

REGULATOR INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:7909210348 DOC.DATE: 79/09/12 NOTARIZED: NO DOCKET #
 FACIL:50-331 Duane Arnold Energy Center, Iowa Electric Light & Pow 05000331
 AUTH.NAME AUTHOR AFFILIATION
 ROOT,L.D. Iowa Electric Light & Power Co.
 RECIP.NAME RECIPIENT AFFILIATION
 IPPOLITE,T.A. Operating Reactors Branch 3

SUBJECT: Forwards recording/control equipment specs for NRC to complete evaluation of util 790329 submittal.

DISTRIBUTION CODE: A001S COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 17
 TITLE: General Distribution for After Issuance of Operating Lic

NOTES:

ACTION:	RECIPIENT ID CODE/NAME	COPIES		RECIPIENT ID CODE/NAME	COPIES	
		LTR	ENCL		LTR	ENCL
	05 BC <u>ORB #3</u>	7	7			
INTERNAL:	01 REG FILE	1	1	02 NRC PDR	1	1
	12 IRE	2	2	14 TA/EDO	1	1
	15 CORE PERF BR	1	1	17 ENGR BR	1	1
	18 REAC SFTY BR	1	1	19 PLANT SYS BR	1	1
	20 EEB	1	1	21 EFLT TRT SYS	1	1
	22 BRINKMAN	1	1	OELD	1	0
EXTERNAL:	03 LPDR	1	1	04 NSIC	1	1
	23 ACRS	16	16			

SEP 24 1979

MA
4

60

TOTAL NUMBER OF COPIES REQUIRED: LTR 38 ENCL 37

Iowa Electric Light and Power Company

September 12, 1979
LDR-79-192

LARRY D. ROOT
ASSISTANT VICE PRESIDENT
NUCLEAR GENERATION

REGULATORY DOCKET FILE COPY

Mr. Thomas A. Ippolito
Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, MD 20034

Dear Mr. Ippolito:

Your letter of August 16, 1979 requested that Iowa Electric forward information to demonstrate that the automatic recording/control equipment for chlorine is acceptable to enable your staff to complete their evaluation of our submittal of March 29, 1978.

Enclosed herewith are specifications for the recording/control equipment.

If you have any questions concerning this, please feel free to call us.

Very truly yours,

Larry D. Root

Larry D. Root
Assistant Vice President
Nuclear Generation

LDR/KAM/mz

cc: K. Meyer
D. Arnold
L. Liu
S. Tuthill
E. Hammond
P. Ward
T. Kevern (NRC)
T. Shugart
File: A-117

*Root
9/11*

7909210 348

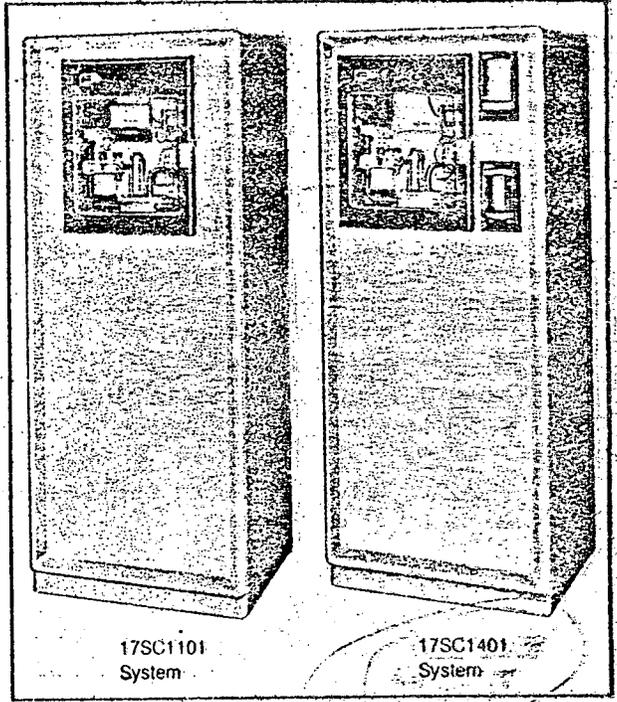
P

Anachlor™ Residual Chlorine Analyzer Systems

SERIES 17SC1000

The Series 17SC1000 Anachlor Residual Chlorine Analyzer System consists of the analyzer itself and associated secondary instruments mounted in an attractive plastic-impregnated fiberglass cabinet. The analyzer used is the Series 17B4200 Anachlor Analyzer Transmitter, an amperometric unit with an electronic output signal. Numerous types of secondary instruments are compatible with the analyzer which permits indication, recording and controlling of chlorine residual as required by the application.

The analyzer's measurement cell is the flow through type with sample water continually flowing past two dissimilar metal electrodes. In the cell a current is generated that is directly proportional to the amount of free or total chlorine residual present in the sample. This signal is conditioned through special circuitry to produce a 4-20 mA dc output which is applied to the secondary instruments. Circular or strip chart recorders are available to provide a record of chlorine residual, and an electronic controller is available to automatically adjust the chlorine feed rate (or sulfur dioxide rate for dechlorination control).



DCR-647

DESIGN FEATURES

- Cabinet Mounted: Permits close coupling of analyzer and secondary instruments for complete protection. Attractive fiberglass cabinet matches associated chlorination equipment.
- Convenient: Continuous operation frees operator for other duties by eliminating the need for frequent laboratory testing.
- Reliable: Automatic temperature compensation is standard. Electrode surfaces are continuously cleaned by action of non-abrasive pellets.
- Versatile: Numerous standard systems are available containing various combinations of indicators, recorders, controllers and alarms.
- Automatic Control: Continuous electronic control is available to control chemical feed rates and maintain the desired chlorine residual.

Sample Conditioning: Turbidity and chemicals normally found in raw and treated waters do not affect cell operation. Potassium permanganate and ozone, however, do have an adverse affect. A motor-driven filter is recommended when settleable solids are present in the sample.

Output: 4-20 mA dc into 0-750 ohms max. is available at the analyzer. This signal which is proportional to chlorine concentration is transmitted to cabinet mounted instruments.

Sensitivity: The unit will recognize and respond to residual changes as low as 0.01 mg/l chlorine.

Ambient and Sample Temperature Limits: 0-50°C (32-122°F)

Temperature Compensation: A thermistor provides automatic signal compensation for changes in sample temperature.

Power Supply Requirements: 120 Vac ± 10% @ 50/60 Hz, 18 watts maximum.

ENGINEERING SPECIFICATIONS

Operating Range: 0-5, 0-1, 0-2, 0-3, 0-5, 0-10, 0-20 milligrams per liter (mg/l)* ranges are standard; other ranges are available upon request.

Sample Requirements: Water for analysis must be supplied at a reasonably constant pressure of between 0.5 and 2 psig (3.5 - 13.8 kPa) at a flow of 0.5 gpm (2 l/min) minimum.

* 1 mg/l = 1 part per million (ppm)

Chemicals: The Anachlor analyzer is designed to use dilute acetic acid for pH reduction. If desired, hi-capacity pH 4 buffer solution may be used. Potassium Bromide (Ref. U.S. Patent No. 3,412,199) is used for free residual measurement. Potassium Iodide and Sodium Hydroxide are used for total residual measurement. A 30-day supply is furnished with each analyzer system.



THE ANACHLOR SYSTEMS COMPANY
 15500 E. 15th Avenue, Denver, CO 80202
 Telephone: (303) 751-1000
 Telex: 350000 ANACHLOR
 Cable: ANACHLOR
 Copyright © 1975 by The Anachlor Systems Company

Connections

Sample Inlet: 1/2-inch (12.7 mm) ID hose adaptor.

Drain: 1-inch (25.4 mm) ID hose adaptor.

Electrical: Junction box provided with two 3/4 NPT conduit connections. Instruments supplied are interconnected and wired to the Junction Box.

Materials of Construction

Cabinet: Attractive, self-supporting unit of fiberglass-reinforced plastic for corrosion resistance. Two-tone aqua and white finish is permanently impregnated in the fiberglass material.

Anachlor Residual Chlorine Analyzer: All materials in contact with the water sample resist corrosion from chlorinated water, waste water, and added reagents. Measurement cell, thermistor, and other components are housed in a die-cast aluminum case finished with corrosion-resistant paint.

Shipping Weight: A typical Anachlor analyzer system consisting of analyzer, secondary instruments and a fiberglass cabinet weighs approx. 250 lbs (113 kg).

SECONDARY INSTRUMENTS

The Series 17SC1000 Anachlor Residual Chlorine Analyzer Systems can include various electronic secondary instruments as follows:

Recorders —

~~Type 1321 Miniature Electronic Strip Chart Recorder~~

Type 1100DB Large Case Electronic Circular Chart Recorder.

~~Controller — Type 53EG4 Indicating Electronic Fixed Scale Controller~~

~~Alarms — High and/or Low switch contacts can be supplied in the Large Case or Miniature Electronic Instruments~~

Note: For details of the analyzer and secondary instruments listed above, refer to the appropriate Specifications: 17B4200, 51-1321, 51-1102DB and 53EG/EH4000.

OPERATION OF ANALYZER

Sample water enters the analyzer, is filtered and then flows through the flow control valve, the flow rate indicator, the head control block and finally into the measurement cell. A thermistor, mounted in the sample stream, senses changes in the sample water temperature and automatically compensates the cell output. Prior to sample entry into the measuring cell, reagents are added to adjust sample pH and to select free or total residual measurement.

In the cell, the sample water flows upward between the concentrically-mounted, outer (copper), Counter Electrode and the inner (gold), Measuring Electrode. A motor coupled to the Measuring Electrode, rotates it at 1550 rpm to maintain ideal, reproducible, electrolysis conditions at the electrode surface and have the cell output independent of slight flow variations. The measurement cell functions like an ordinary wet cell

except that the current varies linearly with changes in residual chlorine content of the sample. When water is present in the cell, the measuring electrode becomes polarized or charged and essentially no current flows in the circuit. However, if chlorine is present, the measuring electrode is depolarized in proportion to the chlorine concentration and allows current to flow in the cell. The Counter Electrode is oxidized and completes the electrical circuit.

The depolarization current passes through a load resistor network causing a potential drop which is applied to a specially-designed, solid-state amplifier and signal conditioner. Suitable zero and span adjustments can be made at this point to calibrate the electronic 4-20 mAdc amplifier output to read in terms of residual chlorine concentration. Suitable electronic secondary instruments use the 4-20 mAdc amplifier output to indicate, record or control chlorine residual.

OPTIONAL EQUIPMENT

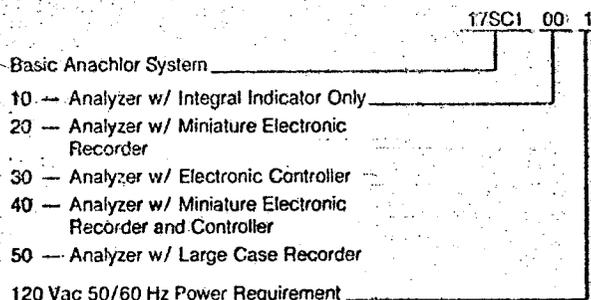
- Manual or motor driven Cuno Auto-Klean¹ filter (wall mounted)
- Sample pump
- Amperometric titrator

¹: T.M., AMF Inc.

ORDERING INFORMATION

- Model Number
- Optional equipment
- Application (raw water, finished water, water pollution control plant effluent)
- Range in mg/l
- Free or total residual measurement

MODEL NUMBER DESIGNATION



EQUIPMENT DESCRIPTION

The residual chlorine control system shall be of the amperometric type for the measurement of (free) (total) residual over a range of 0 to _____ mg/l.

The sampling cell shall contain two electrodes which continually detect the chlorine residual in the sample and generate an electric signal proportional to the residual. The cell shall be provided with non-abrasive plastic pellets which are continually impelled against the electrodes to prevent the adherence of any foreign material to the electrode surfaces. The noble metal electrode shall be rotated by a motor drive to provide the impelling force for the cleaning pellets and to eliminate the need for close control of sample flow rate.

A thermistor, immersed in a sample stream, shall form a part of the electrical circuit in order to compensate, automatically, for all changes in the cell output due to water temperature changes. The analyzer shall be furnished with a sample flowrate meter to permit easy setting of the optimum flow for minimum consumption of reagent feed requirements. The reagent feed pump shall be a motor-driven, positive displacement type. The analyzer shall operate without the use of dilution water.

The chlorine residual (recorder) (indicator) shall be the (large case) (miniature) electronic type with (chart) (scale) direct reading in mg/l of chlorine. Electronic circuits shall be the modular plug-in type for ease of maintenance.

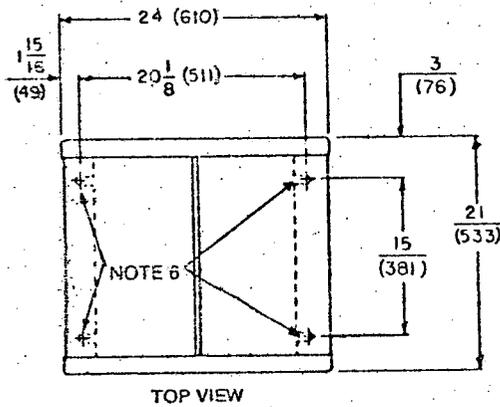
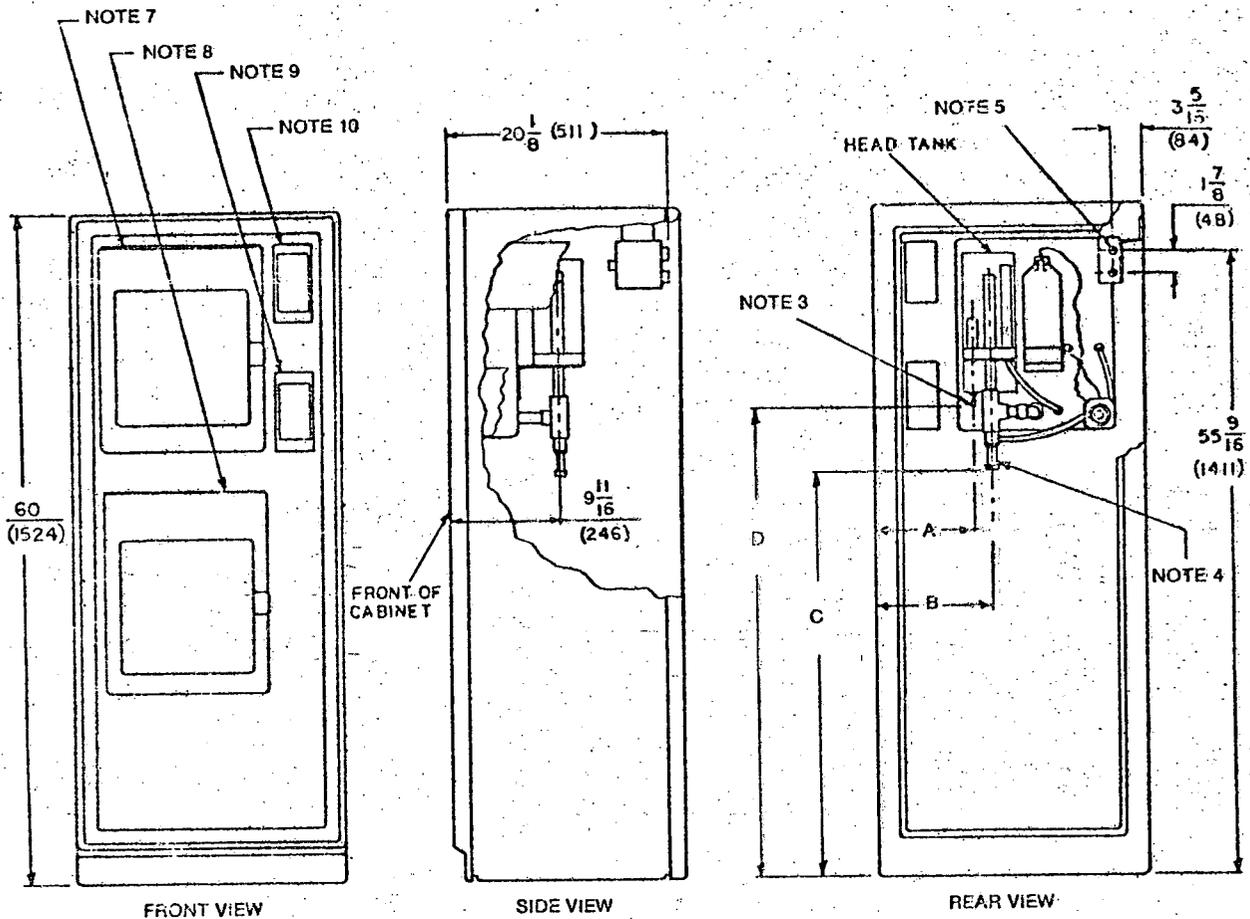
The system shall also include an electronic controller to provide automatic control of chlorine residual. The control signal shall be 4-20 mA dc and shall adjust the feed rate of the (chlorination) (sulfonation) equipment.

All components shall be supplied in matching cases mounted on a fiberglass-reinforced polyester cabinet. The cabinet shall have ample wall thickness and reinforcement to provide a free-standing, self-supporting enclosure. The cabinet shall be impregnated two-tone aqua and white color. The residual chlorine analyzer system shall be located in a room away from the chlorinator(s) to avoid possible corrosive damage by chlorine.

A thirty-day supply of chemicals shall be supplied with the system. The system shall be the Fischer & Porter Series 17SC1000 Anachlor Residual Chlorine Analyzer System.

Note: Specifications are subject to change without notice.

DIMENSIONS



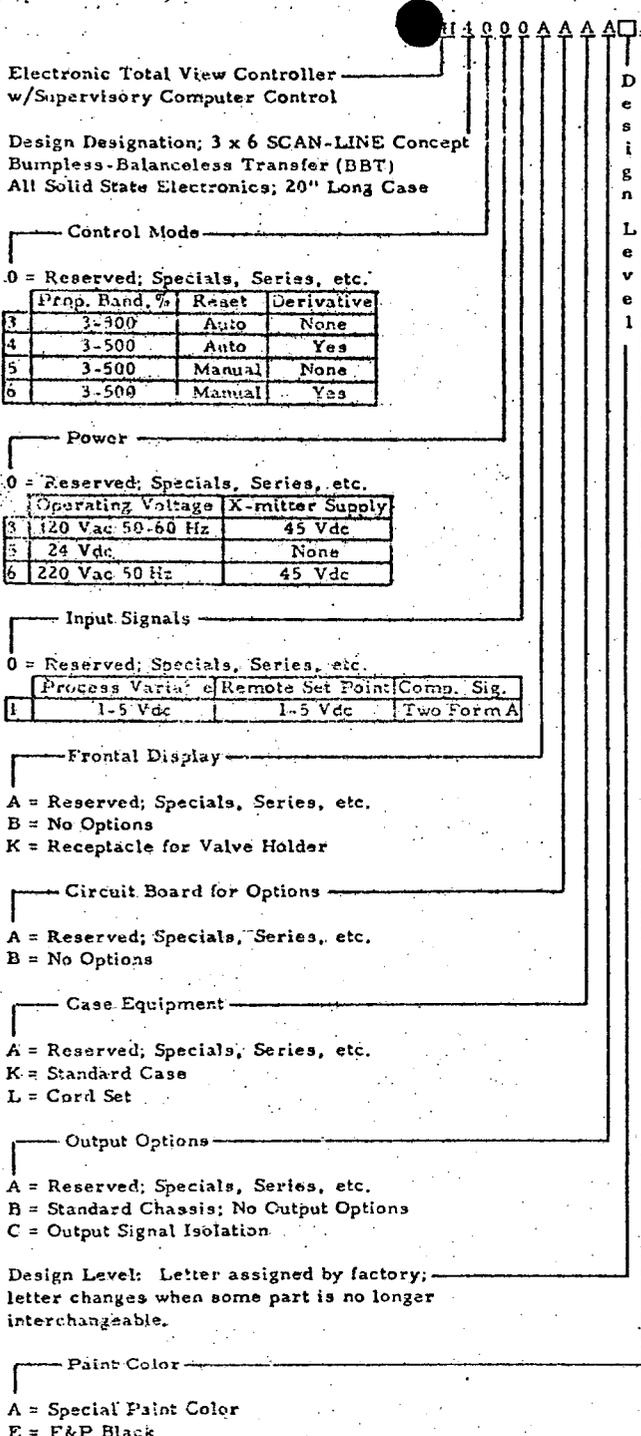
	System With		
	Analyzer Only	Optional Miniature Recorder and/or Controller	Optional Large Case Recorder
A	6-7/16 (164)	8-25/32 (223)	6-7/16 (164)
B	7-15/16 (202)	10-9/32 (261)	7-15/16 (202)
C	35-3/8 (899)	35-3/8 (899)	13-1/2 (343)
D	45-1/2 (1156)	45-1/2 (1156)	23-5/8 (600)

NOTES:

1. All dimensions are in inches (mm are in parenthesis).
2. Required clearance behind cabinet is 26 (560) minimum.
3. Sample inlet conn 1/2 NPT1 x 1/2 (12,5) I.D. hose adaptor.
4. Drain conn. 1 (25,4) I.D. hose adaptor.

5. Junction box with two (2) 3/4 NPT1 electrical connections for power supply and signal output.
6. Four (4) mtg. slots in base for 1/2 (12,7) bolts.
7. Analyzer or optional large case recorder.
8. Analyzer when supplied with optional large case recorder.
9. Optional controller when system is supplied with miniature recorder.
10. Optional miniature recorder or controller.

DCR-647

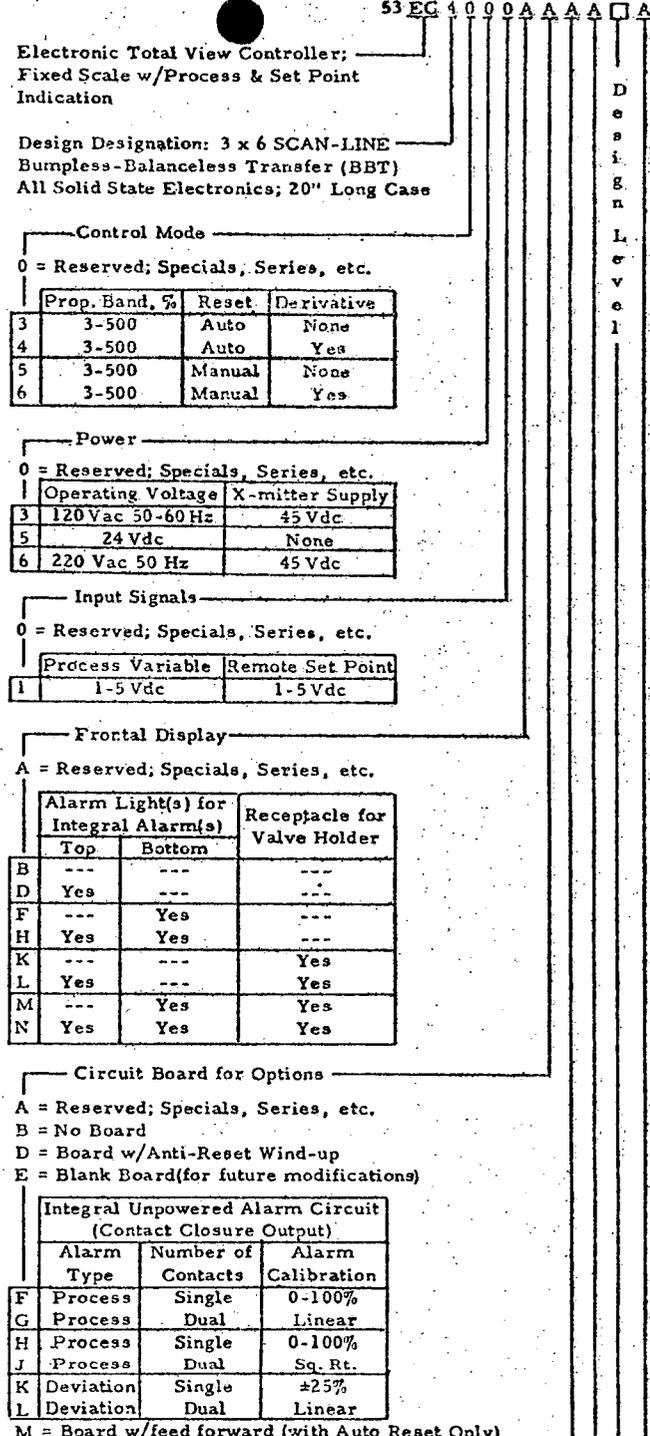


(and vice-versa) shall be balanceless-bumpless and shall be accomplished by two pushbuttons located on the front of the instrument. Manual pushbuttons shall provide two speed control of the output (6 or 100 seconds full scale).

Proportional band and manual reset shall have continuous adjustments. Automatic reset ranges shall be adjusted in 12 steps, derivative ranges are to be adjustable in 11 steps plus "OFF" position-

Indicating controller may be equipped for remote set point computer operation. It shall also be suitable for future field installation of computerized components. Electronic Indicating Control Station shall be F&P Type (53EG), or (53EH).

ORDERING INFORMATION
Specify: Model Number & Options desired.



DCL-647

Electronic TOTAL VIEW Indicating Controller

53EG/EH4000

File Section
57ESL

TYPE 53EG/EH

The Fischer & Porter Total View indicating controllers (Type 53EG and 53EH) provide exceptionally distinct visual indication of process variable and set point, by using two independent meters and an easily changeable fixed scale. The output signal of the controller is indicated on a separate meter, thus allowing the operator to determine the set point, process, and output status at a glance, and makes the Total View station particularly effective in multi-station, high density applications. Balanceless-bumpless transfer from automatic to manual and vice-versa is a standard feature. On manual, push-buttons provide two speed control of the output.

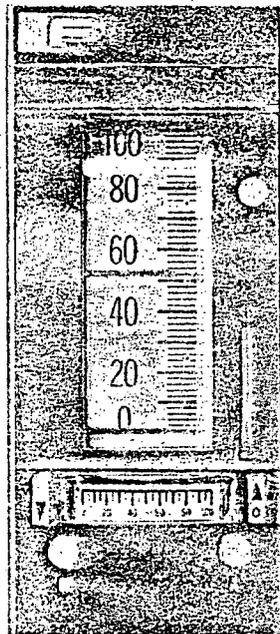
DESIGN FEATURES

- Rapid reading — direct indication on all scales.
- Scales are easily changeable.
- Individual instrument cases allow total flexibility in panel layout.
- Balanceless-bumpless transfer and two speed manual station output for operator's convenience.
- Non-illuminated or illuminated transfer buttons.
- Set point preview with illuminated transfer buttons.
- Set point is visible in either remote or local control.
- Versatile; — standard remote-local set point switch makes unit compatible with ratio, cascade, or computer applications.
- 24 Vdc, 120 Vac, or 220/240 Vac operation.
- High input impedance allows paralleling of instruments.
- Solid state design including integrated circuits for reliability.
- Driftless soft set point for computer application (53EH).
- Balanceless-bumpless transfer between computer and local set point (53EH).
- 53EG field convertible to 53EH.

CONTROLLER TYPES & DESCRIPTION

Type 53EG: Basic analog controller with local set point set via a thumbwheel and an internal switch for cascade (remote set point) application.

Type 53EH: Same as Type 53EG, but with a driftless soft set point for computer applications and front panel switch for computer set point control.



ENGINEERING SPECIFICATIONS

Process Variable Input Signal: 1-5 Vdc or 1-5, 4-20, 10-50 mAdc with use of external shunt resistors.

Set Point Input Signal

Type 50EG — 1-5 Vdc or 1-5, 4-20, 10-50 mAdc with use of external shunt resistors.

Type 50EH — Contact closure. Two Form A Contacts; Contact open or close — 3 milliseconds, minimum. Speed: 100 pulses per second, maximum. Set point change: 0.1% of span per pulse.

Input Impedance (process variable and set point): 1 meg ohm for voltage inputs; 250 ohms for 4-20 mAdc; 100 ohms for 10-50 mAdc; 1000 ohms for 1-5 mAdc.

Output: 4-20 mAdc into loads of 0-750 ohms; 0-1000 ohms with output isolator (reduce load by 100 ohms when Valve Holder is specified).

Performance

Gain — Zero frequency gain greater than 1000.

Tracking — $\pm 0.1\%$ of span.

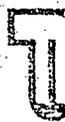
Accuracy of Indication — (process & set point) $\pm 1.5\%$ of span.

Operational Limits

Temperature Limits: 4° to 52°C (40° to 125°F).

Temperature Effect — 0.5% per 28°C (50°F) from ref temp of 25°C (77°F)

DCR-647



SPECIFICATION 53EG/EH4000

Proportional plus automatic reset.
Proportional plus manual reset.
Proportional plus automatic reset plus derivative.
Proportional plus manual reset plus derivative.
Control Ranges
Proportional Band — 3-500% with automatic or manual reset; continuously adjustable.
Reset:

Automatic — 0.02 to 50 minutes (12 steps)

Manual — Continuously adjustable (0-100%).

Derivative: 0.01 — 8 minutes (11 steps and off).

Auto-Manual Transfer (and vice versa): Balance-less-bumpless transfer (BBT) via two non-illuminated or illuminated pushbuttons. The optional illuminated pushbuttons are provided with a separate momentary switch for set point preview to aid in transferring between local and remote set points.

Manual Control

By two speed increase and decrease pushbuttons. 6 or 100 seconds full scale drive.

Manual Control Drift — 1% of span maximum per 8 hours at reference conditions.

Local Remote Switch

Two position switch located on instrument chassis.

Type 50EG — When on remote set point, indicating light on front of instrument is illuminated.

Type 50EH — When on computer set, indicating light on front of instrument is illuminated.

Output Limiters

One high and one low output limiter located on instrument chassis (limiters are on automatic operation only).

Approximate Range — 2-22 mA dc both limiters.

Electrical Requirements

Standard — 120 Vac ($\pm 10\%$), 50/60 Hz.

Optional — 24 Vdc ($\begin{smallmatrix} +2 \\ -0 \end{smallmatrix}$),
220/240 Vac ($\pm 10\%$), 50 Hz.

Power for two wire transmitter is 45 Vdc ($\pm 10\%$); @ 20 mA dc, short-circuit protected.

Power Consumption (basic controller)

ac powered (53EG) — 17 VA; 12 Watts

ac powered (53EH) — 25 VA; 18 Watts

dc powered (53EG) — 0.200 Adc

dc powered (53EH) — 0.300 Adc

Materials of Construction

Chassis — Aluminum with cast aluminum bezel

Circuit Boards — Coated glass-epoxy

Case — Steel

Mounting: Flush panel. Requires 3x6 inch cutout. Units can be mounted on 3-inch horizontal centers and 9-inch vertical centers on a high density mounting grid.

Scales

Process & Set Point — Changeable 3-1/4" vertical; 0-100% graduations (other scales are available). See Catalog S-59 for standard scales available.

Output — Horizontal, fixed, 1-5/8-inches scale graduated 0-100%.

board. Knockout holes for 1/2" or 3/4" conduit.
Dustproof removable rear cover included.
Weight: Approximately 15 pounds (6.8 kg).

OPTIONS & ACCESSORIES

Integral Process and Deviation Alarms (Type 53EG Only):

ENGINEERING SPECIFICATION

Type of Alarms:

Process Alarms	Deviation Alarms
low alarm	minus deviation alarm
high alarm	plus deviation alarm
low and high alarms	minus and plus deviation alarms

Alarm Range: 0-100% for process alarms. $\pm 25\%$ for deviation alarms.

Setting Mode: by calibrated dial(s).

Process Dial: 0-100 linear, 0-100 square root.

Deviation Dial: 0-25 linear.

Alarm Relay Contacts: Single pole, single throw, normally closed contact (contact closed on alarm or on power failure).

NOTE: For two alarms (high-low construction or plus-minus deviation three connections are brought out to rear of case.

Alarm Contact Rating: 10 Watts (resistive 0.5 Amp. maximum).

Dial Setting Accuracy: $\pm 5\%$ for process alarms. $\pm 2\%$ for deviation alarms.

Repeatability: 0.5% of span.

Deadband (fixed): 0.3 to 0.7% of span.

Alarm Lights: One or two alarm lights located on front of instrument. Available only in conjunction with integral alarms.

Valve Holder Receptacle: Allows replacement of the controller by a portable "Hard" manual loading station (Type 55VH) without disturbing the final control element.

Anti-Reset Windup Module — prevents process variable overshoot in a process start-up situation.

Feed Forward Module — provides corrective action to cancel process disturbance before it affects the controlled variable.

Cord Sets — simplifies panel wiring.

Special Bezel Colors

Output Signal Isolation

Class I, Group D, Division 2 construction (24 Vdc or 120 Vac versions).

EQUIPMENT DESCRIPTION

The indicating control station shall be Total-View design, solid state electronic model housed in a 3" x 6" x 20" case suitable for single, multiple, or high density panel mounting. It shall have a highly readable, changeable scale (1-11/32" wide by 3-1/2" high) and shall have an output of 4-20 mA dc into 0-750 ohms without load adjustments. Output signal limiters shall be a standard feature.

The unit shall be provided with a two-position switch to provide for control from local or remote set point. EG: When instrument is set on remote set point, a light on front of instrument is illuminated. EH: When instrument is set on computer set point control, a light on front of instrument is illuminated.

Transfer from automatic to manual control

3 x 6-Inch Miniature Electronic Recorder

TYPE 1321

The Fischer & Porter Miniature Electronic Recorder is a null balance, servo-operated, strip chart potentiometer using a unique TORQ-ER™ motor which incorporates a "Flux-Bridge" (contactless feedback system). The 3 x 6 inch Recorder is available with one or two servo-operated pens. Each pen has its own scale and records on a 4-inch rectilinear chart.

Solid state integral alarm(s) with alarm light(s) are available for one or two pen recorders. The Type 1321 recorder is compatible in appearance with F&P SCAN-LINE® instrumentation. It can be mounted individually or in a high density array without the use of special packaging.

DESIGN FEATURES

- TORQ-ER motor with a "Flux-Bridge".
- Integrated circuits for greater reliability.
- Adjustable damping.
- Servo-operated pens.
- Electrically isolated inputs.
- Electrical zero and span adjustment — no mechanical adjustment.
- Pull-out chassis provides 10 hours of chart visibility without disturbing operation.
- All components integrally mounted.
- Optional solid state alarm(s) and alarm light(s)
- Approved by  for intrinsic safety in "ESL System 24".
- Optional two-wire transmitter power supply.
- Optional cord set.
- Optional connector type cord set

ENGINEERING SPECIFICATIONS

Input Signals: Standard 1-5 Vdc or 1-5, 4-20 or 10-50 mAdc derived through use of external shunt resistors; Optional — 0-4 Vdc or 0-1 Vdc. Recorder can be adapted to accept many other current or voltage signals.

Input Impedance (Voltage inputs): 250 k ohm/volt

Performance (at reference conditions)

Accuracy: ± 0.5% of span

Dead Band: 0.1% of span

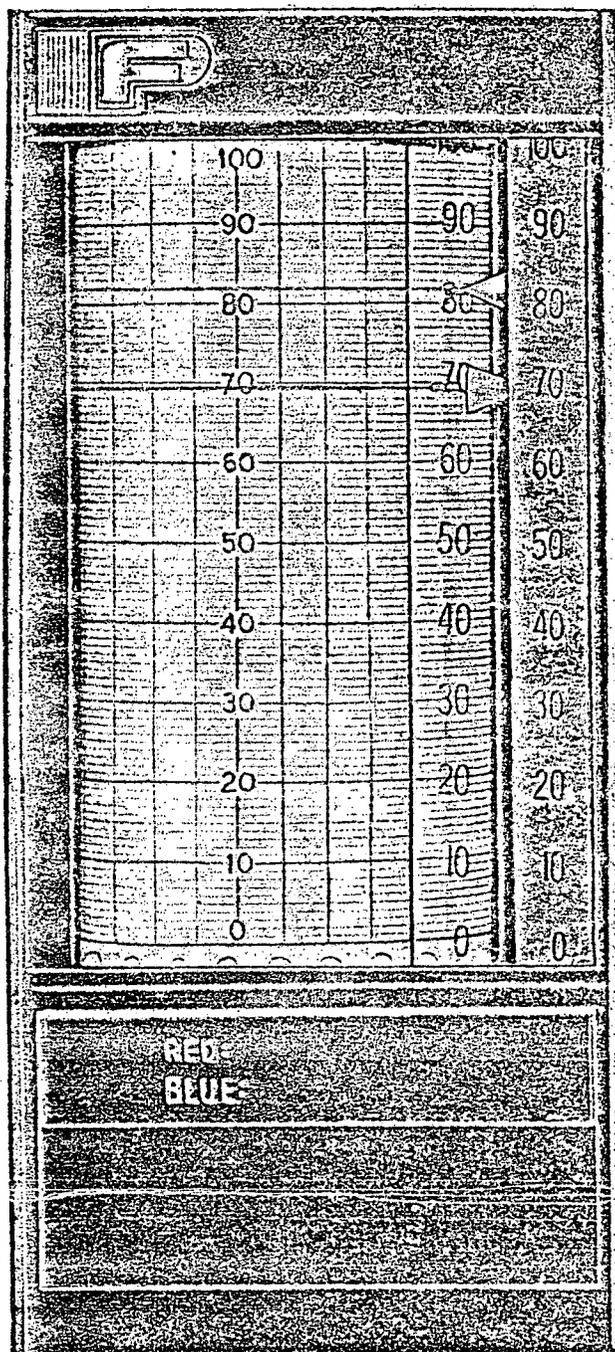
Repeatability: 0.2% of span

Pen Speed: Adjustable 0.33 seconds to 20 seconds for 63.2% recovery from step input change.

Operational Limits: 40° to 120°F ambient temperature (4° to 52°C).

Power Supply: 120 Vac ± 10%, 50 or 60 Hz, 24 $\frac{1}{2}$ Vdc, 220 Vac ± 10% 50 Hz.

Two-Pen Recorder



Power Consumption

120 Vac Units

1 Pen: 14.2 W, 17.4 VA

2 Pen: 17.8 W, 21.1 VA

24 Vdc Units (Current draw)

1 Pen: 80 mA

2 Pen: 160 mA

NOTE: 24 Vdc units will require 120, 220 or 24 Vac for chart drive. Chart drive power consumption is 6.7 W, 7.9 VA.

DCL-647

F&P

SPECIFICATION 51-1321
Supersedes Specification 51-1321
Issued August 1972

Type of Alarms:

Low Alarm
High Alarm
Low & High Alarms

Alarm Range: 0-100% full scale

Setting Mode: By-25 turn potentiometer(s)

Alarm Relay Contacts: Single pole; single throw, normally closed contact (contact closed on alarm or on power failure).

NOTE: Normally open contacts (contact open on alarm or on power failure) are available on a special basis.

NOTE: For 2 alarms (high-low construction) Three connections are brought out to rear of case.

Alarm Contact Rating: 2 A max. @ 28 Vdc resistive load or 0.5 A max. @ 120 Vac resistive load.

Alarm Lights: One red alarm light supplied with each alarm. Alarm lights are energized on alarm condition.

Availability of Alarms

Single Pen Recorder: One high and/or one low alarm.

Two Pen Recorders (alarm on-red pen only): same arrangement as single pen recorder.

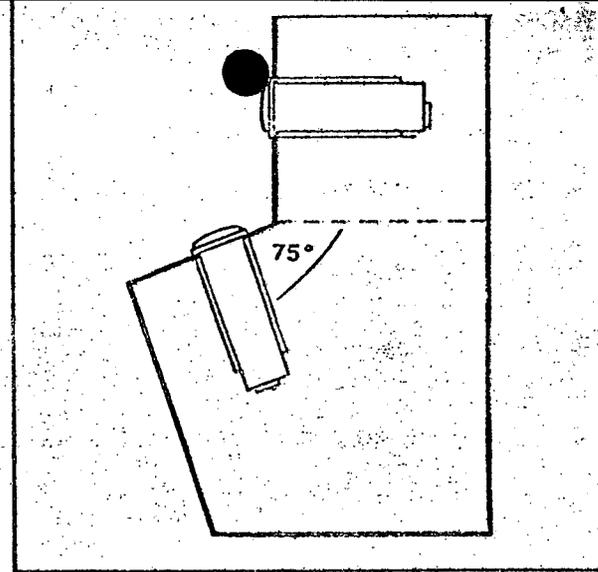
Two Pen Recorders (alarms on both pens): one high or one low alarm per pen, in any combination.

Dial Setting Resolution: 0.4% of span

Repeatability: 0.2% of span

Deadband (fixed): 0.75% of span (average)

Mounting: Flush panel. Instrument may be angle-mounted on panels or consoles up to 75° below



horizontal (see drawing above). Requires 3 x 6 inch cutout. Units can be mounted on 3-inch horizontal centers and 9-inch vertical centers or on 6-7/8-inch vertical centers on a high density mounting grid.

Electrical Connections: Barrier type terminal board. Knockout holes for 1/2-inch or 3/4-inch conduit. Dust-proof removable rear cover included.

Materials of Construction

Case: Enameled steel

Door: Enameled die cast door with plastic window (standard color is black).

Chassis: Aluminum with cast aluminum bezel.

Circuit Boards: Glass-epoxy.

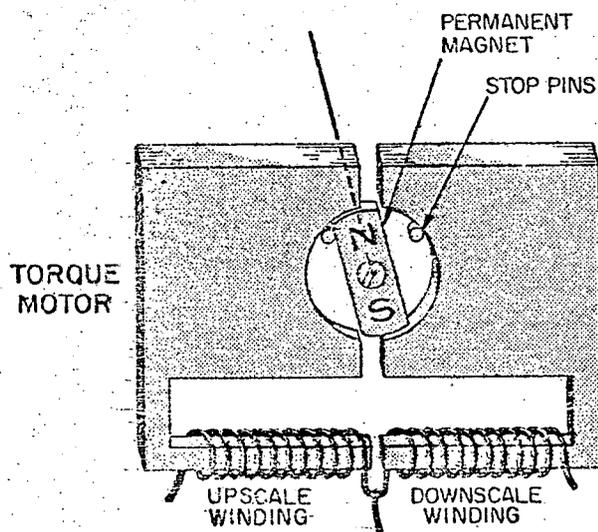


Fig. 2 —TORQ-ER— The prime mover for the Fischer & Porter Electronic Recorder is a TORQ-ER illustrated in sketch above. It consists of a permanent magnet armature that is actuated by the application of a dc current (120 mA) through either an upscale or a downscale winding. Important features are:

- Drive current does not flow through either coil unless the movement is necessary (unlike rotary solenoid where current flows even during static condition thus generating heat).
- Rotation is limited (35 degrees) — eliminating need for drive cords or reduction gears.
- DC operation — allowing easier emergency back-up.

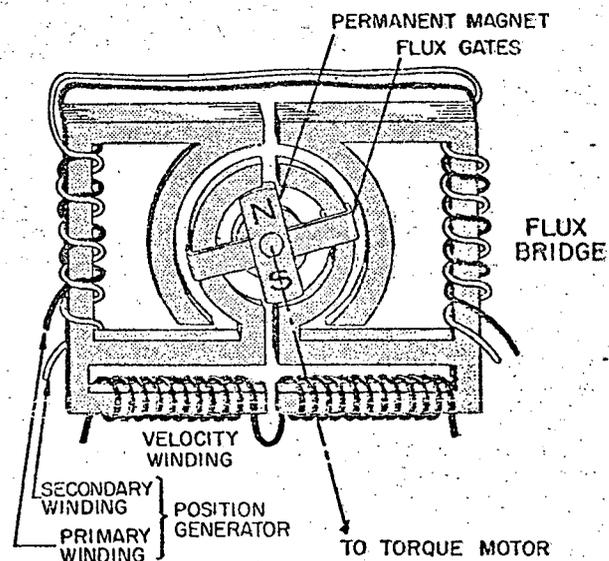


Fig. 3 —FLUX BRIDGE— The unique Fischer & Porter "Flux Bridge" is a contactless solid state position feedback device used in conjunction with the TORQ-ER previously described. A 10 kHz oscillator in the amplifier is used to energize the primary coils. The voltage developed in the secondary coils is proportional to the position of the gates that are directly coupled to the TORQ-ER armature shaft providing a feedback signal proportional to armature position. A permanent magnet attached to the flux gates operates in conjunction with a velocity coil to provide a rate (proportional to speed) feedback signal. This signal is applied as a degenerative feedback to the amplifier input to reduce the pen speed.

Inking System: High rise capsule/capillary inking system using fiber tip pens.

Ink Supply: Up to 6 months

Ink Colors: First pen, red; second pen blue.

Chart: 4-inch vertical, rectilinear strip chart with a duration of one month under normal operation. (7/8 inch per hour).

Chart Ranges: See Catalog C-59

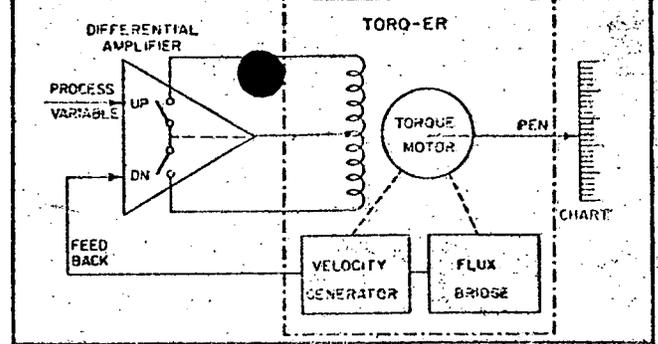
Chart Speed: Standard, 7/8-inch per hour; optional, 2-5/8-inch per hour, 13-1/8-inch per hour, 7/8-inch per minute and 2-5/8-inch per minute. Other speeds available as special options.

Optional Two Speed Chart Drive: Any combination of above listed single speed chart drives.

NOTE: On instrument with two speed chart drive 3 position (low-off-high) chart mechanism switch is standard.

Scales: A 4-inch vertical scale with numerals is provided for each pen.

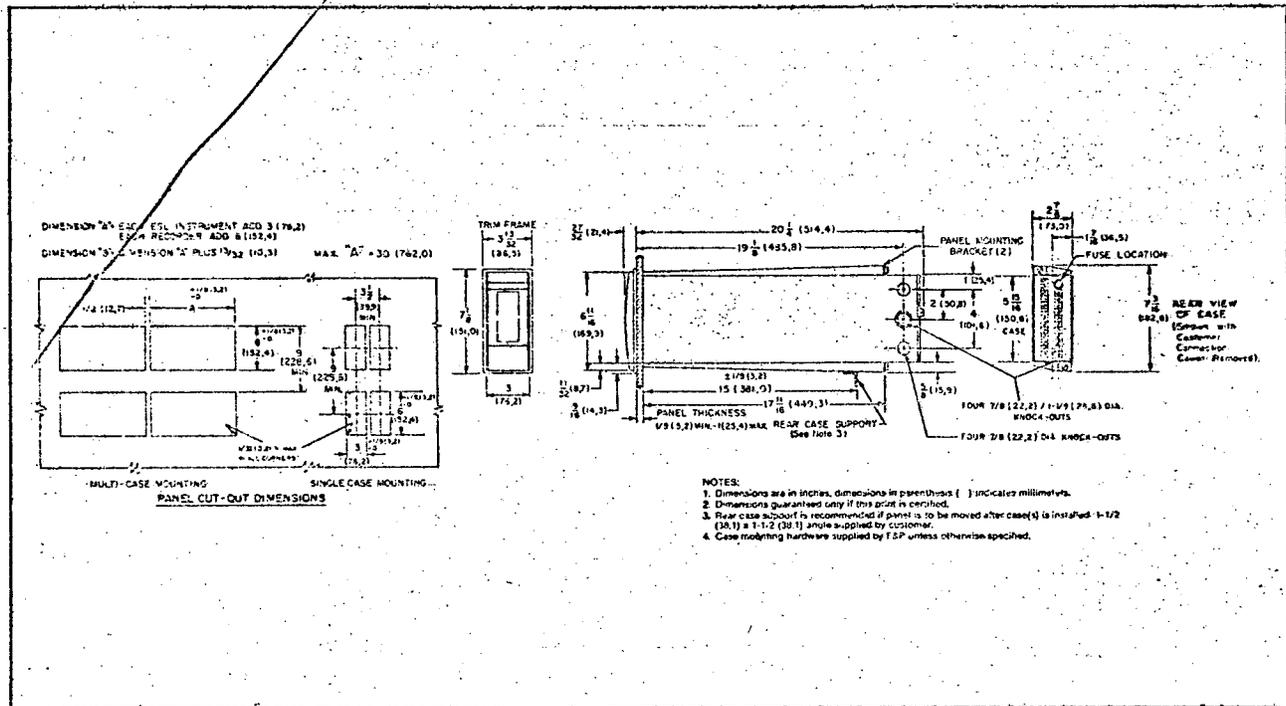
Output of Optional Power Supply for Two Wire Transmitter: 24-27 Vdc @ 20 mAdc for each pen.



OPERATION OF 3 x 6 RECORDER

As shown, the process variable signal is an input to a differential amplifier that energizes solid state "up" or "down" switches located within the amplifier assembly. These switches apply current to the TORQ-ER (see Fig. 2) which positions the pen on a 4-inch rectilinear chart. The TORQ-ER is also connected to a Flux-Bridge (see Fig. 3) and velocity generator to provide a pen position feedback signal as a second input to the differential amplifier.

DIMENSIONS



EQUIPMENT DESCRIPTION

The 3 x 6-inch Miniature Electronic Recorder, Type 1321 shall be of solid state design and shall be equipped with servo operated pen(s). The instrument shall contain a TORQ-ER servo motor with a "Flux-Bridge" (contactless feedback system). The instrument may be supplied with one or two recording pens and all components associated with the recorder shall be mounted inside the recorder case. The recorder shall utilize rectilinear charts. The pull out chassis will provide 10 hours of visible chart without disturbing operation of the recorder.

The recorder may be powered by a 120 Vac or 24 Vdc and shall be suitable for 1-5 Vdc input or 1-5, 4-20, 10-50 mAdc derived through use of external

shunt resistors. The recorder may be also supplied with other optional input ranges.

The instrument may be also supplied with the following optional features: one or two solid state process variable alarms per pen and a dual speed chart speed mechanism.

The recorder shall match in appearance other Fischer and Porter board mounted electronic instruments and shall be suitable for horizontal high density mounting on a 3-inch centers.

To complete the EQUIPMENT DESCRIPTION of a specific unit, include data outlined under ORDERING INFORMATION.

DCL-647

ORDERING INFORMATION

Order by instrument type number and word description and/or model number.

Specify:

Number of Pens

Scale(s) and chart range

Input signal

Power supply (on 24 Vdc instrument specify chart drive voltage).

Power supply frequency

Chart speed

Specify Options:

Special input signal(s)

Dual speed chart mechanism

Transmitter(s) power supply

Cord set

Connector type cord set

Special paint

Alarm(s)

Class I, Group D, Div. 2 construction

MODEL NUMBER DESIGNATION

See table marked with corresponding digit number for proper placement of digits in model number.

Electronic Scan-Line Recorder 51-1321 DBX 1 LB M
 1 2 3 4 5 6 7

One Pen Recorder -Red Pen-

		CBX	DBX	EBX	FBX
Record Only		X			
Alarm	High		X		
	Lo			X	
	Hi & Lo				X

Two Pen Recorder -Red and Blue Pens-
Alarms on Red Pen Only

		CCX	DCX	ECX	FCX
Record Only		X			
Alarm	High		X		
	Lo			X	
	Hi & Lo				X

Two Pen Recorder -Red and Blue Pens-
Alarms on Both Pens

		DDX	DEX	EDX	EEX
Alarm	Hi Hi	X			
	Hi Lo		X		
	Lo Hi			X	
	Lo Lo				X

Red Pen Blue Pen

Input Signal	2
1-5 Vdc	1
0-4 Vdc	2
0-1 Vdc	3

Amplifier and Chart Drive Power Requirements

Amplifier Voltage	Chart Drive Voltage	3
120 Vac, 50-60 Hz	120 Vac, 60 Hz	1B
	120 Vac, 50 Hz	1C
24 Vdc	120 Vac, 60 Hz	2B
	120 Vac, 50 Hz	2C
	24 Vac, 60 Hz	2D
	24 Vac, 50 Hz	2E
220 Vac, 50 Hz	120 Vac, 60 Hz	3B
	120 Vac, 50 Hz	3C

Note: Model number designation X stands in place of Factory code identification. Proper digit is assigned by Factory and computer spacing requirement is assured by using X.

Chart Drive Selection			4
Chart Speed	Chart Switch		
	With	Without	
7/8"/h	X		B
		X	C
2-5/8"/h	X		D
		X	E
13-1/8"/h	X		F
		X	G
7/8"/min	X		H
		X	J
2-5/8"/min	X		K
		X	L
Dual Speed Chart Drives Inc. "Slow-Off-Fast" Switch			
7/8"/h & 7/8"/min			M
2-5/8"/h & 2-5/8"/min			N
13-1/8"/h & 2-5/8"/min			P

2-Wire Transmitter Power Supply	5
Without Power Supply	X
No. 1 Pen	B
No. 2 Pen	C
No. 1 & No. 2 Pens	D

Case Equipment	6
Standard Case	1
With Cord Set	2
With Connector Type Cord Set	3

Paint Color	7
F&P Black	1

Note: Specifications are subject to change without notice.

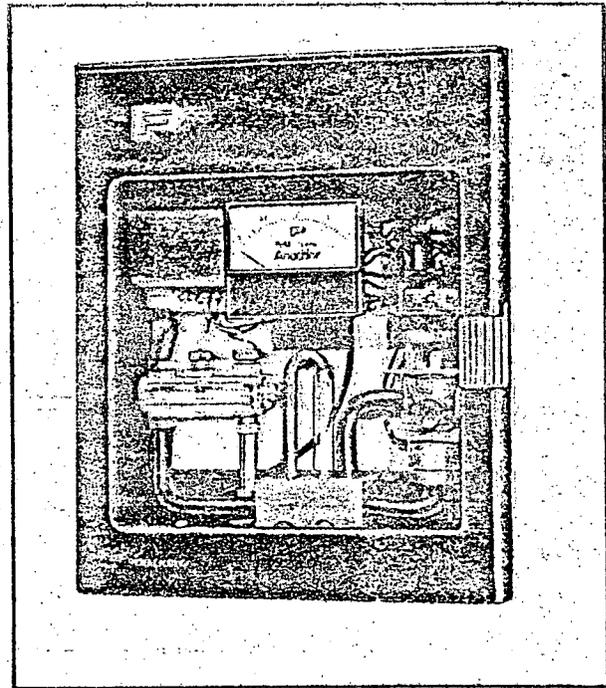
Anachlor™ Residual Chlorine Analyzer Transmitter

SERIES 17B4200

The Series 17B4200 Anachlor Residual Chlorine Analyzer Transmitter is an amperometric device designed to provide continuous measurement of the concentration of residual chlorine in water. The analyzer uses a flow through measurement cell containing two dissimilar metal electrodes. As the water sample flows past the electrodes, a current is generated which is directly proportional to chlorine concentration. Either free or total chlorine residual may be measured by proper reagent selection.

A specially-designed, solid-state amplifier and signal conditioner mounted within the analyzer converts the generated current signal to an isolated 4-20 mAdc output suitable for use with standard electronic secondary instruments. Necessary zero and span adjustments are part of the circuitry and automatic temperature compensation of the cell output is supplied to eliminate errors due to changes in sample water temperature.

The analyzer is also supplied with a self-contained direct reading indicator to eliminate the need for additional instrumentation at the point of measurement. This feature permits wall mounting of the analyzer on a swivel bracket with electronic transmission to remotely



located recording and controlling instrumentation. For systems with the Anachlor analyzer and associated instruments mounted in the same cabinet, refer to Specification 17SC1000.

DESIGN FEATURES

- **Wall Mounting:** Provides easy access for routine maintenance functions. Permits location near point of measurement with electronic transmission to remotely located instruments.
- **Low Cost:** No need for expensive cabinets and instrumentation. Reagent cost is minimized by automatic reagent feed system using dilute acetic acid.
- **Convenience:** Continuous operation frees operator for other duties by eliminating the need for frequent laboratory testing.
- **Reliability:** Electrode surfaces are continuously cleaned by action of non-abrasive pellets. Automatic temperature compensation is standard.
- **Easy Maintenance:** Ruggedly constructed components are readily accessible for easy disassembly.

ENGINEERING SPECIFICATIONS

Operating Range: 0-0.5, 0-1, 0-2, 0-3, 0-5, 0-10 and 0-20 milligrams per liter (mg/l)* ranges are standard; other ranges available upon request.

Sample Requirements: Water for analysis must be supplied at a reasonably constant pressure of between

* mg/l = 1 part per million

0.5 and 2 psig (3.5 - 13.8 kPa) at a flow of 0.5 gpm (2 l/min) minimum.

Sample Conditioning: Turbidity and chemicals normally found in raw and treated waters do not affect cell operation. However, potassium permanganate and ozone do have an adverse effect. A motor-driven filter is recommended when settleable solids are present in the sample.

Output: 4-20 mAdc into 750 ohms maximum.

Sensitivity: The analyzer will recognize and respond to residual changes as low as 0.01 mg/l chlorine.

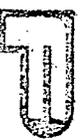
Ambient and Sample Temperature Limits: 0 - 50°C (32 - 122°F)

Temperature Compensation: A thermistor provides automatic signal compensation for changes in sample temperature.

Power Supply Requirements: 120 Vac ± 10% @ 50/60 Hz.

Chemicals: The analyzer is designed to use dilute acetic acid for pH reduction. If desired, conventional pH 4 buffer solution may be used. Potassium Bromide (ref. US Patent No. 3,412,199) is used for free residual measurement. Potassium Iodide and Sodium Hydroxide are used for total residual measurement. A 30-day supply is furnished with the analyzer.

DCL-647



SPECIFICATION 17B4200
 SUPPLEMENT 17B4200
 ISSUED JUNE 1973

Connections

Sample Inlet: 1/2-inch (12,5 mm) ID hose adaptor.
 Drain: 1-inch (25,4 mm) ID hose adaptor.
 Electrical: Two 7/8-inch (22,2 mm) dia. holes for 1/2 inch (12,5 mm) conduit connections.

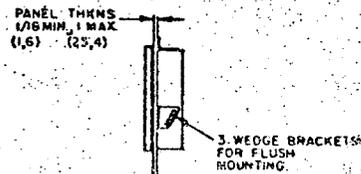
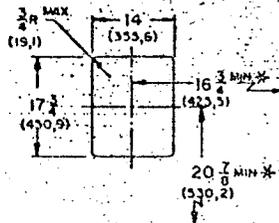
Indicator: Integrally mounted within the analyzer and direct reading in mg/l residual chlorine. Accuracy

is $\pm 2\%$ full scale.
 Note: Indicator may be located nearby if other indicating device is located nearby.

Materials of Construction: All materials in contact with water sample resist corrosion from chlorinated water, waste water, and added reagents. Measurement cell, thermistor, and other components are housed in a die-cast aluminum case finished with corrosion-resistant paint.

Shipping Weight: Analyzer — 35 lb (15,9 kg);
 Chemicals (one month supply) — approx. 20 lb (9 kg).

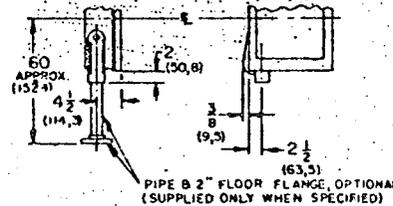
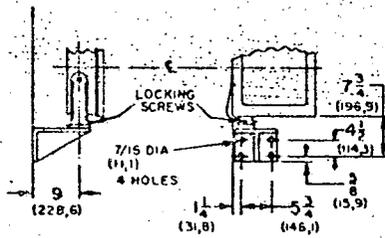
DIMENSIONS



* MINIMUM DISTANCE OF INSTRUMENTS FROM CENTERLINE TO CENTERLINE.

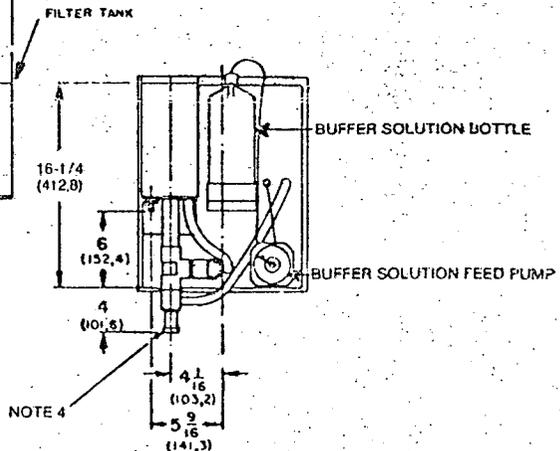
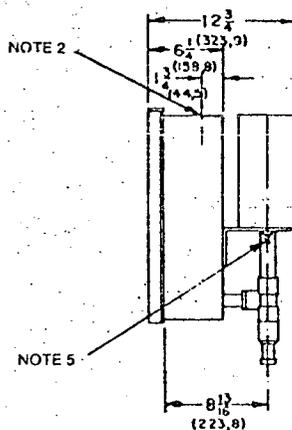
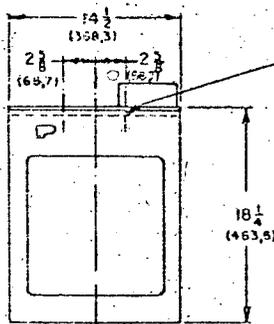
FLUSH MOUNTING

MINIMUM CLEARANCES TO SWING INSTRUMENT FOR SERVICING OF PIPE OR SURFACE MOUNTED UNITS.



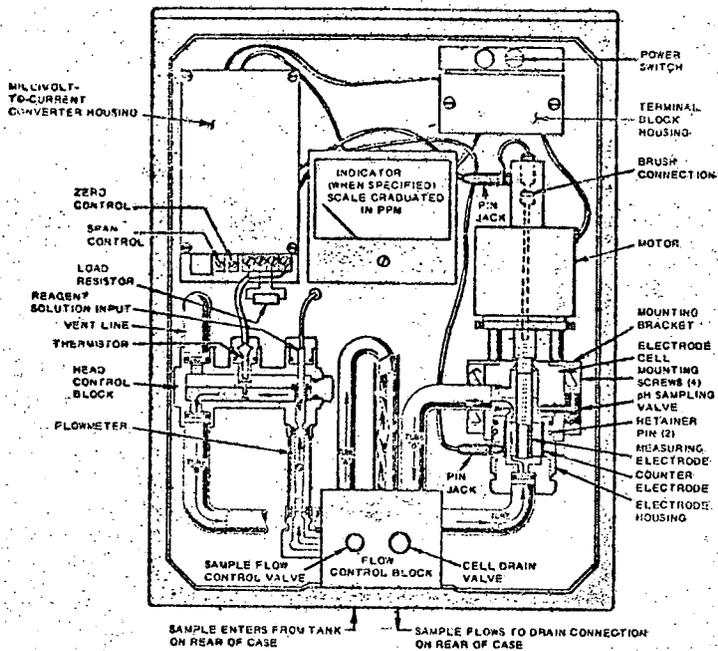
SURFACE MOUNTING

PIPE MOUNTING



NOTES

1. All dimensions in inches, mm in parentheses.
2. Power supply & signal output — two 7/8" (22,2) dia. holes by 1/2" (12,5) electrical conduit connections.
3. Pipe & surface mounting require rigid support for instrument, approximate weight of 40 lbs (18,1 kg).
4. Drain connection — 1" (25,4) I.D. Hose Adaptor.
5. Sample Inlet connection — 1/2" (12,5) I.D. Hose Adaptor.



OPERATION OF ANALYZER UNIT

The sample stream is filtered in the tank on the back of the housing, and then enters the Analyzer unit through the inlet in the rear of the Flow Control Block. It passes through the Sample Flow Control Valve and up the metering tube into the Head Control Block where reagent (dilute acetic acid or buffer solution to maintain constant pH) is smoothly and continuously added by means of a special positive displacement-type Feed Pump Assembly.

Buffered sample flows down through the Flow Control Block and up to the bottom of the Electrode Cell Assembly. Sample flow rate is adjusted to approximately 150 cc per minute. Flow rate is not critical since the relative velocity between the measuring electrode and the sample is established by rotating the electrode at high speed.

In the Electrode Cell Assembly, the sample passes up through the annular space between the concentrically mounted outer (copper) Counter Electrode and inner (gold) Measuring Electrode and out to the drain.

The space between the electrodes contains plastic pellets which are continuously agitated by the swirling of water in the cell. The pellets keep the electrode surfaces clear of any material which might tend to adhere.

The Measuring Electrode is coupled to a motor which operates at 1550 rpm. The electrical signal from the Measuring Electrode is picked up by a spring-loaded brush on top of the motor and the circuit is completed

through a thermistor for temperature compensation, precision resistors and the stationary counter electrode.

The composition of the electrodes is such that the polarization of the Measuring Electrode prevents current flow is the absence of a strong oxidizing agent. The presence of the smallest trace of strong oxidizer, such as chlorine, will permit a current to flow by depolarizing the electrodes. The amplitude of the self-generated depolarization current is proportional to the concentration of the strong oxidizing agent. The generated current is passed through a precision resistor, and the millivoltage across the resistor is applied to the specially designed solid state amplifier and signal conditioner. Suitable zero and span adjustments can also be made to calibrate the electronic 4-20 mAdc amplifier output to read in terms of residual chlorine concentration and display it on the direct reading indicator.

When measuring free residual, Potassium Bromide is added to the buffer and reacts with the free chlorine to liberate bromine in an amount equal to the free chlorine. The bromine depolarizes the measuring cell in the same manner as chlorine does and a current directly proportional to the free residual is generated.

When measuring total residual, potassium iodide is added to the buffer. This reacts with the free and combined chlorine to liberate iodine in an amount equal to the total chlorine. The iodine depolarizes the cell in the same manner as chlorine and a current directly proportional to the total residual is generated.

DCR-647

EQUIPMENT DESCRIPTION

The Residual Chlorine Analyzer Transmitter shall be of the amperometric type for the measurement of (free) (total) chlorine residual over a range of 0 to _____ mg/l. The sampling cell shall contain two dissimilar metal electrodes which continually detect the chlorine concentration and generate a proportional current signal. The cell shall be provided with non-abrasive plastic pellets which are continually impelled against the electrodes to prevent the adherence of any foreign material to the electrode surfaces. The noble metal electrode shall be rotated by a motor drive to provide the impelling force for the cleaning pellets and to eliminate the need for close control of sample flow rate. A constant head tank with a plastic mesh sleeve type filter shall be part of the analyzer.

A thermistor, immersed in the sample stream, shall form a part of the electrical circuit to compensate automatically for all changes in cell output due to sample temperature changes. The analyzer shall be furnished with a sample flow rate meter to permit easy setting of the optimum flow. The reagent feed pump shall be a motor-driven, positive displacement type, and shall pump dilute acetic acid into the sample to reduce the pH to a suitable measuring level. The analyzer shall be complete with integral solid state amplifier/signal conditioner with 4-20 mA dc output. The Residual Chlorine Analyzer Transmitter shall be the Fischer & Porter Series 17B4200 Anachlor analyzer with integral direct reading indicator and shall be designed for (wall) (panel) (pipe stand) mounting.

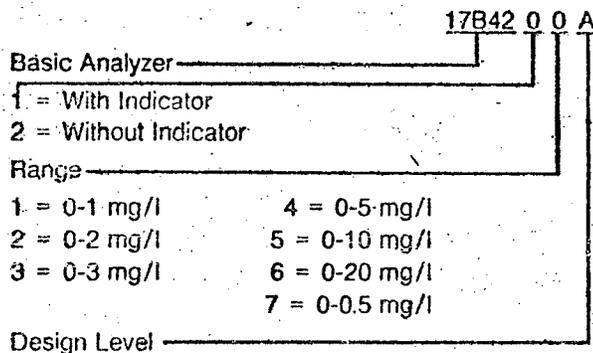
OPTIONAL EQUIPMENT

- Motor-driven filter
- Sample Pump
- Amperometric titrator
- Remote indicator/recorder/controller
- Additional chemicals
- Modification for break point application
- Modification for sea/salt water application

ORDERING INFORMATION

- Series Number
- Voltage and frequency
- Optional equipment
- Application (raw water; finished water, water pollution control plant effluent)
- Range in mg/l
- Free or total residual measurement
- Mounting arrangement

MODEL NUMBER DESIGNATION



Note: Specifications are subject to change without notice.