output LED stays out. We had the customer place a jumper across the output terminals, but the output LED does not illuminate. The output LED remaining out indicates that the output circuit on the module is “Blown” and the module needs to either be replaced and/or repaired by the factory.

The API **LoopTracker® LEDs** indicate input and output signal levels, while the **Functional Test Switch** will, when pressed, output its own constant, preset, and independant output test signal. Designed to diagnose problems fast, you will save hours in the field. All API units come with a lifetime warranty.

 | www.api-usa.com | www.cecomp.com

Using the built-in 4-20 mA loop power supply

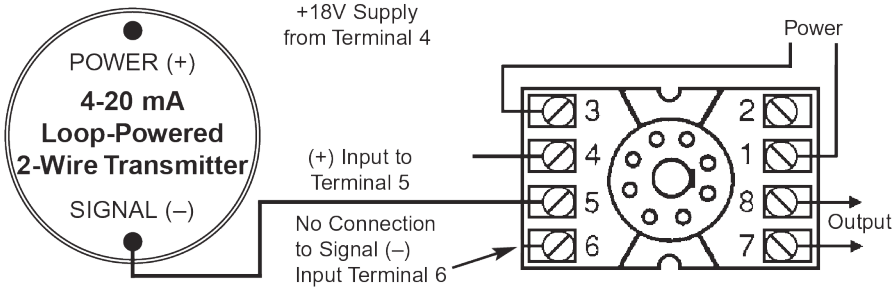
TS1017

Many API and APD modules have a built-in loop power supply which can be used to power the 4-20 mA input current loop. The wiring diagrams below give examples of how a two-wire transmitter can be powered by the module's loop power supply and also provide input to the module.

When using the built-in loop power supply, there is no connection to the module's signal minus (–) input terminal. An internal 50 ohm resistor across the input terminals allows you to do this without any problems.

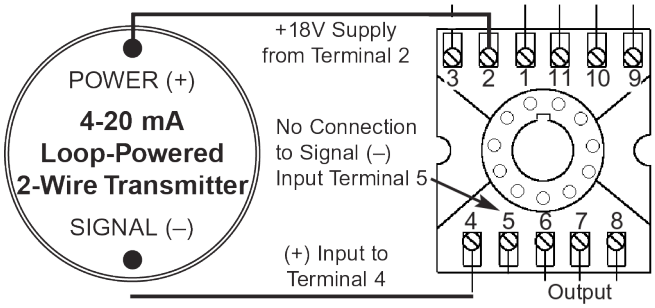
8-Pin Plugin Modules

API 4300 G
API 4380 G
API 4380 G HV3
API 4385 G



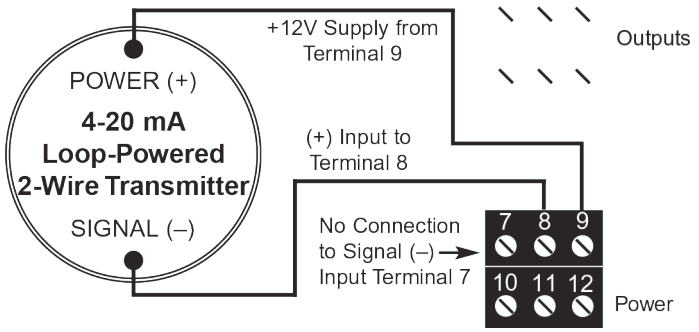
11-Pin Plugin Modules

API 1005 G
API 1025 G
API 1080 G
API 1090 G



DIN Style Modules

APD 1080
APD 1090
APD 4380



Plugin style modules are preferable when "hot-swapability" is required for minmal process shutdown. DIN mount style modules are a more common and updated design. Contact the factory for assistance choosing the right module for your process.

 | www.api-usa.com | www.cecomp.com

Terms & Definitions

API TECH SUPPORT - TS1018

Accuracy: The closeness of an indication or reading of a measurement device to the actual value of the quantity being measured. Accuracy calcula-tions are based on the linearity, hysteresis, and repeatability characteristics of the transducer/sensor and supporting electronics, the range of the transduc-er/sensor, as well as the resolution being displayed. Usually expressed as a ±% of full scale output of the transducer/sensor/system.

A/D (Analog to Digital): Conversion of a continuously varying signal (analog) to discrete binary numbered values (digital).

Alarm Condition: The input (process signal) has crossed the set (trip) point and the relay has changed states into an alarm condition. Relay will remain in this state until input signal returns to normal condition.

Background Noise: The total amount of noise from all sources of interfer-ence in a process loop, independent of the presence of a data/control signal.

Chatter: Describes a condition where the input signal hovers near the set (trip) point, causing the relay to trip off, then back on in short bursts. Generally solved by adding or expanding the deadband.

Clipping: A phenomena which occurs when an output signal is limited in some way (usually in amplitude) by the full range of an amplifier/unit.

Common-Mode Rejection (CMR): The ability of a device to eliminate the effect of AC or DC noise between the input signal and ground. Normally expressed in dB at DC to 60 Hz.

D/A (Digital to Analog): Conversion of a discrete binary numbered values (digital) to a continuously varying signal (analog).

Deadband: The range through which an input can be varied without initi-at-ing an observable response. Deadband is usually expressed in percent of span.

Dual Alarm Trip: A unit that accepts one input signal, has two set (trip) points, and one output relay per set point. Each set point is independent of the other and can be set between 0-100% of the input range.

Electrical Interference: Electrical noise induced upon the signal wires that obscures (interferes with) the wanted information signal.

Fail-Safe: Relay coil is energized when the input signal is in the normal oper-ating condition. In the alarm condition, the relay coil de-energizes. Considered a safety measure because, in the event of a loss of power to the unit or other failure, the unit “fails” to an alarm condition.

Gain: The amount of amplification used in an electrical circuit.

High Alarm: The relay changes state when the input signal reaches or exceeds the set (trip) point.

Hysteresis: The difference in output from a transducer/sensor when a meas-ured value is first approached with increasing and then decreasing values.

Input Impedance: The total opposition, both resistive and reactive, that the unit presents to the input signal loop.

Linearity: The closeness of a calibration curve to a specified straight line. Linearity is expressed as the maximum absolute deviation of any calibra-tion point on a specified straight line during any one calibration cycle.

Loop Resistance: The total resistance in a circuit to current flow caused by the resistance of all components.

Loop Impedance: The total opposition (resistive plus reactive) to current flow in a circuit.

Low Alarm: The relay changes state when the input signal falls to or below the set (trip) point

MOV (Metal Oxide Varistor): A voltage dependent resistor whose resist-ance predictably changes with voltage, often used as transient protectors.

Negative Temperature Coefficient: A decrease in resistance with an increase in temperature.

Noise: An unwanted electrical signal on any signal wires.

Non-Fail-safe (Reverse Acting): Relay coil is de-energized when the input signal is in the normal condition. In the alarm condition, the relay coil ener-gizes. There is no alarm when there is a loss of power.

Normal (Non-Alarm) Condition: The process signal has not crossed the set (trip) point.

Normally Closed (N/C): Describes a set of relay contacts that in the un-powered state have continuity across them.

Normally Open (N/O): Describes a set of relay contacts which in the unpowered state have no continuity across them.

Optical Isolation: Two circuits which are connected only through an LED transmitter and photoelectric receiver with no electrical continuity between them.

Positive Temperature Coefficient: An increase in resistance with an increase in temperature.

Relay (Mechanical): An electromechanical device that completes or inter-rupts a circuit by physically moving electrical contacts.

Relay (Solid State): A solid state switching device which completes or inter-rupts a circuit electrically with no moving parts. Commonly called an SSR.

Repeatability: The ability of a transducer/sensor to reproduce output read-ings when the same measured value is applied to it consecutively.

Reset: The action of returning to the normal (non-alarm) condition.

Resistance: Opposition to current flow offered by a purely resistive com-po-nent, measured in ohms.

Response Time: The time required by a sensor to reach 63.2% of its final value in response to a step-change input. This is typically called “one time constant.” Five time constants are required for the sensor to stabilize at 100%of the step change value.

Root Mean Square (RMS): Square root of the mean of the square of the sig-nal taken during one full cycle.

Sensitivity: The minimum change in input signal to which an instrument/ sen-sor can respond.

Set Point: The point at which an alarm/controller is set to control a system.

Single Alarm Trip: A unit that accepts one input signal, has one set (trip) point, and one output relay. The set point can be set between 0-100% of the input range.

Span: The difference between the upper and lower limits of a range expressed in the same units as the range.

Span Adjustment: The ability to adjust the gain of a sensor/unit so that the output signal corresponds to the maximum input signal. The adjust-ment range is normally expressed in counts or percentage.

Transducer: A device that converts energy from one form to another. This term is generally applied to devices that take physical phenomenon (pressure, temperature, humidity, flow, etc.) and convert it to an electrical signal.

Triac: A solid state switching device used to control alternating current.

Trip Point: Value at which alarm relays change to an alarm condition.

True RMS: The true root-mean-square value of an AC or AC-plus-DC sig-nal. For a perfect sine wave, the RMS value is 1.11072 times the rectified average value. This value is often used to determine the power of a signal. For significantly non-sinusoidal signals, a true RMS converter is required.

Volt: The unit of potential difference and electromotive force. One volt will send a current of one ampere through a resistance of one ohm.

Voltage: The electrical potential difference that exists between two points and is capable of producing a flow of current when a closed circuit is con-nected between the two points.

Zero Adjustment: The ability to adjust the output from a sensor/unit so that the minimum output corresponds to the minimum input. The adjust-ment range is normally expressed in counts or percentage.

 | www.api-usa.com | www.cecomp.com

What is deadband?

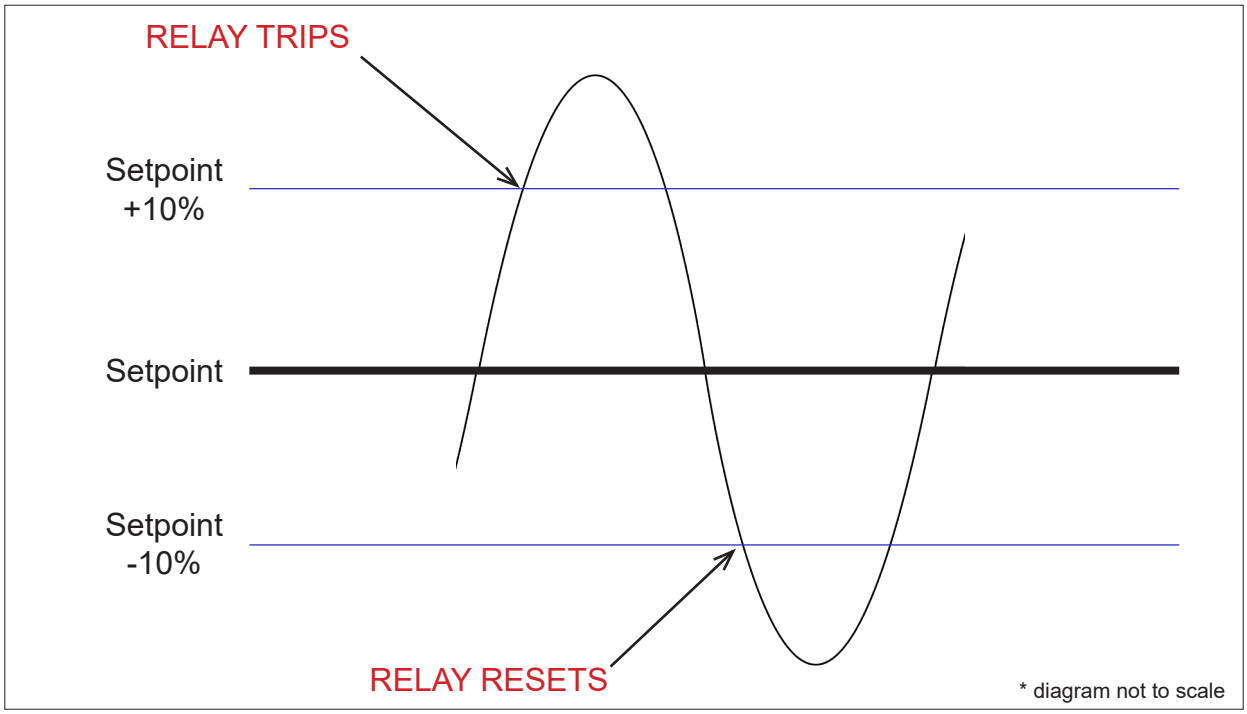
API TECH SUPPORT - TS1019

DEFINITION

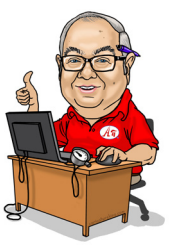
Deadband is the range through which an input can be varied without initiating an observable response. Deadband is usually expressed in percent of span.

EXAMPLE

A 20% total deadband is applied to the setpoint of a monitored parameter. The relay will trip and reset to its untripped state as indicated in the following graph:



20% TOTAL DEADBAND



Any digital unit with setpoints, relays or “alarm trips” may serve the function described here. The Cecomp and API engineering teams can help you determine how best to set up your process for alarming using our smart technology.

 | www.api-usa.com | www.cecomp.com

RFI & EMI

API TECH SUPPORT - TS1020

Electrical interference, or noise, is an unwanted electrical signal that can cause intolerable error in, or complete disablement of an electronic control or measurement systems. Interference or electrical noise is broken down into two somewhat overlapping categories: Radio Frequency Interference (RFI) and Electromagnetic Interference (EMI). Some of the more commonly encountered sources of interference are:

- Mobile and stationary radio, television and hand-held transmitters such as walkie-talkies
- Cell phones
- Fluorescent lights
- Radar
- Weather-related electrical discharges such as lightning
- Static discharges
- Induction heating systems
- High-speed power switching elements such as SCRs and thyristors
- High AC current conductors
- Large solenoids or relays
- Transformers
- AC or DC motors
- Ultrasonic cleaning or welding equipment
- Welding equipment
- Engine ignition systems

The effects of Radio Frequency Interference (RFI) and Electromagnetic Interference (EMI) can cause unpredictable and non-repeatable degradation of instrument performance and accuracy, and even complete instrument failure. This can result in reduced process efficiency and production, plant shutdowns, and sometimes dangerous safety hazards.

There are two basic approaches to protecting and electronic system from the harmful effects of radio frequency and electromagnetic interference. The first is to keep the interference from entering the system or instrument using special shielding, designs and terminal filters. The second is to design the system or instruments circuitry so that it is inherently immune to RFI/EMI.

EMI and RFI intereference can be accounted for by designing the system so that it is inherently immune to RFI/EMI. The API and Cecomp engineering teams are available to assist you with your project design.

 | www.api-usa.com | www.cecomp.com

Relay protection & EMI suppression

API TECH SUPPORT - TS1021

When using API alarm module relays to switch inductive loads, maximum relay life and transient EMI suppression is achieved by using external protection. All external protection devices should be placed directly across the load and all leads lengths should be kept to a minimum length.

For AC inductive loads (see Figure 1), place a properly-rated MOV across the load in parallel with a series RC snubber. A good RC snubber consists of a 0.1 µF polypropylene capacitor of sufficient voltage and a 47 Ohm ½ Watt carbon film resistor.

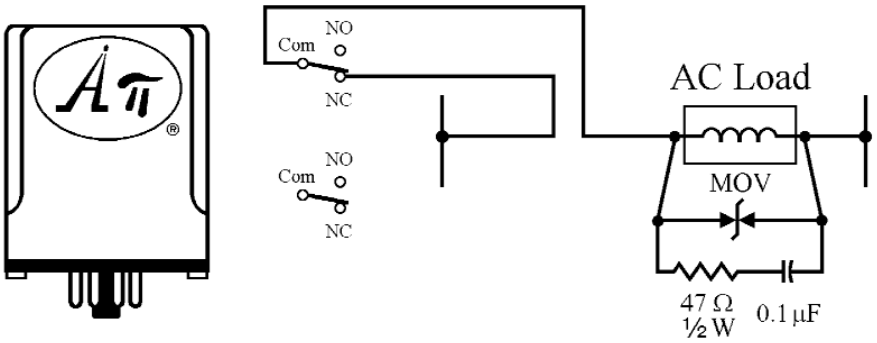


Figure 1: AC inductive loads

For DC inductive loads (see Figure 2), place a diode across the load (1N4006 recommended) being sure to observe proper polarity. Use of an RC snubber is an optional enhancement.

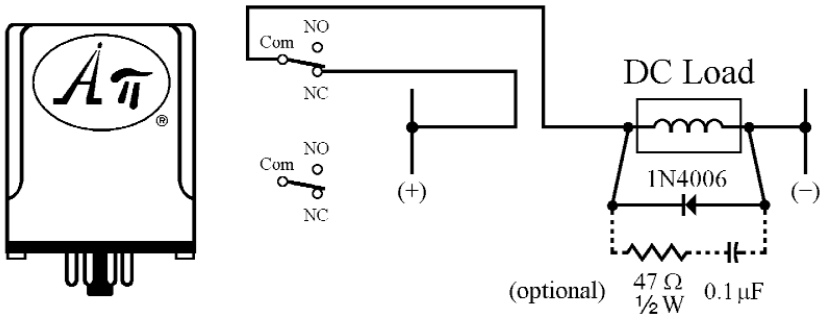


Figure 2: DC inductive loads

API's standard heavy-duty relay contacts are rated 7A @ 240 VAC (resistive) and can directly control most devices.

 | www.api-usa.com | www.cecomp.com

Common thermocouple sensor types

API TECH SUPPORT - TS1022

Type	Polarity & Material	Wire ID Properties	Wire Color	Practical Temp Range	Outer Insulation	Limits of Error
J	+ Iron	Very magnetic	White	32 to 1336°F	Black (Ext. grade)	±4°F or 0.8% of rdg
	– Constantan		Red	0 to 724°C	Brown (T/C grade)	±2°F or 0.4% rdg
K	+ Chromel		Yellow	32 to 2282°F	Yellow (Ext. grade	±4°F or 0.8% of rdg
	– Alumel	Slightly magnetic	Red	0 to 1250°C	Brown (T/C grade)	±2°F or 0.4% rdg
N	+ NICROSIL	Greater stiffness	Orange	32 to 2282°F	Orange (Ext. grade)	±4°F or ±0.8% of rdg
	– NISIL		Red	0 to 1250°C	Brown (T/C grade)	±2°F or ±0.4% of rdg
T	+ Copper	Copper color	Blue	–299 to 700°F	Blue (Ext. grade)	±1.5°F or 0.8% of rdg, ±1% rdg <32°F
	– Constantan		Red	–184 to 371°C	Brown (T/C grade)	±0.9°F or 0.4% rdg, ±0.8% rdg <32°F
E	+ Chromel	Greater stiffness	Purple	32 to 1652°F	Purple (Ext. grade)	±3°F or 0.5% rdg
	– Constantan		Red	0 to 900°C	Brown (T/C grade)	±1.8°F or 0.4% rdg
R	+ Pt 13%Rh	Greater stiffness	Black	32 to 2700°F	Green (Ext. grade)	±5°F or ±0.5% of rdg
	– Platinum		Red	0 to 1482°C	Green (T/C grade)	±2.5°F or ±0.25% of rdg
S	+ Pt 10%Rh	Greater stiffness	Black	32 to 2700°F	Green (Ext. grade)	±5°F or ±0.5% of rdg
	– Platinum		Red	0 to 1482°C	Green (T/C grade)	±2.5°F or ±0.25% of rdg

NOTES:

- Extend thermocouples up to 2000 feet or 100 Ohms maximum resistance.
- If extending, extension wire must be the same type as the thermocouple.
- Types of Thermocouple Junctions:
  - **Exposed** - Fast response time. Junction fully exposed.
  - **Grounded** - Slower response time. Junction isolated from contaminants, but attached to end of sheath.
  - **Ungrounded** - Slowest response time. Thermocouple wires completely encased by sheath.

Atmosphere for exposed junction

Type J	Reducing
Type K or N	Clean oxidizing
Type T	Mildly oxidizing and reducing or with moisture
Type E	Vacuum, inert mildly oxidizing or reducing
Type R or S	Resists oxidation and corrosion, but contaminated by hydrogen, carbon, and metal vapors

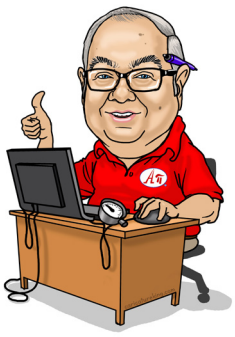
TEMPERATURE CONVERSION

°F = (°C x 9/5) + 32

°C = (°F – 32) x 5/9

 | www.api-usa.com | www.cecomp.com

Application Notes



 | www.api-usa.com | www.cecomp.com

Monitor and control a dam bubbler system

APPLICATION A101

Type of Company: Public Utility

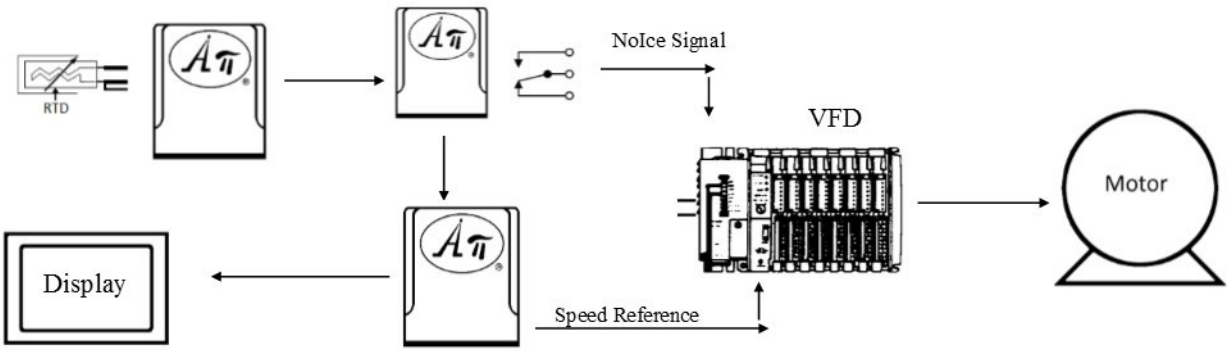
Location: Michigan

Floodgates, also known as crest gates, are adjustable gates used to control water flow and water elevation in flood barriers and reservoir, river, stream, or levee systems. These gates must be able to operate year-round, so systems that keep ice from affecting their operation can be required. A bubbler deicing system works by releasing fine air bubbles from perforated air diffusion tubing in target areas to ensure the gates remain free of ice obstructions.

By Royalbroil - Own work. White Rapdis Dam, Menominee River. Michigan.

The Engineering Issue

- The engineer has three requirements when the outside temperate is below 25°F. The requirements are:
  - Automatically turn on the bubbler system
  - Decrease the crest gate speed during its weekly test
  - Ensure the test does not start without a visual check for ice



The engineer used three different API units. An API 4001 GL senses the outside temperature via an RTD. This signal goes to a local display, an API 1000 G and an API 4300 G M01. The API 1000 G alarm contacts are set so that the Variable Speed drive will not start without a “No Ice” manual switch being turned on. The API 4300 G M01 output signal is used as the speed reference to the Variable Speed drive. This inverted signal slows down the Variable Speed drive as the outside temperature decreases.

Problem. Solved.

Monitoring voltage on SCR motor drives

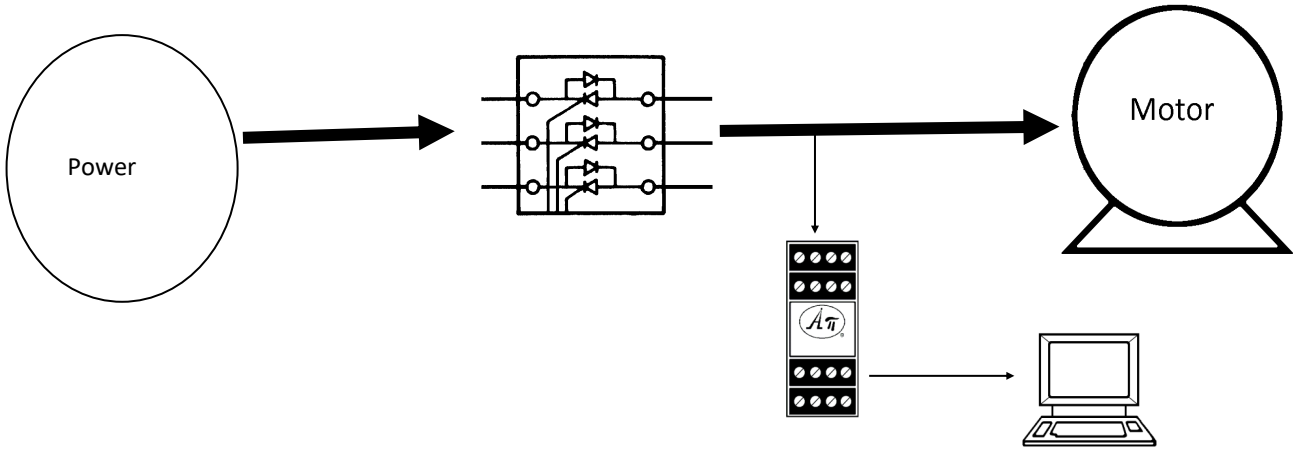
APPLICATION A102

Type of Company: Manufacturer, Oil Drilling Rigs
Location: Texas

Many oil drilling rigs utilize SCR drives because the application requires smooth, stepless speed control with reverse and braking capabilities. SCR drives are becoming the standard for DC motor drives because they are efficient, cost effective and built to last.

The Engineering Issue

- The engineer has a requirement to monitor the high voltage DC on the SCR drive
- The power usage and efficiency of the drive must be integrated into the control and power monitoring system.



The engineer used an APD HV-DC to monitor the 1000VDC on the SCR drive. The APD HV-DC also provides isolation for the analog input card to the PLC as well as the ability for sinking/sourcing for the 4-20 mA output signal for either single-ended or differential inputs.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring blower motor speed and vent position

APPLICATION A103

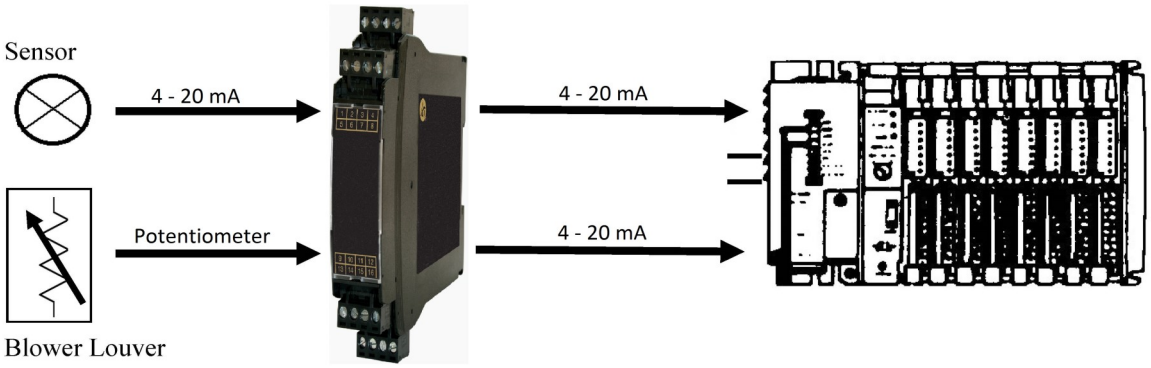
Type of Company: Manufacturer, Centrifugal Air Compressors

Location: Missouri

High-efficiency centrifugal air compressors are typically used for municipal wastewater aeration as well as myriad other industrial process applications. These systems are aerodynamically designed to minimize turbulence, thus streamlining flow through the compressor for the downstream aeration system. They maintain excellent efficiency throughout the entire operational range of the compressor and can provide overall control and monitoring of the aeration system.

The Engineering Issue

- The engineer has a requirement for signal conversion/isolation on a 4-20 mA motor speed control loop and a resistance feedback loop for blower louver position.
- The PLC they are using needs single-ended, sinking inputs for both channels.



The engineer used a custom modified APD 2208 unit. The APD 2208 is a two channel unit with one channel being a potentiometer input and the other a DC input. The APD units are field-configurable for sinking or sourcing.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring station battery current and voltage

APPLICATION A104

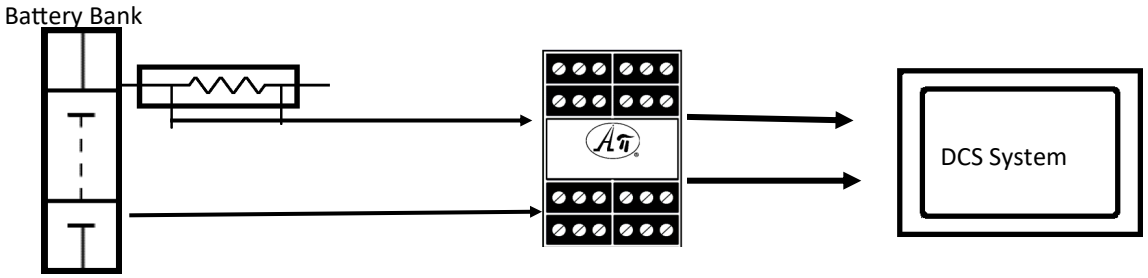
Type of Company: Public Utility

Location: Wyoming

A battery room is a room in a facility used to house batteries for large-scale custom-built backup or uninterruptible power systems providing electric power for telecommunication and computing equipment in server centers, electric power plants, telephone company facilities, and remote telecommunications stations. The batteries may provide power for minutes, hours or days depending on the electrical system design. Often batteries for large switchgear line-ups are 125 V or 250 V nominal systems, and feature redundant battery chargers with independent power sources.

The Engineering Issue

- The engineer has a requirement to monitor the following:
    1. The voltage directly from the station batteries
    2. The current for the station batteries from an existing DC millivolt shunt
- Both signals must interface with his newly installed DCS system.



The engineer used an APD 2000 with Channel 1 factory-ranged for the output from the DC shunt and Channel 2 factory-ranged for the battery voltage. The unit has independent span and zero adjustments as well as LEDs to help the maintenance technician with installation and maintenance.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Automatically select pH transmitter

APPLICATION A105

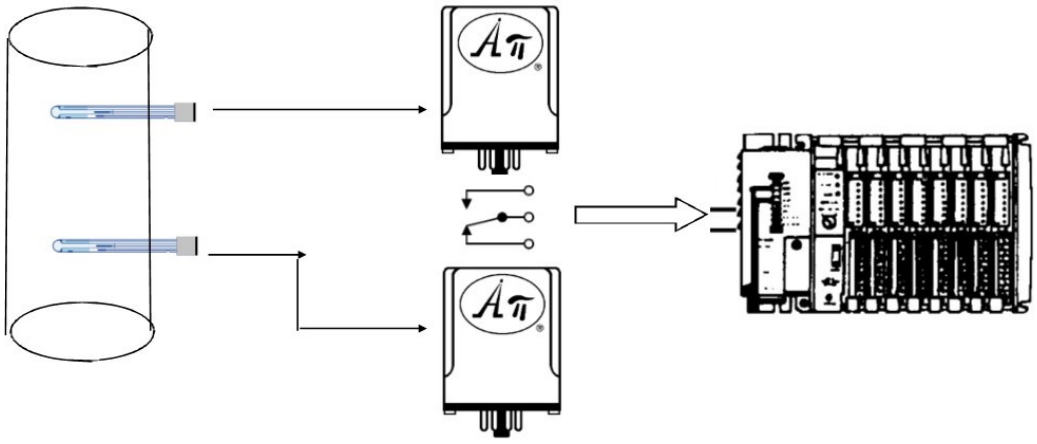
Type of Company: Chemical Plant

Location: Texas

Central to the modern world economy, the chemical industry converts raw materials into more than 70,000 different products for many different applications. Chemical processes such as chemical reactions are run in chemical plants to produce a wide variety of solid, liquid, and gaseous materials. The process will typically use a primary pH transmitter and a redundant secondary (backup) pH transmitter due to this being a critical process variable.

The Engineering Issue

- The engineer only has one available analog input channel on the analog input card for the PLC, so there is a need to automatically choose which pH transmitter (4-20 mA output) to use for controlling the process.



The engineer used two API 1000 G's. Since the primary pH transmitter is configured to have an output of 22 mA in the event of electrolyte loss or removal from the process, a cost-effective solution is to use two API 1000 G's to automatically select the secondary pH transmitter output as the PLC input when the primary pH transmitter goes to 22 mA.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Automatically control air damper position

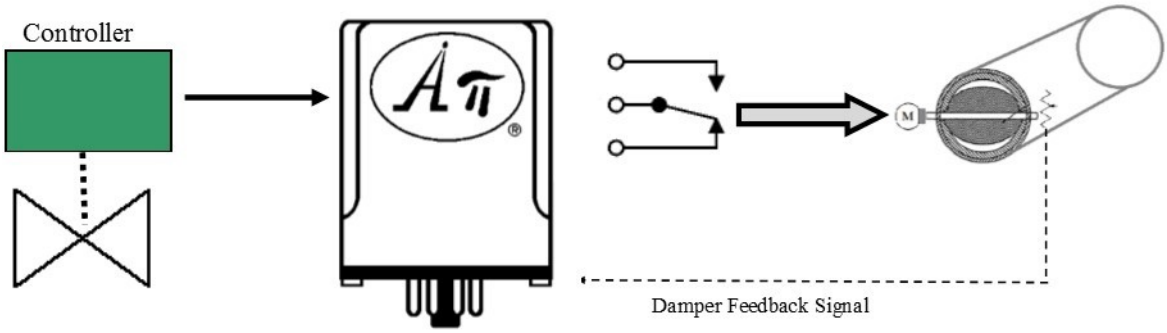
APPLICATION A106

Type of Company: Asphalt Plant
Location: Illinois

Asphalt manufacturers produce several different types of mixes for many different applications. The manufacturing process requires that both a gas fired burner and an air damper be accurately controlled. It is important that both track properly so the desired operating temperature can be maintained and consistent product can be produced.

The Engineering Issue

- The engineer has a requirement to match the air damper position to the gas valves position.
- The damper control signal from the gas valve controller must be changed to a mechanical relay contact closure that will operate the damper motor to open and close the air damper.



The engineer used an API 3200 G to convert the signal from the gas valve controller. The API 3200 G accepts the 0-1 VDC damper control signal from the gas valve controller and accepts the damper feedback of its position via a potentiometer. The end result is automatic control of the air damper to match the position of the gas valve.

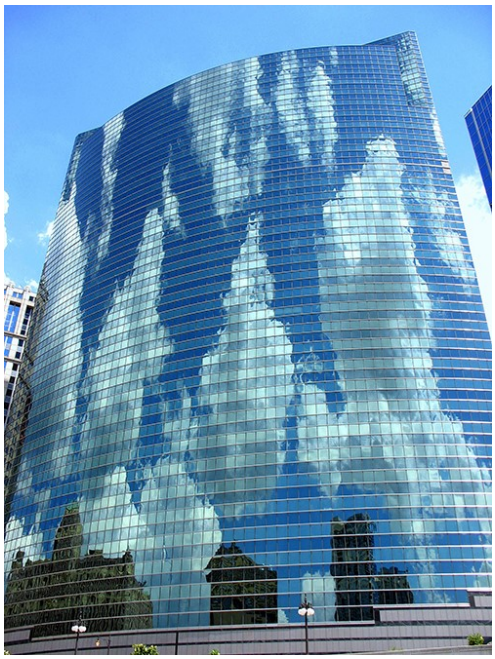
Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Controlling SCRs for supplemental heat

APPLICATION A107

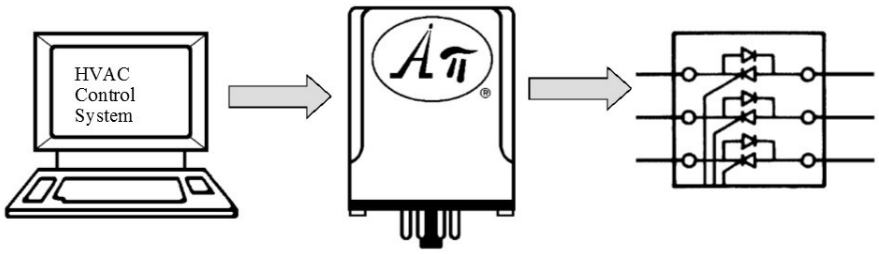
Type of Company: Building Maintenance Management
Location: Chicago, Illinois



Commercial buildings use a complex HVAC system to climate control the environment in the building. Many times in cold climates due to building upgrades and changes, SCR electric heaters have to be installed for supplying supplemental heat to certain areas of the building. The SCR electric heaters allow time proportioning the power which provides continuously variable heat output to meet the exact needs of the area. In one case, a Barber Colman HVAC system currently outputs a 6-9 VDC signal, but needs to be able to output a proportional control signal for the supplemental SCR electric heaters.

The Engineering Issue

- The engineer has a requirement to a 0-10 VDC input signal to their Robicon SCR electric heaters for proper operation.
- An override switch function is also required for troubleshooting as well as emergency control of the SCRs.



The engineer used a custom-modified, specially-ranged API 4300 G. As an added feature on the API 4300 G, the functional test pushbutton switch was replaced with a toggle switch. When the functional test toggle switch is in the manual position, the unit will output a 5 VDC signal independent of the input signal, which can be varied for troubleshooting or manual control.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor pressure on an autoclave

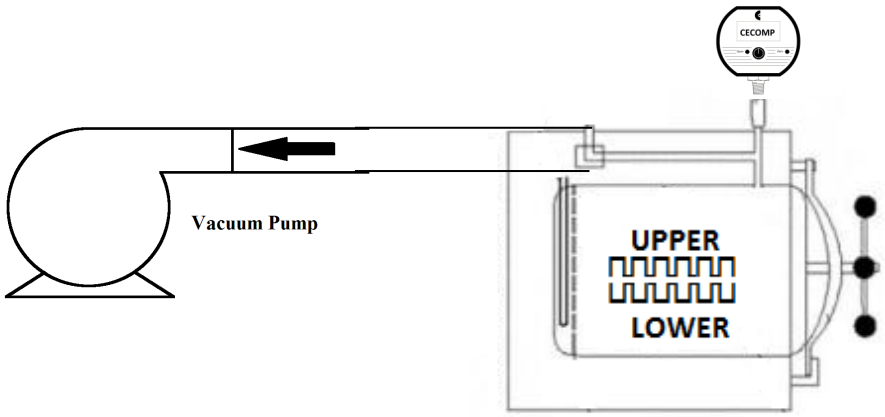
APPLICATION C108

Type of Company: Manufacturer, Aircraft Components
Location: Washington State

An autoclave is used to manufacture aircraft parts using a carbon fiber resin-based compound. This process is typically called vacuum-assisted resin transfer molding and requires an applied vacuum plus an elevated temperature in the autoclave so that there are no air bubbles remaining in the part. For quality and integrity of the aircraft parts, the air bubble removal process is critical.

The Engineering Issue

- The engineer has a requirement for a local, accurate, visual indication of the applied vacuum.
- This local indication must be highly accurate, repeatable, and easy to read.



The engineer used an ultra-rugged Cecomp DPG1000B30inHg (vac) to monitor the vacuum applied to the part as it was being finished in the autoclave.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Controlling water level in a tank

APPLICATION C109

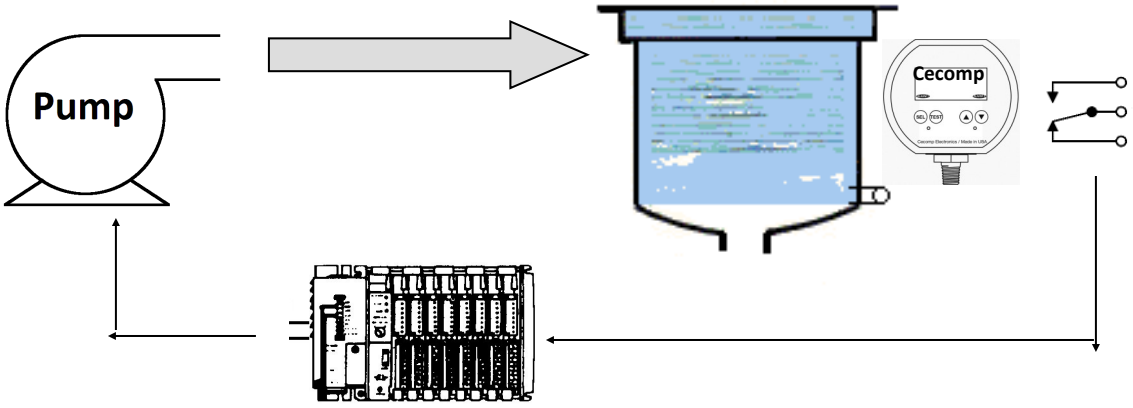
Type of Company: Public Utility
Location: Minnesota

The current water level in a water tower tank is being manually maintained using an analog gauge that is monitoring head pressure, and a simple on/off motor controller for the pump. This type of control is useful in maintaining water levels in tanks, landscaping ponds, waterfalls, and many other applications.


Photo by Raysonho

The Engineering Issue

- The engineer needs to automate the water level control process and increase the accuracy of the water level readings.
- There is a requirement to maintain local monitoring of the head pressure.



The engineer used a Cecomp F16ADA. The F16ADA relays are set to automatically send a signal to the pump controller to turn the pump on and off in order to maintain the water level at a predetermined set point. The gauge will show an accurate head pressure locally as well.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor hydrostatic test on tanks

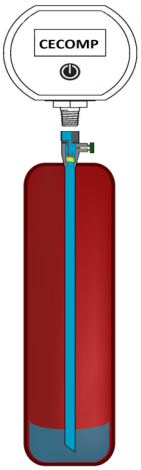
APPLICATION C110

Type of Company: Manufacturer of Fire Extinguisher - Service
Location: Illinois

Fire extinguishers' cylinders become weaker with age. Because of this, in buildings other than houses they are generally required to be serviced and inspected by a Fire Protection service company at least annually. Hydrostatic testing is a pressure test in which the thickness and serviceability of the cylinder is measured.

The Engineering Issue

- The engineer requires an accurate pressure measurement of the hydrostatic test for cylinders and fire extinguishers.
- The test equipment needs to be portable, rugged, accurate, and have an easy-to-read visual indication of the pressure.



The engineer used a Cecomp F4B ultra-rugged battery-powered gauge to monitor the pressure and record the pressure values on his certification documents. The F4B is highly accurate and comes in a durable NEMA 4X case.

Problem. Solved.

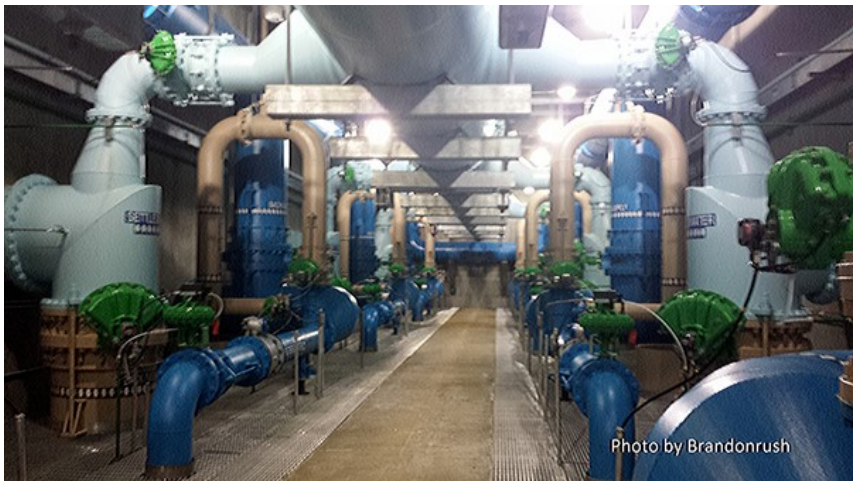
 | www.api-usa.com | www.cecomp.com

Monitoring flow on pumps

APPLICATION C111

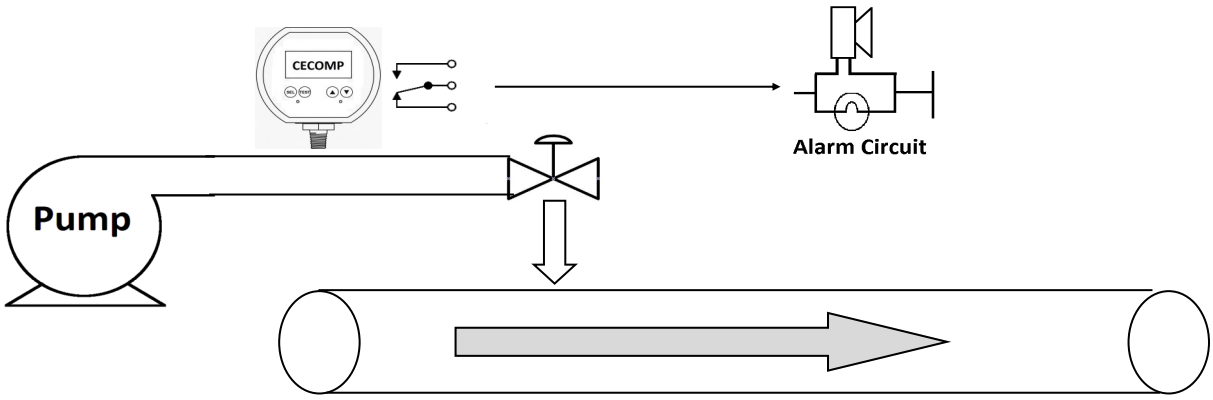
Type of Company: Public Utility
Location: Virginia

Water purification for human consumption is the process of removing undesirable chemicals, materials, and biological contaminants from raw water. The water is treated and tested per Environmental Protection Agency regulations. During the treatment process, chemicals must be added to the water prior to sending it out to the municipal distribution system.



The Engineering Issue

- The engineer has a requirement to use specialized injection pumps for injecting chemical additives into the water.
- The chemical injection pumps were getting plugged up and the proper amount of chemical additives were not being added to the water.



The engineer used a Cecomp F16ADA to monitor and alarm the combined pressure on the discharge pipe from the pumps. If a pump problem like a blocked line occurs the pressure would drop signifying a problem and the F16ADA low alarm contact would actuate a remote alarm light and sound a horn to notify the operator that there was a pump problem.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring pressure on tube trailers

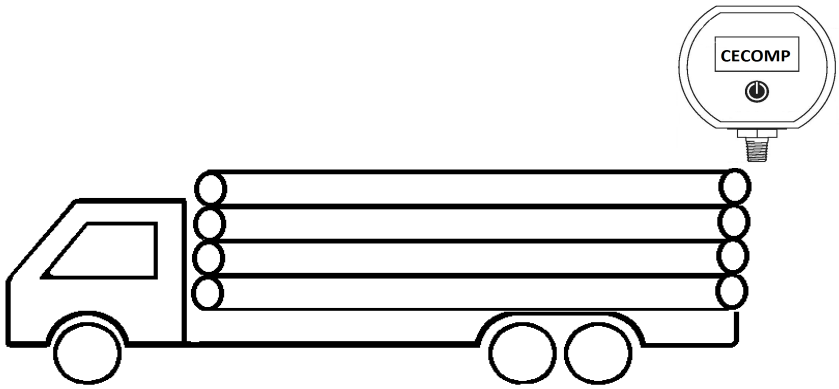
APPLICATION C112

Type of Company: Industrial Gas Supplier
Location: California

Industrial gas suppliers furnish and transport industrial gases (helium, hydrogen, oxygen, etc.) to their customers for use in applications such as food processing, agriculture, and pharmaceuticals. Much of the transportation of the compressed gases to the customer's site is done using tube trailers. Tube trailers consist of 10 to 36 high-pressure cylinders varying in length from 20 to 36 feet that are each pressurized from 2400 to 3600 psig.

The Engineering Issue

- The engineer has a requirement to accurately monitor and record the pressure in the tubes prior to the truck leaving the gas supplier's facility.
- FM approval is required due to the use of explosive gases.



The customer purchased a Cecomp DPG2000B with the high accuracy option. The DPG2000B has an accuracy of 0.1% with the HA option and is intrinsically safe with FM Approval. It is also very rugged, so calibration will not be affected by rough field conditions.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor high-speed strain gauge pressure sensors

APPLICATION A113

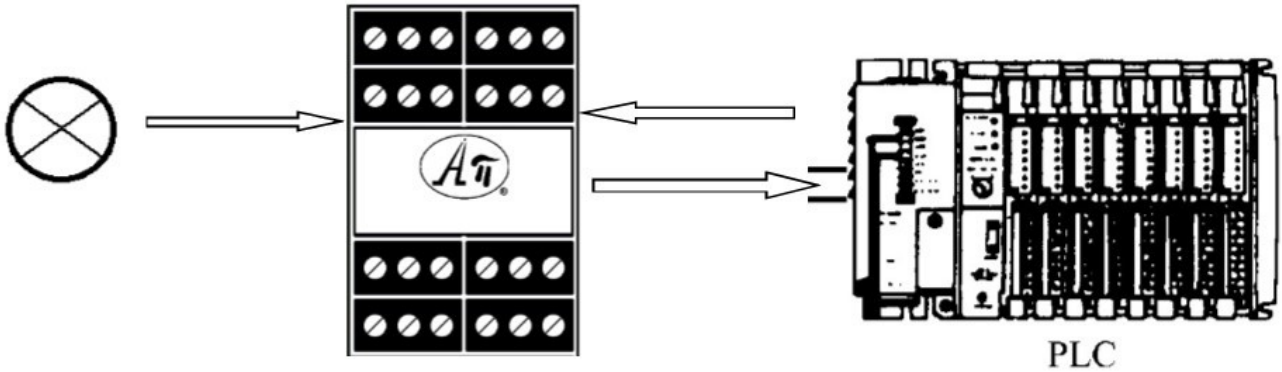
Type of Company: Manufacturer—Tablet & Pill Presses
Location: Pennsylvania

Blister packaging tooling machines, *rotary tablet and pellet presses*, and *tablet press control* systems are used in the pharmaceutical industry, industrial tooling industry (such as fireplace log manufacturers), and blister packaging for all sorts of products. These machines require signal conversion/isolation for specialized fast-responding strain gauge signals because the sensor signal conditioning must typically be accomplished via external signal conditioning.

Photo by Elizabeth-Hata International Inc

The Engineering Issue

- The engineer has a requirement to update the current signal conditioners, as the previous manufacturer is no longer in business. The updated signal conditioner needs to interface with the upgraded PLC and have faster response time.



The API engineering team worked with this pharmaceutical company to design and manufacture a custom-modified fast responding version of the APD series of strain gauge isolators for this OEM.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Accurately monitoring hydrostatic pressure testing in a gas pipeline

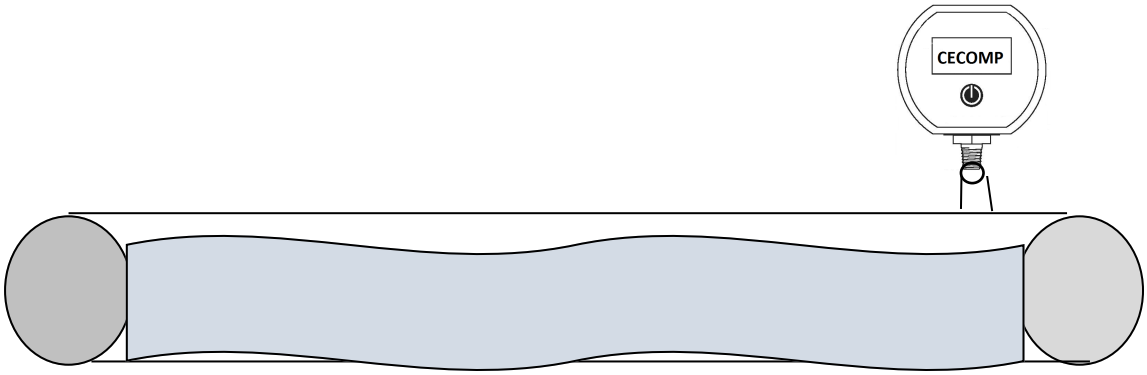
APPLICATION C114

Type of Company: Public Utility
Location: Kansas

The DOT requires that any new/replaced pipeline carrying natural gas be tested hydrostatically. Each section is filled with water and pressurized up to a level higher than the maximum pressure at which the pipeline will operate when carrying natural gas. The test pressure is held for a specific period of time to determine if the pipeline meets the design strength requirements and if any leaks are present.

The Engineering Issue

- The engineer has a requirement to accurately measure and record the test pressure.
- The analog gauges they currently use have significant errors due to mechanical shock and adverse field conditions.



The engineer used a Cecomp DPG1000B digital pressure gauge to monitor the test. This Cecomp gauge has 0.25% accuracy over the full pressure range, 1 PSI resolution, and can handle the "abuse" because of their ruggedness both electrically and mechanically.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

De-icing aircraft

APPLICATION A115

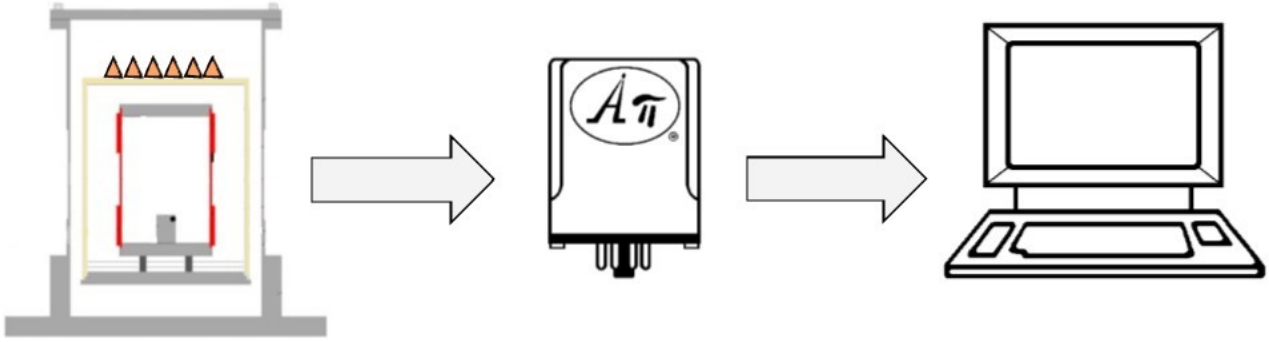
The airport deicing system for aircraft uses both compressed air and heated de-icing fluid to de-ice aircraft in a timely fashion. As part of the overall system, an online dat-alogging servicing system was developed. This was required because airport mainte-nance technicians typically only check out the deicers when the winter storm warning is announced. If the deicer needed service, there would be no way for the de-icing sys-tem company's service technician to get to the airport to service the system in time for the aircraft to have an on-time takeoff.

Type of Company: Airport Services Company (OEM)

Location: Wisconsin

The Engineering Issue

- One of the main issues for the servicing system was that the outputs from the burner control system sensors were not compatible with the inputs for the I/O board on the data logging servicing system.



The API engineering team built out an OEM product to solve this issue; a custom-ranged API 6010 G 5A interface the outputs from the burner control system to the inputs to the I/O board.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring power usage on DC motors

APPLICATION A116

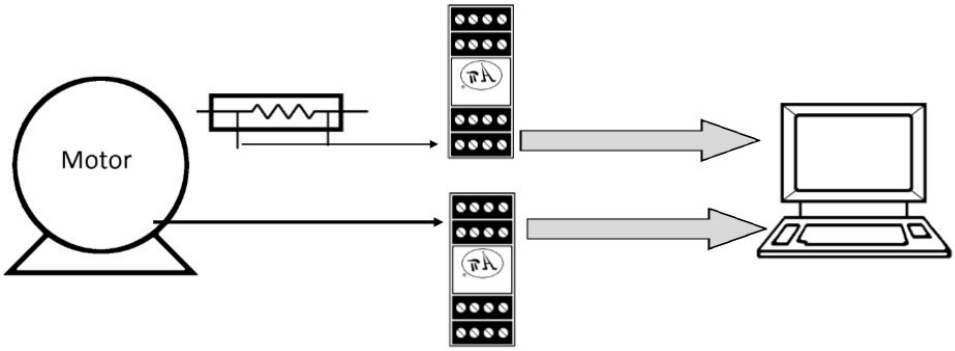
Type of Company: Coke Plant
Location: Pennsylvania

Coke is used as a fuel and as a reducing agent in smelting iron ore in a blast furnace. It is there to reduce the iron oxide (haematite) in order to collect iron. During ironmaking, iron ore, coke, heated air and limestone or other fluxes are fed into a blast furnace. The heated air causes the coke combustion, which provides the heat and carbon sources for iron production. Limestone or other fluxes may be added to react with and remove the acidic impurities, called slag, from the molten iron.


Photo by employee of US Government - Public Domain

The Engineering Issue

- The engineer has a requirement to monitor both the voltage and current on large DC motors used in the smelting process.
- This information will be sent to a PLC to calculate power usage and efficiency and integrate this information into the plant control and power monitoring system. Isolation for the analog input card to the PLC is required.



The API engineer recommended an APD HV-DC and an APD 4300. He recommended they use a Simpson external shunt to develop the motor current signal to the range-specific APD 4300, then use the APD HV-DC for a high-voltage 500 VDC signal. The APD units provide isolation for the analog input card and also allow for sinking/sourcing for the 4-20 mA output signal for either single ended or differential inputs. The customer can now integrate motor usage/operation into their plant control and power monitoring system.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor pressure on a vacuum chamber

APPLICATION C117

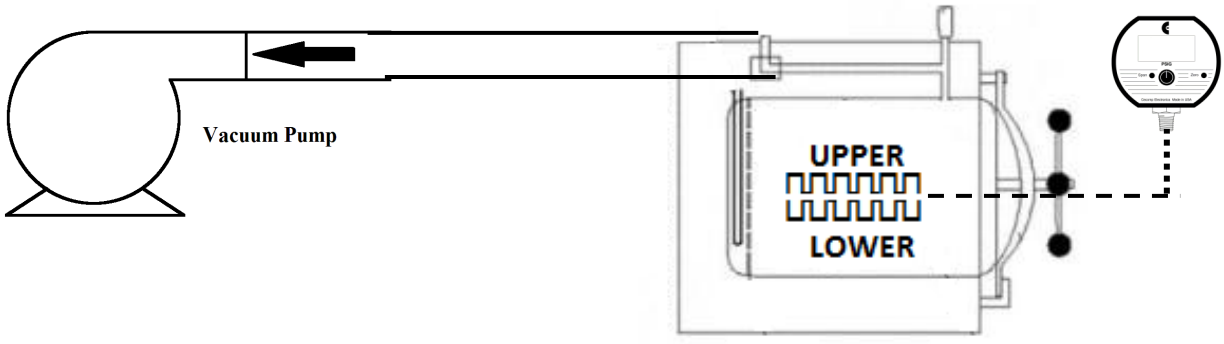
Type of Company: Manufacturer, Aircraft Components

Location: Washington State

Fiberglass-reinforced composite plastic parts are typically manufactured using a vacuum forming process. A glass-reinforced plastic part is typically a thin "shell" construction and the part may be of nearly any arbitrary shape, limited only by the complexity and tolerances of the mold used for manufacturing the shell.

The Engineering Issue

- The engineer has a requirement to ensure that there are no air bubbles remaining in the part which could cause a “part failure” when put in service.
- The accuracy and repeatability of the applied vacuum applied to the part while in the vacuum-forming chamber is critical for air bubble removal.



The engineer used an ultra-rugged Cecomp DPG1000B to monitor the vacuum applied to the part while in the chamber. With a high-quality Cecomp product, the gauge is accurate and repeatable and will serve the engineer for years.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Split signals for separate monitoring and control

APPLICATION A118

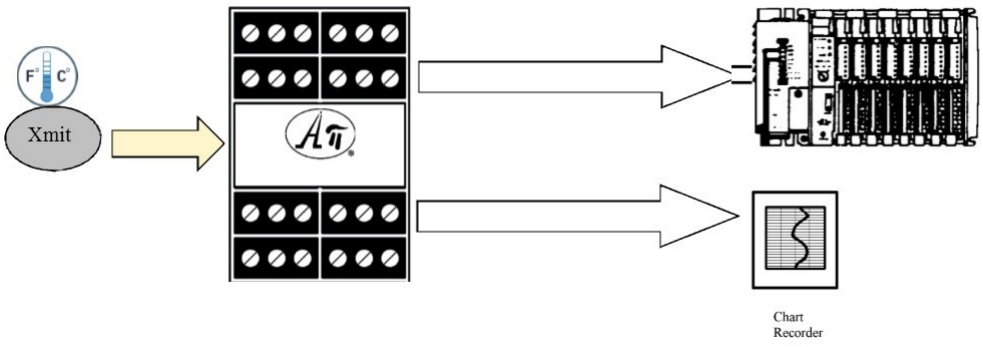
Type of Company: Plastics Manufacturer

Location: Texas

The principal plastic manufacturing processes are: blow molding, casting, compression molding, extrusion, fabrication, foaming, injection molding, and rotational molding. These processes are used to produce large numbers of identical items, from high-precision engineering components to disposable consumer goods. One of the commonly monitored process variables used to control these manufacturing systems is temperature, and many times different departments need to monitor the same temperature. This particular company is using loop-powered temperature transmitters to control their systems, and both a chart recorder and a DCS system to monitor.

The Engineering Issue

- The QC engineer and process engineer both need to monitor the output from one of their temperature transmitters but they cannot add another set of sensors.
- The process engineer wants to ensure that, if the QC engineer "breaks the loop" by taking the chart recorder or DCS offline for any reason, it does not affect production.



The engineer used an APD 4393 IsoSplitter. The APD 4393 is placed in series with the loop-powered transmitter and the DCS to accept the 4-20 mA signal and provides two optically-isolated outputs that are linearly related to the input. The input signal is filtered, amplified, and split, then passed through to both output stages. The two isolated output channels provides a simple and economical solution.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring vacuum in chemical tanks

APPLICATION C119

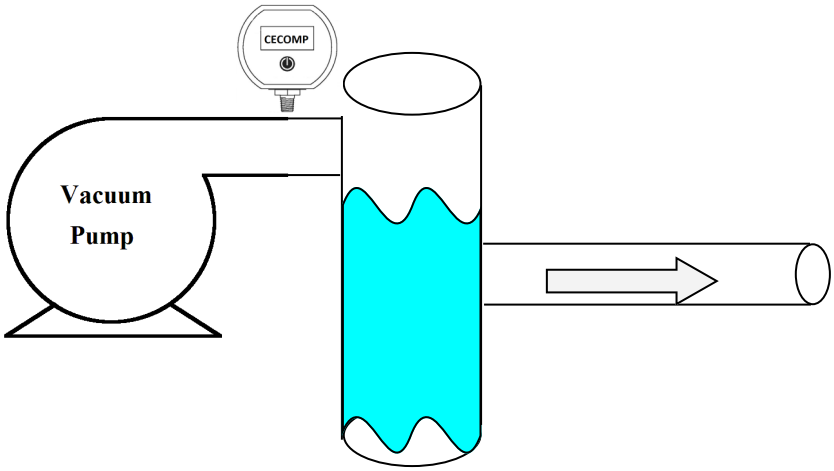
Type of Company: Chemical Plant
Location: Oregon


Photo by Alicia Fagerving

Most organic solvents manufactured in the pharmaceutical industry are flammable. Many of these solvents are volatile and give off "solvent vapors" that can explode in the air. During the process a vacuum is maintained on the tanks to reduce the "solvent vapors" in the air and to move chemicals into and out of the tanks.

The Engineering Issue

- The engineer has a requirement to monitor the vacuum level on the tanks
- Keeping the vapor level at a low value is critical to both personnel and plant safety



The engineer used a Cecomp DPG2000B. The DPG2000B is intrinsically safe, accurate and is very rugged so reliability is not at issue.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Local and remote monitoring of test chambers

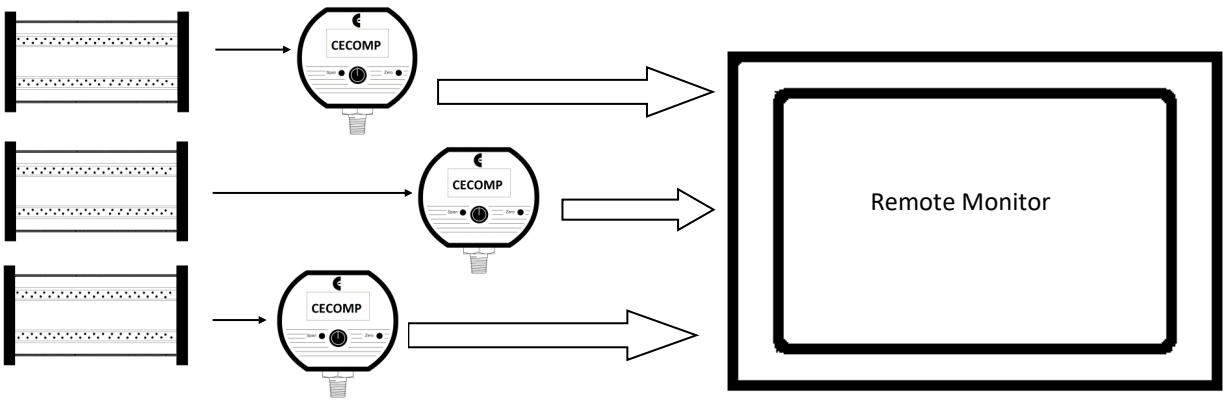
APPLICATION C120

Type of Company: Chemical Plant
Location: Texas

Styrene is used to manufacture pipes for many different applications. The manufacturer of the finished pipe must test the burst pressure of the pipe to verify the quality of their product. The burst pressure is tested in a small chamber where the pressure must be monitored and recorded for their QC files.

The Engineering Issue

- The engineer is currently using an analog gauge for monitoring the test chamber but has a requirement that they increase the accuracy of their “burst tests” locally, add remote monitoring and plan for future automation.



Cecomp furnished the engineer “free” application assistance and he used a Cecomp F16DR pressure gauge with a digital display and a retransmission output. This unit allows him to locally monitor the pressure very accurately and remotely monitor the pressure. He will be able to change from just a remote monitor to a PLC in the future to fully automate his testing process.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring flare stack burnout

APPLICATION A121

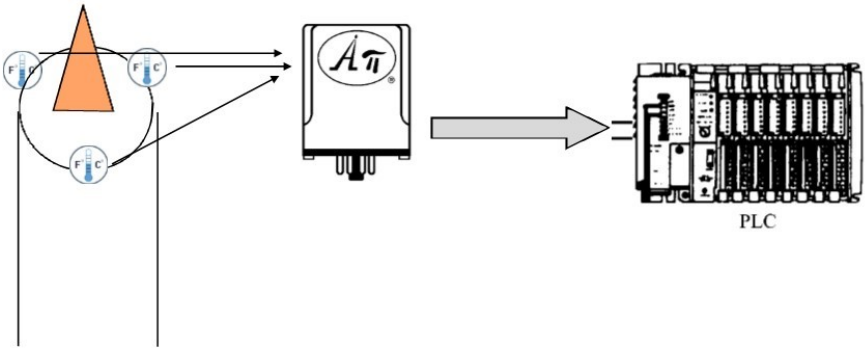
Type of Company: Public Utility
Location: Washington State

A gas flare, alternatively known as a flare stack, is a gas combustion device used in industrial plants such as petroleum refineries, chemical plants, and natural gas processing plants. Flare stacks are primarily used for burning off flammable gas released by pressure relief valves during unplanned over-pressuring of plant equipment. During plant or partial plant startups and shutdowns, flare stacks are also often used for the planned combustion of gases over relatively short periods.


By Varodrig -Ula platform, Wikimedia Commons

The Engineering Issue

- The engineer has to add local indication and a PLC for logging and alarm notification functions to the current burn-off flame monitoring system on an emissions flare stack.
- They currently use 3 individual thermocouples each displaced by 120º and connected to three separate chart recorders. This configuration is due to the wind causing the flame to lean away from the stack.



API built a custom-modified API 4130 G L unit which removed the burnout detection circuitry so there is no conflict with the burnout detection current from the current chart recorders. The API engineering team also recommended the customer get the EXTSUP option, since the Allan Bradley SLC500 PLC the customer is using requires a single-ended input instead of a differential input.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Leak detection on a life raft

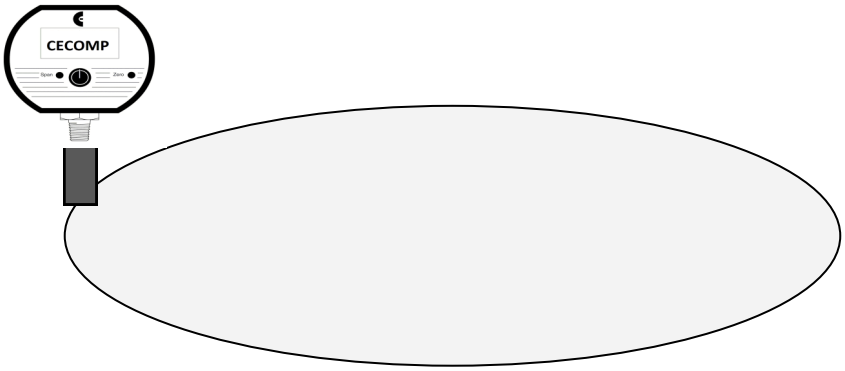
APPLICATION C122

Type of Company: Airline
Location: Minnesota

All aircrafts going over a large body of water must have a life raft. The life rafts must be tested to ensure there is a proper inflation system and must maintain adequate pressure for a specified period of time after inflation. Under static conditions and when inflated and stabilized at the nominal operating pressure, the pressure in each inflatable chamber must not fall below the minimum operating pressure in less than 24 hours.

The Engineering Issue

- The engineer had a requirement to improve the testing accuracy of the currently used analog gauge.
- The engineer needed an easy to read and cost effective visual indication of the pressure on the life rafts so that they could verify a “no leak” condition during the test.



The engineer used a Cecomp DPG1000B with an extended shutoff time to monitor the raft pressure. It is accurate, easy to read and very rugged.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring aircraft tire pressure

APPLICATION C123

Type of Company: Airline
Location: Minnesota

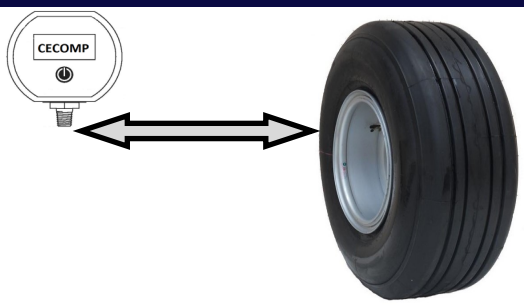
The FAA requires that a “cold” tire pressure check be made and logged on all aircraft landing gear tires every day using a “calibrated” pressure gauge as an aircraft tire can lose 1 or 2 percent pressure a day. The aircraft manufacturer has also notified the airlines that electronic devices that are used in aircraft hangers must meet the National Electrical Code.

Photo by Vmenkov

The Engineering Issue

- The engineer has three requirements:

1. Increase the accuracy of the monitoring gauge so that the inflation pressure would be better maintained on the tires for longer wear and increased tire integrity
2. A digital gauge that is rugged, FM approved Intrinsically Safe (IS), easy to read and cost effective for a visual indication of the tire pressure.
3. Gauge must maintain calibration and withstand the use and abuse on the tarmac.



The engineer used a custom Cecomp DPG2000BBL with an extended temperature range LCD and tarmac ruggedness built in. After using the gauge, the engineer stated:

- The gauge was “very tough, durable, and almost bulletproof”
- Due to the gauge maintaining accuracy and calibration they increased the number of takeoffs and landings per tire

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring vacuum on pump motors

APPLICATION C124

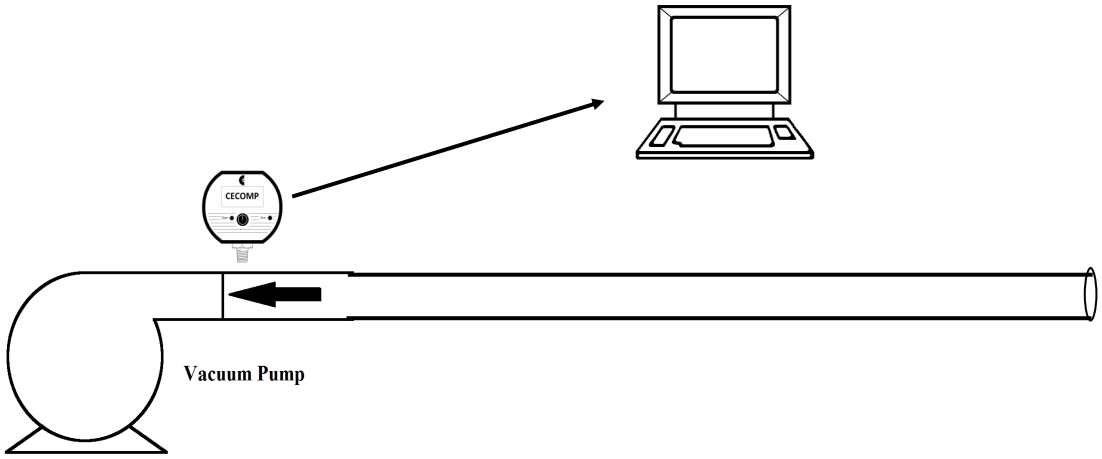
Type of Company: Shallow Water Dredging

Location: Virgina

Eco-friendly shallow water dredging uses a “drag head” along the bottom and has suction pumps on both the port and starboard side. Excess water in the dredged materials is spilled off as the heavier solids (mainly sand) is filtered out and settles to the bottom of the hopper. When the hopper is filled with solid material (slurry), the dredger stops dredging and goes to a dump site and empties its hopper.

The Engineering Issue

- The engineer has to monitor the vacuum on the suction pumps so that proper suction is maintained.



The engineer used a Cecomp DPG1000L. The DPG1000L gave him both a visual indication and a 4-20 mA signal to send to an onboard PLC.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor and control the melt pressure in an extruder

APPLICATION A125

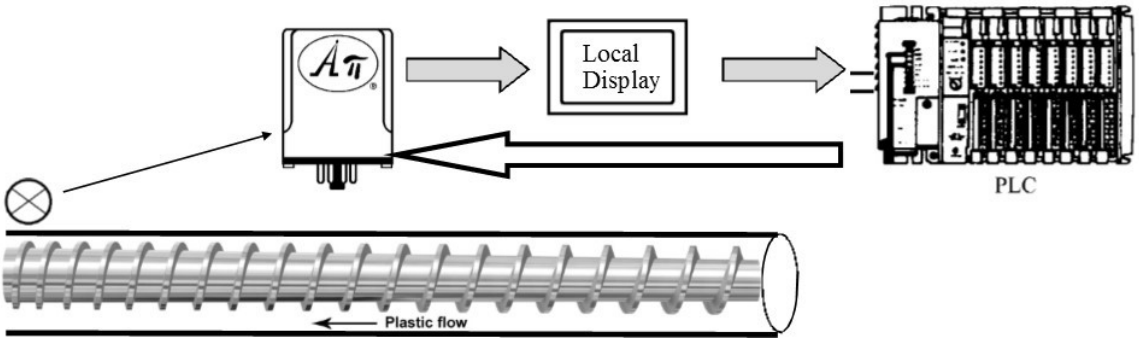
Type of Company: Plastics Manufacturer
Location: Massachusetts

The plastic extrusion process starts by feeding plastic material from a hopper into the barrel of the extruder. The material is gradually melted and the molten polymer is then forced into a die, which shapes the polymer that hardens during cooling. The customer is using a Dynisco melt pressure transducer on their extruder, and an Allen-Bradley MicroLogix 1000 PLC for recording and control functions.


Par Paul Goyette. fr.wikipedia.org. Tuyaux en PVC extrudé

The Engineering Issue

- The engineer wants to locally monitor and control the polymer melt pressure for compliance and product validation.
- The melt pressure signal must be compatible with the Allen-Bradley PLC and have a “system calibration” function.



The engineer selected a API 4059 G M02, which provides excitation power to the transducer and is field-rangeable for the excitation supply, sensitivity/ transducer output, and DC current output. This unit also has 20 V compliance so the output signal can be looped thru both the local display and the PLC for control and recording. An added feature of this API unit is that it utilizes the pressure transducer's internal calibration resistor to unbalance the bridge to a specified value (typically 80% of full scale) when the functional test switch is in the CAL position, ensuring accurate system calibration.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring water level in a tank

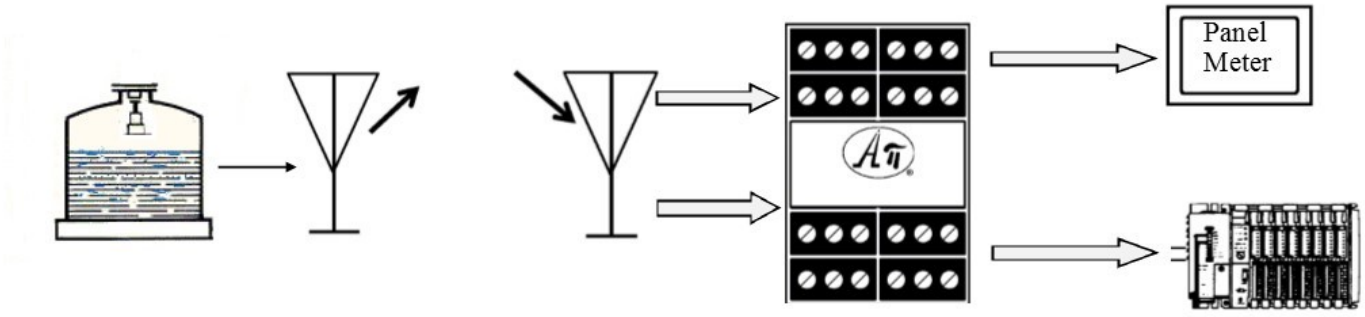
APPLICATION A126

Type of Company: Public Utility
Location: New Mexico

A water tower is an elevated structure supporting a water tank constructed at a height sufficient to pressurize a water supply system for the distribution of potable water, and to provide emergency storage for fire protection. Water towers are able to supply water even during power outages, because they rely on hydrostatic pressure produced by elevation of water (due to gravity) to push the water into domestic and industrial water distribution systems; however, they cannot supply the water for a long time without power, because a pump is typically required to refill the tower.

The Engineering Issue

- The engineer has a requirement to monitor the water level in a remote water tower using a previously installed Delta Controls Model 591 cable-suspended transmitter.
- The level transmitter signal is sent to an Zlinx radio modem which is sending a signal to both a Honeywell PLC and a panel meter. When both devices are connected to the radio receiver channels a ground loop is formed and causes erroneous readings.



The engineer used an APD 2000 to isolate both signals. The APD 2000 isolated signal conditioner provides three-way isolation and eliminates the ground loop degradation problems.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring vacuum on diesel engines

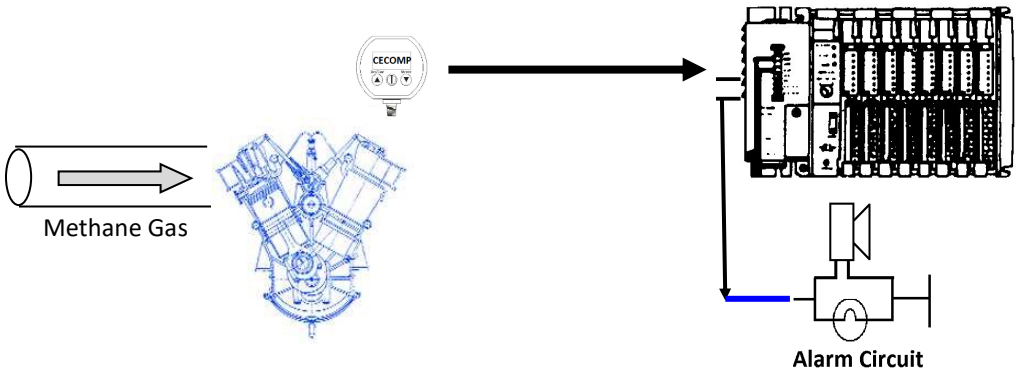
APPLICATION C127

Conventional sewage treatment involves three stages, called *primary*, *secondary* and *tertiary treatment*. The process is designed so that the final water product can be discharged into a stream, river, bay, lagoon or wetland, or it can be used for the irrigation of a golf course, greenway or park. If it is sufficiently clean, it can also be used for groundwater recharge or agricultural purposes.

Type of Company: Public Utility
Location: Arizona

The Engineering Issue

- The engineer has a requirement to use diesel engines running on methane gas created during the treatment process.
- The manifolds of the engines must be monitored to ensure that they never run under positive pressure, otherwise they will malfunction.



The engineer used a Cecomp F16L vacuum gauge. The F16L gives the customer both a visual indication and a 4-20 mA signal to send to their PLC for both data logging and alarming.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Interface level transmitter with PLC

APPLICATION A128

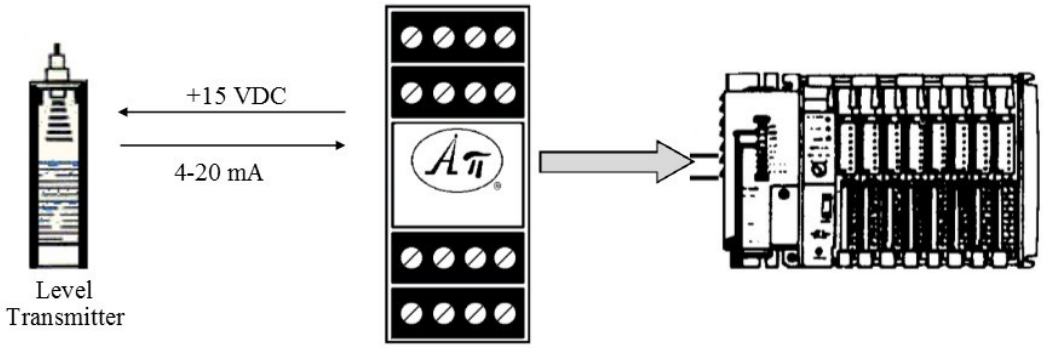
Type of Company: Manufacturer, Cardboard

Location: Connecticut

Because corrugated cardboard is such a versatile packaging material, millions of tons are used each year to protect and display products. From the paper mill, rolls of kraft paper are transported to a corrugating, or converting, plant. At the plant, three layers of kraft paper are crimped and glued to form corrugated cardboard, which is then processed to make boxes. This customer uses a Bindicator Level transmitter and interfaces it to a Rockwell Automation PLC. They had been using an interface device that was no longer made, and the engineer had to replace it with a generic loop-powered isolator.

The Engineering Issue

- The replacement isolator was powered by the PLC's +24 VDC power supply but it caused issues for both the power supply and the PLC.
- The engineer needed a signal isolator to both power the transmitter and to interface with the PLC input card.



The engineer used an APD 4380 to interface the sensor to the PLC. The Bindicator Level transmitter was powered from the APD internal +15 VDC input signal power supply (sourcing input) and the PLC was connected as a current sinking output from the APD.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor pressure on large refrigeration units

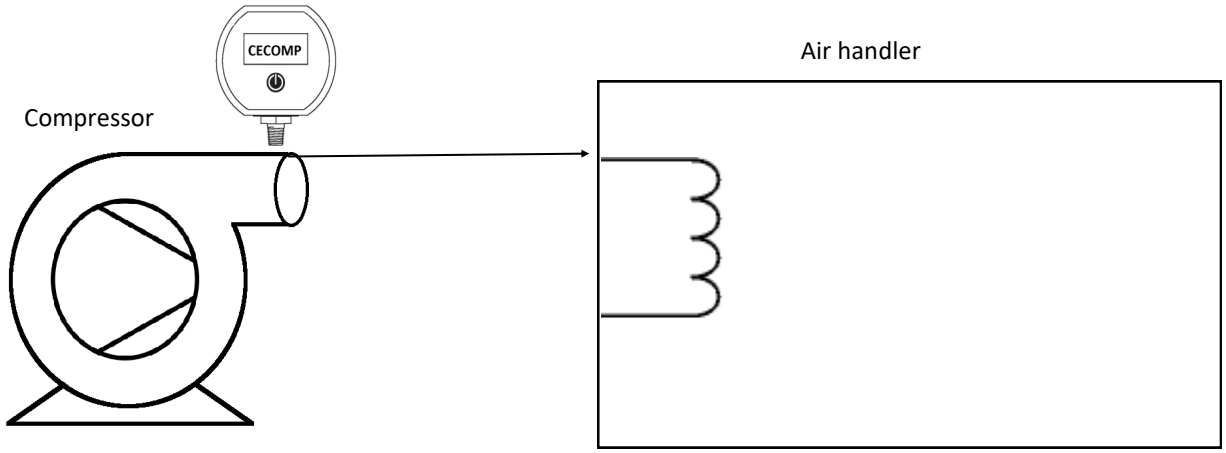
APPLICATION C129

Type of Company: Refrigeration Energy Management
Location: Georgia

Large refrigeration units at retail stores are used to keep foods cold. These units have to be "balanced" for optimum refrigeration and energy efficiency. The process of balancing these units requires accurate implementation of both mechanical and control strategies to establish performance baselines.

The Engineering Issue

- The engineer has a requirement for accurate, portable, easy to read and cost effective visual indication of the pressure on the compressors for these units so that they can be correctly "balanced."



The engineer will use a Cecomp F16B to monitor the pressure on the refrigeration units and adjust the system balance accordingly. The engineer stated that this simple improvement to the process could result in an energy savings up to 20% a month and a 6-month payback.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Certifying boiler pressures

APPLICATION C130

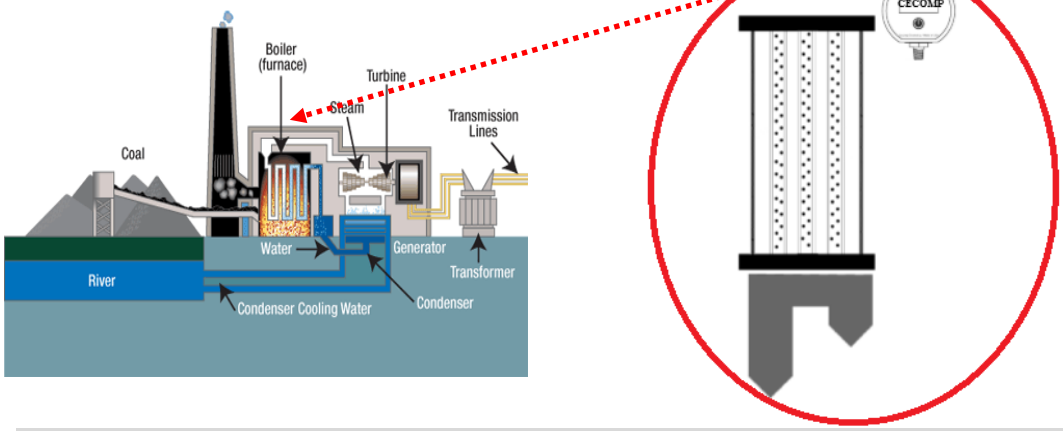
Type of Company: Public Utility - Coal-Fired Power Plant

Location: Missouri

A coal-fired power plant typically brings coal into the plant for the boiler via a belt from either a barge or a storage pile. Highly purified water, pumped through pipes inside the boiler, is turned into steam by the heat. The steam reaches very high temperatures and pressures up to 3,500 psi that is then piped to the turbine. The turbine turns a shaft. On the end of the shaft is a magnet that revolves inside a coil to create electricity.

The Engineering Issue

- The engineer needs replacements for obsolete gauges used to certify the plant's boilers' pressures.
- The digital gauges must be accurate, readily available and rugged.



The customer will retrofit his boiler certification system with a fleet of six F4B gauges in NEMA 4X housings: two @ 5000 psig, two @ 2000 psig, one @ 1000 psig and one @ 300 psig.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor negative pressure on fume hood

APPLICATION C131

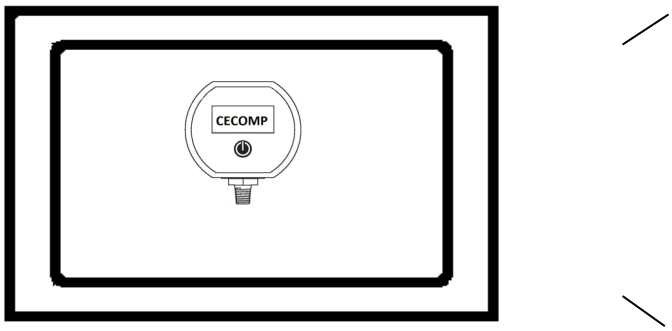
Type of Company: Pharmaceutical Company
Location: Illinois

A fume hood is a large piece of scientific equipment common to laboratories designed to limit a person's exposure to hazardous and/or unpleasant fumes. The hood works with sash positioning controls to let the HVAC system know how much the sash is being opened. The controls then let the system know to reduce or increase the fan speed and thus the volume of air that needs to be exhausted.

Photo by employee of US Government-Public Domain

The Engineering Issue

- The engineer has a requirement to replace all of the mercury manometers used to monitor the pressure for the fume hood.
- She requires a portable, cost-effective, accurate electronic manometer that has no mercury and does not require an electrician to install.



The engineer used a Cecomp ARM760AD (Absolute Reference Manometer) to monitor the negative pressure (vacuum) inside the fume hood. Cecomp also furnished a special connector via the wall-mount power supply that does not require an electrician to install.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Accurately monitoring pressure in a gas pipeline

APPLICATION C132

Type of Company: Public Utility
Location: Florida

Local gas utilities are regulated utilities involved in the delivery of natural gas to consumers within a specific geographic area. When the natural gas in a transmission pipeline reaches a local gas utility, many operators and technicians are required to check the gas pressure at the various 'stops' along the local utility transmission line. Since gas is billed by volume and that volume is calculated from their temperature / pressure formula, it is essential pressure be measured and recorded at each 'stop.'


Photo by Glen Dillon

The Engineering Issue

- Pressure variance is rampant due to the significant accuracy errors that analog dial gauges incur under normal usage because of mechanical shock and field conditions.
- The engineer has a requirement to increase (from previous records kept) the pressure accuracy measured and recorded at each 'stop.'

The engineer used a Cecomp F16B digital pressure gauge. This Cecomp gauge has 0.25% accuracy over the full pressure range, 0.1 PSI resolution, and can handle the "abuse" due to rugged and high-quality electrical and mechanical component parts.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring water quality using pH and ORP

APPLICATION A133

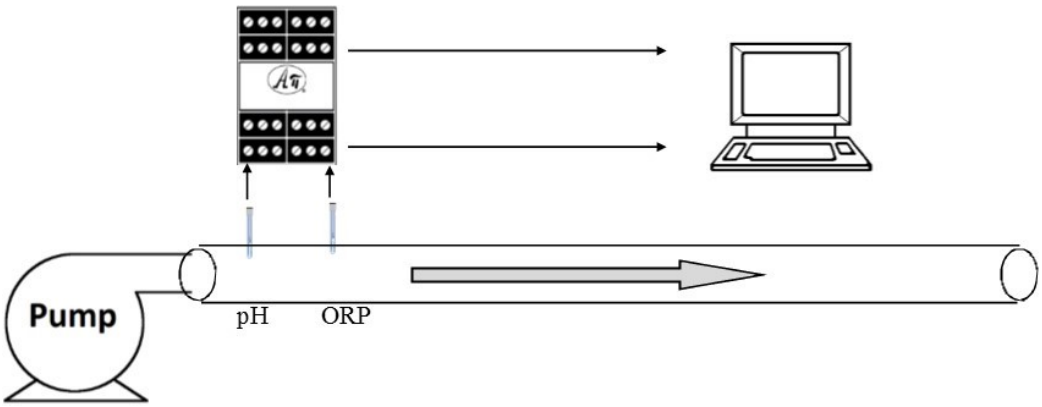
Type of Company: Manufacturer, Chemical Systems

Location: Illinois

Proper sanitation of swimming pools is needed to prevent the transmission of infectious waterborne diseases. Sanitation methods include a water filter to remove pollutants, disinfection to kill infectious microorganisms, and regular testing of pool water, including chlorine and pH levels. When any pool chemicals are used, it is very important to keep the pH of the pool in the proper range as a higher pH drastically reduces the sanitizing power of chlorine due to reduced oxidation-reduction potential (ORP). The customer manufactures the equipment and control system to maintain water quality in commercial swimming pools.

The Engineering Issue

- The engineer has a requirement to monitor the pH and ORP of the water to ensure that the chemicals used to sanitize the undesired contaminants are at the proper and safe levels.
- The Van London-pHoenix pH and ORP sensors and the Automation Direct PLC are experiencing interface interaction and isolation issues.



The API engineering team created a custom-modified APD 2000 to interface the outputs from the sensors (one channel for pH and one channel for ORP) to the inputs to the PLC. The OEM APD 2000 also furnishes isolation, eliminating the interaction problems between PLC input channels.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Controlling water level in a tower

APPLICATION A134

This customer is a water commission that supplies water to many communities. Water towers pressurize a water supply system for the distribution of potable water, and provide emergency storage for fire protection. The water is stored in standard water towers around the distribution area. The levels and control are handled at the main distribution / pumping facility 20 miles away from the main pumping station, as well as at the water commission control room even farther away.

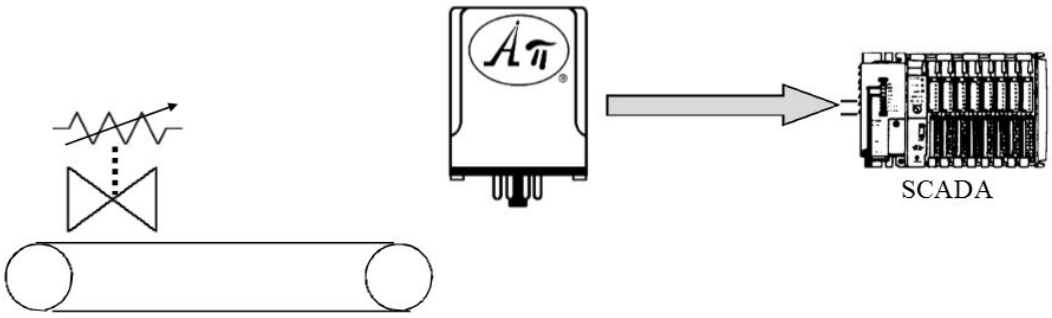
Type of Company: Public Utility

Location: Illinois

By Brandonrush - Own work. Wikimedia Commons.

The Engineering Issue

- The engineer must know the exact position of each valve in each water tower, since all of the tower water levels must be monitored at the main distribution / pumping facility.
- The engineer has already replaced standard linear position feedback potentiometers with precision 10-turn potentiometer on each of the tower valves and needs to convert these position signals to a 4-40 mA signal for the RTU card on the existing HSQ Technology brand SCADA control system.
- They had to be able to “hot-swap” out units to ensure minimum down time.



The engineer used an API 4003 GI with a custom external supply modification. This allows the customer to use a common power supply for all of the various inputs to the RTU card on the SCADA control system. Also, since the unit is a “plug-in” module, it has “hot swap-ability” to minimize down time.

Problem. Solved.

Monitoring drainage doors

APPLICATION B135

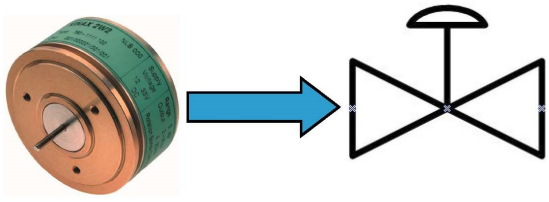
Type of Company: Public Utility
Location: Illinois

Sewage is created by residences, institutions, hospitals, and commercial and industrial establishments. Raw influent includes household waste disposed of via sewers, liquid waste from industry and commerce. Conventional sewage treatment involves three stages, called *primary*, *secondary* and *tertiary treatment*. To move sewage through these stages, it passes through different tanks via drainage doors in treatment facilities. The final water product can be discharged into a stream, river, bay, lagoon, or wetland, or it can be used for the irrigation of a golf course, green way, or park.


By David Medcalf, Wikimedia Commons: Sewage works

The Engineering Issue

- The engineer has a requirement to accurately control the position of the valve that controls drainage doors during treatment processes and integrate this information into an Emerson Process (formerly Fisher/Rosemount) Delta V plant control system.
- Since each drainage door has different opening characteristics, the customer must be able to modify the unit's analogue output in the field.
- Additionally, the unit must be small enough to install in the valve actuator housing and be able to operate in a high-temperature and generally challenging environment.



The field-programmable Kinax 2W2 the engineer chose has an accurate and repeatable linear 4-20 mA signal for the valve position that can be interfaced with the plant control systemIt has excellent temperature stability with no drag on the valve gearing. Finally, it is small enough (1.10 in deep, 1.95 in high) to easily fit in the actuator housing.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

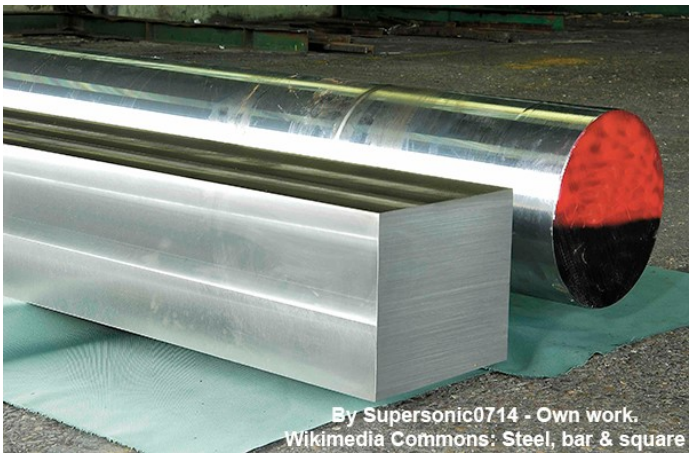
Monitoring power usage on motors and compressors

APPLICATION B136

Type of Company: Steel Plant

Location: Ohio

A steel mill is an industrial plant for the manufacture of steel and a mini-mill is traditionally a secondary steel producer, though many of the world's largest steel producers are using mini-mills exclusively. Most of the energy usage is from the furnace and the motors inside the plant. A typical mini-mill will have an electric arc furnace for scrap melting, a ladle furnace or vacuum furnace for precision control of chemistry, a strip or billet continuous caster for converting molten steel to solid form, a reheat furnace and a rolling mill.



The Engineering Issue

- The engineer needs to monitor power usage and efficiency on compressor and feeder motors and integrate this information into the plant control and power monitoring system.

The engineer used a Camille Bauer Model A210 with EMMOD203. They installed the A210 during a monthly maintenance shutdown, after which the customer had a cost-effective visual power monitor. The EMMOD203 allowed the customer to fully integrate the energy information into their plant control and power monitoring system which allowed them to reduce operating costs.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring vacuum pump motors

APPLICATION C137

Type of Company: Manufacturer, Food Packaging Machines

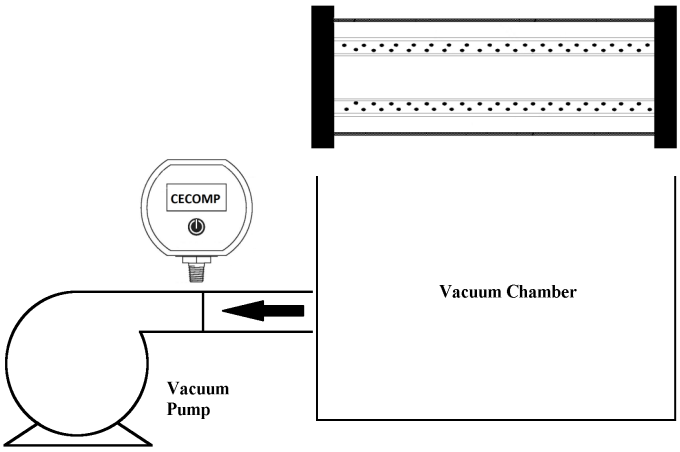
Location: South Carolina

Vacuum packing is a method of packaging that removes air from the package prior to sealing. The intent of vacuum packing is to extend the shelf life of foods and, with flexible package forms, to reduce the volume of the contents and package. Food agencies require that these machines have good food hygiene and be maintained such that it operates at acceptable levels.

Photo by Jwallingford1

The Engineering Issue

- To ensure that the machines are operating at "acceptable levels," the field service technician must not only monitor the vacuum pumps and regulators operations, but document these operations as well.
- The engineer requires a portable, accurate, rugged and reliable vacuum gauge.



The engineer used a Cecomp ARM760BBL. The ARM760BBL gives a visual indication of the applied vacuum. The ruggedness of the gauge ensures that calibration is reliably maintained.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor pressure on a boiler feed pump

APPLICATION C138

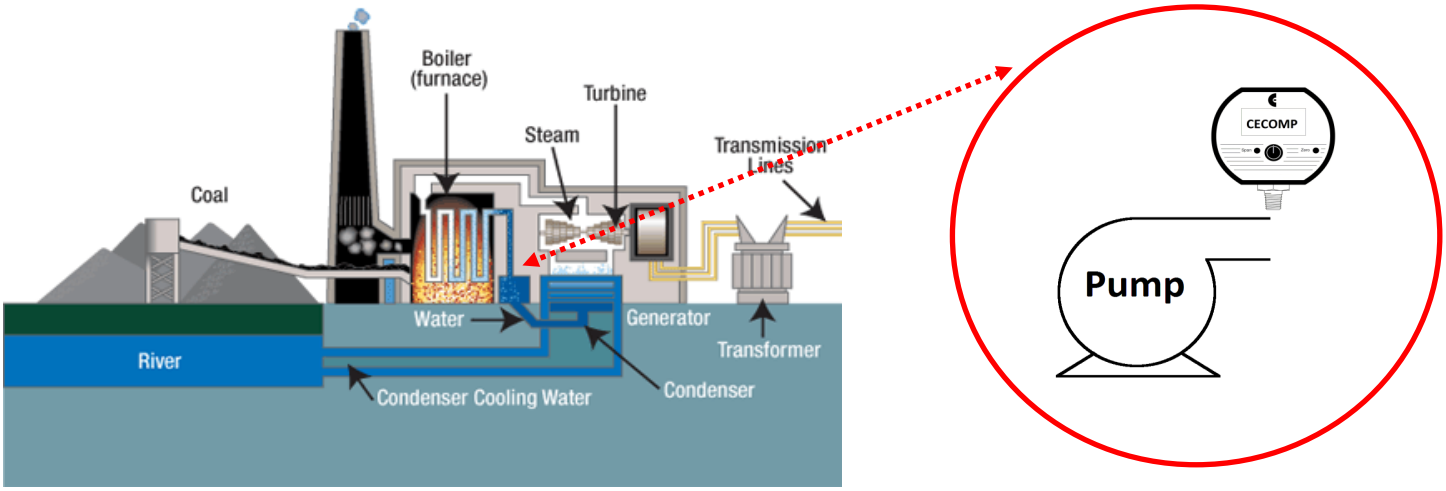
Type of Company: Public Utility - Coal-Fired Power Plant

Location: Missouri

A coal-fired power plant typically crushes the rough coal into pieces and then brings it into the plant for the boiler. Highly purified water, pumped through pipes inside the boiler, is turned into steam by the heat. The steam reaches very high temperatures and pressures up to 3,500 psi, and is piped to the turbine. The turbine turns a shaft. On the end of the shaft is a magnet that revolves inside a coil to create electricity.

The Engineering Issue

- The engineer needs to have an accurate and easy-to-read visual indication of the pressure on the boiler feed pump.
- The digital gauge must be accurate, readily available and rugged.



The engineer used a Cecomp F4B digital pressure gauge. It is accurate, rugged and comes in a NEMA 4X case.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor load cells for weighing containers

APPLICATION A139

Type of Company: Cargo Handling Operation

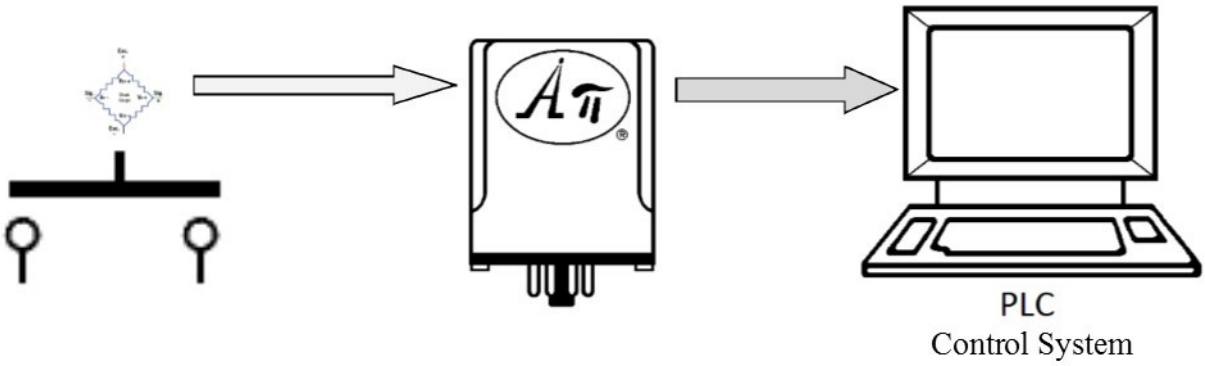
Location: Georgia

A container crane (also container handling gantry crane or ship-to-shore crane) is a type of large dockside gantry crane found at container terminals for loading and unloading intermodal containers from container ships.

This customer is a leader in the operation of modern seaside shipping terminals who specialize in the handling of container, reefer, break-bulk and RoRo cargoes.

The Engineering Issue

- They are using load cells on the cranes to weigh cargo but require a PLC interface device that is; 1) “hot-swappable;” 2) Field range-able and; 3) Easy to calibrate.



The engineer used an API 4058 G. The API 4058 G provides the excitation power to the load cell and is fully field range-able for the excitation supply, sensitivity (output from the transducer) and DC current output. A 4-20mA signal is sent for indication and to ensure proper cargo weight. The unit is hot swappable for minimum system downtime.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor engine RPM to control engine torque

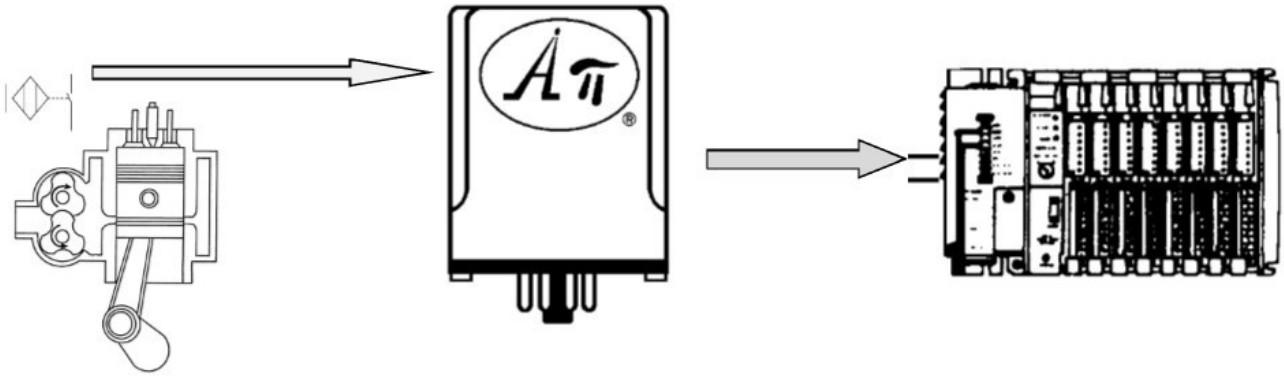
APPLICATION A141

Type of Company: Motor Manufacturer, Engineering Solutions Div.
Location: Wisconsin

A motor manufacturer changed a Cummins engine RPM sensor interface so it was no longer compatible with the Parker engine controller on a customer's log harvester. The customer had contacted them to find a interface device to convert the engine sensor Pulse Width Modulated (PWM) output to be compatible with the engine controller. Harvesters are commonly used in the heavy forestry industry for felling, delimbing and buking trees.

The Engineering Issue

- The engineer has a requirement to monitor the engine RPM sensor via the motor manufacturers interface.
- The RPM sensor interface must be compatible with the currently-used engine controller.



API engineers built a custom-modified API 4300 G. The modification ensured the unit input was compatible with the output from the sensor interface, and that the unit output was compatible with the engine controller input.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Manual boiler control during testing

APPLICATION A142

Type of Company: Manufacturer, Burner Systems

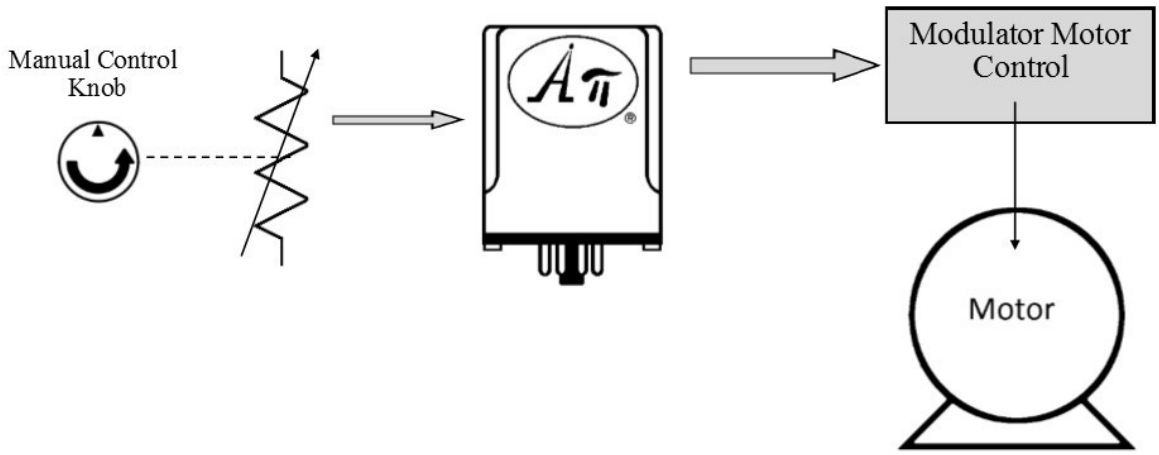
Location: Wisconsin

Forced-draft burners use combustion air blowers to provide pressurized air to oxidize the fuel and to produce different flame patterns. These combustion air blowers pull air through the heat exchanger which greatly increases fuel efficiency while allowing the heat exchangers to become smaller. The blowers run continuously, increasing electrical usage, and require a means to proportion airflow to the rate of fuel flow. By keeping tighter control of the air/fuel ratio, one can better control the combustion reaction.

Photo by R-office

The Engineering Issue

- The engineer requires control of the burner jack shaft for manual boiler control in testing situations.
- The manual control system requires that they convert a potentiometer slide wire to a 4-20 mA input signal for a Honeywell modulator motor controller.



The engineer used an API 4003 G I. The 4003 G I accepts the slide wire input and converts it to a 4-20mA signal for the motor controller. The modulator motor will adjust the jack shaft, which is mechanically linked to the damper box (air flow), fuel control (gas) and oil pump.

Problem. Solved.

Split signals for separate monitoring and control

APPLICATION A143

This pharmaceutical company uses an Emerson Process (formerly Fisher/Rosemount) Delta V automation management system to control the plant manufacturing system. The HVAC engineers want to monitor differential pressure, relative humidity and temperature separately in their clean rooms, but the Delta V system also needs to monitor these signals to maintain product compliance and archive FDA validation for QA purposes. The company cannot add another set of sensors.

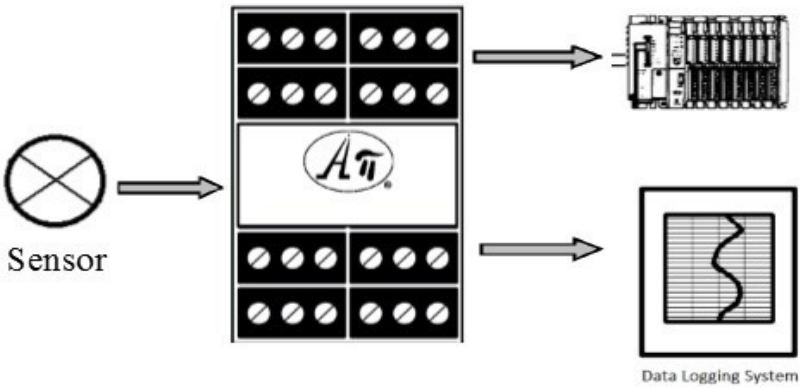
Type of Company: Manufacturer, Pharmaceuticals

Location: Illinois

photo by Rudolf Simon - M+W Group GmbH: Stuttgart, Germany

The Engineering Issue

- The process signal must be monitored in two places simultaneously; One of the signals must go to the process control system and the other signal must be provided to the quality assurance monitoring system.



The engineer used an APD 4393 DC-to-DC IsoSplitter®. The APD 4393 accepts the 4-20 mA signal from the sensor and provides two optically isolated outputs that are linearly related to the inputs. The two isolated output channels provided an economical solution where more than one output device needs to be connected to the same input signal.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring motor current on DC motors

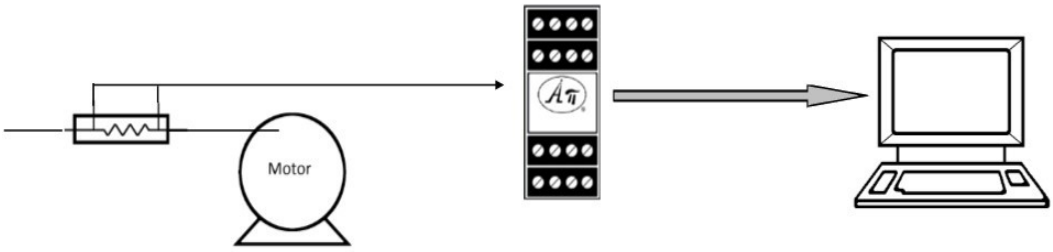
APPLICATION A144

Type of Company: Steel Plant
Location: Indiana

A steel mill is an industrial plant for the manufacture of steel and a mini-mill is traditionally a secondary steel producer which usually obtains most of its iron from scrap steel. A typical mini-mill will have an electric arc furnace for scrap melting, a ladle furnace or vacuum furnace for precision control of chemistry, a strip or billet continuous caster for converting molten steel to solid form, a reheat furnace and a rolling mill. Most of the energy usage is from the furnace and the motors inside the plant.

The Engineering Issue

- The engineer has a requirement to monitor motor current on their DC motors and integrate this information into the plant control and power monitoring system (PLC).
- There are currently ±100mV shunts installed but they need both to isolate the shunts from the PLC and convert the signal to ±10 VDC for the analog input card.
- The current panel is almost full, so there are space considerations.



The engineer used an APD 4380, factory-calibrated for a ±100mV input and ±10 VDC output. Since the unit is only 22 mm wide and has full three-way isolation it satisfied all of the customer needs, allowing them to fully integrate their plant energy usage information into their control and power monitoring system.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Separate monitoring and control system functions

APPLICATION A145

Type of Company: Manufacturer, Pharmaceuticals

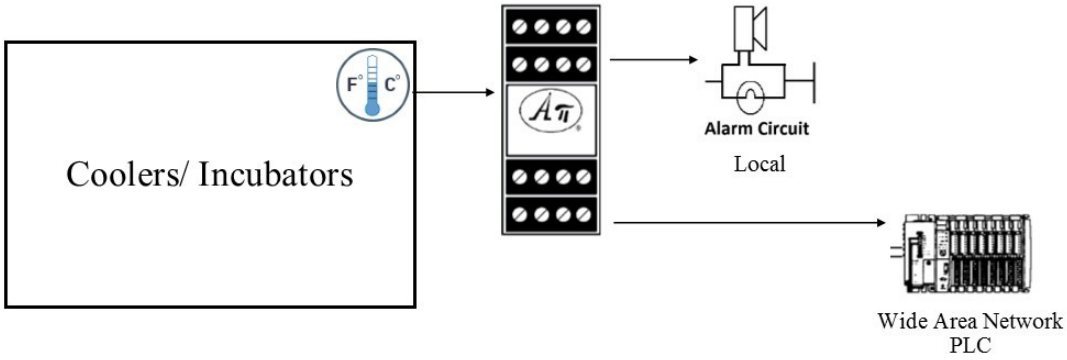
Location: Illinois

A reagent is a substance or compound added to a system to cause a chemical reaction, or added to see if a reaction occurs. In synthetic chemistry, reagents are used to cause a desired transformation of an organic compound. The biotech revolution grew from developing reagents to identify and manipulate the chemical matter of cells. A large pharmaceutical manufacturer is developing diagnostic reagents that are extremely expensive to produce.

By Orderinchaos - Own work, www.commons.wikimedia.org/w/index.php?curid=33678228

The Engineering Issue

- The company needs a reliable system to monitor coolers at +2° to +8°C and incubators at +35°C to +38°C. A total of 32 temperature points need to be measured. RTDs are being used.
- When temperatures are outside the required temperature band, a local alarm triggers and an alarm signal (contact open) is sent to an Allen Bradley PLC. The PLC interfaces with a wide area network to a 24/7 monitoring facility. If the alarm is not resolved locally in 15 min, a technician is sent to investigate the out-of-tolerance temperature.



The APD 1430 accepts RTD signals and has dual Form C SPDT relay outputs. The company used one for the coolers and one for the incubators. Each was configured as a “band” alarm in order to provide the required out-of-tolerance notifications. One relay on each unit was used for a local light/horn and the other went to the PLC monitoring circuit. The API factory also saved field time by pre-configuring the units with the customer’s set points.

Problem. Solved.

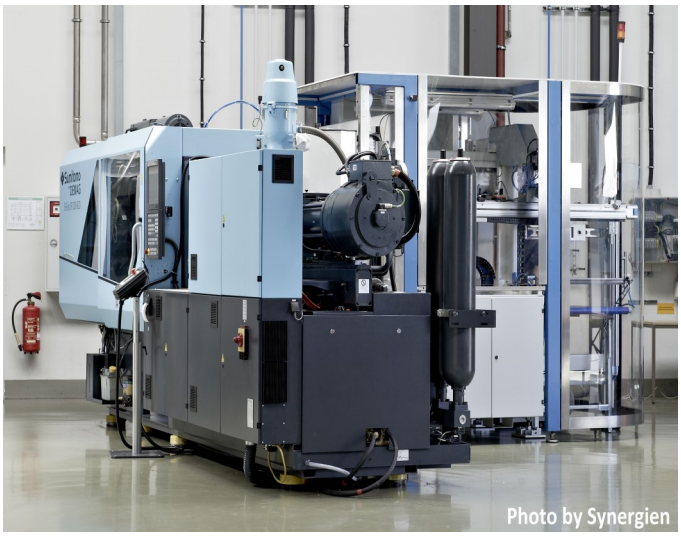
 | www.api-usa.com | www.cecomp.com

Monitoring critical heater operation

APPLICATION A146

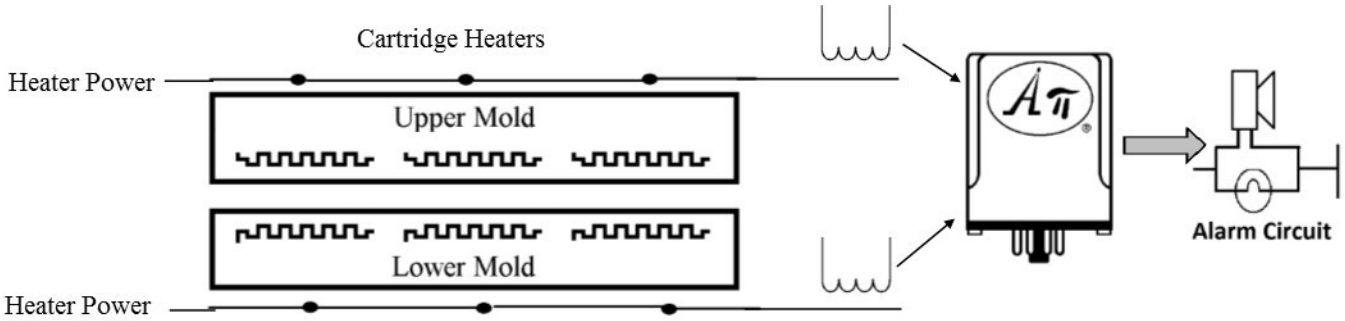
Type of Company: Manufacturer, Gasketing
Location: Illinois

A gasket is a mechanical seal which allows for *"less-than-perfect"* mating surfaces on machine parts where they can fill irregularities. Gaskets are traditionally produced by cutting from sheet materials, but use of injection molded gaskets is increasing. Liquid silicone rubber or thermoplastic rubber are commonly specified for injection molded gaskets, use in electronics, and rugged enclosures with demanding sealing requirements in outdoor conditions.



The Engineering Issue

- The engineer has a requirement to monitor the operation of both the upper and lower heaters in the mold used to manufacture gaskets.
- If any one heater in either the upper or lower mold becomes defective, the gasket will have a “cold” spot and will be rejected by QC. Since all defective material is scrapped, it is imperative that both the operator and the maintenance technician are immediately notified of a defective heater.



The engineer used an API 1600 G. The API 1600 G monitors the current from a CT connected to the heaters. If the current draw is “low,” the relay contacts sound both an alarm and a light to notify both the maintenance technician and the operator. The result is less scrap and a higher yield.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor load cells for weighing material

APPLICATION A147

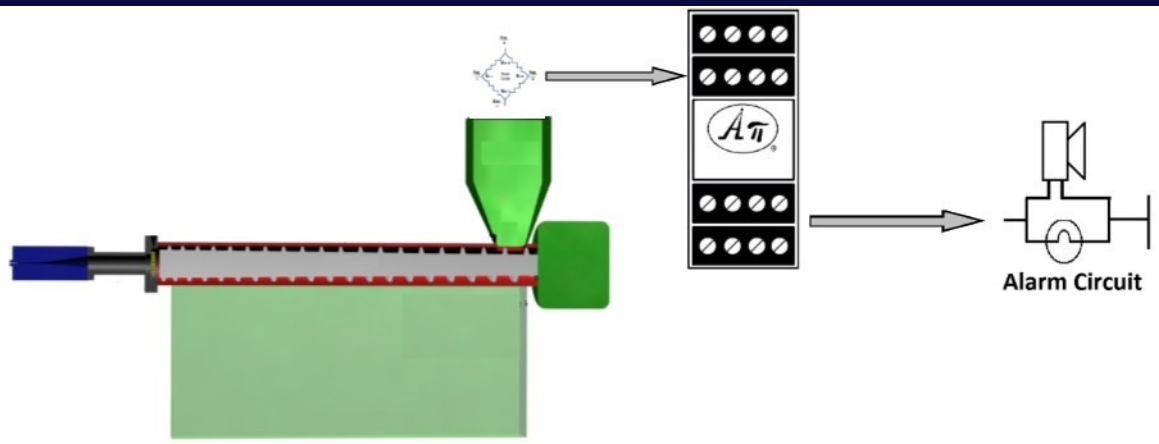
Type of Company: Manufacturer, Foam Cups

Location: Illinois

Polystyrene often is used in applications where hygiene is important, such as health care and food service products. Expanded polystyrene beads are typically used to manufacture foam cups. Foam cup manufacturers heat the pellets and expand the pellets to whatever sizes they need and then mold it into the required product size. The customer is a leader in manufacturing foam coffee cups. They are using a load cell attached to large canvas bags suspended above the cup-making machines.

The Engineering Issue

- When the weight of the bag reaches a pre-determined low level, the engineer wants to sound an alarm and flash a light so the operator can refill the back before it is empty to keep the machine operation running continuously.
- They need an interface device for the load cell attached to the bag that will excite the load cell and be easy to calibrate for the control system.



The engineer used an APD 1500. The APD 1500 provides the excitation power to the load cells. Its alarm trip points are field-settable via a multi-turn potentiometer and the relay output triggers the alarm and lights to indicate low weight/material level in the bag.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Split flowmeter signals for alarming and monitoring

APPLICATION A148

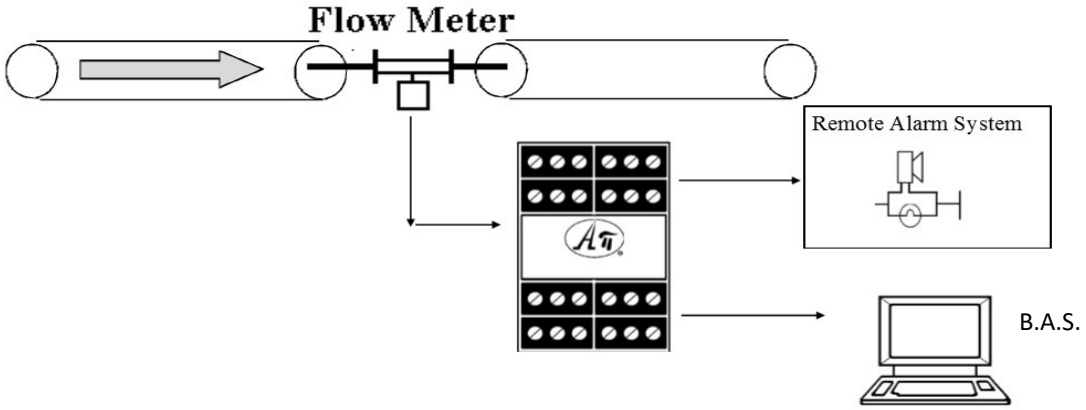
Type of Company: Natural Gas Distribution Company

Location: Illinois

Gas flowing from higher to lower pressure is the fundamental principle of the natural gas delivery system. Within each distribution system, there are sections that operate at different pressures, with regulators controlling the pressure. The gas utility's central control facility continuously monitors flow rates and pressures at various points in its system because the operators must ensure that the gas reaches each customer with sufficient flow rate and pressure to fuel equipment and appliances. They also ensure that the pressures stay below the maximum pressure for each segment of the system.

The Engineering Issue

- The gas company has to send their customer a 4-20 mA signal from the flow meter for the customer's remote alarm monitoring system, and for their building automation system.
- They cannot add another flow meter and have discovered that both isolation and increased drive capability are required for this signal.



The engineer used an APD 4393 IsoSplitter®. The APD 4393 accepts the 4-20 mA signal from the flow meter and provides two optically isolated outputs with 20 V compliance. The unit isolates and amplifies the flow meter signal and provides an economical solution.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring level of chemical in tank

APPLICATION C150

Chloride is a useful and reliable chemical indicator of river / groundwater fecal contamination, as chloride is a non-reactive solute and ubiquitous to usage in sewage treatment & potable water. Many water regulating companies around the world utilize chloride to check contamination levels of rivers and potable water sources as fecal contamination of water sources are highly prevalent worldwide, accounting for the majority of unsafe drinking water.

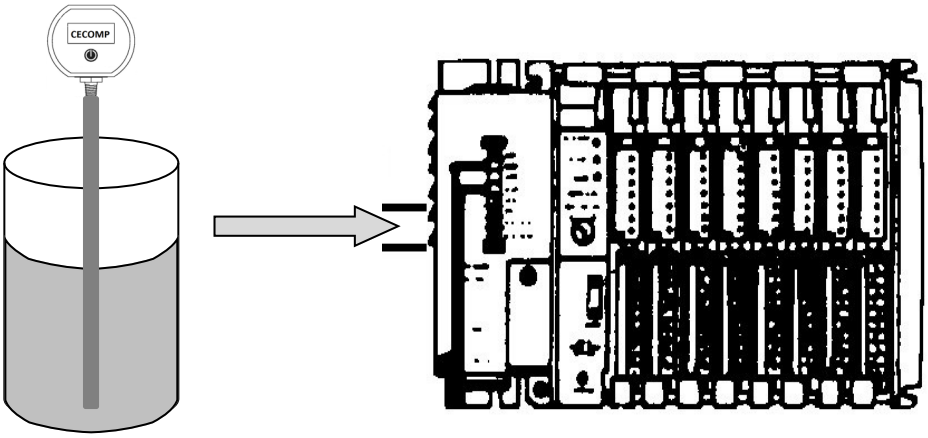
Type of Company: Public Utility - Groundwater Treatment

Location: Texas

By Orderinchaos - Own work, www.commons.wikimedia.org/w/index.php?curid=33678228

The Engineering Issue

- The engineer has a requirement to accurately monitor the level of chloride in a tank.
- The requirement is for a local visual display in feet of water column and a signal to send to the PLC for data logging and alarming.



The engineer used a Cecomp DPG1000L. The DPG1000L gives both a visual indication scaled in feet of water column and a 4-20 mA signal to send to their PLC for both data logging and alarming.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Controlling limestone added to ash on conveyor

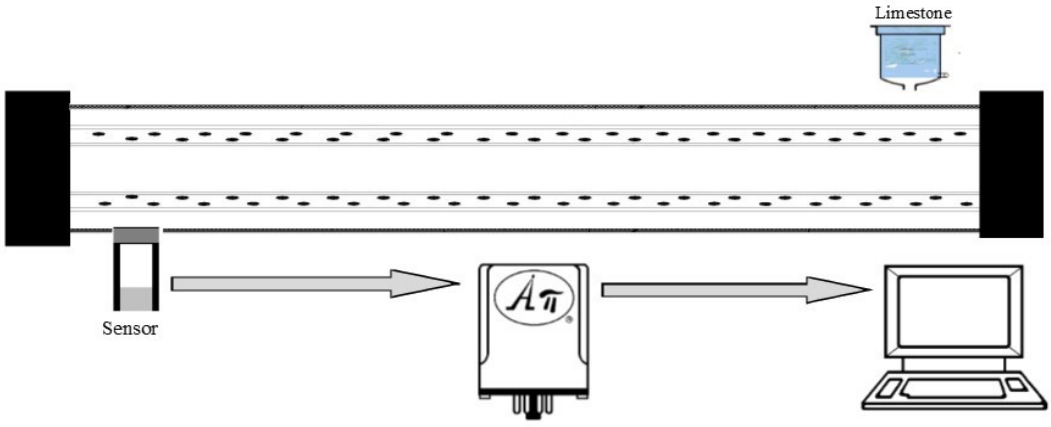
APPLICATION A151

Type of Company: Public Utility
Location: Hawai'i

Waste-to-energy (WtE) is the process of generating energy in the form of electricity from the primary treatment of waste. Incineration, the combustion of organic material such as waste with energy recovery, is the most common WtE implementation. Ash (incombustible residue) can contain high concentrations of various metals and harmful chemicals that were in the original waste. After the ash cools on a conveyor, magnets and other mechanical devices pull metals from the ash for recycling. The ash is treated with limestone before landfill disposal.

The Engineering Issue

- The engineer has a requirement to control the amount of limestone added to the ash.
- They are using a Pepperl+Fuchs DK10 laser print mark contrast sensor to monitor the amount of limestone that must be added to the ash but they need to both scale and isolate the output from the sensor so it is compatible with the plant ABB control system.



The engineer used an API 4300 G. This allows them to use a standard off-the-shelf unit that is factory-ranged for their specific range and, since it is a "plug-in" module, it gives the application "hot swap-ability."

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring natural gas pressure in piping systems

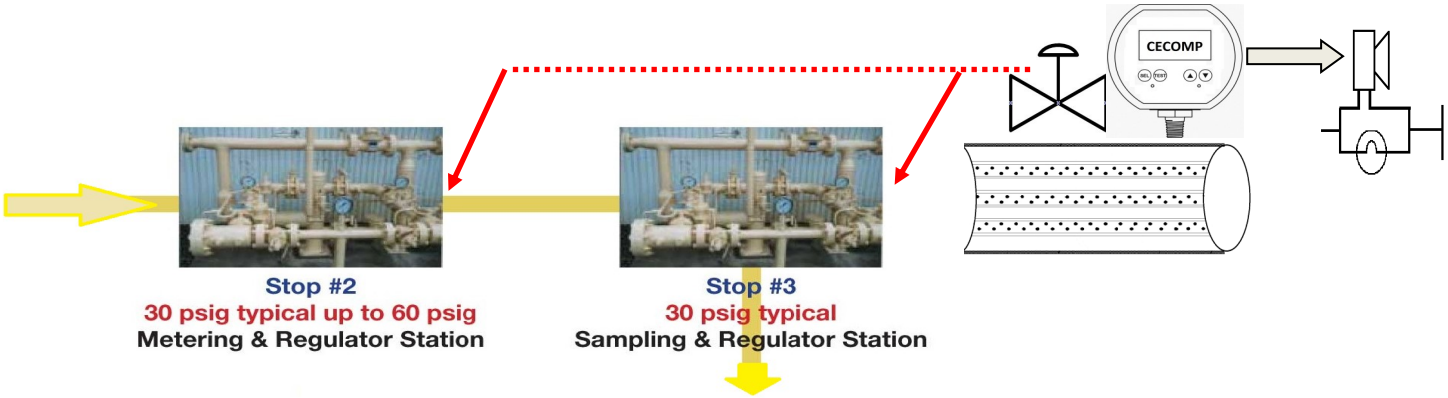
APPLICATION C152

Type of Company: Equipment Manufacturer
Location: Massachusetts

A portable pressure monitoring device is an instrument that is used to monitor natural gas pressure in a piping system while either corrective or preventative maintenance is performed on the pressure regulating valves. A pressure regulator's primary function is to match the flow of gas through the regulator to the demand for gas placed up-

The Engineering Issue

- The engineer has a requirement for both a visual and an audible alarm to indicate any deviation from the operator-specified pressure levels in the pipeline system while performing the regulator maintenance.
- The regulator maintenance technician requires a digital readout of the pressure with the ability to enter alarm limits.



The engineer used a Cecomp F16ADA which can be powered by a 12VDC battery. The F16ADA has both a visual indication that can be scaled in operator-selected engineering units, and a relay output to power the audible alarm.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring AC current on railroad crossings

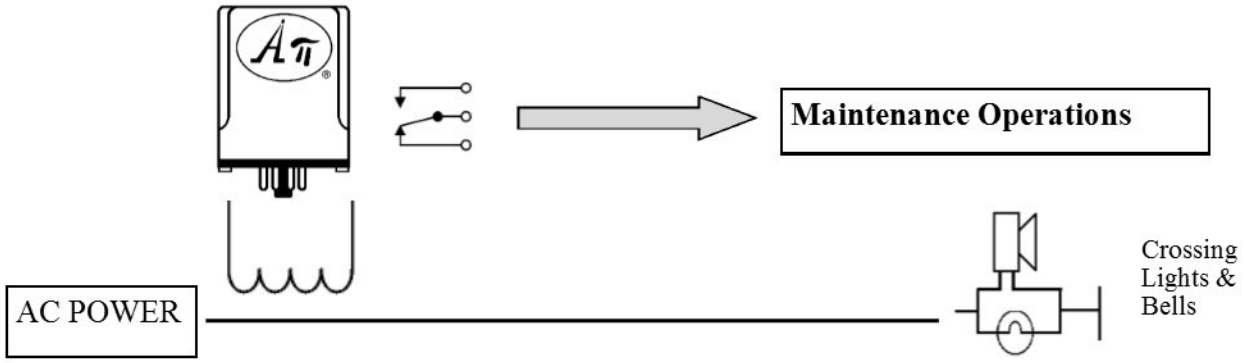
APPLICATION A153

Type of Company: Railroad
Location: Saskatchewan, Canada

In many countries, railroad crossings on less important roads and railway lines are often "open" or "uncontrolled," usually with warning lights or bells to warn of approaching trains. These ungated crossings represent a safety concern and many accidents have occurred due to failure to notice or obey the warning. Crossings with crossing bells, lights, and/or gates greatly reduce accidents. Approximately 30 seconds before arriving at the crossing, the train trips a track circuit near the crossing, triggering these notifications.

The Engineering Issue

- The engineer has a requirement to monitor the current flowing thru the flashing lights to ensure proper operation in several remote locations.
- If the flashing lights are not operating properly, the maintenance operation center must send someone to repair the system.



The engineer used an API 1600 G. The unit's low alarm was used to notify the maintenance operations center that the light circuitry is not drawing enough current for proper operation. This solution allowed the operation center to reduce maintenance costs by only sending out a crew when necessary.

Problem. Solved.

Monitor vacuum on kiln

APPLICATION C154

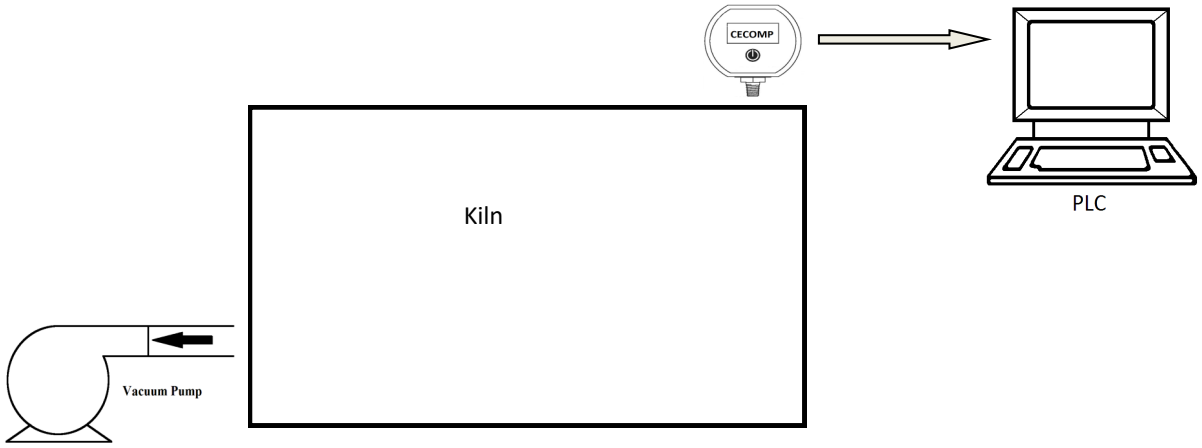
Type of Company: Manufacturer, Lumber

Location: Ohio

Wood drying reduces the moisture content of wood before its use. When the drying is done in a kiln, the product is known as kiln-dried timber or lumber, whereas air drying is the more traditional method. Some companies use a custom retort process which reduces the atmospheric pressure to the kiln in order to decrease the drying time, typically by a factor of 4. This process also reduces typical kiln drying defects which increases the yield substantially.

The Engineering Issue

- The engineer requires a digital gauge to accurately monitor the reduced atmospheric pressure of the kiln.
- A signal from the gauge must also be sent to the PLC to control the vacuum motors.



The engineer used a Cecomp DPG1000L absolute pressure gauge which gave both an accurate visual readout of the atmospheric pressure and a 4-20 mA signal to the PLC for vacuum control.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring temperature in chillers

APPLICATION A155

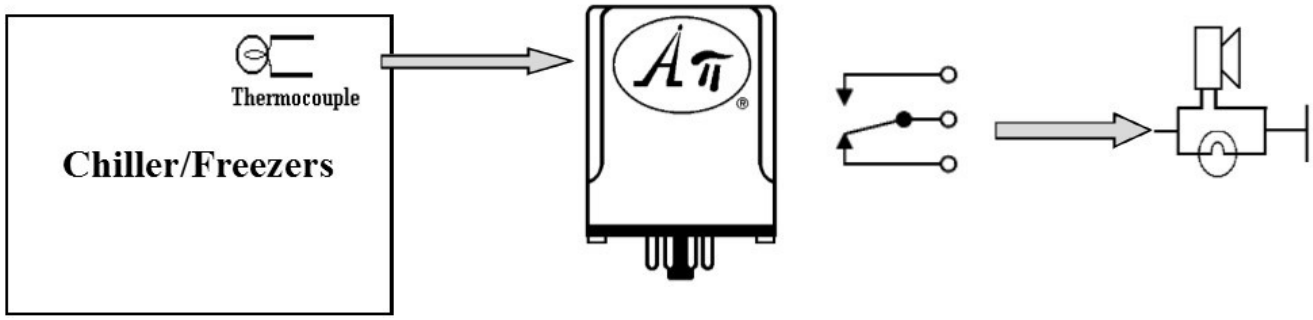
Type of Company: Manufacturer, Pharmaceuticals

Location: Illinois

Process control enables mass production of consistent products from continuously operated processes while preventative maintenance monitoring is a way of improving overall equipment reliability and reducing defects in manufactured product. In today's manufacturing process, preventative maintenance monitoring systems and process control systems are both used to reduce labor costs and improve the quality of the final product.

The Engineering Issue

- The plant's engineers have two requirements:
  - Control the temperature for the chillers and freezers in an Emerson Process Delta V process control and building automation management system.
  - Monitor the temperature for the chillers and freezers for the HVAC preventative maintenance system.
- They cannot input the non-validated HVAC sensor into the validated process control PLC.



The engineer used an API 1220 G. The API 1220 G accepted the non-validated HVAC thermocouple input and has two independent relay outputs to indicate temperature deviations.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Maintain line pressure for purified water lines

APPLICATION C156

Type of Company: Pharmaceutical Company

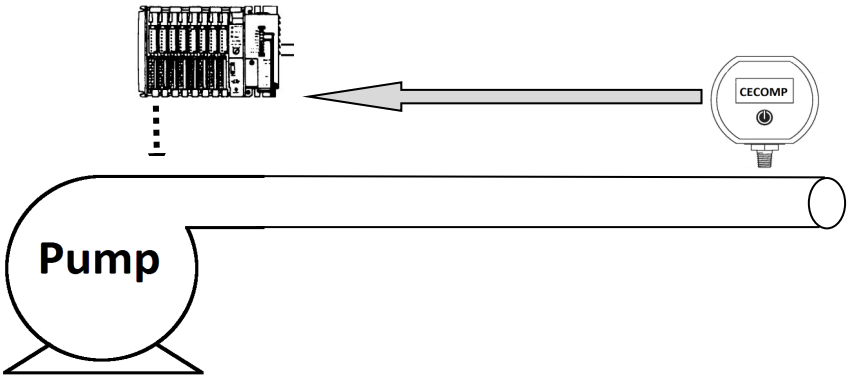
Location: Illinois


Photo by Cjp24 from Wikimedia Commons

Water purification is the process of removing undesirable chemicals, biological contaminants, suspended solids and gases from contaminated water for a specific purpose. Pharmaceutical companies that produce drugs and chemicals typically use purified water throughout the plant during the production process and proper water pressure under varying water system loads must be maintained.

The Engineering Issue

- The engineer has a requirement to monitor and control the water line pressure to determine activation of the water pumps
- The building automation system (BAS) requires a 4-20 mA signal input signal and the technician needs a local display



The engineer used a Cecomp DSGL1 which is mounted on a 1” tri-clamp sanitary fitting. This provides a visual indication of the water pressure in the lines and a 4-20 mA signal to send to the Building Automation System (BAS) to control the water pumps in order to maintain the proper line pressure under varying water system loads.

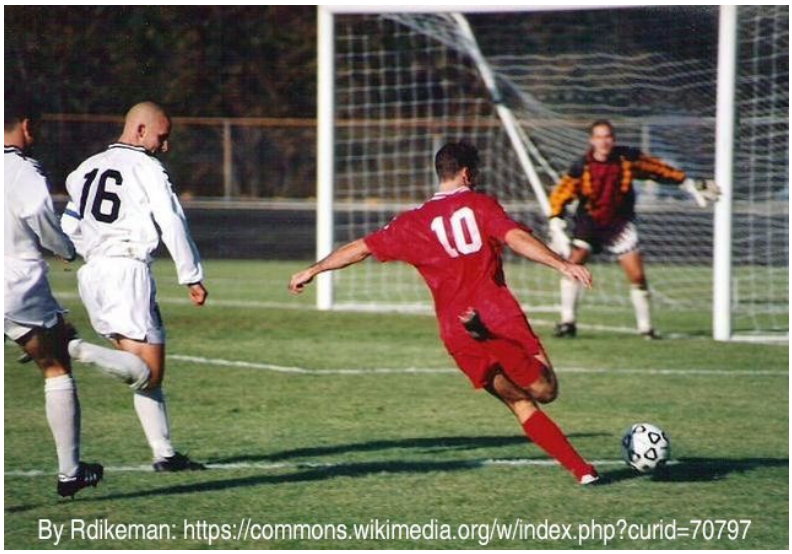
Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor QC pressure test on soccer balls

APPLICATION C157

Type of Company: Manufacturer, Soccer Balls
Location: Oregon



The recognized international governing body of soccer is FIFA. FIFA requires that soccer balls maintain a pressure between 0.6 and 1.1 bar (at sea level) during the entire game, which ensures that the ball will respond consistently when making long passes and deep crosses. During an average game the ball is kicked approximately 2000 times and it needs to perform identically to the way

The Engineering Issue

- The engineer has a QC test requirement to inflate the soccer ball to 0.8 bar and ensure that the pressure loss does not exceed 0.15 bar after 72 hours.
- The gauge needs to be portable, rugged, accurate and have an easy-to-read visual indication of the pressure.

The engineer used a Cecomp DPG1000B to monitor the pressure and record the pressure values on their test documents. This Cecomp gauge has 0.25% accuracy over the full pressure range so it is very accurate and easy to read. It is also very rugged both electrically and mechanically.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

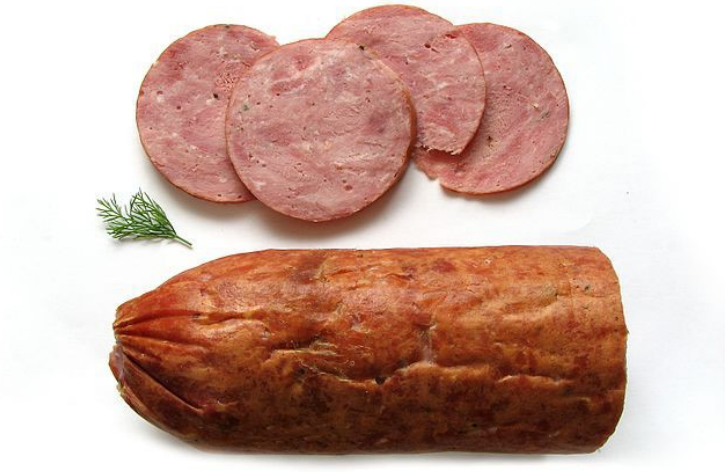
Monitor elasticity and leak test

APPLICATION C158

Type of Company: Manufacturer, Edible Collagen Casings

Location: New Jersey

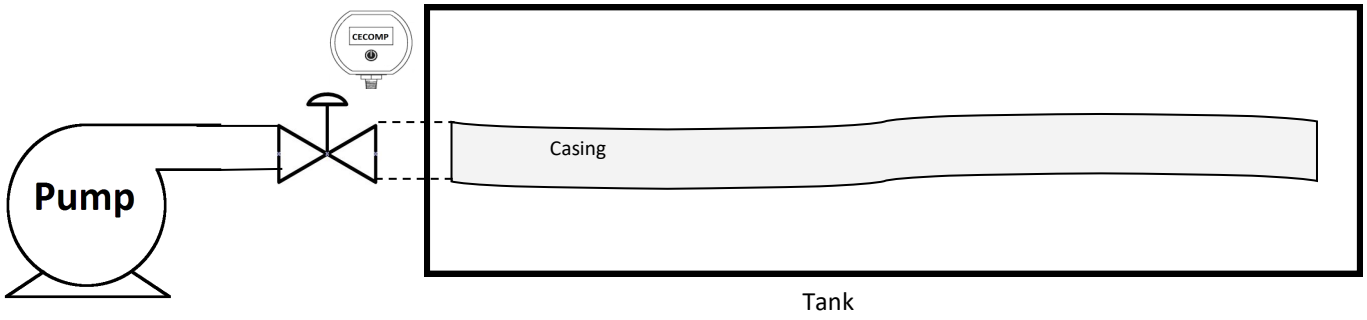
Collagen has a wide variety of applications, from food to medical. It is widely used in the form of collagen casings for sausages (interestingly also used in the manufacture of musical strings!). The importance of collagen is that it is a biopolymer, a natural material which is readily assimilated by the human body. During the sausage casing manufacturing process, 30 foot links of casing must be inflated to 1.5 psi and submerged in a water bath. This tests the casing for both elasticity and leakage.



By Mariuszjbie - Own work, https://commons.wikimedia.org/w/index.php?curid=2908283

The Engineering Issue

- The engineer has to accuracy and reliably monitor the air pressure inside the inflated and submerged casing.
- They also want an easy-to-read local visual indication of the pressure.



The engineer used a Cecomp DPG1000B to monitor the pressure test. This gauge is ultra-rugged, very accurate and easy to read.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Control valves with no potentiometer feedback

APPLICATION A159

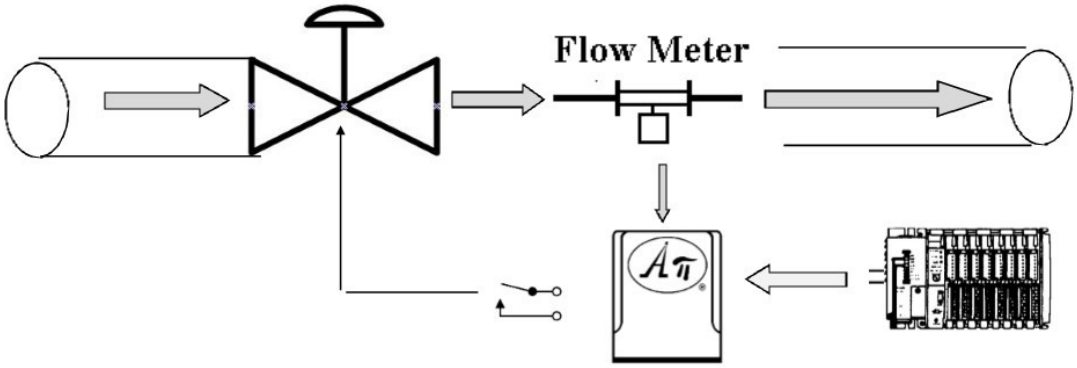
Type of Company: Manufacturer, Valves

Location: Virginia

Valves are found in virtually every industrial process, including water and sewage processing, mining, power generation, processing of oil, gas and petroleum, food manufacturing, chemical and plastic manufacturing and many other fields. A control valve is a valve used to control fluid flow by varying the size of the flow passage as directed by a signal from a controller. This enables the direct control of flow rate and the consequential control of process quantities such as pressure, temperature, and liquid level. A valve actuator will typically have the valve position and condition monitoring in an integral unit mounted on the valve body.

The Engineering Issue

- The engineer has a requirement for a more precise feedback system enabling more accurate control of flow thru the valve.
- They will be using a 4-20 mA signal from an inline flowmeter for the feedback system.



The engineer used an API 3200 G M420. The API 3200 G M420 accepts the 4-20 mA control signal from any PLC (Honeywell, ABB, Foxboro, etc.), accepts the 4-20 mA feedback signal from the flow meter, and has a mechanical relay contact closure that will open and close the valve. The result is more accurate control of flow thru the valve.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Splitting a signal to both a PLC and a controller

APPLICATION A160

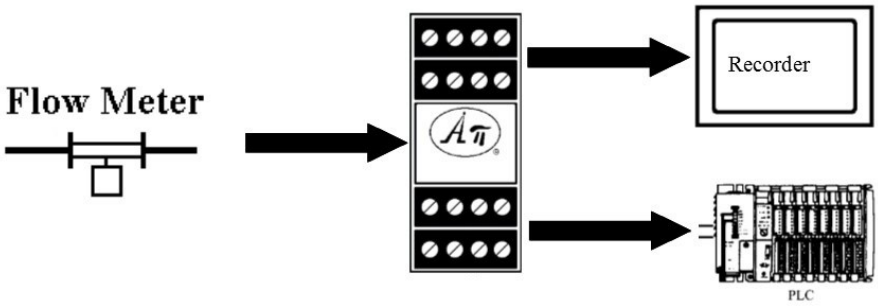
Type of Company: Manufacturer, Foam Insulation Panels
Location: Minnesota

Heating and cooling costs can account for 50-70% of energy costs in the average American home. To help reduce heating and cooling costs, maintain uniform temperature, and lower noise levels in homes and commercial properties, builders turn to rigid foam insulation panels. The basic types of rigid foam board insulation are expanded polystyrene, extruded polystyrene, and polyisocyanurate unfaced or foil faced.

This customer is a manufacturer of these foam panels. During the manufacture of the panels, chemicals are injected to expand foam insulation cells. The company uses a Micro Motion flow meter to monitor the amount of chemical injected.

The Engineering Issue

- The company added an Allen Bradley (Rockwell Automation) PLC for better process control and monitoring; however, the flow meter signal from the process must still go to the Partlow recorder/controller for the purposes of controlling the machine drive motors as well as the chemical pump.
- The flow meter signal had to simultaneously connect to both PLC and the controller.



The customer choses to use an APD 4393 IsoSplitter® between the flow meter and the controller. The APD 4393 was able to power the flow meter and has two independent outputs: one was used for the recorder/controller and the other for the Rockwell PLC.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Isolating signals with a hot swappable unit

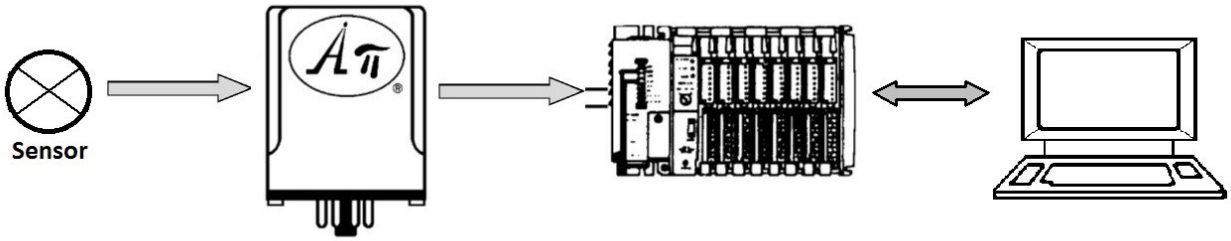
APPLICATION A161

Type of Company: Public Utility
Location: Florida

The customer is a public utility that uses unmanned pumping stations (or lift stations) in its sewage collection system. Lift stations handle gravity-fed underground pits (commonly called wet wells) which store raw sewage. Wet wells are equipped with electrical instrumentation to detect sewage levels. When levels rise to a predetermined point, the lift station pump will be started to lift the sewage upward through a pressurized pipe system where the sewage is discharged into a gravity manhole. From here the cycle starts all over again until the sewage reaches its point of destination, usually a treatment plant.

The Engineering Issue

- The engineer has a requirement for a “hot swappable” device to that will:
  - ◊ Isolate all the instrumentation signals (pump motor, level sensors, etc.) to the custom PLC input card and the main control motherboard.
  - ◊ Eliminate large spikes, often generated by lightning in this zone, thereby protecting the input cards of the customer’s application-specific expensive custom PLC.



The engineer used an API 4380 G. This allowed the use of a standard off-the-shelf module that is field range-able and since it is a “plug-in” module it gives the “hot swap-ability” that is required. It allows the service trucks to carry “spare ice cubes” (our modules are clear) and replace any “blown” module to minimize system down time.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor flow and pressure on DI water equipment

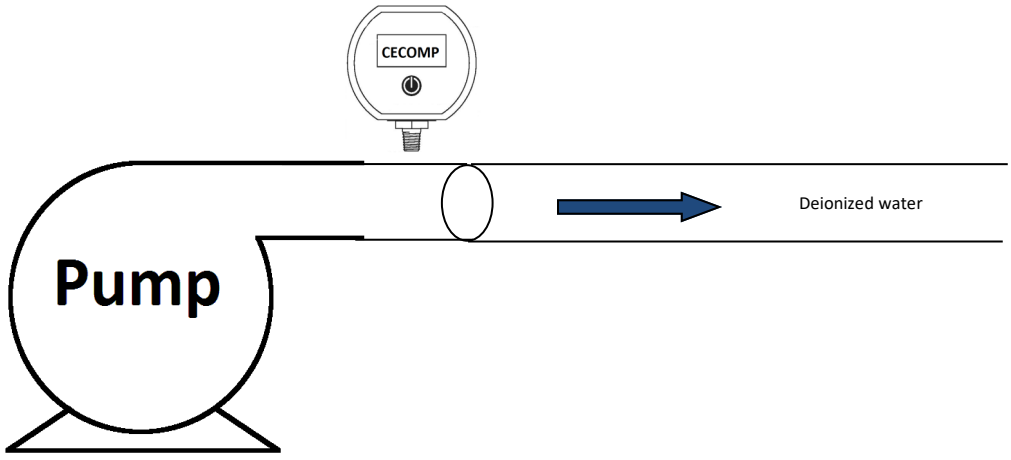
APPLICATION C162

Type of Company: Manufacturer
Location: Arizona

Deionized water is water that has had almost all of its mineral ions removed and can used to manufacture instruments and reagents that automate tissue processing and slide staining for cancer diagnostics. These instruments and solutions are used in clinical histology and drug development research laboratories worldwide to reduce errors, support diagnoses and inform treatment decisions for anatomic pathology professionals. The flow rate of the deionized water is critical to the manufacturing process.

The Engineering Issue

- The engineer required a digital gauge to accurately visually monitor the pressure of the water to ensure that the flow rate was within specification.



The engineer used a Cecomp DPG1000B gauge which gave the operator an accurate visual readout of the pressure.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor regulated air flow leak tests

APPLICATION C163

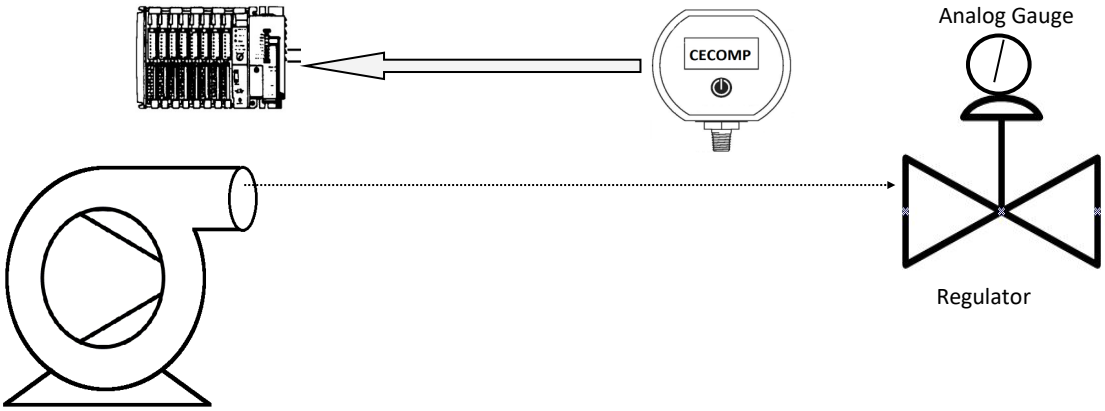
Type of Company: Manufacturer, CO2 Regulators
Location: Texas

CO2 regulators are used in soda dispensing machines. Before shipment and installation, the leak rate and accuracy of the regulators must be checked. The testing procedure requires that the regulator manifold be pressurized then checked for leakage. During this test, the accuracy of the attached analog gauge must be verified and recorded.

The Engineering Issue

The engineer had two major requirements:

1. Increase the accuracy of the test in order to save time.
2. Improve manufacturing procedures by using a PLC to record the results.



The engineer used a Cecomp DPG1000DR with the high accuracy option. This gave them an analog voltage output to send to their PLC and the high accuracy (0.1%) option to increase the accuracy of the test.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring current in DC motor

APPLICATION A164

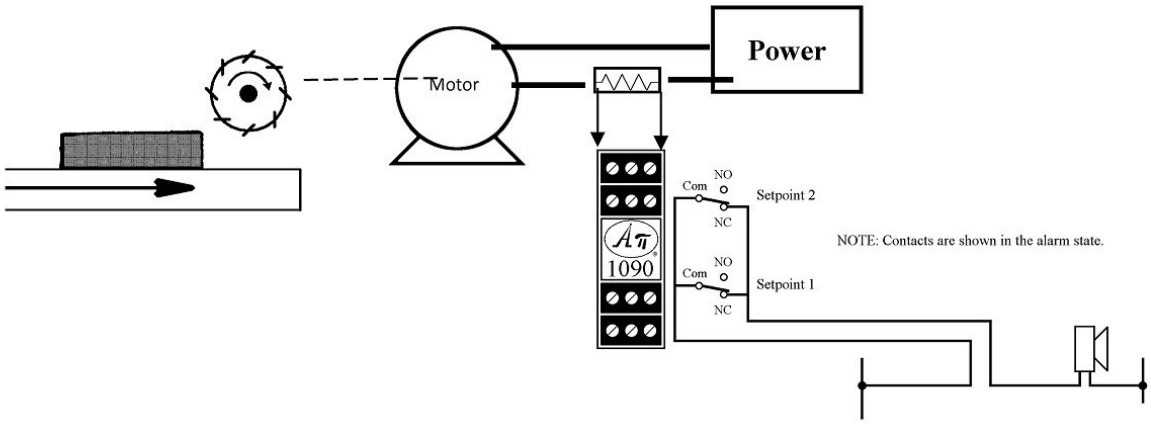
Type of Company: Chicken Processing Plant

Location: Tennessee

The customer is a leading global technology solutions provider to high-value segments of the food processing industries. The customer has developed a high speed horizontal slicer to decrease the time required to process chickens in their plant. The internal temperature of the chicken must be maintained at 40° F so the slicer is in a temperature controlled room that is maintained very close to “freezing” (32°F) which is required for the best “cutting” speed of the slicer.

The Engineering Issue

- The slicer runs at a very high speed and the engineer/operator needs to monitor the motor current to ensure it operates at optimum efficiency. If the current is outside the manufacturer-specified bandwidth, the slicer will not function at optimum speed.
- The engineer has installed a DC shunt in series with the DC power for the motor and needs to sound an operator “out of range” audible alarm if the motor current is outside of the limits.



The engineer used a factory calibrated APD 1090. The free factory calibration allowed the engineer to use a standard off-the-shelf module.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Hardware shutdown for furnace over temperature alarm

APPLICATION A165

Type of Company: Manufacturer/Supplier of Gasses

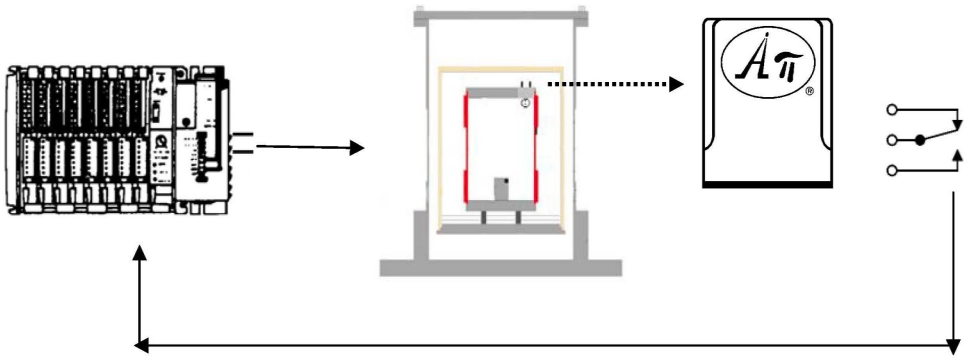
Location: New York

Powder coating is a type of coating that is applied as a free-flowing, dry powder. Powder coatings contain no solvents and release negligible amounts of Volatile Organic Compounds (VOCs) into the atmosphere. The coating is typically applied electrostatically and is then cured under even heat distribution in a furnace to allow it to flow and form a "skin." The customer has designed a new furnace that uses an application-specific custom PLC to maintain extremely accurate heat control. The PLC can shut furnace software down in case of an overtemperature event but has limitations.

Photo by S zillayali

The Engineering Issue

- The PLC uses software to shut the furnace down in case of an overtemperature event, but there must be a hardware shutdown for the control power to the furnace.
- This hardware shutdown is to prevent the furnace from going to an over-temperature condition in case of any software issues and needs to be “failsafe.”
- The hardware shutdown system must be easy to repair in the field.



The engineer used a API 1200 G. This specially-ranged unit was not only “failsafe” but also has a latching relay functionality that requires someone to manually reset the furnace and verify that the power is operating properly. It is easy to“hot-swap” out to repair in the field.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring inlet pressure for potable water

APPLICATION C166

Type of Company: Public Utility
Location: California

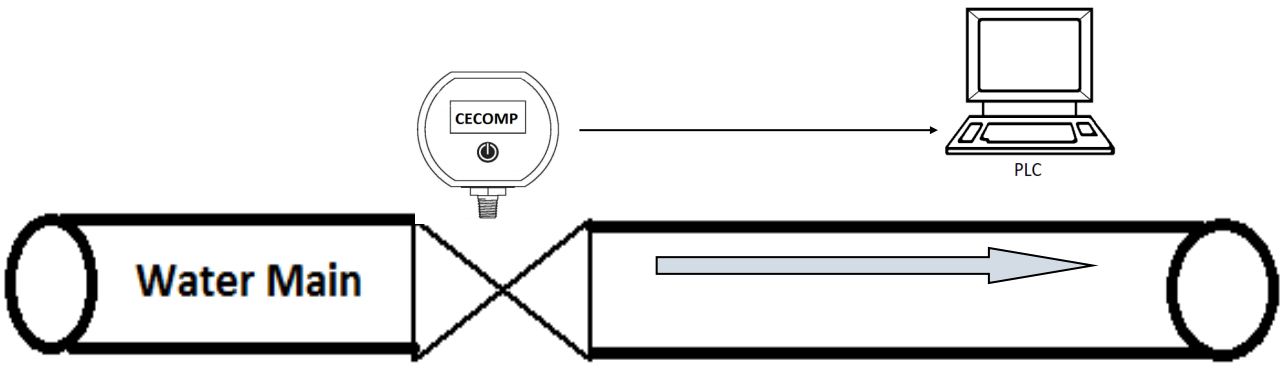
Potable water (drinking water) is water safe enough to be consumed by humans (or animals) or used with low risk of immediate or long term harm. Typical uses (for other than drinking purposes) include toilet flushing, food preparation, washing and landscape irrigation. Water is typically billed by volumetric (per usage) and metering of the water supply by the utility allows to it charge for water based on use, which is perceived by many as the fairest way to allocate the costs of water supply to users.


By Yuval Y - Wikimedia Commons

The Engineering Issue

The engineer has two requirements:

1. Visually monitor the inlet pressure for a military installation.
2. Log the pressure on a PLC for data logging, billing and alarm if low water pressure.



The engineer used a Cecomp F16LN NEMA4X digital pressure gauge. The F16LN has both a visual indication and a 4-20 mA signal to send to the PLC for both data logging and alarming.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Isolating and converting a flow meter output

APPLICATION A167

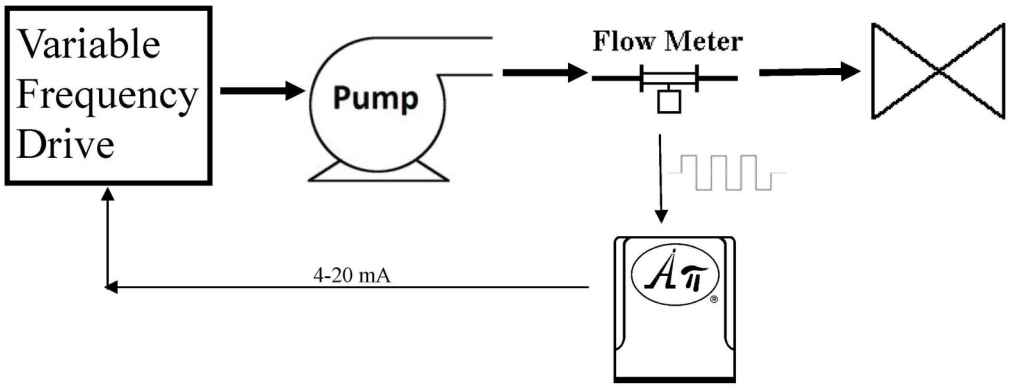
Type of Company: Cemetery
Location: California

Our customer is a consultant for a cemetery, currently using an older irrigation system. Older systems typically need a booster pump installed to increase, or "boost" the water pressure of the sprinkler system. The pump pulls water from the municipal system and then pushes it into the irrigation system at a higher volume and pressure than the main water line alone. Increased pressure improves the spray distance and performance of the sprinkler heads allowing for better coverage and reduction of annual system water usage.

The Engineering Issue

The system uses a Yaskawa variable frequency drive (VFD) to power the pump and a Data Industrial flow meter to monitor water usage.

- The engineer has a requirement to convert the flow meter's frequency output signal to a 4-20 mA input signal for the VFD.
- The device not only needs to convert the output from the flow meter but also isolate the signal to the VFD drive.



Since they need both conversion and isolation, they chose an API 7010 G. This module was factory-calibrated for their specific range requirement, making for ease of installation / setup. The unit is "hot swapable" for minimum downtime in the event of power spikes or storms.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor methane gas pressure in a production well

APPLICATION C168

Type of Company: Energy Services Company

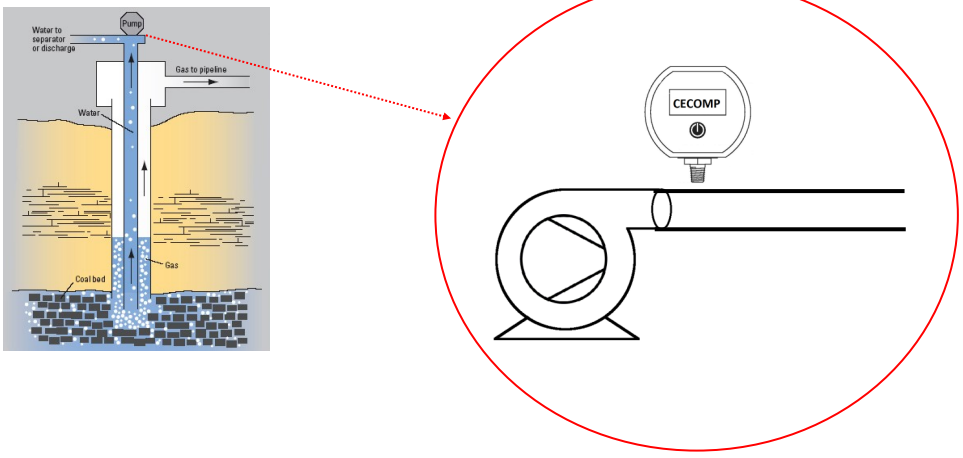
Location: Wyoming

Methane adsorbed into a solid coal matrix will be released if the coal seam is depressurized. Energy service companies can produce methane by drilling wells into a coal seam. The goal is to decrease the water pressure by pumping water from the well. The decrease in pressure allows methane to desorb from the coal and flow as a gas up the well to the surface. Methane is then compressed and piped to market.

The Engineering Issue

The engineer has two requirements:

- To monitor the pressure of the methane gas in the production well.
- To monitor the compressor operation.



The engineer used a Cecomp DPG1000B. This gave them a standard and reliable gauge that could be used either to monitor the methane gas pressure or to monitor the compressor operation.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Isolate and control the signal to a hydraulic control valve

APPLICATION A169

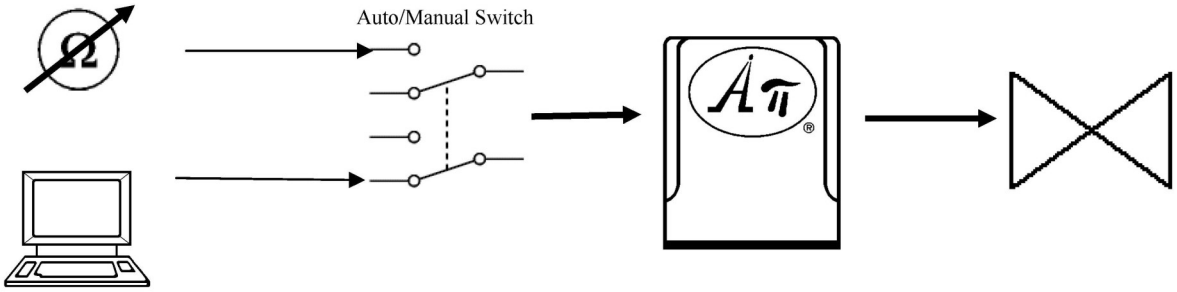
Type of Company: Oilfield Services

Location: Texas

This leading oilfield services company utilizes an older induced hydraulic fracturing system. Hydraulic fracturing is a process used in natural gas wells in the United States where water, sand and chemicals are pumped underground to break apart rock and release gas. Hydraulic fracturing enables access to shale reservoirs deep below the earth's surface where there would not otherwise be sufficient permeability or reservoir pressure to allow natural gas and oil to flow from the rock into the wellbore at economic rates.

The Engineering Issue

- The engineer has a requirement to upgrade the equipment by adding a PLC for automatic control and a potentiometer for manual control.
- Both the PLC and the potentiometer output a 0-10 VDC signal but the hydraulic control valve requires a 4-20 mA isolated input signal. The valve also requires input signal isolation.



The engineer used an API 4385 G. The API 4385 G accepts the 0-10 VDC control signal from either the PLC or the potentiometer and converts it to a 4-20 mA signal for the valve. The unit also provides full 3-way isolation so the end result is more accurate control of the valve.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Pressure test leak detection for explosion protection

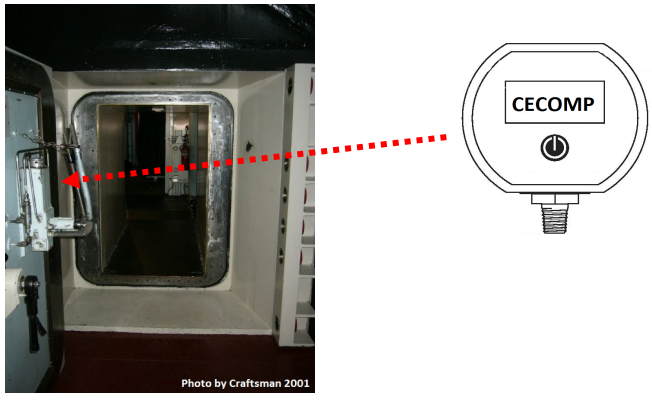
APPLICATION C170

Type of Company: Manufacturer
Location: Massachusetts

Explosion protection is used to protect all sorts of buildings and civil engineering infrastructures against internal and external explosions or deflagrations. The technology of explosion protection employed would typically be from least to most expensive: explosion doors and vents, then explosion suppression, then isolation – or combinations thereof. To optimize cost efficiency, doors typically have lower release pressure capabilities, are not susceptible to fatigue failures or subject to changing release pressures with temperature changes, are capable of leak-tight service, service temperatures of up to 2,000°F, and can be more cost-effective in small quantities.

The Engineering Issue

- The engineer has a requirement to perform a pressure leakage detection test on their system. The device used to visually monitor the test must be intrinsically safe.



The engineer used a Cecomp DPG2000BBL pressure gauge. This gauge is accurate, very rugged and an Intrinsically Safe FM-approved model.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Isolate and convert the signal from a positive displacement gas meter

APPLICATION A171

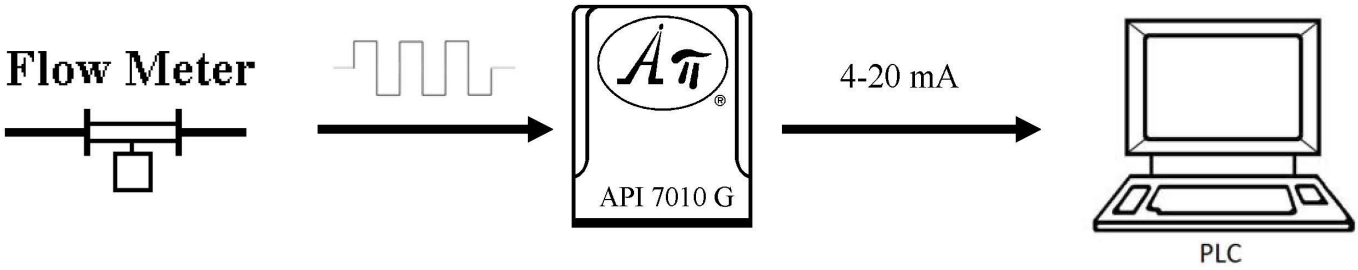
Type of Company: Natural Gas Supplier Distribution Company

Location: Ohio

Local distribution companies typically transport natural gas from pipeline delivery points to households and businesses through thousands of miles of distribution pipe. The delivery point where the natural gas is transferred from a transmission pipeline to the local gas utility is often termed the 'citygate', and is an important market center for the pricing of natural gas in large urban areas. Typically, utilities take ownership of the natural gas at the citygate, and deliver it to each individual customer's meter. Natural gas companies rely on the durability and flexibility of these meters and instruments for the custody transfer of natural gas in residential, commercial, and industrial applications around the globe.

The Engineering Issue

- The customer offers a rotary type positive displacement type meter designed to measure the volume of gases and gas mixtures with a very high degree of accuracy. This "Roots" meter has a pulse output for cubic feet of gas flow but their customer requires a unit which will provide an isolated 4-20 mA signal ranged for the "application specific" rate of gas flow as the input for their PLC.



The engineer used an API 7010 G. The API 7010 G is a factory-calibrated unit that accepts the pulsed output from the gas meter and converts it to a range specific 4-20 mA signal for the end user's PLC. The unit also provides full 3-way isolation so the end result is more accurate monitoring of the gas flow.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring Turbine engine testing

APPLICATION C172

Type of Company: Executive Aircraft Maintenance Repair Facility (MRO)

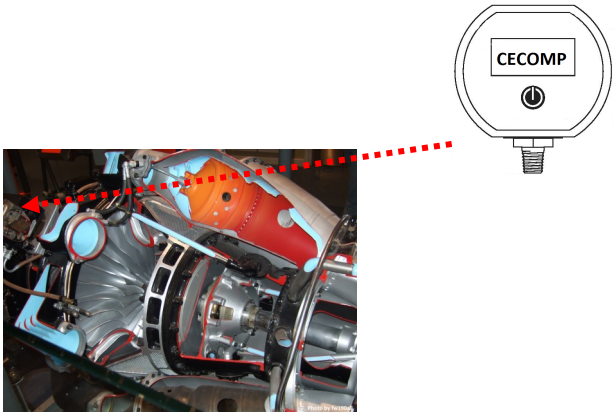
Location: Nebraska

Turbofan engines (TFE731) are commonly used on business jet aircraft. Engines require both Major Periodic Inspection (MPI) and Compressor Zone Inspection (CZI) checks after the TFE engine manufacturer's specified number of engine operation hours, as well as any time there is either high oil pressure or oil leakage. These checks require that pressure/vacuum readings on the transfer gearcase, fan gearcase and the accessory gearcase be recorded.

Photo by API

The Engineering Issue

- The engineer has a requirement for three digital pressure gauges that are accurate, rugged, easy-to-read and cost-effective, requiring a visual indication of pressure/vacuum readings.
- The engine must be operating at takeoff power during the inspection/test whether on the tarmac, in the hanger or at a certified MRO facility.



The engineer used a custom-modified Cecomp DPG1000B. This gauge is "very tough, durable, and accurate" and is able to withstand aircraft lubricants such as "skydrol," which will soften/deteriorate many plastic materials and paints.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Calibrate valves for operation

APPLICATION C173

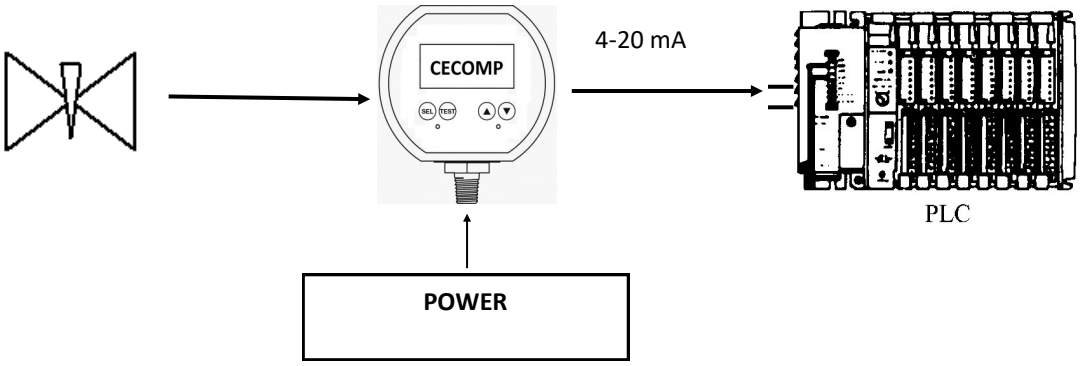
Type of Company: Manufacturer
Location: New Hampshire

A cooking system is lightweight, reliable and includes all the elements required for outdoor cooking in a single unit. Also called camp stoves, cooking systems can be used in diverse situations, such as for outdoor food service, catering and in field hospitals. In many backcountry areas, open fires are prohibited due to forest-fire danger or the scarcity of available firewood, so an easily transportable cooking system is the only option.

The Engineering Issue

The engineer has a requirement to:

1. Calibrate the valves and record the results for each cooking system.
2. Perform and record the results for a pressure test on the completed cooking system.



The engineer used a Cecomp DPG1000DR gauge with the panel mount option for installation in a test fixture. This gives the operator an accurate visual readout of the pressure and a 4-20 mA output signal to their PLC.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Over temperature alarm for motor bearings

APPLICATION A174

Type of Company: Public Utility

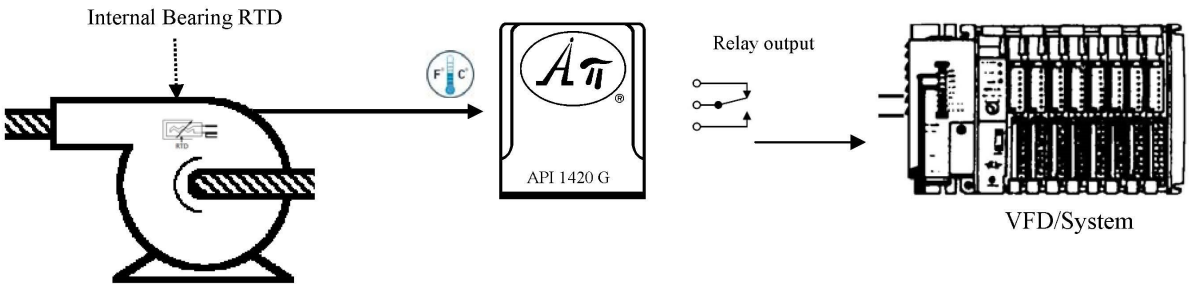
Location: Florida

The customer is supplying potable water to a municipality. Potable water (drinking water) is water safe enough to be consumed by humans or used with low risk of immediate or long-term harm.

The customer uses a variable frequency drive (VFD) to control the pumps in order to maintain the proper water pressure in the pipes. Any system setup must be easy to repair/replace in the field.

The Engineering Issue

- The company wants to monitor the bearing temperature using the internal RTD attached to the pump's motor bearings.
- If the bearing temperature exceeds the manufacturers safe limits, they want to alarm the VFD/system so pump speed can be decreased in case of an over temperature warning. If at that point temperatures continue to rise, the VFD/system must be shut down, as this indicates a lack of bearing lubrication or failure, and maintenance notified.



The engineer used an API 1420 G to monitor the internal RTD attached to the pump motor bearings. The API 1420 G has "failsafe" relay operation, is easy to replace in the field, and it has two independent setpoints – one for the initial over temperature warning (HI) and the second for the pump shutdown (HI/HI).

Problem. Solved.

Monitoring water level in a remote tank

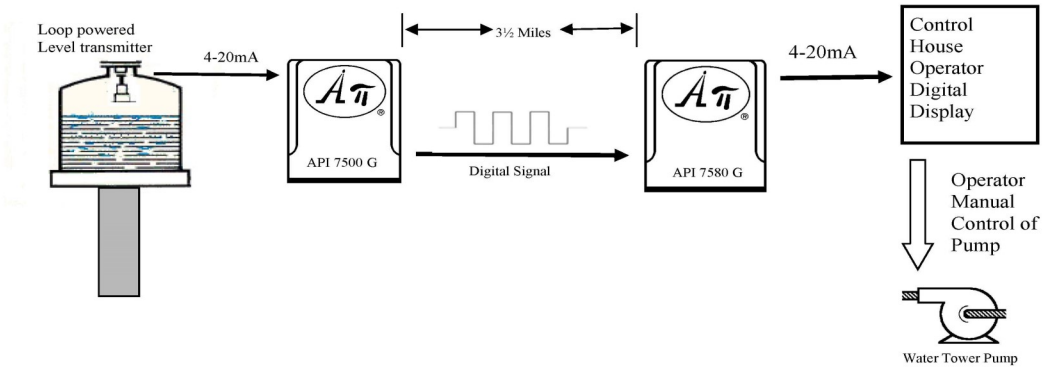
APPLICATION A175

Type of Company: Public Utility
Location: Alberta, Canada

Water towers are elevated structures supporting a water tank constructed at a height sufficient to provide potable water and emergency water storage. In rural communities, remote water towers run on much the same equipment as those in areas with large populations, but face different challenges. One small local utility company is using a standard cable-suspended loop-powered level transmitter to monitor level in a water tower tank.

The Engineering Issue

- The control house is over three miles away and the transmitter's signal must be monitored and the tower operated from this location.



The engineer used an API 7500 G to convert the 4-20 mA signal to a frequency and transmit it over "old" installed phone wires to the control house. An API 7580 G was used in the control house to convert the frequency signal back to a 4-20 mA signal. The signal is then displayed on a digital display to indicate the height of the water in the tower.

Problem. Solved.

Monitor autoclave vacuum to PLC

APPLICATION C176

Type of Company: Manufacturer, Composite Materials

Location: Texas

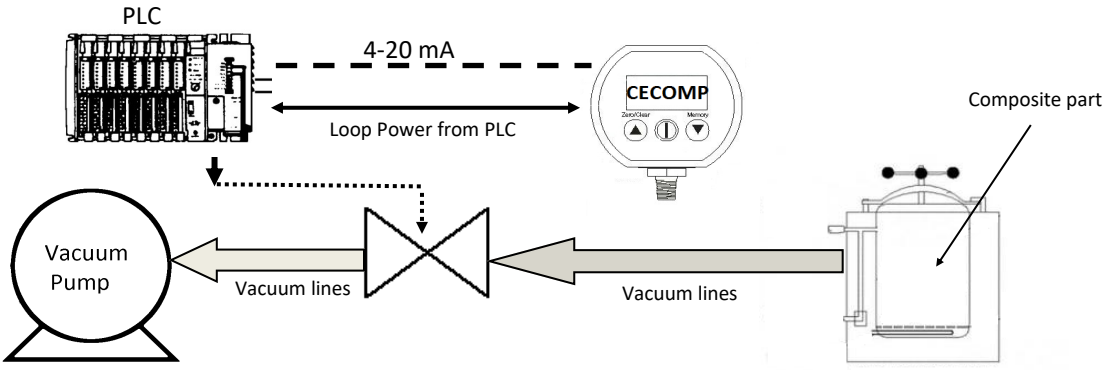
Polymer-matrix composite manufacturing is a multibillion-dollar industry in the U.S. that uses high temperature/pressure process equipment. These “advanced” materials combine the properties of high strength and high stiffness, low weight and corrosion resistance which make them ideal for aircraft and aerospace structural parts as well as sporting goods equipment. After initial molding, the composite material is moved to an autoclave for final forming and cure under heat, vacuum and pressure.

By Sterilgutassistentin - Wikimedia Commons

The Engineering Issue

The engineer has the following requirements:

- Monitor the vacuum and send a signal to the PLC for each of 16 vacuum lines to an autoclave.
- If any one of the vacuum lines springs a leak or something happens to that line, close it off so that the “bad” vacuum line will not have an adverse effect on the other lines.



The engineer used a Cecomp F16L gauge for each vacuum line. This gives the operator an accurate visual readout of the pressure and a 4-20 mA output signal to the PLC from each line.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Isolate and split the signal for furnace SCR control

APPLICATION A177

Type of Company: Manufacturer, Specialty UHT Materials

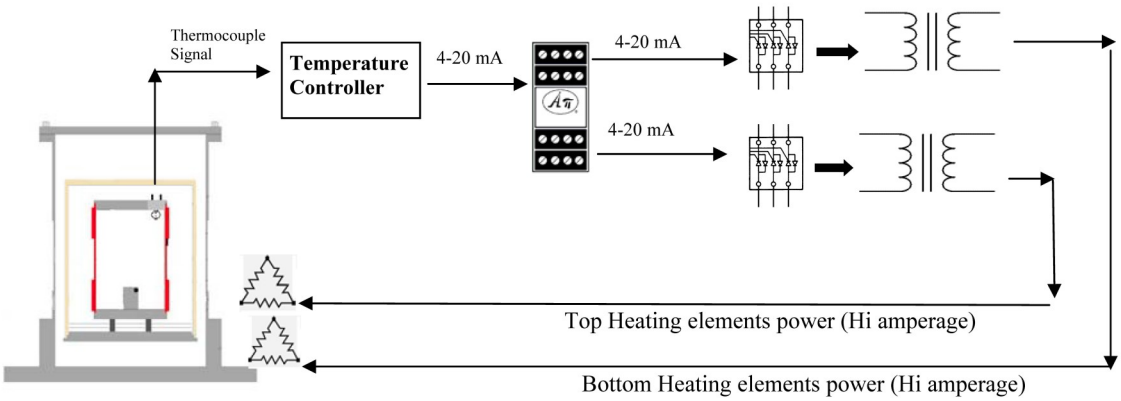
Location: New Hampshire

An ultra-high temperature (UHT) continuous furnace system is used in the manufacture of many high-density, ultrahigh temperature materials. These specialty metals and compounds are used in an array of defense and industrial manufacturing applications. Many UHT furnaces use SCR (silicon controlled rectifier) power control for the heating elements. The use of an SCR power control offers the most precise means of controlling electric heaters. Heater life is extended, production is increased and product quality is improved. The process requires use of two banks of SCRs, one for the top heating elements and one for the bottom heating elements.


Photo by Cjp24

The Engineering Issue

- The banks of SCRs fire high-amperage transformers for the furnace heating elements. The temperature controller does not have enough current drive capacity to drive both SCR banks.



The APD 4393 IsoSplitter® is a factory-calibrated unit that accepts the 4-20 mA signal from the temperature controller and gives them two 4-20 mA output signals. Each output signal has 1000 Ω drive capability which gives enough drive for controlling the 3-phase SCR power modules in the upper and lower zones independently. The unit also provides full 3 way isolation so the end result is more accurate control of the power applied to each temperature zone.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor OTR tire pressure in mines

APPLICATION C178

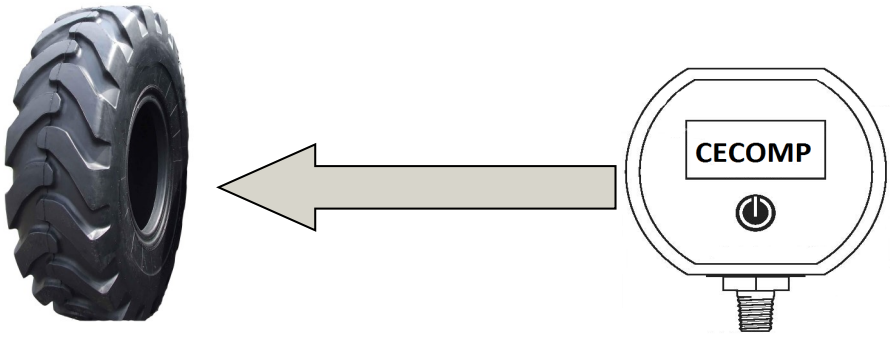
The increasing cost of OTR tires for heavy equipment has made “work load” (or *Ton Kilometer Per Hour)* an important parameter in tire selection and equipment maintenance for the mining industry. Loaders, earthmovers and mining vehicles are used on surfaces that are generally not well kept — with adverse rock, sand, gravel, and damp soil conditions, correct tire pressure is critical for proper operation and work load of the tires. Mining and pit operations are constantly changing and in most cases the distances between the pit, crusher and conveying systems are increasing. This means the tires are working longer and harder with less cooldown time, so proper tire maintenance is becoming even more critical.

Type of Company: Technical Maintenance & Sales

Location: Minnesota

The Engineering Issue

- The engineer has a requirement to check the OTR tire pressure at the start of every shift to ensure that there are no problems with the tires.
- This check requires a rugged, accurate, and intrinsically safe digital pressure gauge as there is the possibility of explosive gases in mine and pit areas.



The engineer used an Ultra-Ruggedized Cecomp DPG2000BBL digital pressure gauge. This gives the operator an FM approved (intrinsically safe) gauge with an accurate visual readout of the tire pressure.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring wind speed

APPLICATION A179

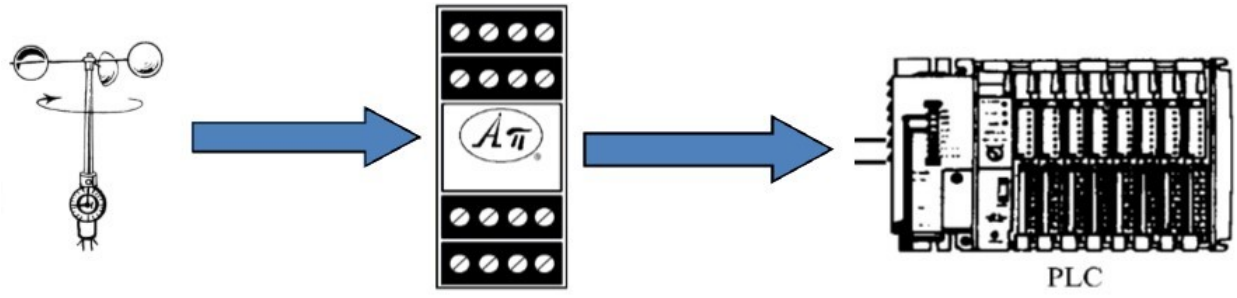
Type of Company: Manufacturer, Anemometers
Location: Massachusetts

This company manufactures self-powered anemometers for use on cranes, wind turbines, and other outdoor staging equipment. Wind speed must be monitored on these large structures due to equipment and personnel safety risks associated with strong winds. The effects of wind on these structures has the potential to affect the stability and/or structural integrity of the crane/turbine which may lead to material falling or people being knocked over, perhaps from a height.


Photo by Elvert Barnes

The Engineering Issue

- The company's customer needs to monitor the DC voltage signal from the self-powered anemometer.
- This application requires that the anemometer signal be powered, isolated and converted, and sent to the PLC so that crane/turbine control is restricted during sustained strong winds.



The company's engineer used an APD 4380 to power the anemometer and convert the output to a 4-20 mA signal for the PLC. The APD 4380 converts and isolates the signal. Additionally, the output can be "sinking" or "sourcing" to properly interface with their customer's PLC.

Problem. Solved.

Pressure check on turbine engine exhaust gas

APPLICATION C180

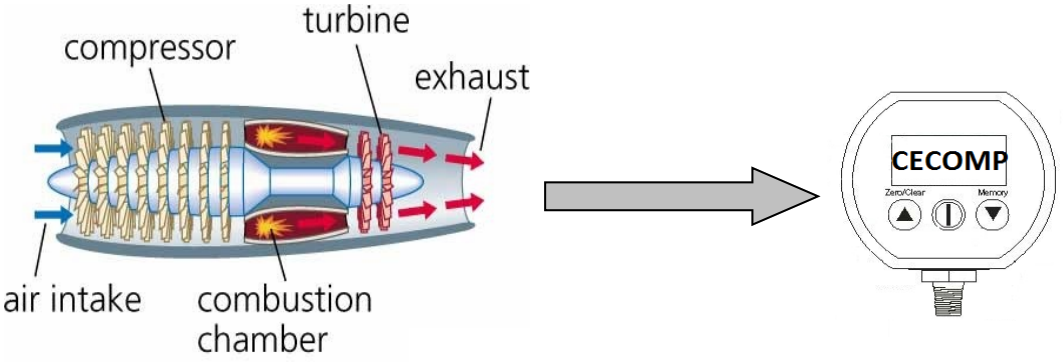
Turbine engine repair and overhaul organizations perform aircraft maintenance checks on commercial/civil aircraft after a certain amount of time or usage. In a turbine engine, pressure ratio is the chamber pressure divided by the exit pressure. The pressure ratio, being a measure of how much the gas expands, determines how much thermal energy is converted to mechanical energy. At higher compression ratios, efficiency increases, creating more mechanical power output and lowering the exhaust temperature.

Type of Company: Service - Engine Overhaul & Repair

Location: New Jersey

The Engineering Issue

- The engineer requires an accurate pressure check for the exhaust gas on their turbine engines which will be used to determine the pressure ratio.
- Gauge must maintain calibration and withstand the use and abuse in the hanger



The engineer used a Cecomp F20B gauge. This rugged gauge gives the technician an accurate visual readout of the exhaust pressure to use in his overall pressure computations.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Test and calibrate diesel engine governors on locomotives

APPLICATION C181

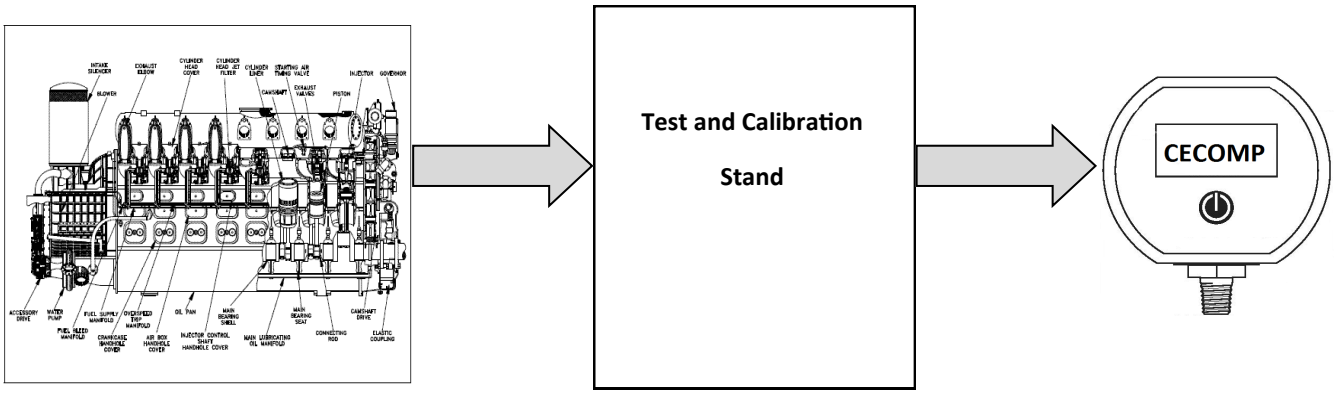
Type of Company: Technical Maintenance & Sales

Location: Illinois

The important components of diesel-electric propulsion are the diesel engine, the main generator/alternator-rectifier, traction motors, and a control system. The control system consists of the engine governor and electrical and/or electronic components, including switchgear, rectifiers and other components, which control or modify the electrical supply to the traction motors. The governor ensures that the engine speed stays high enough to idle at the proper RPM but that it will not rise too high when full power is demanded. During overhaul, the governor must be refurbished/remanufactured and then tested and calibrated using a test and calibration stand.

The Engineering Issue

- The engineer requires an accurate visual indication of the pressures on the test stand when calibrating the governor.



The engineer used a Ultra-Ruggedized Cecomp F16B gauge. This gives the technician an accurate visual readout of the test stand pressure.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Test and check calibration of in-place analog gauges

APPLICATION C182

Type of Company: Natural Gas Pipeline Service

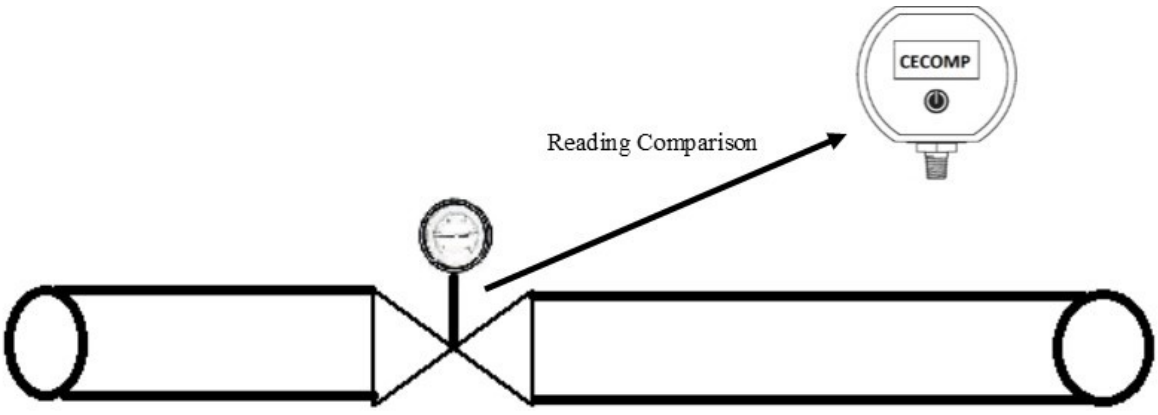
Location: Wisconsin

Pipeline repair and maintenance activities typically require depressurizing the pipeline to remove gas from the affected section of pipe to ensure safe working conditions. Part of the technician's routine maintenance is to use a "working standard" gauge to perform a field reading comparison test on the installed analog pressure gauge to ensure that the gauge is operating properly and reading correctly.

Photo by Glen Dillon

The Engineering Issue

- The engineer needs an accurate, rugged, and reliable digital pressure gauge to use as the "working standard" for their field technicians.



The engineer used a Cecomp Ultra-Ruggedized F16B digital pressure gauge. This gives the technician an accurate visual readout to check the reading and operation of the in-place analog gauge.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring hydro-electric generator speed

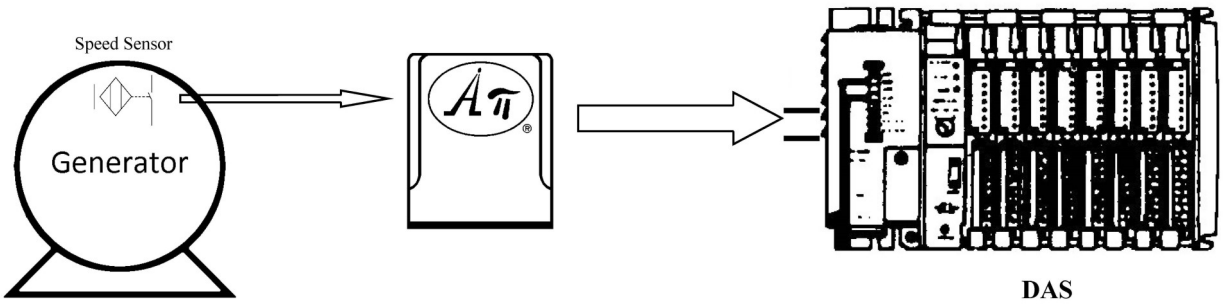
APPLICATION A183

Hydroelectric generators are used to produce AC power. The frequency of the AC power supplied to the system varies as load and generation change. The primary reason for accurate frequency control is to allow the flow of alternating current power from multiple generators through the network to be controlled. Temporary frequency changes are an unavoidable consequence of changing demand. Exceptional or rapidly changing mains frequency is often a sign that an electric distribution network is operating near its capacity limits, dramatic examples of which can sometimes be observed shortly before major outages.

Type of Company: Public Utility
Location: Georgia

The Engineering Issue

- The engineer is required to monitor and record the speed of the generators to verify the frequency supplied to the system.



The engineer used an API 7010 G to convert the frequency output from a speed sensor to a 0-10 VDC signal for the DAS. The API 7010 G converts and isolates the frequency signal to the data acquisition systems (DAS).

Problem. Solved.

Monitoring pressure transducer

APPLICATION A184

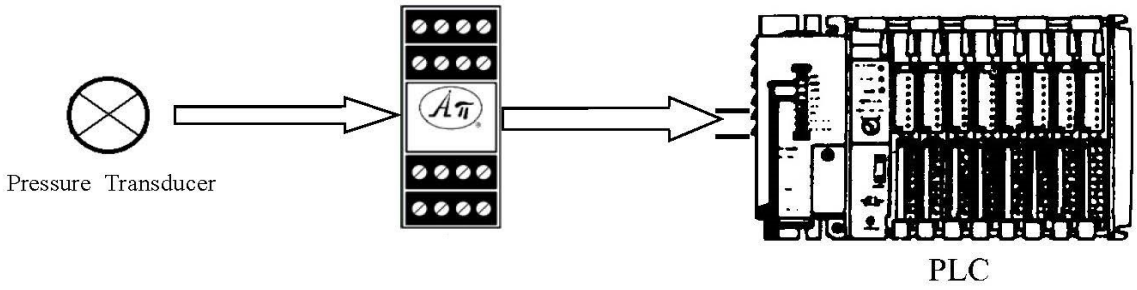
Type of Company: Consulting Engineer, Plastics Extrusion

Location: North Carolina

This company is an engineering firm that provides, among other services, engineering and technical consultation for the extrusion industry. Their current customer manufactures polymer monofilament guitar stings and stranded nylon strings, which are used for musical instruments. These processed strings are round and even throughout their length which avoids the disadvantage of tuning sensitivity from humidity changes and gives them greater strength.

The Engineering Issue

- The current system has an installed Dynisco pressure transducer, and their engineer requires an interface device for an upgrade to a Siemens PLC.
- This interface device must be able to supply the required excitation, be field rangeable, be easy to calibrate and be able to be changed from sink to source if required.



The engineer used an APD 4059. The APD 4059 supplies the excitation voltage for the pressure transducer and allows the engineer to not only change the range but also gives him offset capabilities. The APD 4059 can be changed from a sinking output to a sourcing output by changing the output wire hookup positions, and provides optical isolation.

Problem. Solved.

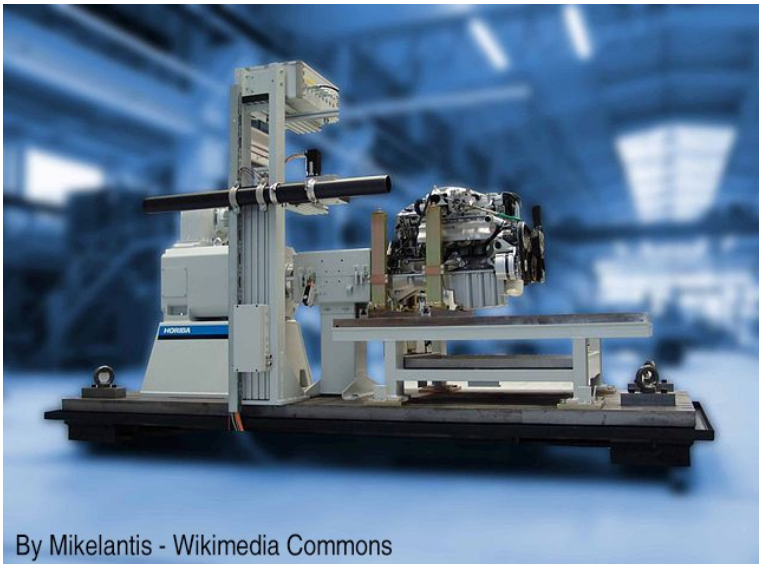
Test engine compression for wear

APPLICATION C185

Type of Company: Automotive Manufacturer

Location: Michigan

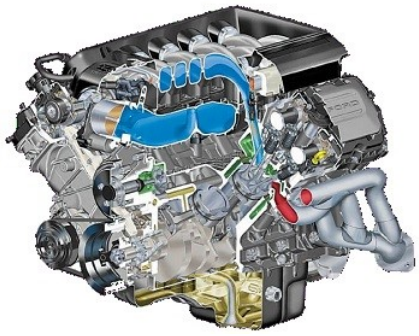
An engine test is used to diagnose any long-term problems in the engine and improve engine performance. An engine is installed on a test stand and a durability test can be run for several weeks at a time. During this test, the engine needs to be periodically shut off and have various compression and cylinder tests performed to accurately monitor the engine condition.

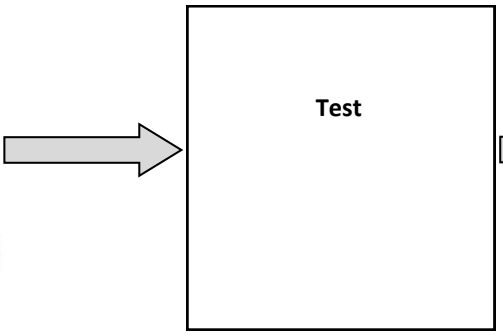


By Mikelantis - Wikimedia Commons

The Engineering Issue

- The engineer requires an accurate visual indication of the compression for each cylinder: the technician must verify that the cranking compression value for each cylinder match one another to the best of the technician's ability.
- The gauge needs to be portable, rugged, accurate and have an easy-to-read visual indication of the pressure.





The engineer used a Cecomp Ultra-Ruggedized F16B gauge. This gives the technician an accurate visual readout of the cylinder compression.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Over temperature alarm for motor operation

APPLICATION A186

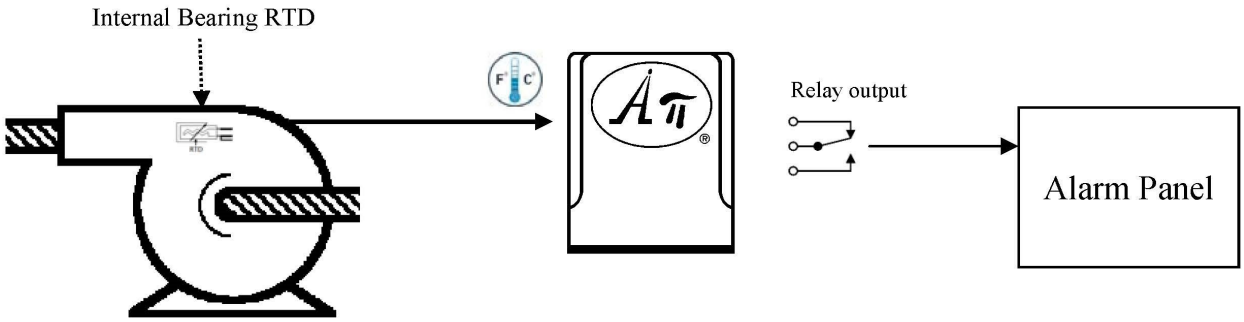
Type of Company: Public Utility

Location: Ohio

Sewage comes from residences, institutions, hospitals, and commercial and industrial establishments. At one point in the sewage treatment process, wastewater is treated by aerobic bacteria. Wastewater flows to air-through-water aeration tanks. The tank aeration system is a fine bubble diffusion system consisting of an air mixing manifold system in the bottom of the tank. Blower nozzles force heated air into the water, creating a turbulent mixing action and the perfect environment for bacterial action. As you can imagine, continuous operation is critical for sewage treatment plants!

The Engineering Issue

- Should a blower motor shut down, it is vital the operators/technicians be notified to resolve the problem and get the system back up and running as quickly as possible
- Since the blower motors are critical to the process, there must be two inputs to the alarm panel – one to notify them about overheating and the other to tell them that the motor has shut down.



The engineer used an API 1420 G to monitor the internal RTD attached to the blower motor bearings. The API 1420 G has “failsafe” relay operation, is easy to replace in the field, and it has two independent setpoints – one for the initial over temperature warning (HI) and the second for the motor shut down alarm (HI/HI).

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor vacuum pressure for printing press pickups

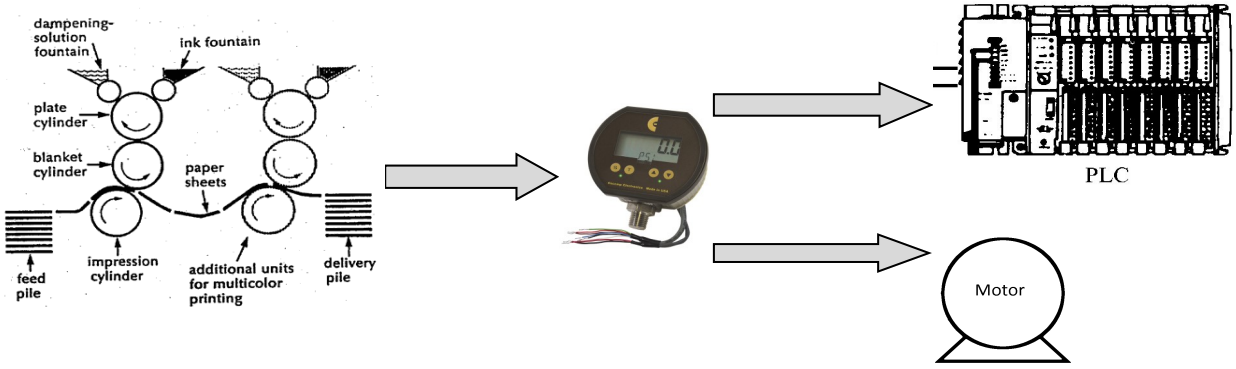
APPLICATION C187

Type of Company: Printing
Location: Texas

The production of currency is not an easy or simple task, but rather one that involves highly trained and skilled craftspeople, specialized equipment, and a combination of traditional old world printing techniques and sophisticated, cutting-edge technology. Offset printing, required to add subtle background colors to the paper, is the first printing operation that occurs on the "blank" paper sheets. A vacuum pickup feeds a blank sheet to the offset press, after which the paper passes between the face and back blankets. In this fashion, the press simultaneously prints a complete image on the paper.

The Engineering Issue

- The engineer needs to accurately monitor the vacuum pickups but the digital gauge she currently use does not withstand the presses vibrations.
- The engineer requires a rugged gauge with an alarm to shutdown the motors on the press if the vacuum pickup is not operating properly.



The engineer used a Cecomp Ultra-Ruggedized F16DAR gauge. This gives the engineer an accurate visual readout, an analog signal to send to the operational PLC and an alarm signal to shutdown the motors on the press if the vacuum pickup system is not operating properly.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor hydrogen sulfide (H_2S) gas for oil wells

APPLICATION A188

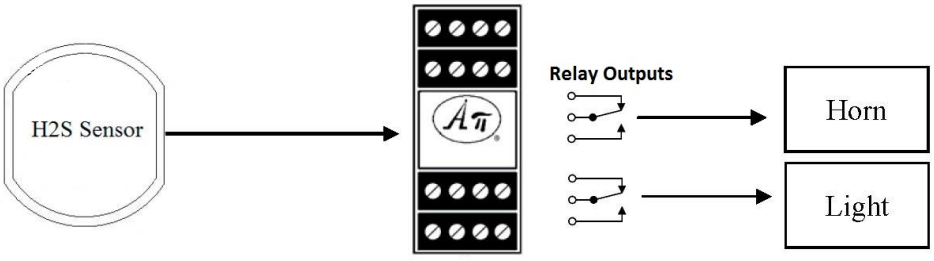
Type of Company: Oil Producer

Location: Texas

Our customer is one of the largest independent crude oil and natural gas companies in the United States. Hydrogen Sulfide gas can be one of the most vicious and deadly hazards in the oil and gas industry. It goes by names such as H_2S or sour gas and is a highly toxic, colorless, combustible gas. It is heavier than air and has the unmistakable odor of rotten eggs. Leaks in drilling applications can see large quantities of H_2S released, which becomes extremely hazardous to well-site personnel. Areas that are susceptible to H_2S leaks include the drillers stand, blow-out preventer, shale shaker, and mud tank.

The Engineering Issue

- The engineer has a requirement for two relay outputs, one to sound a horn and the other to illuminate a warning light, when the H_2S levels exceed the recommended "Short Term Exposure Levels."
- The engineer is using a Redline unit that senses hydrogen sulfide gas and gives a 4-20 mA output.



The engineer used an APD 1080 as the alarm unit for the 4-20 mA signal. The APD 1080 has "failsafe" relay operation, is easy to replace in the field, and it has one set-point to operate both relay contacts – one for horn warning signal and the second to illuminate the warning light.

Problem. Solved.

Monitor deep vacuum for food packaging machine

APPLICATION C189

Type of Company: Food Processor

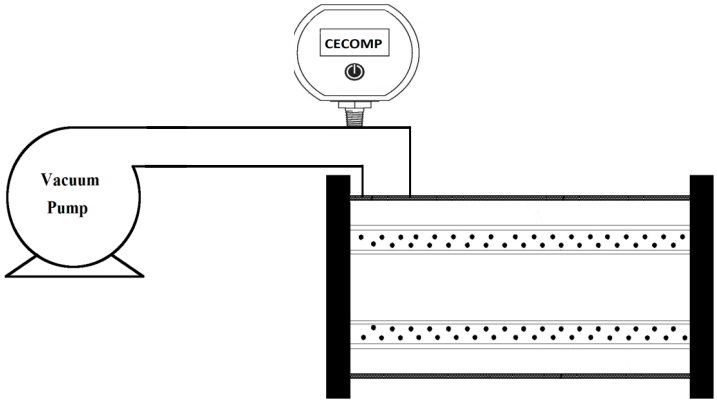
Location: Missouri

Vacuum packing or vacuum packaging is a method of packaging that removes air from the package prior to sealing. This reduces atmospheric oxygen, limiting the growth of aerobic bacteria or fungi, and prevents the evaporation of volatile components. It is commonly used to store dry foods (cereals, nuts, cured meats, etc.) over a long period and fresh foods, such as vegetables, meats, and liquids, on a short-term basis. This method increases food storage safety by a significant margin.

Photo by Erikoinentunnus

The Engineering Issue

- The engineer is using a high speed “sealed air” machine with multiple chambers to vacuum seal poultry products and requires the operator to verify that the machine is drawing a deep vacuum 3 times per shift.
- The engineer requires an easy to read vacuum gauge that is accurate, rugged and reliable.



The engineer used a Cecomp ARM760B. This gauge gives the operator a visual indication of the applied vacuum. Also, the ruggedness of the gauge ensures that calibration is maintained.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring a steam condensate line

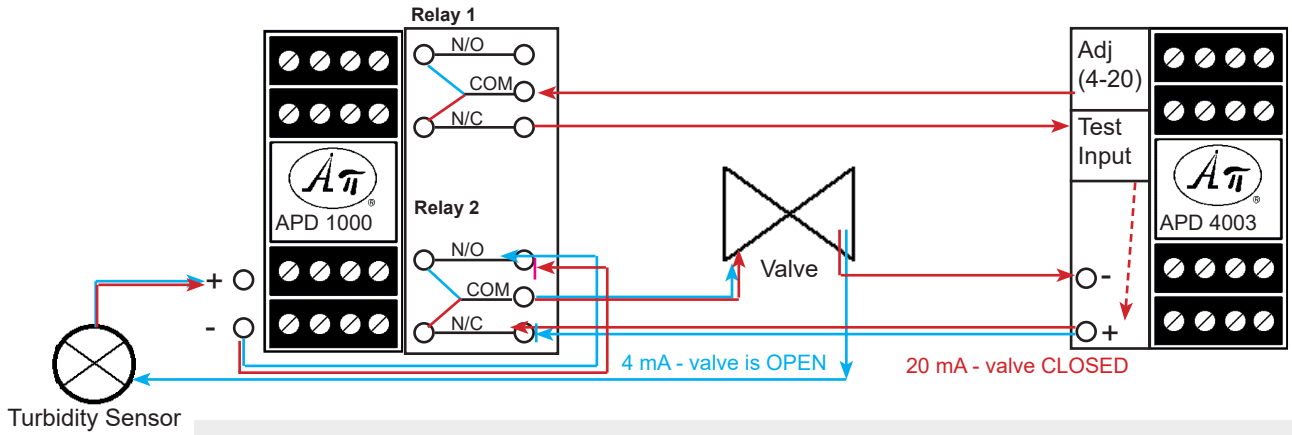
APPLICATION A190

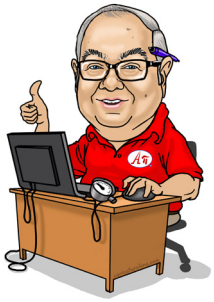
The customer is a public utility that uses coal to produce electricity. In a fossil fuel power plant, chemical energy stored in fossil fuels are converted successively into thermal energy, mechanical energy and, finally, electrical energy. Coal travels to a boiler, which heats water to create steam that flows into a turbine. The turbine turns a shaft. On the end of the shaft is a magnet that revolves inside a coil to create electricity. At full load, the boilers can burn 380 tons of coal/hr.

Type of Company: Public Utility
Location: Illinois

The Engineering Issue

- The engineer has a requirement to monitor the steam condensate line to the boiler. He has installed a turbidity sensor, and needs close a valve when that sensor indicates oil or other contaminants in the line.
- The sensor outputs a 4-20 mA signal.





The engineer used an APD 1000 and an APD 4003. The APD 1000 has two failsafe relay outputs and it monitors the 4-20 mA output from the turbidity sensor. When the process is “safe,” both relay outputs are energized (blue path) and the process runs normally. When the output from the turbidity sensor exceeds the set-point on relay 2, both relays de-energize (red path). This causes the APD 4003 to output a 20 mA signal to the loop, forcing the valve to close fully.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor pressure on tires during dynamometer testing

APPLICATION C191

Type of Company: Automobile Manufacturer

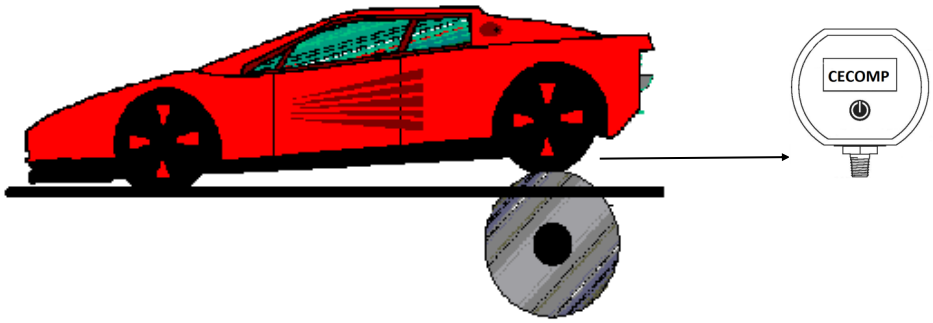
Location: Michigan

A chassis dynamometer, sometimes referred to as a rolling road, measures power delivered to the surface of the "drive roller" by the drive wheels. Chassis dynamometers can be fixed or portable, and can do much more than display RPM, horsepower, and torque. Chassis dynamometer test cells often integrate emissions sampling and measurement, engine speed and load control, data acquisition, and safety monitoring into a complete test cell system.

Chrysler 200 By Greg Gjerdinge. Wikimedia Commons

The Engineering Issue

- The engineer is using the chassis dynamometer to perform thermal profiling and reliability temperature testing on the tires while testing other performance aspects of the vehicle.
- The test cell is subjected to extreme temperatures and the engineer needs a rugged and accurate tire pressure gauge to monitor the tire pressure whenever the tests calls for stoppages/pauses in the procedure.



The engineer used a Cecomp DPG1000B. The DPG1000B gives an accurate visual indication of the tire pressure, plus the ruggedness of the gauge ensures that calibration is maintained.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor vacuum on a CNC machine

APPLICATION C192

Type of Company: Manufacturer, Milled Parts

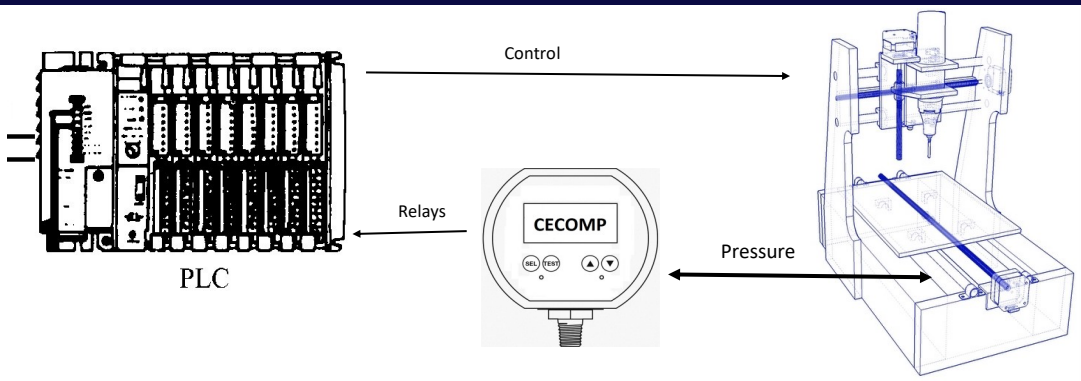
Location: Minnesota

Milling machines were first invented to mass-produce interchangeable parts. Although the first machines were crude, they assisted man in maintaining accuracy and uniformity while duplicating parts that could not be manufactured with the use of a manual file. This eventually resulted in the development of computerized machines to alleviate errors and provide better quality in the finished product. A ***computer numeric controlled*** (or CNC) device refers to any machine tool (i.e. mill, lathe, drill press, etc.) that uses a computer to electronically control the motion of one or more axes on a machine.

Photo by S zillayali

The Engineering Issue

- The engineer uses a vacuum system to hold the material onto the machine work table, so the vacuum system must be operating properly before the machine begins operation.
- The engineer requires a visual indication for the operator and a signal to the computer to ensure that the vacuum is at the proper level.



The engineer used a Cecomp F16ADA digital pressure gauge with alarms. The gauge is configured so that, if both LEDs on the front face are green, the vacuum is at the proper level. The operator can use the LCD display to verify the vacuum levels. The relay sends a signal to the PLC so that the machine cannot operate if the vacuum level is not at the proper level.

Problem. Solved.

Monitoring pressure transducer

APPLICATION A193

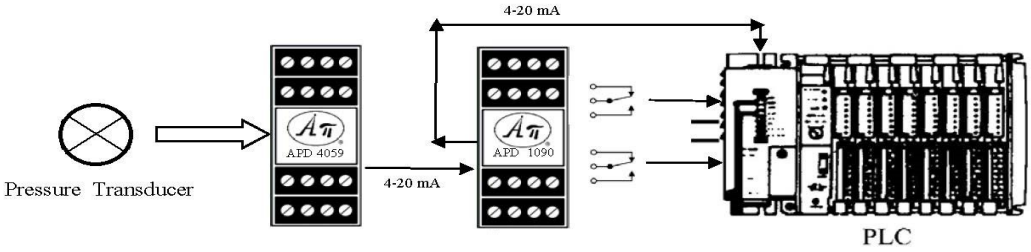
Type of Company: Consulting Engineer

Location: Illinois

In Extrusion Blow Molding (EBM), plastic is melted and extruded into a hollow tube (a parison). This parison is then captured by closing it into a cooled metal mold. Air is then blown into the parison, inflating it into the shape of the hollow bottle, container, or part. After the plastic has cooled sufficiently, the mold is opened and the part is ejected. The company is a consulting engineering firm that provides engineering and technical services to, among others, the extrusion industry. Their current customer manufactures plastic bottles and packages for the food industry, and they are updating their extrusion blow molding system.

The Engineering Issue

- The engineer must increase system thru put and reduce waste. The system has an installed Dynisco pressure transducer and he needs to replace an obsolete amplifier signal control board to interface with it for their upgrade to an ABB PLC.
- The pressure transducer must be powered. Additionally, they need to be able to range the unit in the field, have two relays, and have an analog output that can be changed from sink to source if required.



The engineer used an APD 4059 and an APD 1090. The APD 4059 supplies the excitation voltage for the pressure transducer and allows the engineer to not only change the range but gives him offset capabilities. The APD 4059 can be changed from a sinking output to a sourcing output by changing the output wire hookup positions plus the unit gives them optical isolation. The APD 1090 supplies the two relay outputs required for the upgraded PLC operation.

Problem. Solved.

Over temperature alarm for motor bearings

APPLICATION A194

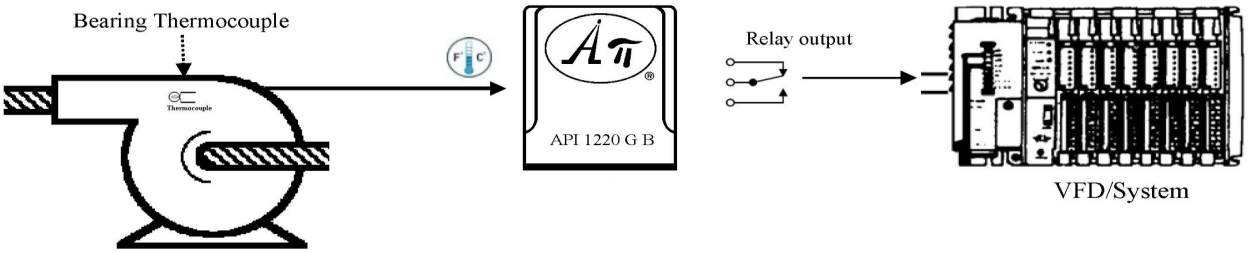
Type of Company: Public Utility

Location: Arizona

This public utility supplies potable water to a municipality. The water supplied to households, commerce and industry meets drinking water standards, even though only a very small proportion is actually consumed or used in food preparation. The utility uses a variable frequency drive (VFD) to control pumps in order to maintain proper pressure in consumers' water pipes.

The Engineering Issue

- The engineer wants to monitor the bearing temperature using internal thermocouples attached to the pump motor bearings and alarm the VFD/system in the event of an over-temperature warning.
- They need to be notified of two distinct types of alarm conditions: an over-temp alarm and a failed sensor alarm (open thermocouple). It must also be "failsafe," meaning an alarm condition is shown upon loss of power.



The engineer used API 1220 G units with downscale burnout protection to monitor the internal pump motor bearing thermocouples. The API 1220 G B has "failsafe" relay operation, is easy to replace in the field, and has two independent set-points – one for the over temperature warning (HI) and the second for the open thermocouple (LO).

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor fluid pressure on dispensing system

APPLICATION C195

Type of Company: Manufacturer, Machinery

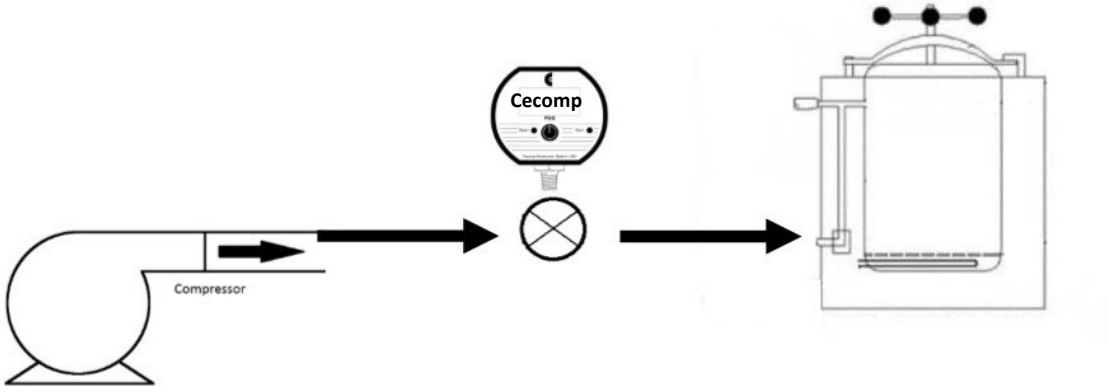
Location: Rhode Island

The customer designs and manufactures dispensing equipment and systems for industrial adhesives, lubricants, sealants and coatings, as well as equipment used in the testing and inspection of electronic components for curing and surface treatment processes. In a tank reservoir assembly, controlled fluid tank pressure is essential to ensure consistent, repeatable and accurate deposits from the dispense valve as well as to prevent fluid contamination, evaporation, and contain fumes. The customer needs to offer exceptional full-to-empty fluid pressure control, regardless of input

Photo by Udhayinfo1

The Engineering Issue

Their reservoir system uses a precision regulator which maintains a accurate and constant output pressure regardless of input pressure fluctuations. A rugged and accurate digital gauge was required that would allow each production shift to set the pressure accurately within tenths of psi with no analog readout error.



The engineer used a Cecomp DPG1000B to ensure constant, accurate monitoring of input pressures and fluctuations with this ultra-rugged digital pressure gauge.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor flow through water filtering systems

APPLICATION C196

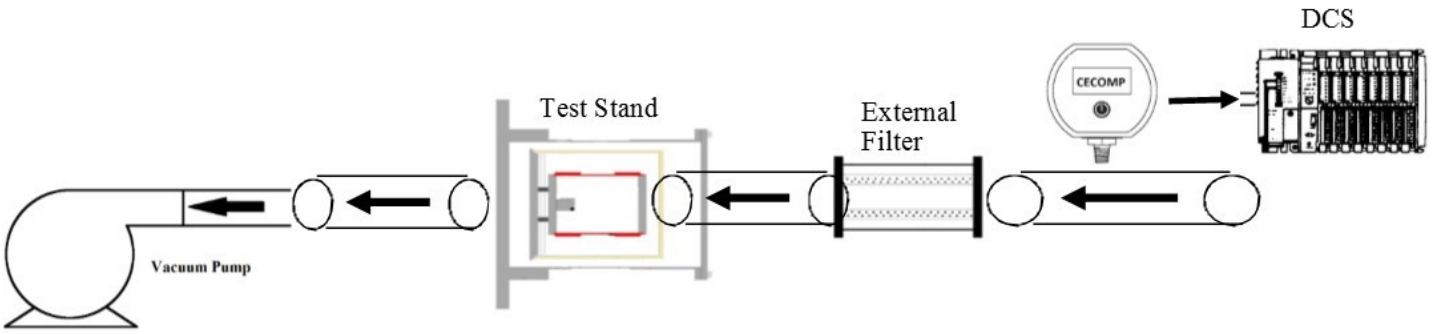
Type of Company: Manufacturer, Filtration Systems

Location: Wisconsin

The most common treatment process for bottled water is to use a filtration system so that the water will contain fewer total dissolved solids than tap water; i.e. it will be more "pure." The water is "sucked" through the filter, which traps any microorganisms/contaminants that may be present in the water. Before the filtering systems can be shipped to end users, an operational test of the system must be performed. A test stand with the installed filter system receiving "pure" water from an external filter is used for the operational test and the results are logged by a DCS system.

The Engineering Issue

- The engineer is required to monitor and record the flow (pressure) through the external filtration system for the test stand during the operational test.
- A rugged and accurate digital gauge with an output that can be sent to the DCS is required for the operational test.



The engineer used a Cecomp DPG1000L, which provides an accurate visual indication as well as a 4-20 mA signal for the analog input card on the DCS. The ruggedness of the gauge ensures that calibration is maintained even in the harsh test conditions.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor load pins on winch system

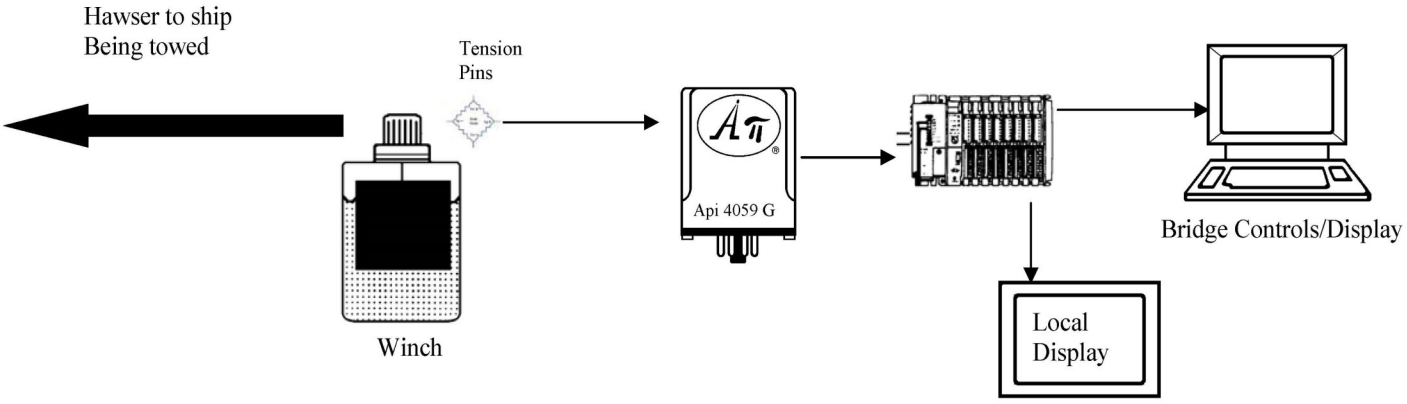
APPLICATION A197

Type of Company: Manufacturer
Location: Mississippi

In the offshore tugboat world, winches are always located on a tug's stern and they are wound with thousands of feet of heavy wire rope. A typical towing winch for 2 1/4-inch wire has a footprint of maybe 15 feet square with a weight near 50,000 pounds and can have a line pull of up to 200,000 pounds. When the tugboat is actually towing, the tug's Hawser Line—a large, heavy rope used for towing—should be kept at a constant tension. Knowledge of Hawser tension is critical for tug safe operations. Typically, Hawser tension is measured by relying on brake tension pins (load cells) installed on the winch.

The Engineering Issue

- The engineer has a requirement to interface the output from the winch tension pins to a PLC for both local indication and for transmission to the bridge controls/displays.



The engineer used a API 4059 G. The API 4059 G supplies the excitation voltage for the tension pins then converts and isolates this strain gauge signal for the PLC. Since it is a "plug-in" module, it gives has the "hot swap-ability" that is required for at-sea towing operations.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor gas flow for testing of production capability

APPLICATION C198

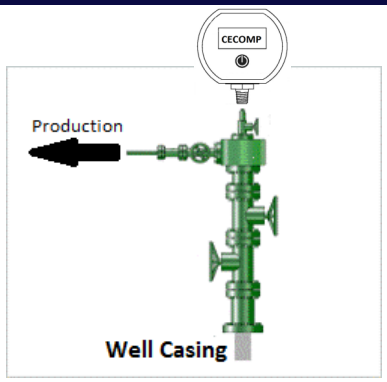
When a natural gas well is in the production stage and the rigs used to drill and complete the well have moved off the wellbore, the top is outfitted with a collection of valves called a production tee (typically referred to as a christmas tree). A "packer leakage test" must be commenced on each completed well within seven days after actual completion and annually thereafter. These tests must also be done whenever remedial/repair work has been done on a well during which the tubing has been disturbed. All pressures through the entire test must be continuously measured and recorded with pressure gauges.

Type of Company: Natural Gas Services Company

Location: Oklahoma

The Engineering Issue

- The accuracy of the gauges must be checked at the beginning of the test and at the end of the test with a deadweight pressure gauge to verify accuracy.
- The engineer requires a high-accuracy, portable digital gauge that can be used as an "electronic deadweight" for accuracy verification and as a backup (ready spare) gauge for the test procedure. Ruggedness is an absolute must for this application.



The engineer used a Cecomp DPG2000B-D4 with the high accuracy (0.1%) option, which provides the engineer an accurate visual indication. The ruggedness of the gauge ensured that calibration was maintained even in harsh conditions.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Shaft speed simulator for diesel engine training

APPLICATION A199

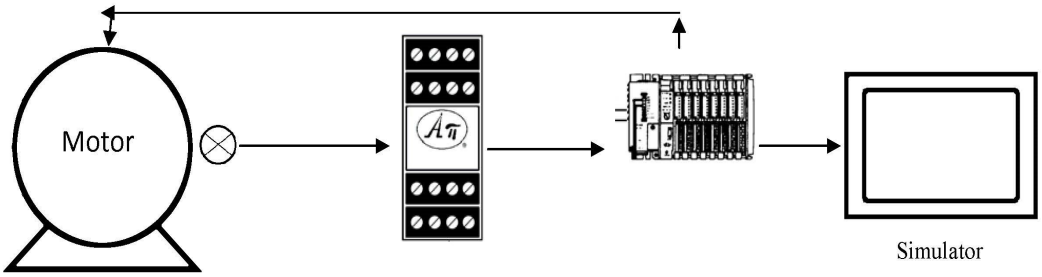
On a ship, the engine room typically contains several engines for different purposes. Main / propulsion engines are used to turn the ship's propeller and move the ship through the water. Somewhat smaller engines drive electrical generators that provide power for the ship's electrical systems. Our customer designs custom controls and is currently on a project to manufacture a control system for a diesel engine room simulator for U.S. Navy personnel. Engine room simulators train and assess the competence of engine department personnel in a controlled but hands-on environment. Engine rooms are hot, noisy, sometimes dirty, and potentially dangerous so proper personnel training is critical.

Type of Company: Design & Manufacturing Firm

Location: Delaware

The Engineering Issue

- The controls engineer is required to supply power to a transmitter and isolate the output from a loop powered proximity switch monitoring the shaft on a DC motor.
- The isolated output has to be connected to a PLC that controlled the speed of the motor and transmits the ship's shaft speed data to the engine room simulator.



The engineer used an APD 4300. The APD 4300 has a loop excitation power supply and provides an optically isolated DC output that can be wired for either a sinking or sourcing PLC input. Since the unit was factory calibrated, they were able to put it into use immediately.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor gas pressure for cleaning and testing of pipeline

APPLICATION C200

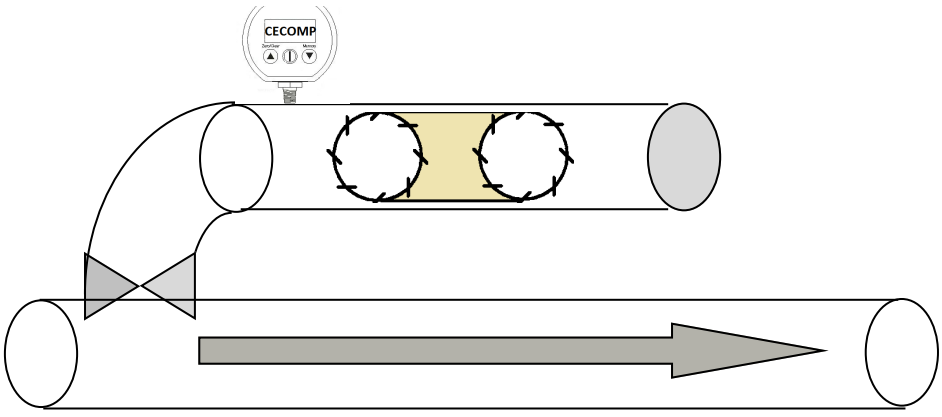
Type of Company: Public Utility

Location: Illinois

A pig is a device inserted into a pipeline which travels freely through it, driven by the product flow to do a specific task within the pipeline. These tasks fall into several different areas: hydrostatic testing, pipeline drying, internal cleaning, internal coating, liquid management, batching, and inspection. A utility usually conducts pigging on a regular basis to improve flow efficiency and clean the line to prevent corrosion. Pipeline "pigs" are introduced into the line via a pig trap, which includes a launcher and receiver.

The Engineering Issue

- Before inserting the pig in the launcher or retrieving the pig from the receiver, the technician/engineer must verify that the launcher/receiver no longer has pressure applied.
- The engineer has a requirement for a rugged, accurate digital gauge that is intrinsically safe for usage in potentially flammable and explosive conditions.



The engineer used a Cecomp DPG2000B Intrinsically Safe (FM-approved) gauge which provides the technician/engineer an accurate visual indication of the gas pressure. The ruggedness of the gauge ensured that calibration was maintained even in these harsh conditions.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Isolating and converting a moisture sensor output

APPLICATION A201

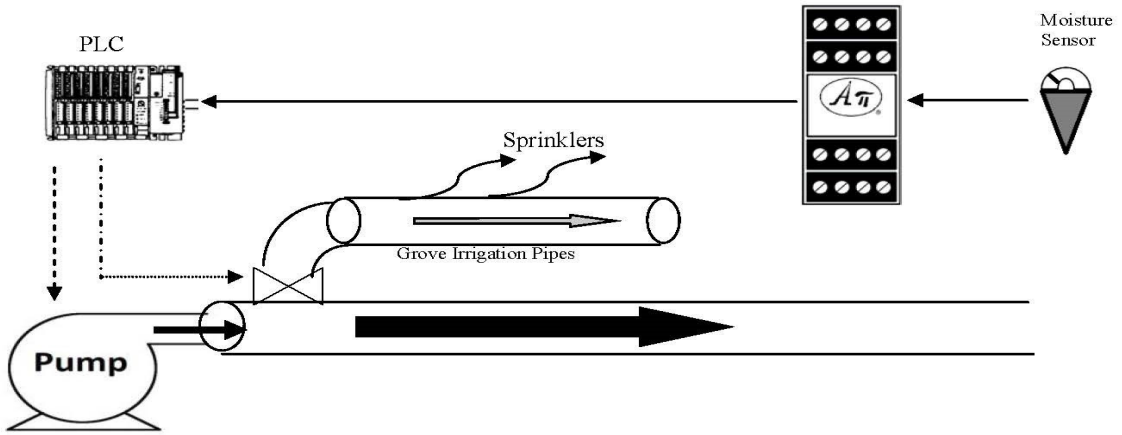
Type of Company: Public Utility

Location: California

The customer is a public utility providing water for a new, unique irrigation project. It is designed for orchard growers to use significantly less water via a pressurized, automated mico / drip irrigation system. This unique system will play a critical role to better serve the individual needs of growers while preserving natural resources, since field water efficiency of drip irrigation can be 80-90% when properly managed. The system uses an Allen Bradley Mircologix 1400 PLC to control the pump and valves.

The Engineering Issue

- They need inputs to the PLCc from moisture sensors in the grove to indicate optimal water delivery times, which vary with environmental conditions.
- The engineer needs an interface device to convert and, above all, isolate the PLC input. Additionally, it must be powered by the low voltage DC power from solar cells.



The engineer used an APD 4300. The APD 4300 is a standard off-the-shelf unit that was factory calibrated for the specific range requirements of the moisture sensor. The DC output can be wired for either a sinking or sourcing PLC input and the unit can be powered by the low voltage DC power from solar cells.

Problem. Solved.

Test and check hyperbaric chamber operation

APPLICATION C202

Type of Company: Medical Center

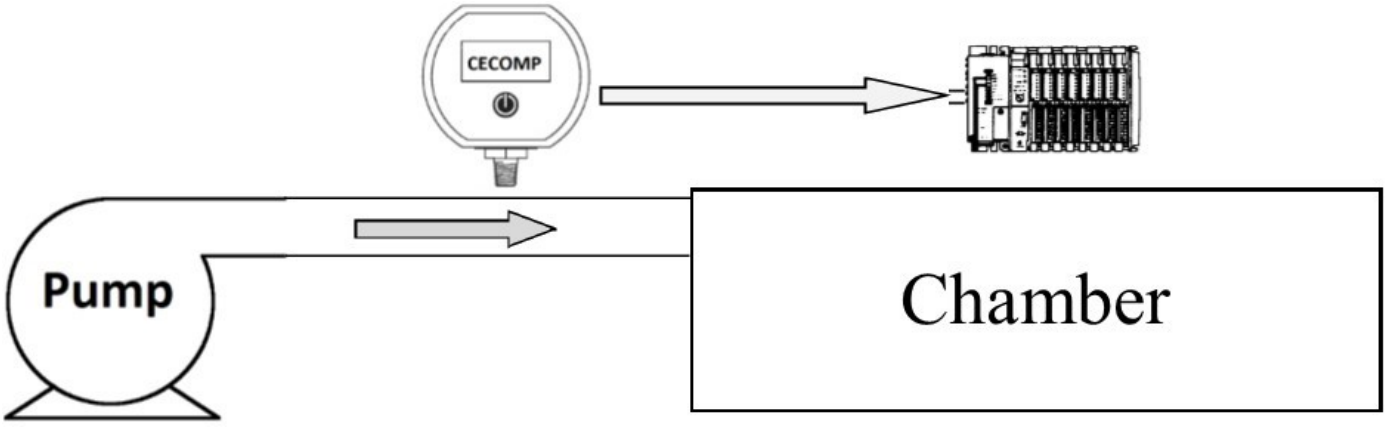
Location: Utah

Hyperbaric oxygen therapy is a type of treatment for patients with chronic wounds, tissue damage from radiation, and certain infections, as well as for those with emergency conditions such as carbon monoxide poisoning, diving accidents, and gas embolism. It uses a special pressure chamber as a means of delivering 100% oxygen in order to increase the amount of oxygen in the blood. The air pressure inside a hyperbaric oxygen chamber is about two and a half times higher than the normal pressure in the atmosphere. This helps blood carry more oxygen to organs and tissues in the body.

Photo by OpenStax College-Anatomy & Physiology

The Engineering Issue

- The technician/engineer must perform a weekly test to ensure that the chamber is operating properly.
- The engineer has a requirement for an accurate visual indication and an analog output of the chamber's pressure to the PLC throughout the test.



The engineer used a Cecomp Ultra-Ruggedized DPG1000DR gauge. This gives the technician an accurate visual readout of the pressure with a 4 -20 mA output to the PLC.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Testing and activating a tornado siren

APPLICATION A203

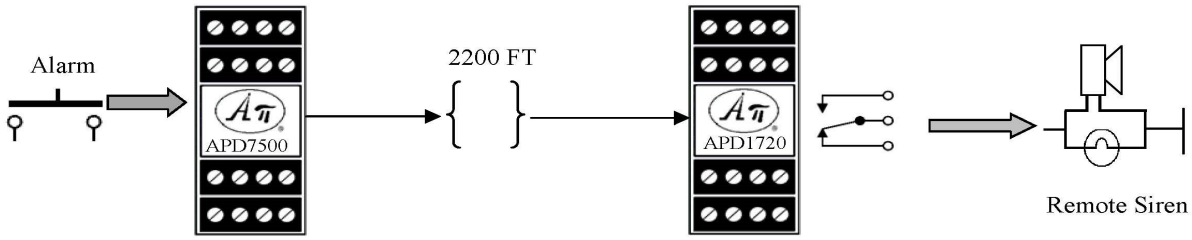
Type of Company: Aluminum Manufacturing/Processing Plant
Location: Arkansas

A tornado siren (also known as a civil defense siren) provides emergency warning of approaching danger. Initially designed to warn of air raids in World War II, they were adapted to warn of nuclear attack and of natural destructive weather patterns such as tornadoes.

The engineer who contacted us works in a plant that has one such alarm. The plant produces tabular alumina, various grades of Calcinated Alumina, and does testing of various products for their customers. The plant has a remote tornado siren that an entry guard must sound in case of inclement weather or other emergency.

The Engineering Issue

- The engineer has a requirement for a simple and cost effective circuit to do the following: 1) ensure that the power is "on" to the alarm circuit; 2) ensure that there is not a broken wire between the guard shack and the energizing relay for the remote siren; 3) have an easy and fast way to apply power to the energizing relay for the remote siren and; 4) not have to replace 2200 feet of wire.



The engineer used custom APD 7500 and APD 1720 units. The APD 7500 is powered by the same circuit that powers the remote siren and is located in the alarm tower. It automatically sends a signal over the 2200 feet of telephone wire to the APD 1720, located in the guard house. The APD 1720 is powered by an independent power supply: if the power to the remote siren is "off" (i.e. no power to the APD 7500 or a broken wire in the telephone cable), the unit will fail to alarm condition and notify maintenance of the problem. In case of emergency, the guard throws the "ALARM" switch in the guard shack, which modifies the APD 7500 output. This will causes APD 1720 to energize the relay and activate the remote siren.

Problem. Solved.

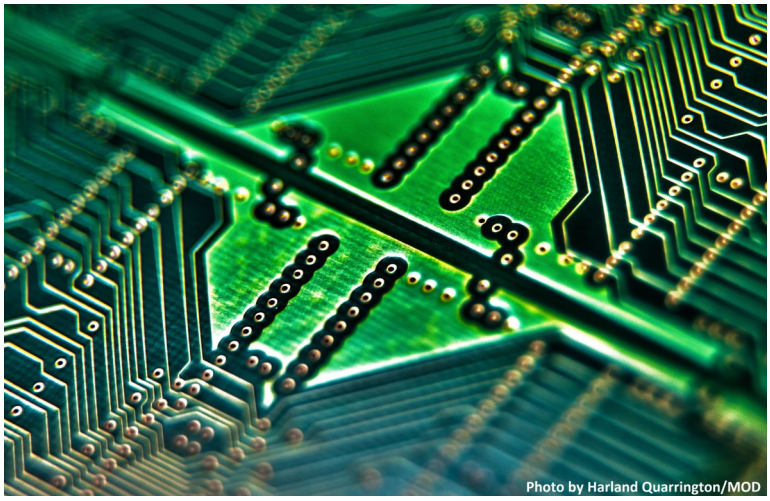
 | www.api-usa.com | www.cecomp.com

Acid washing for printed circuit boards

APPLICATION C204

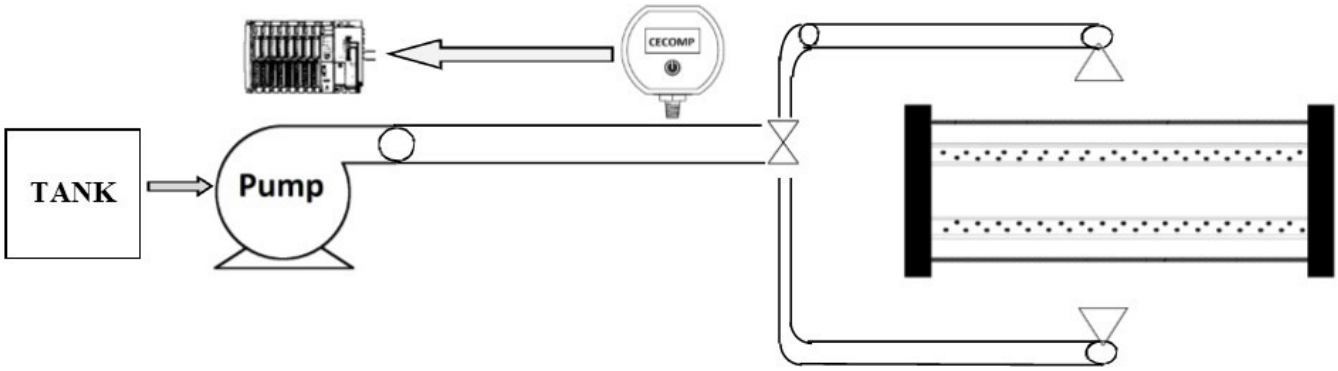
Printed circuit boards (PCBs) are used in electronic products from the simplest to the most advanced. There are many steps required to manufacture a printed circuit board (PCB) but one of the most critical is to use a spray to remove undesired copper from the board. As substrate materials have become thinner and more flexible, spray pressure and speed of the conveyor on the PCB manufacturing machines can have a very dramatic effect on the quality of the printed circuit board.

Type of Company: Manufacturer, PCBs
Location: Pennsylvania



The Engineering Issue

- The engineer has a requirement to provide an accurate visual indication of the sprayer pressure and an analog output signal to the machine PLC.



The engineer used a Cecomp F4L NEMA 4X digital pressure gauge. This ultra-rugged gauge gives an accurate visual readout of the pressure, with a 4-20 mA output being sent to the PLC.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Control for an HVAC system

APPLICATION A205

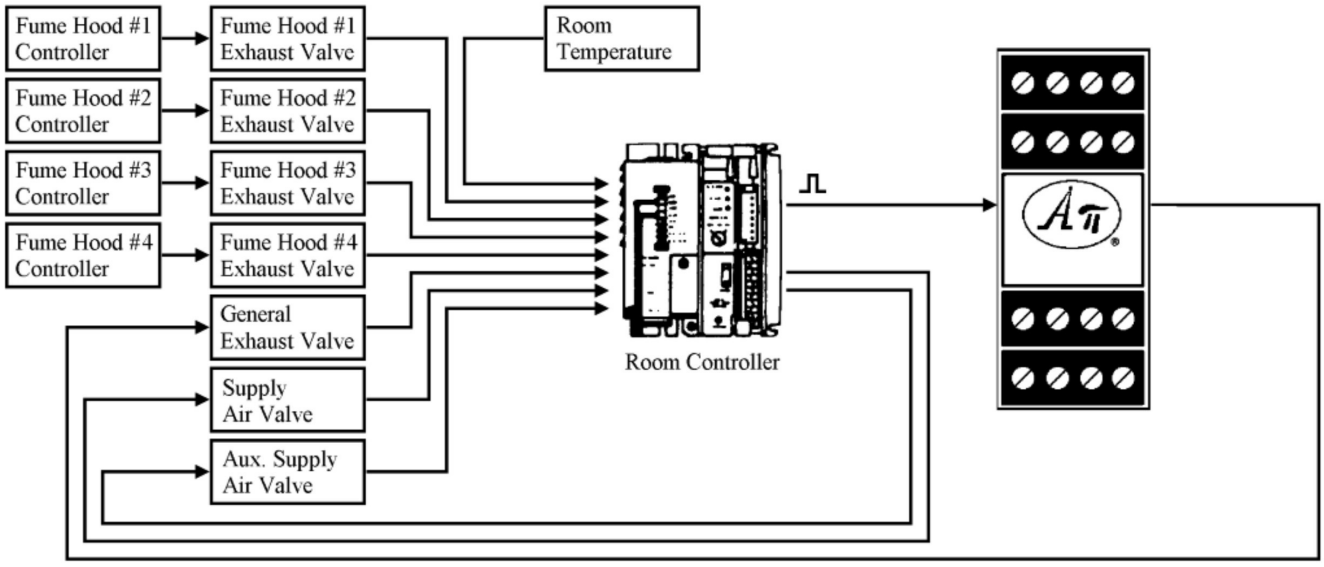
Type of Company: Manufacturer, Pharmaceuticals
Location: Illinois

A pharmaceutical company is converting an old HVAC system into an energy-efficient VAV (variable air volume) system. The 4 fume hoods in their lab will determine amount of air exhausted. A room controller must monitor, among other things, room temperature and air quality, and operate air valves based on room air conditions to maintain comfortable room temperature and ensure safety.


Photo by Eileen Kane

The Engineering Issue

- **The room controller has 8 analog inputs, 2 analog outputs and 1 frequency output, but 3 analog outputs are required for the new system.**



The engineer used an APD 7580 Isolated Frequency to DC Transmitter module to convert the frequency output of the room controller to an analog signal for the third analog output required to control the general exhaust air valve.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Testing concrete beams for flexural strength

APPLICATION C206

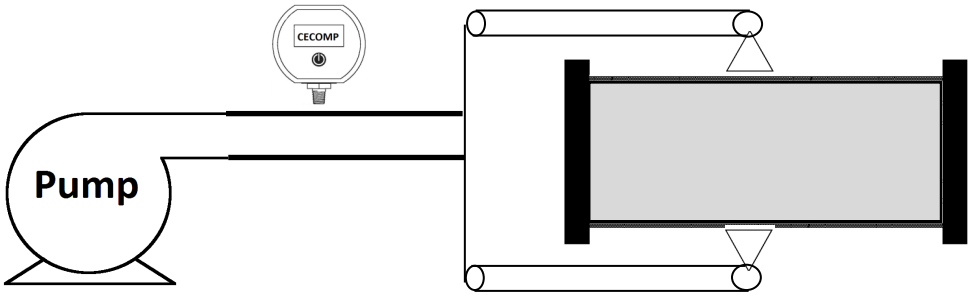
Type of Company: Public Transportation Agency
Location: Illinois


Photo by Royalbroil at English Wikipedia

Most state DOTs will require a test for "flexural strength" of concrete beams used on paving projects. Flexural strength is one measure of the tensile strength of concrete. It is a measure of the concrete beam or slab to resist failure. This test utilizes a beam testing machine which permits a hydraulic load to be applied until a beam failure is obtained.

The Engineering Issue

- The engineer has a requirement to accurately measure and record the "beam failure" pressure.
- The currently-used analog gauges have significant errors due to mechanical shock and field conditions.



The engineer used a Cecomp F16B digital pressure gauge to monitor the test. This Cecomp gauge has 0.25% accuracy over the full pressure range, a 1 PSI resolution, and can handle the "abuse" because of its ruggedness, both electrically and mechanically.

Problem. Solved.

Load limiting device on hoist

APPLICATION A207

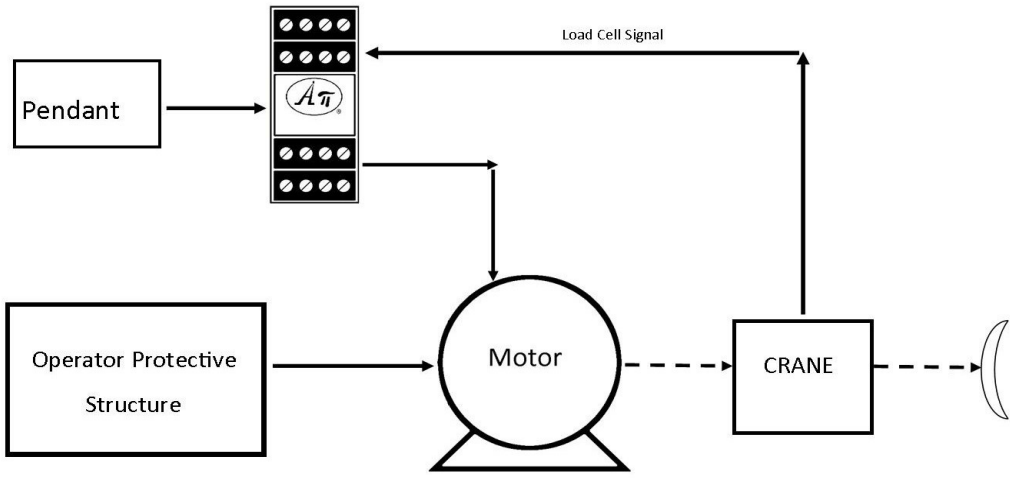
Type of Company: Logging & Lumber Company

Location: Idaho

There is a wide variety of logging truck designs. Some have integrated flatbeds, some are discrete tractor units, and some spread a load between the tractor unit and a dollied trailer pulled behind it. To load the logs, the truck may be fitted with one or more cranes or hoists. Truck-mounted loaders are boom type loaders mounted directly to the log truck (see photo). The operator station and boom are mounted together on a pedestal, though the system does have a hand-held pendant for remote operation. The logs are commonly unloaded by letting them roll sideways off the truck.

The Engineering Issue

- The truck design engineer is required to come into OSHA compliance as follows: When there is a load attached to the hoist, driver must be required to operate the hoist from the “operator protective structure” (the operator station on the boom) and not from the hand-held pendant.



The engineer used an APD 1080. While there is a load on the crane, the relay output on the APD 1080 disables the pendant’s operating signal.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Split signal from flowmeter for separate display/ control and chart recording

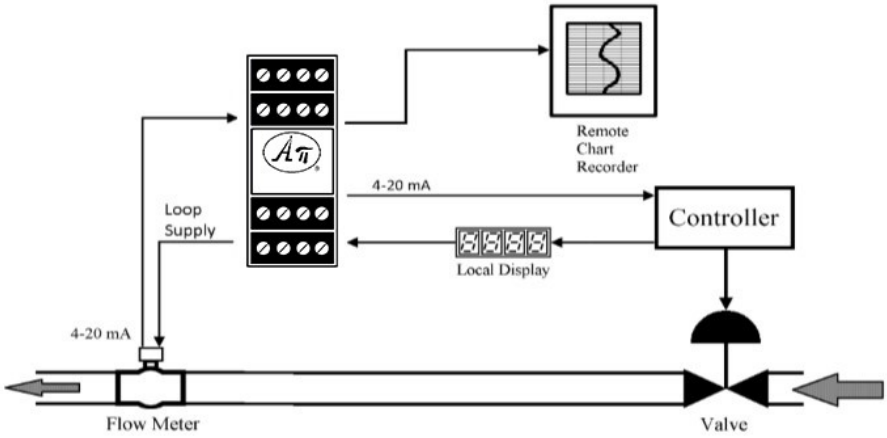
APPLICATION A208

Type of Company: Manufacturing, Chemicals
Location: Unknown

Industries that produce chemicals, metals, wood, paper and most other products use water in some part of their production process. Industrial reliance on water makes it essential to properly control the flow of the water during the manufacturing process.

The Engineering Issue

- The chemical process requires a controlled flow rate of water with a local display of that flow rate and also a chart of the flow rate for record-keeping purposes.
- The engineer only has a single loop-powered flow meter installed.



The engineer used an APD 4930 to power the flow meter. The unit accepts an existing 4-20 mA input signal, splitting and optically isolating it into two linearly-related output signals. One signal goes to the chart recorder, and the other goes to the controller and local display.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Keeping fuel tank farms safe

APPLICATION B209

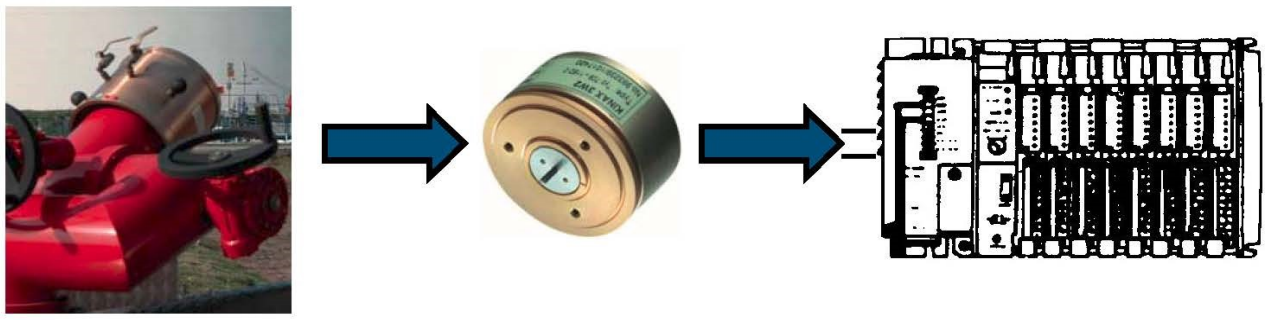
Tank farms are used to store fuel that will be either dispensed at the tank farm site, delivered to an end user, or transferred to other locations. Adequate fire protection at tank farms is critical. No area is absolutely safe because of the inherent hazard fuel presents. Also, a fire in one part of the facility endangers other areas, so if a fire breaks out it must be controlled and extinguished as quickly as possible.

Type of Company: Public Utility
Location: Unknown


By Tim Evanson from Cleveland Heights, Ohio. Arnegard North Dakota. Wikimedia Commons

The Engineering Issue

- Firmly installed rotating extinguishing guns are used in case of fire.
- The engineer needs an accurate feedback system to know the exact direction a gun is pointing at all times.



The engineer installed Camille Bauer KINAX 3W2 angular position encoders to provide feedback on the exact position of the gun at any given time.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

SINEAX V604s as an “input card“ for videographic recorders

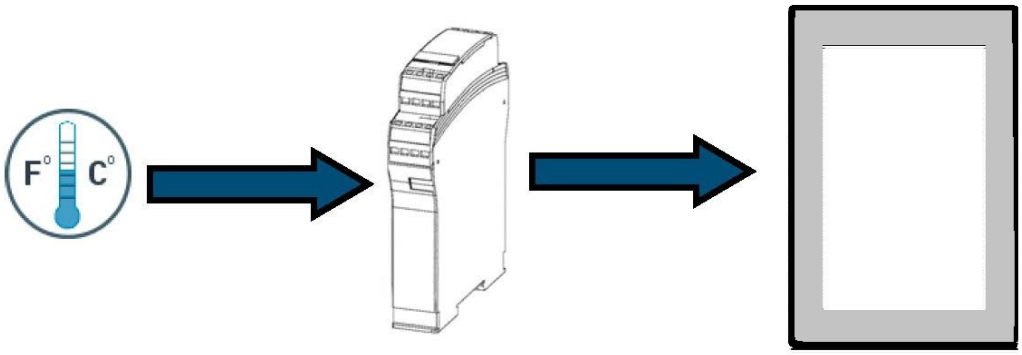
APPLICATION B210

Type of Company: Public Utility
Location: International

Many sewage treatment plants use videographic recorders for collecting, storing and transmitting data. Sewage contains many substances and this is the most effective manner of collecting the many types of varied data in an easy and reliable manner. In addition, the operator can enjoy comfortable on-site visualizing with fast access to historical data.

The Engineering Issue

- The engineer needed to connect four new temperature inputs to the existing videographic recorder so he could monitor them by specified limits.
- The primary problem was that all of the analogue inputs were occupied.



The engineer used four SINEAX V604s which isolated and linearized the temperature inputs and then transferred them to the videographic recorder via MODBUS.

Problem. Solved.

Monitor wind turbine operation

APPLICATION B211

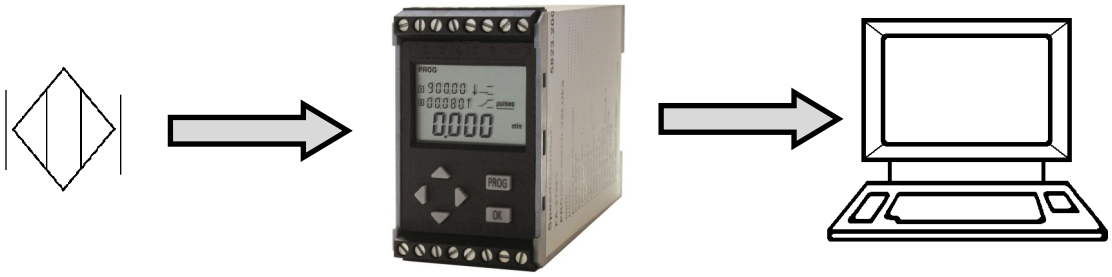
Type of Company: Wind Farm
Location: International

Wind turbines can provide large amounts of electricity, cleanly and reliably, at prices competitive with any other new electricity sources. Wind turbines operate on a simple principle. The energy in the wind turns propeller-like blades around a rotor. The rotor is connected to the main shaft, which spins a generator to create electricity. Modern wind turbine controls need to measure and/or control as many as 500 parameters for safety, reliability and efficiency.

By Chris Lim. Wind Power Plants, Xinjiang, China. Wikimedia Commons

The Engineering Issue

- An analogue output is required to correctly tie into the wind farm's system.
- The engineer has to locally and remotely monitor the frequency and switching operations for the following:
  - ◊ The speed and direction of the rotor
  - ◊ The speed of the generator



The engineer used a Rheintacho CRRA (Rotas Programmable Speed Monitor). The programmable speed monitor allows monitoring of rotor speed and direction as well as generator speed alarm situation parameters to be clearly defined. It has an analogue output. Last, the LCD display shows both the measured value and the limit value along with the frequency.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitoring hydro-electric generator speed

APPLICATION A212

Type of Company: Public Utility

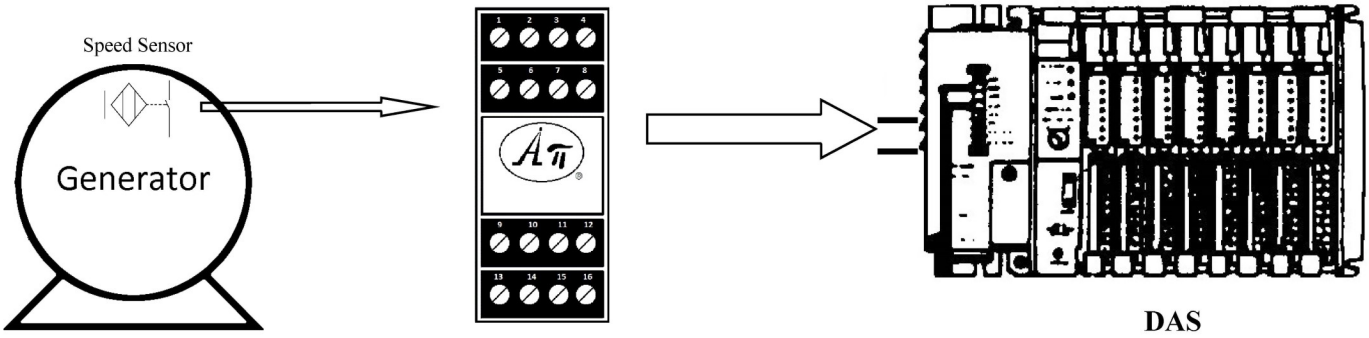
Location: Georgia

Hydroelectric generators are used to produce AC power. The frequency of the AC power supplied to the system will vary as load and generation change. The primary reason that accurate frequency control is required is to allow control of the flow of alternating current power from multiple generators through the network. Temporary frequency changes are an unavoidable consequence of changing demand. Exceptional or rapidly changing mains frequency is often a sign that an electric distribution network is operating near its capacity limits, dramatic examples of which can sometimes be observed shortly before major outages.

Photo by John Hollingsworth

The Engineering Issue

- The engineer has a requirement to monitor and record the speed of the generators to verify the frequency supplied to the system.



The engineer used an APD 7010 to convert the frequency output from a speed sensor to a 0-10 VDC signal for the DAS. The APD 7010 converts and isolates the frequency signal to the Data Acquisition Systems (DAS).

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

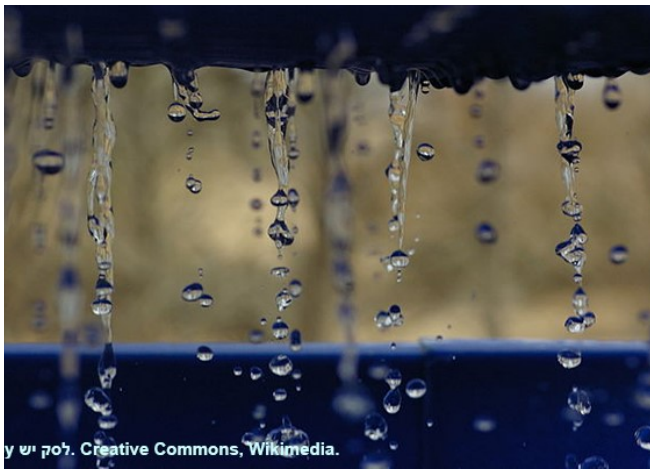
Monitor flow through water filtration systems

APPLICATION C214

The most common treatment process for bottled water is to use a filtration system so that the water will contain fewer total dissolved solids than tap water; i.e. it will be more "pure." The water is "sucked" through the filter, which traps any microorganisms or contaminants. Before the filtering systems can be shipped to the end users, an operational test of the system must be performed. A test stand with the installed filter system and receiving "pure" water from an external filter is used for the operational test and the results are logged by a DCS system.

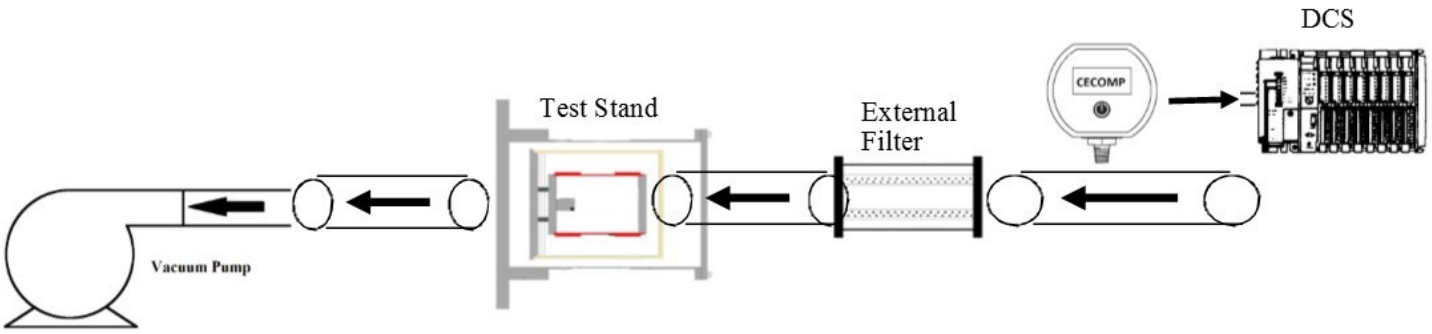
Type of Company: Manufacturer, Water Filtration Systems

Location: Wisconsin



The Engineering Issue

- The engineer is required to monitor and record the flow (pressure) through the external filtration system for the test stand during the operational test.
- A rugged and accurate digital gauge with an output that can be sent to the DCS is required for the operational test.



The engineer used a Cecomp F16DR which provides an accurate visual indication as well as a 4-20 mA signal for the analog input card on the DCS. The ruggedness of the gauge ensures that calibration is maintained even in harsh conditions.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor slurry pressure in pipe

APPLICATION C215

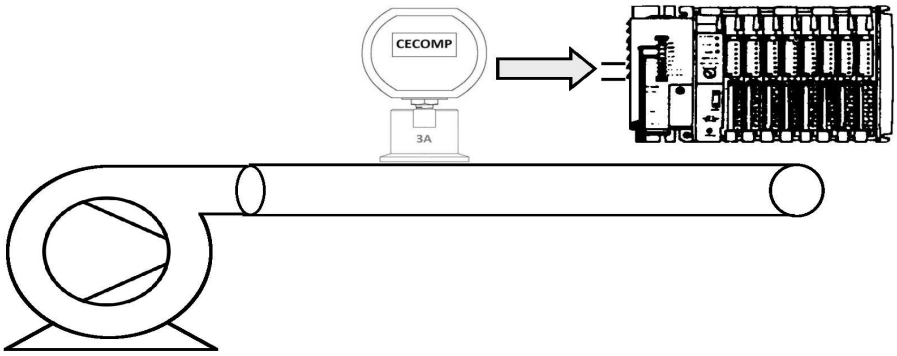
Type of Company: Manufacturer, Pet Food
Location: Unknown

Pet food is formulated for domesticated animals. Wet pet food (canned food) generally consists of meat, meat byproducts, cereals, grain, vitamins, and minerals. The meat products intended for canned food must be delivered fresh and processed within three days. The manufacturing process entails grinding and cooking the meat and meat byproducts in a large kettle. After grinding and cooking the meat, other ingredients are added and well mixed. The food mixture (an abrasive slurry) is then pumped through pipes out of the kettle and into the can-filling machine. The machine dispenses the mixture into cans or pouches for delivery.

Wikimedia commons photo by Thomas Vaclavek

The Engineering Issue

- The engineer has a requirement to monitor the slurry flow from the kettle to the can filling machine and in the event of a blockage send an alarm to the PLC.
- The slurry is highly viscous so it may clog the pressure port of a gauge and a sanitary cleanliness level is critical.



The engineer used a Cecomp DSGA4 digital sanitary pressure gauge with alarms. The gauge is set up so that if both LEDs on the front face are green, the slurry is flowing properly. The operator can use the LCD display to verify proper operating pressure. The relay operates to send a signal to the PLC so that the pumps can be shut down if there is a blockage in the slurry line.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor pressure on a vacuum chamber

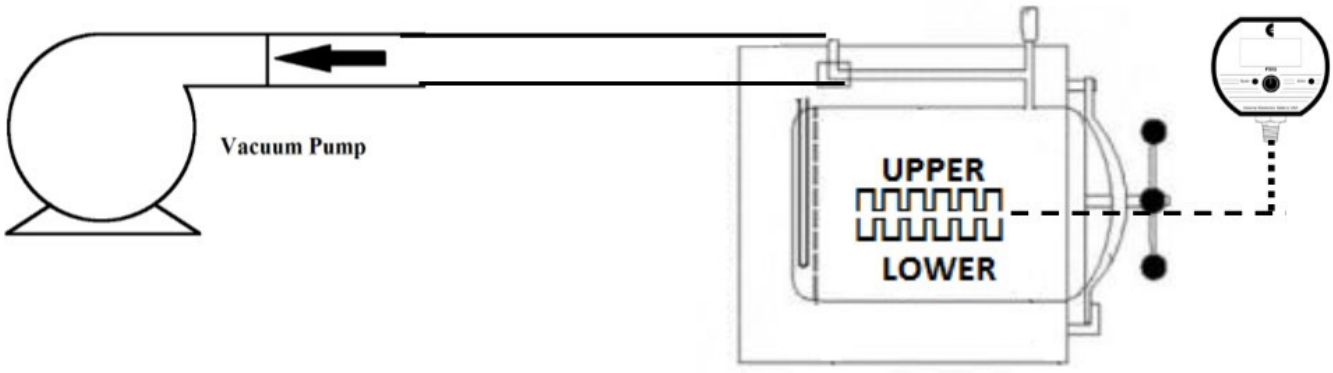
APPLICATION C216

Type of Company: Manufacturer, Aircraft Components
Location: Washington

Fiberglass-reinforced composite plastic parts are typically manufactured using a vacuum forming process. A glass-reinforced plastic part is typically a thin "shell" construction and the part may be of nearly any arbitrary shape, limited only by the complexity and tolerances of the mold used for manufacturing the shell.

The Engineering Issue

- The engineer has a requirement to ensure that there are no air bubbles remaining in the part which could cause a “part failure” when put in service.
- The accuracy and repeatability of the applied vacuum applied to the part while in the vacuum forming chamber is critical for air bubble removal.



The engineer used an ultra-rugged Cecomp F22B to monitor the vacuum applied to the part while in the chamber. This gauge is very accurate and repeatable.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

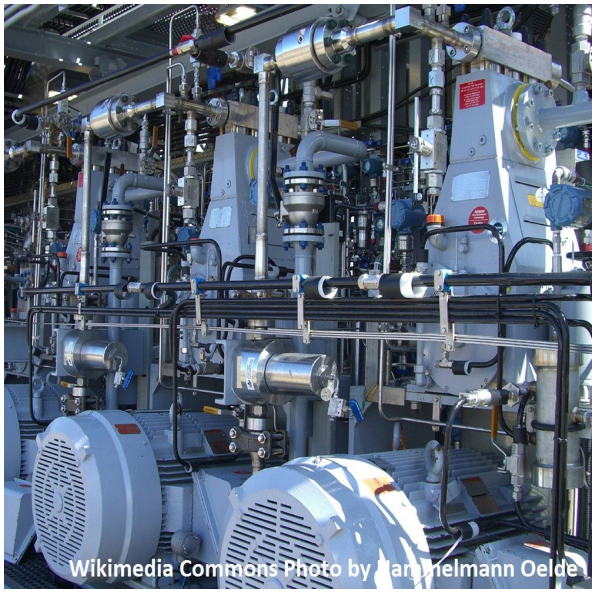
Test water pressure in public water distribution system

APPLICATION C217

Type of Company: Public Utility

Location: Texas

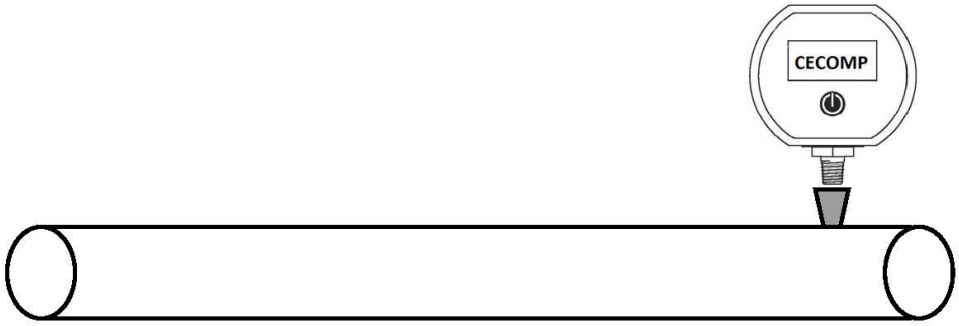
Water purification for human consumption is the process of removing undesirable chemicals, materials, and biological contaminants from raw water. The water is treated and tested per the Environmental Protection Agency regulations. State regulatory agencies evaluate the quality of the water and the water pressure in the distribution system of the public water system. In poorly managed systems, water pressure can be so low as to result only in a trickle of water or so high that it leads to damage to plumbing fixtures and waste of water.



Wikimedia Commons Photo by Hans Helmann Oelde

The Engineering Issue

- The engineer has a requirement for accurate and easy-to-use gauges to test the water pressure.
- The gauges must maintain calibration and be field durable.



The engineer used highly accurate Cecomp F16B battery-powered gauge to test the water pressure. This Cecomp NEMA 4X gauge has 0.25% accuracy over the full pressure range, 0.1 PSI resolution, and can handle the “abuse” because of their ruggedness both electrically and mechanically.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Monitor and control the melt pressure in an extruder

APPLICATION A218

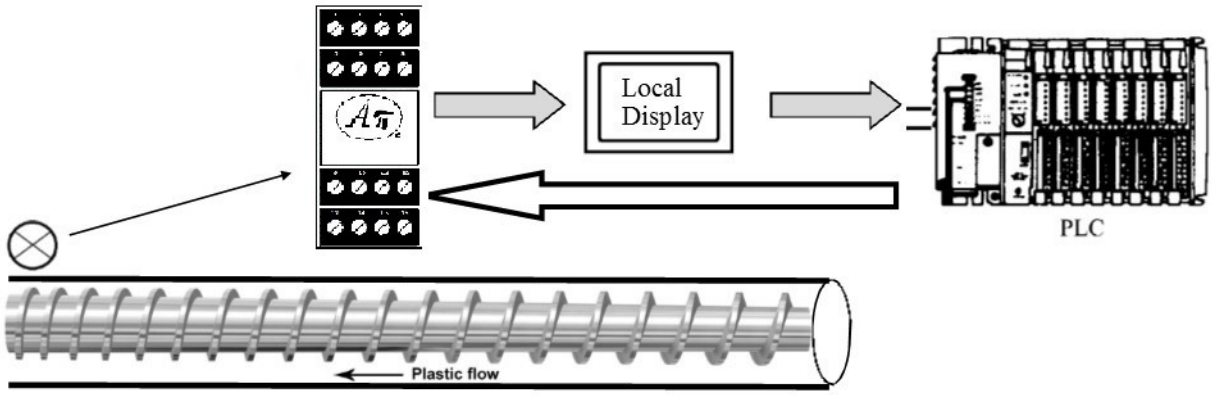
Type of Company: Manufacturer, Plastics
Location: Wisconsin

Plastics extrusion is a high-volume manufacturing process in which raw plastic is melted and formed to produce large numbers of identical items from high precision engineering components to disposable consumer goods. Plastic material is gradually melted and the molten polymer is then forced into a die, which shapes the polymer into a shape that hardens during cooling. The customer is using a Dynisco melt pressure transducer on their extruder.

Photo by Cip24

The Engineering Issue

- The engineer has a requirement to locally monitor and control the polymer melt pressure for product consistency compliance.
- The melt pressure signal must be compatible with an Allen-Bradley PLC and have a "system calibration" function.



The engineer used an APD 4059. The APD 4059 has 20 V compliance so the output signal can be looped thru both the local display and the PLC for control and recording. An added feature of the APD 4059 is that the M02 option utilizes the pressure transducer's internal calibration resistor to unbalance the bridge when the functional test switch is in the CAL position, ensuring accurate system calibration.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com

Pump control of steam heating system

APPLICATION C219

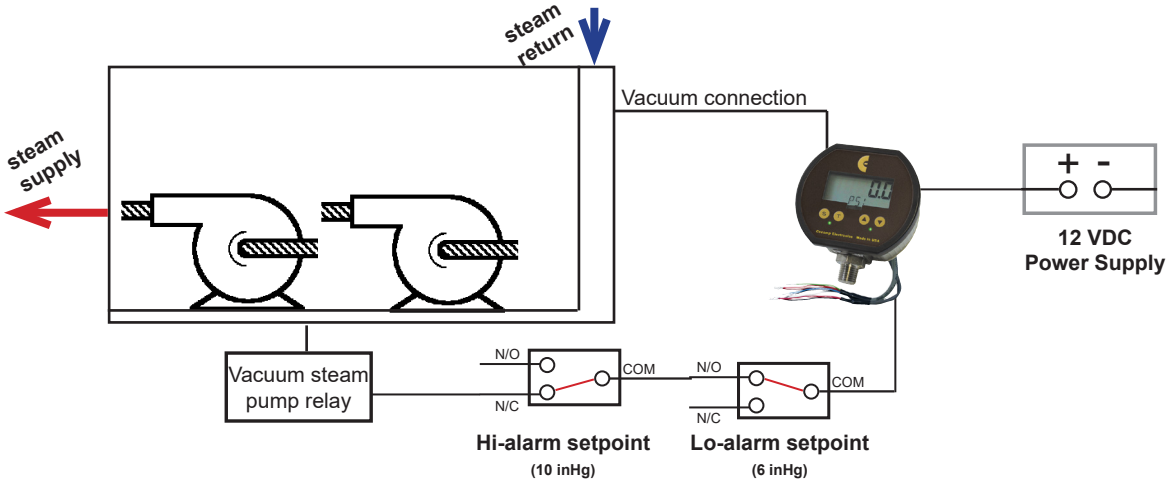

By J. Crocker, commons.wikimedia.org/w/index.php?curid=1873383

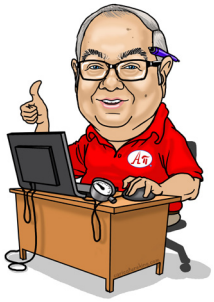
Type of Company: Private Steam Heating Company
Location: Chicago, Illinois

Many residential and office buildings and other facilities use steam systems for heating, and vacuum steam switches are often used to control the vacuum steam pumps.
As the system ages, the traditionally installed vacuum switches often do not function properly and become very difficult to adjust. The system wanders back and forth and is constantly overshooting the vacuum parameter settings.
The result is poor heating regulation and complaints from residents - as well as customers.

The Engineering Issue

- The company must replace failing traditional vacuum switches that were installed on the original pumps.
- The switches must accurately control a very narrow range (6 to 10 inHg of vacuum) to ensure consistent resident comfort.





The "old" vacuum switch was replaced with a Cecomp compound vacuum/pressure gauge, F16ADA-30V15PSIG, that includes pushbuttons, a digital display, and two relay switches. Due to the display and smoothness of operation, the engineer was able to easily and precisely set the lo and hi setpoints. After an entire heating season of testing, the engineer reported the gauge worked flawlessly and the heating system maintained the temperatures as required.

Problem. Solved.

Improving automotive vacuum systems efficiency

APPLICATION C220

Type of Company: Blower & Vacuum Systems
Location: Connecticut

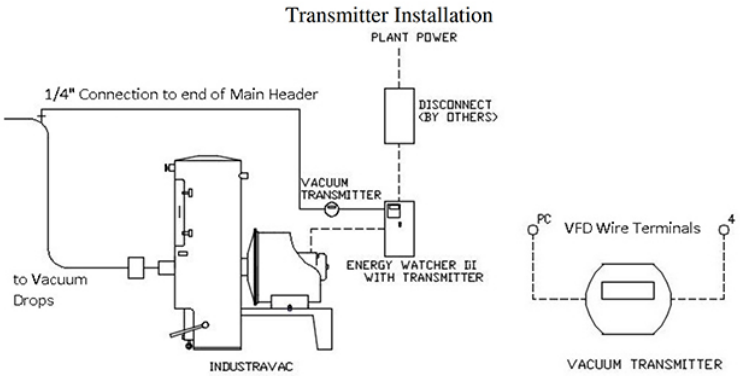
The Spencer Turbine Company recently introduced a new energy-efficient vacuum control system for the car care industry.

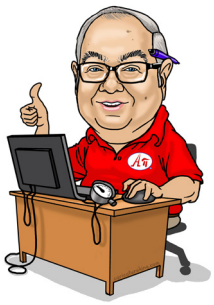
Coined the *Energy Watcher III®*, the product monitors multi-user car wash vacuum cleaner systems and automatically reduces the vacuum motor speed during low-use periods, thus reducing power consumption overall.

Car washes, car rental companies, and similar operations will quickly benefit from reduced operational cost and improved energy efficiency, as well as increased vacuum life.

The Engineering Issue

- The Spencer engineer required a device to continually monitor the vacuum system and send a 4-20 mADC signal to a VFD (Variable Frequency Drive) to increase or decrease their motor speed accordingly.





Spencer evaluated and selected the Cecomp DPG1000L loop-powered digital vacuum gauge and found it to be accurate, quick to react to changes in vacuum pressure, and technician-friendly. It is able to produce the required 4-20 mA signal and maintains calibration. In addition, the Cecomp DPG1000L includes a LCD display that indicates real-time vacuum level, important during system startup or troubleshooting.

Problem. Solved.

Safe Monitoring of Inactive Loops

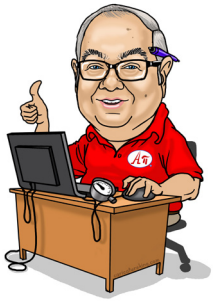
APPLICATION C221

Applies To: Most Industrial Processes

The customer requires a digital pressure transmitter to monitor process pressure at a location that is several hundred feet from the controller. The most cost effective solution is a 2-wire, loop-powered digital pressure gauge because it uses the same two wires for power and to retransmit the pressure reading via the 4-20mADC loop.

The Engineering Issue

- If the loop supply is turned off for maintenance, the technician cannot perform any work at the remote location without verifying the pressure is at zero.



The customer installed a **Cecomp SuperCap Loop-Powered Digital Pressure Transmitter**. This transmitter includes a Super Capacitor that allows the technician to display pressure readings when the loop power to the gauge is turned off. By pressing a button, the engineer can configure the transmitter to turn on for 15 second intervals or to be on continuously, up to 40 minutes. The SuperCap automatically recharges when the loop-power is turned back on and a fully discharged SuperCap will recharge in two hours. Also, the SuperCap will hold its charge for up to a year if it is not used and the power remains off. And, the SuperCap requires NO maintenance.

Problem. Solved.

 | www.api-usa.com | www.cecomp.com