**FINAL REPORT
FOR
DIRECT DISCHARGE SYSTEM**

**CHARLES GIBSON SITE
TOWN OF NIAGARA, NEW YORK**

Prepared for:
Olin Corporation

Prepared by:
Rust Environment & Infrastructure
Greenville, South Carolina

May 1997

List of Attached Drawings:

Drawing No.

	Cover Sheet
1	Site Plan
2	Civil/Mechanical Details
3	Electrical Details

1.0 INTRODUCTION

The Charles Gibson Site (Site) is a remediated inactive hazardous waste disposal site (NYSDEC Registry No. 9-32-063) located in Niagara Falls, New York. The remedy consisted of re-routing a section of Cayuga Creek around and away from the disposal area, installation of a fully circumscribed slurry wall barrier and installation of a double flexible membrane liner cap with a perimeter collection drain system. The remedial action was completed in 1990. Plans for the operation and maintenance (O&M) of the containment remedy for the site and long term groundwater monitoring are in place.

During 1996, construction of a sewer connection was completed which allows direct discharge of groundwater from the perimeter collection drain system to the local wastewater treatment facility. The direct discharge system became fully operational during March 1997 and is monitored under a discharge permit (No. 45) issued by the City of Niagara Falls Wastewater Treatment Facility (Appendix A).

1.1   Background

Prior to the construction of the direct discharge system, groundwater was pumped from the Site (Manhole B) on a periodic basis and transported to an approved TSD facility for disposal. The objectives of the direct discharge system were to minimize operation and maintenance, and allow for real time measurement of the volume of groundwater being discharged to the sanitary sewer system.

1.2   Direct Discharge System Approvals

Design and installation of the direct discharge system were completed with active participation of the New York State Department of Environmental Conservation (NYSDEC), Town of Niagara, and the City of Niagara Falls. All sanitary sewer system tie-in requirements for the Town of Niagara were met during design and construction. The NYSDEC was provided design drawings.

2.0   DIRECT DISCHARGE SYSTEM

The direct discharge system consists of an automatic pumping system that discharges, through dual containment pipe, to the sanitary sewer system. A flow monitoring system records daily discharge data via telemetry to Olin Corporation.

2.1 Groundwater Collection and Transfer

Groundwater is collected in a perimeter collection drain system installed as part of the Site remedy. A ½ hp submersible pump was installed at the bottom of Manhole B, located in the southeast corner of the Site. The pump operates automatically based on the level of groundwater within Manhole B. Float switches for the pump are set so that the pump maintains a groundwater level which provides an inward gradient. The pump float switches are set to turn the pump on at elevation 564.474 feet, and to turn the pump off at elevation 561.00 feet.

Collected groundwater is pumped to the sanitary sewer line on Tuscarora Road through a dual containment pipe. The dual containment piping was installed using directional drilling techniques. The pipe was installed under the Site cap as shown on the attached drawings. The carrier pipe is a 2-inch, high density polyethylene (HDPE) pipe. Secondary containment is provided using a 4-inch HDPE pipe. All pipe connections were made using butt fusion techniques. The pipe penetration at Manhole B was extrusion welded to the HDPE manhole. The 4-inch pipe was connected to the existing house connection. A cleanout was installed downstream of the connection for maintenance purposes.

2.2 Instrumentation and Control Functional Description

All the instrumentation and control equipment is located in a NEMA 4X enclosure as shown on the attached drawings. A Sparling (Tiger Mag) magnetic flow meter was installed in Manhole B. The magnetic flow meter transmits a pulse output (one pulse equals 10 gallons pumped) to the flow meter transmitter. The flow meter transmitter totalizes daily flows and communicates with the phone dialer. The phone dialer transmits daily flow totals via telemetry to Olin Corporation. The detailed Instruction, Operation and Maintenance Manual for the instrumentation is included in Appendix B.

3.0 MONITORING AND REPORTING

The Site monitoring and reporting requirements for the City of Niagara Falls Wastewater Discharge Permit No. 45 are summarized in Table 1.

TABLE 1

CHARLES GIBSON SITE
1505 Tuscarora Road
Niagara Falls, NY 14304
Discharge Monitoring Permit No. 45
Permit Monitoring Station Identification: MS#1 (Manhole B)

DISCHARGE LIMITATIONS AND MONITORING REQUIREMENTS

PARAMETER	DISCHARGE LIMITATIONS			MONITORING REQUIREMENTS	
	Annual Avg.	Daily Max.	Units	Measurement Frequency	Sample Type
Flow	350	500	gal/day	Continuous	Flow meter
Total Suspended Solids	100	200	lbs/day	1/ quarter	1 grab sample
Soluble Organic Carbon	25	50	lbs/day	1/ quarter	1 grab sample

### DISCHARGE MONITORING REPORTING REQUIREMENTS

PARAMETER	REPORTING FREQUENCY	REPORTING DATES
Flow	Quarterly	2/28, 5/31, 8/31, 11/30
Total Suspended Solids	Quarterly	2/28, 5/31, 8/31, 11/30
Soluble Organic Carbon	Quarterly	2/28, 5/31, 8/31, 11/30

DISCHARGE MONITORING AND SAMPLING SCHEDULE

QUARTER	SAMPLE DATE
FIRST	2nd week in December
SECOND	2nd week in March
THIRD	2nd week in June
FOURTH	2nd week in September

Note: Grab samples are required to be collected
at Manhole B (MS#1).

APPENDIX A
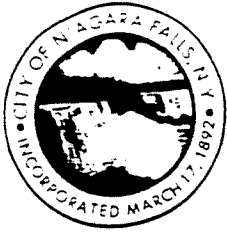
City of Niagara Falls, New York

P.O. Box 69. Niagara Falls. NY 14302-0069

August 28, 1995

Ms. Lorraine Miller
Olin Corporation
P.O. Box 248
1186 Lower River Road NW
Charleston, TN 37310

Dear Mrs. Miller,

The City has completed the review of your discharge permit application. Attached is a copy of your facilities discharge permit. Please note all condition, limitations and reporting requirements.

Please contact Mr. Joel Paradise at (716)286-4978 to arrange contact for monitoring and inspections at the site. Please also notify Mr. Paradise prior to initiating the discharge.

Sincerely,

DEPARTMENT OF WASTEWATER
FACILITIES

Albert C. Zaepfel
Industrial Monitoring Coordinator

ACZ/kkl

cc: W. Bolents
        J. Paradise
        File 45A

CITY OF NIAGARA FALLS

DEPARTMENT OF WASTEWATER FACILITIES

SIGNIFICANT INDUSTRIAL USER

WASTEWATER DISCHARGE PERMIT

PERMIT NO. 45   OLIN CORPORATION - (CHARLES GIBSON SITE)

In accordance with all terms and conditions of Chapter 250 of the City of Niagara Falls Municipal Code; Sewer Use Ordinance, as adopted by City Council on July 25, 1983; et seq. and also with all applicable provisions of Federal and State Law or regulation:

Permission is Hereby Granted To: OLIN CORPORATION

located at: CHARLES GIBSON SITE - 1505 TUSCARORA ROAD, NIAGARA FALLS, NY 14304

classified by SIC No(s): NONE

for the contribution of wastewater into the City of Niagara Falls Publicity-Owned Treatment Works (POTW).

Effective this   1ST   day of   SEPTEMBER, 1995

To Expire this   1ST   day of   SEPTEMBER, 2000

This permit modified _____

_____

Robert E. Game
Director of Wastewater Facilities

Signed this 25th day of   August   19 95

DISCHARGE IDENTIFICATION

OUTFALL	DESCRIPTION	LOCATION	RECEIVING
MS # 1	Monitoring Site No. 1 (Manhole B)	1505 Tuscarora Road	Groundwater leachate from inactive hazardous waste landfill

WASTEWATER DISCHARGE PERMIT REQUIREMENTS FOR:	ACTION REQUIRED	REQUIRED DATE OF SUBMISSION
A. **Discharges to the City Sewer**		
1. Identification of all discharges to the City Sewer System on a current plant sewer map certified by a New York State licensed professional engineer.	NONE	SUBMISSION RECEIVED AUGUST 1, 1995
2. Identification of each contributing waste stream to each discharge to the City Sewer System clearly marked on, or referenced to, a current plant sewer map certified by a New York State licensed professional engineer.	NONE	SUBMISSION RECEIVED AUGUST 1. 1995
3. Elimination of all uncontaminated discharges to the City Sewer System. All uncontaminated flows should be clearly identified on a current sewer map certified by a New York State licensed professional engineer.	NONE	
4. Establishment of a control manhole that is continuously and immediately accessible for each discharge to the City Sewer System.	NONE	ESTABLISHED AUGUST 1, 1995
B. **Wastewater Discharge Management Practices**		
1. Identification of responsible person(s) (day to day and in emergencies).	SUBMISSION REQUIRED	15 DAYS MINIMUM PRIOR INITIATING DISCHARGE
C. **Slug Control Plan****		
1. Pursuant to Section 40 CFR 403.12 (v) of the Federal Pretreatment Standards the City will evaluate the permittee, a minimum	NONE	PERFORMED BY THE CITY

WASTEWATER DISCHARGE PERMIT REQUIREMENTS FOR:	ACTION REQUIRED	REQUIRED DATE OF SUBMISSION

of once every two years for the need for a "Slug Control Plan". If a plan is required by the City then the plan shall contain, at a minimum, the following elements:

a)   Description of discharge practices, including non-routine batch discharges;

b)   Description of stored chemicals;

c)   Procedures for immediately notifying the POTW of slug discharges, including any discharge that would violate a prohibition under 40 CFR 403.5 (b), with procedures for follow-up written notification within five days;

d)   If necessary, procedures to prevent adverse impact from accidental spills, including inspection and maintenance of storage areas, handling and transfer of materials, loading and unloading operations, control of plant site run-off, worker training, building of containment structures or equipment, measures for containing toxic organic pollutants (including solvents), and/or measures and equipment necessary for emergency response.

2.   A written commitment from a responsible party of manpower, equipment and materials required to expeditiously control and remove any harmful quantity discharged.   **SUBMISSION REQUIRED**   **30 DAYS AFTER EFFECTIVE DATE OF PERMIT**

＊＊   This section applies to all compounds limited by the City's SPDES Permit and all prohibited wastewater discharges (See Section 250.5.1-A of the Sewer Use Ordinance)

D. General Wastewater Discharge Permit Conditions

1. Flow monitoring should be performed concurrently with any Wastewater Discharge Permit sampling and should be reported at the same time as analytical results. If it is not feasible to perform flow monitoring, an estimate of flow (method of estimated flow preapproved by city) should be submitted with the analytical results.

2. All sampling for billing and pretreatment compliance purposes shall be coordinated through the City's Industrial Monitoring Coordinator.

3. All analysis must be performed by a State certified laboratory using analytical methods consistent with 40 CFR 136 and quality control provisions as required by the City's Environmental Chemist. The permittee shall report the results as directed in Section G of this permit. Results should be reported using the Method Detection Limit (MDL). Reporting results less than MDL shall be indicated in the report by a less than sign (<) followed by the numeric MDL concentration reported by the laboratory. In these cases the pollutant load shall be calculated and reported as zero (0). The MDL shall be defined as the level at which the analytical procedure referenced is capable of determining with a 99% probability that the substance is present. The value is determined in reagent water. The precision at this level is +/- 100%.

4. An estimate of relative production levels for wastewater contributing processes at the time of any pretreatment compliance sampling shall be submitted upon request of the Director of Wastewater Facilities.

5. All samples shall be handled in accordance with EPA approved methods. Chain of Custody records shall be submitted with all sampling results.

6. All conditions, standards and numeric limitations of Section 250 of the Sewer Use Ordinance are hereby incorporated into this permit by reference. These conditions, standards and numeric limitations must be complied with. Failure to comply with any part of said ordinance constitutes a violation and is subject to enforcement actions(s) described in Section 250.9 of said ordinance, and in the City's Pretreatment Administrative Procedure Number Five (5) - "Enforcement Response Guide". In the event of a violation, including slug discharges or spills, the City must be notified immediately by phone and confirmed by letter within five (5) working days.

7. In accordance with Federal Regulation CFR 40, Part 403.12(g), any exceedance of a numeric standard noted by the SIU must be re-sampled, analyzed and resubmitted to the City's Wastewater Facilities (WWF) within 30 days.

8. Sampling frequency for any permitted compounds may be increased beyond the requirements set forth in Section F and G of this permit. If the permittee monitors (sample and analysis) more frequent than required under this permit, all results of this monitoring must be reported.

9. As noted in Section 250.6.2 of the Sewer Use Ordinance, "Personnel as designated by the Director shall be permitted at any time for reasonable cause to enter upon all properties served by the City WWF for the purpose of, and to carry out, inspection of the premises, observation, measurement, sampling and testing, in accordance with provisions of the Ordinance."

10. As noted in Section 250.5.3 of the Sewer Use Ordinance, significant changes in discharge characteristics or volume must be reported immediately to the WWF.

11. As noted in Section 250.5.4 of the Sewer Use Ordinance, samples required to be collected via a 24 hour composite sampler must be retained refrigerated for an additional 24 hour plus unrefrigerated an additional 48 hours (total 72 hours).

12. As noted in Section 250.5.4 of the Sewer Use Ordinance, all "SIU's shall keep on file for a minimum of 5 years, all records, flow charts, laboratory calculations or any other pertinent data on their discharge to the WWF."

13. As noted in Section 250.6.8 of the Sewer Use Ordinance, "Permits are issued to a specific user for a specific monitoring station. A permit shall not be reassigned or transferred without the approval of the Director which approval shall not be unreasonably withheld. Any succeeding owner or user to which a permit has been transferred and approved shall also comply with all the terms and conditions of the existing permit."

14. The Annual Average Limitation is equivalent to the specific SIU allocation, and shall be defined as the permissible long term average discharge of a particular pollutant. These limitations are listed in Section F of this permit. The computation of the Annual Average shall be as follows; for each compound listed in Section G of this permit, the Annual Average shall be the average of the present monitoring quarter and three previous quarters data.

15. The Daily Maximum Limitation shall be defined as the maximum allowable discharge on any one day. The Daily Maximum Limitation will allow for periodic short term discharge fluctuations. These specific limitations are listed in Section F of this permit.

16. Enforcement of the Annual Average Limitation shall be based on the reported average of the last four quarters data vs the Annual Average Limited listed in Section F of this permit. Enforcement of the Daily Maximum Limitation shall be based on individual analysis results vs. the Daily Maximum Limit listed in Section F of this permit. These results may be obtained from self monitoring (Section G), City Verification, incident investigation or billing samples.

17. The City's Administrative Procedure Number 6 "Procedure for Determination and Use of Local Limits" lists all pollutants noted in the City WWF SPDES Permit. The limits defined in the procedure are values which are based on the quantity of substances discharged which can be easily related to the Treatment Plant's removal capacity.

     The pollutants listed in this procedure which are not specifically listed in Section F and G of this permit may be present in the permittee's wastewater discharge, but at levels which do not require specific permit limitations. Consequently, if any of the limits listed in this procedure, for pollutants not identified in Section F and G of this permit, are exceeded then the permittee shall undertake a short-term, high intensity monitoring program for that pollutant. Samples identical to those required for routine monitoring purposes shall be collected on each of at least three operating

days and analyzed. Results shall be expressed in terms of both concentration and mass, and shall be submitted no later than the end of the third month following the month when the limit was first exceeded.

If levels higher than the limit are confirmed the permit may be reopened by the City for consideration of revised permit limits.

E. <u>Specific Wastewater Discharge Permit Conditions</u>

1. <u>Billing Agreement</u>:

Sewer Use billing for Flow, TSS, SOC and any other billable pollutants detected in the permittee's discharge shall be based on quarterly self monitoring report data and City's verification analysis.

2. <u>Flow Measurement and Sample Collection</u>:

a. The estimated volume to be discharged is approximately 200 gallons per day. This flow shall be continuously monitored by a flow measurement system installed in Manhole "B" (MS # 1) as identified on the attached site map. The daily flow as well as average monthly flow shall be reported in the Quarterly Self Monitoring Report.

b. Samples shall be collected during discharge at MS # 1 as required in this permit. The results shall be reported in the permittee's Quarterly Self Monitoring Report.

F. Discharge Limitations & Monitoring Requirements

During the Period beginning the effective date of this Permit and lasting until the expiration date, discharge from the permitted facility outfall(s) shall be limited and monitored by the permittee as specified below.

OUTFALL NUMBER/ EFFLUENT PARAMETER	DISCHARGE LIMITATIONS			MINIMUM MONITORING REQUIREMENTS	
	ANNUAL AVERAGE	DAILY MAXIMUM	UNITS	MEASUREMENT FREQUENCY	SAMPLE TYPE
MS # 1 Flow	350	500	gal / day	Continuous	By Flow Meter
MS # 1 Total Suspended Solids	100	200	lbs / day	1 / Quarter	1 - Grab Sample
MS # 1 Soluble Organic Carbon	25	50	lbs/ day	1 / Quarter	1 - Grab Sample

F.   Discharge Limitations & Monitoring Requirements   con't

SAMPLE TYPE FOOTNOTES

(1)   Sample shall consist of a laboratory composite of four grabs collected equally throughout the batch discharge period. A total of four samples (batches) will be analyzed and reported each quarter for each outfall.

(2)   Sample shall consist of a 24 hour laboratory composite of four grab samples, one taken each six hours, collected for each outfall.

(3)   Sample shall consist of a 24 hour flow proportion composite sample collected from each monitoring station.

(4)   Flow will be monitored continuously via water meters.

(5)   Sample shall consist of a 24 hour time proportion composite sample from each approved discharge monitoring point.

(6)   Determination of quantities shall be derived from five 24 hour time proportion composite samples collected from each approved monitoring point.

(7)   Same as (3), however, 5 samples will be collected per quarter from the monitoring station and analyzed by and at the City's expense.

G. Discharge Monitoring Reporting Requirements

During the period beginning the effective date of this permit and lasting until its expiration date, discharge monitoring results shall be summarized and reported by the permittee; Monthly - 14 days after monitoring period, Quarterly - by the last day of the monitoring period = February 28, May 31, August 31, November 30. Semiannual reports shall be submitted on the last day of the monitoring period = February 28, August 31. The annual average for each parameter listed in Section F, shall be computed and reported quarterly. The individual sample analysis for present quarter shall also be reported quarterly unless directed otherwise in this permit.

OUTFALL NO	PARAMETER	REPORTING FREQUENCY
MS # 1	Flow *	Quarterly
MS # 1	Total Suspended Solids	Quarterly
MS # 1	Soluble Organic Carbon	Quarterly

NOTE: *   DAILY FLOW AND MONTHLY AVERAGE FLOWS SHALL BE REPORTED

H.   <u>Comments/Revisions</u>

    1.

Olin CHEMICALS

June 12, 1996

Mr. Albert C. Zaepfel
Industrial Monitoring Coordinator
City of Niagara Falls
Department of Wastewater Facilities
Enforcement Division
1200 Buffalo Avenue
Niagara Falls, NY 14302-0069

RE: Charles Gibson Site
      Olin Corporation
      Wastewater Discharge Permit No. 45
      Modified Permit - Intrajurisdictional Agreement

Dear Mr. Zaepfel:

Enclosed is the original signed Intrajurisdictional Agreement for Wastewater Discharge Permit No. 45 for the above referenced site.

Please call me at (423) 336-4381 with any questions or comments.

Sincerely,

OLIN CORPORATION

L. M. Miller
Sr. Associate Environmental Specialist

LMM394

cc: J. E. Reed
      M. J. Hinton (NYSDEC)

bcc: J. W. Strassburg
D. L. Cummings

City of Niagara Falls, New York

P.O. Box 69, Niagara Falls, NY 14302-0069

April 18, 1996

Ms. Lorraine M. Miller
Sr. Environmental Associate Specialist
Olin Corporation
PO Box 248
1186 Lower River Road NW
Charleston TN 37310

Dear Ms. Miller:

As discussed with you in our recent phone conversation, enclosed are the modified pages of the permit for Olin's Charles Gibson Site. The changes reflect the need to include an intra jurisdictional agreement because the site is located outside of the City boundary.

Please have a "responsible corporate official" sign the agreement. Please also retain a copy for your files and send the original to me.

Sincerely,

DEPARTMENT OF
UTILITIES/WASTEWATER

Albert C. Zaepfel
Industrial Monitoring Coordinator

ACZ:vr
Encs.
cc: File 45 A
\33.96

CITY OF NIAGARA FALLS

DEPARTMENT OF WASTEWATER FACILITIES

SIGNIFICANT INDUSTRIAL USER

WASTEWATER DISCHARGE PERMIT

PERMIT NO.   45   OLIN CORPORATION - (CHARLES GIBSON SITE)

In accordance with all terms and conditions of Chapter 250 of the City of Niagara Falls Municipal Code; Sewer Use Ordinance, as adopted by City Council on July 25, 1983; et seq. and also with all applicable provisions of Federal and State Law or regulation:

Permission is Hereby Granted To: OLIN CORPORATION

located at: CHARLES GIBSON SITE - 1505 TUSCARORA ROAD, NIAGARA FALLS, NY 14304

classified by SIC No(s): NONE

for the contribution of wastewater into the City of Niagara Falls Publicity-Owned Treatment Works (POTW).

Effective this   1ST   day of SEPTEMBER, 1995

To Expire this   1ST   day of SEPTEMBER, 2000

This permit modified 4/10/96

William G. Bolents
Acting Director of Wastewater Facilities

Signed this 15th day of APRIL   19 96

days and analyzed. Results shall be expressed in terms of both concentration and mass, and shall be submitted no later than the end of the third month following the month when the limit was first exceeded.

If levels higher than the limit are confirmed the permit may be reopened by the City for consideration of revised permit limits.

E.   **Specific Wastewater Discharge Permit Conditions**

1.   **Billing Agreement:**

Sewer Use billing for Flow, TSS, SOC and any other billable pollutants detected in the permittee's discharge shall be based on quarterly self monitoring report data and City's verification analysis.

2.   **Flow Measurement and Sample Collection:**

a)   The estimated volume to be discharged is approximately 200 gallons per day. This flow shall be continuously monitored by a flow measurement system installed in Manhole "B" (MS # 1) as identified on the attached site map. The daily flow as well as average monthly flow shall be reported in the Quarterly Self Monitoring Report.

b)   Samples shall be collected during discharge at MS # 1 as required in this permit. The results shall be reported in the permittee's Quarterly Self Monitoring Report.

3.   **Intra-Jurisdictional Agreement**

The permittee shall abide by the intra-jurisdictional agreement dated April 10, 1996 identified as Attachment No. 1

INTRA JURISDICTIONAL AGREEMENT

THIS AGREEMENT made and entered into as of the <u>10th</u> day of April 1996, by and between the City of Niagara Falls, a municipal corporation duly established by law in the State of New York, hereinafter referred to as the "City," and business corporate signatories of this Agreement, hereinafter referred to as "User."

WITNESSETH:

WHEREAS, the United States Environmental Protection Agency, hereinafter referred to as "USEPA," established mechanisms and procedures for enforcing national pretreatment standards controlling the introduction of wastes from nondomestic sources into Publicly Owned Treatment Works (POTW's); and

WHEREAS, certain rules have been promulgated by the USEPA for the purpose of implementing those mechanisms and procedures; and

WHEREAS, the City has in operation, a POTW which must comply with the rules promulgated by the USEPA; and

WHEREAS, the rules mandate that the City control the contribution of pollutants to the POTW by each Industrial User to ensure compliance with the applicable pretreatment standards and requirements; and

WHEREAS, in compliance with those rules the City has established by Ordinance adopted July 30, 1984 et. seg., a permit system for the purpose of controlling industrial contribution to the POTW which must be complying with by the User; and

WHEREAS, the User desires to contribute industrial wastes into the City's POTW; and

WHEREAS, the source of the User's industrial waste is located in part or wholly outside the legal jurisdiction of the City and the City and User agrees that the User would not be bound by the City's Ordinance unless the User agreed to be so bound; and

WHEREAS, the User, in consideration of the privilege of contributing its industrial wastes to the City's POTW agrees:

1. To be bound and comply with the requirements of the City's Ordinance referred to in the preamble above;

2. To waive as a defense to any actions, civil or criminal by the City, arising out of the User's contributions to the City's POTW, the fact that the User and User's source are not entirely located within the jurisdiction of the City and its ordinances;

3. To comply with all requirements set forth in the approved wastewater discharge permit; and

4. To pay to the City all fees, costs, charges and expenses which are imposed upon the User in accordance with the requirements of the Ordinance or the permits and rate structure authorized by the ordinance; and

5. To the extent provided in the City's ordinance and the permit, and consistent with the procedures therein established, to promptly comply with any orders, directives or notices issued by the City relative to the User's contributions to the POTW including, but not limited to, suspending or reducing the User's quantity or composition

of the contributed industrial wastes when the City has determined the User to be in violation of the permit or if the safety of the public or the operation of the POTW is believed to be endangered.

IN WITNESS WHEREOF, the City and User have caused their respective corporate seals to be hereunto affixed and attested, and these presents to be signed by their respective officers thereunto duly authorized, and this Agreement to be dated as of the day and year first above written.

APPROVED:

USER: Olin Corporation - Charles Gibson Site
(Located on Tuscarora Road near Niagara Falls Blvd.)

BY: _____

TITLE: Senior VP Corporate Affairs

FOR THE CITY OF NIAGARA FALLS:

BY: _____
James C. Galie

TITLE: Mayor - City of Niagara Falls, NY

ATTEST:

Elsie M. Paradise
City Clerk

3

Olin CHEMICALS

P.O. BOX 248, 1186 LOWER RIVER ROAD NW, CHARLESTON, TN 37310
Phone: (615) 336-4000

November 28, 1995

Mr. Albert C. Zaepfel
Industrial Monitoring Coordinator
City of Niagara Falls
Department of Wastewater Facilities
Enforcement Division
1200 Buffalo Avenue
Niagara Falls, NY 14302-0069

RE: **Charles Gibson Site**
        Olin Corporation
        Wastewater Discharge Permit No. 45

Dear Mr. Zaepfel:

This letter is provided to comply with the Wastewater Discharge Permit Requirements for:
Wastewater Discharge Management Practices (Section B.1) for the above referenced site.

The designated Olin person responsible for day to day or emergency contacts relating to the site
for the City of Niagara Falls Wastewater Treatment Facilities is Mr. James E. Reed. Mr. Reed
can be reached at the Olin Niagara Falls operating facility listed below:

                        OLIN CORPORATION
                        2400 Buffalo Avenue
                        Niagara Falls, NY 14303

                        Phone: (716) 278 - 6422 or (716) 278 - 6469

As an update on status, the site has not yet initiated any discharge to the POTW under this
permit. You will be notified prior to initiating any discharge. For any environmental issues
concerning the site please contact me at (423) 336-4381.

                        Sincerely,

                        OLIN CORPORATION

                        L. M. Miller
                        Sr. Associate Environmental Specialist

LMM/cp
359

cc: J. W. Strassburg
        D. L. Cummings
        L. E. Murray
        J. E. Reed
        M. J. Hinton NYSDEC
        D. Woodcook Jr.

                O L I N   C O R P O R A T I O N

City of Niagara Falls, New

P.O. Box 69, Niagara Falls, NY 14302-0069

November 27, 1995

Ms. Lorraine M. Miller
Associate Environment Specialist
Olin - Charles Gibson Site
P.O. Box 248
Charleston, TN 37310-0248

Dear Ms. Miller:

At long last I have updated the City's Self Monitoring Report Form. Hopefully, I have included a complete list of all the pollutants for quarterly reporting. The update was completed in hopes you will no longer have to hand write additional pollutants on the form. The other changes makes it more convenient for the Organic Chemical and Synthetic Fibers Categorical Users (OCPSF) to report their semi - annual analysis results.

Please begin using the new form in the next quarter or two.

Sincerely,

DEPARTMENT OF WASTEWATER FACILITIES

Albert C. Zaepfel
Industrial Monitoring Coordinator

ACZ:md
Enc.
cc: File 45 E

CITY OF NIAGARA FALLS
DEPARTMENT OF WASTEWATER FACILITIES
ENFORCEMENT DIVISION

SELF MONITORING REPORT
SIGNIFICANT INDUSTRIAL USERS

PERMIT NO. _____   QUARTER   _____

INDUSTRY NAME   _____

Pursuant to federal pretreatment reporting requirements and the City Sewer Use Ordinance Chapter 250, Significant Industrial Users shall submit periodic self monitoring and compliance reports. Such reports shall be submitted using this form, according to the following schedule:

Quarterly	-	1st Quarter by February 28th
	-	2nd Quarter by May 31st
	-	3rd Quarter by August 31st
	-	4th Quarter by November 30th
Semi - Annual	-	by February 28th
		AND
	-	by August 31st

Each section of this report form shall be filled out for those parameters listed in Section "G" of the company's Wastewater Discharge Permit. The analysis results must be reported in both concentration and mass. In addition, the calculated annual average load (lbs/day) for each pollutant shall also be reported.

The samples shall be collected at the monitoring points identified in the user permit. Identification of those points in this report should be as listed on Page two (2) of the user permit.

PART II of the report is the Compliance Monitoring section. The user is obligated to determine if the analysis results indicates compliance or non-compliance. All violations noted should be brought to the City's attention immediately upon noting and should also be reported in this section. The analysis result should be compared against all applicable federal, state and local standards and limitations. If no violations are noted then "NO VIOLATIONS" should appear on the report.

Pursuant to 40 CFR Part 403.12 g of the federal standards, all violations noted must be followed up by a sample recollect/analysis and the results submitted to the City within thirty (30) days of first becoming aware of the violation.

Pursuant to 40 CFR Part 403.12 g , all Periodic Self Monitoring Reports must be signed by a "responsible company official" certifying the following statement.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who mange the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed: _____   DATE: _____

\SMRSIU

PART I
ANALYTICAL RESULTS

SIU PERMIT NAME: _____

SIU PERMIT NO: _____

SAMPLE LOCATION (AS PER PERMIT) _____

	RESULTS mg / L		RESULTS LBS / DAY		ANNUAL AVERAGE mg / L	ANNUAL AVERAGE LBS / DAY
DATE SAMPLED						
24 HOUR FLOW IN MGD						
TOTAL SUSPENDED SOLIDS						
SOLUBLE ORGANIC CARBON						
TOTAL PHOSPHOROUS						
TOTAL PHENOL						
OIL AND GREASE						
CADMIUM						
CHROMIUM						
COPPER						
LEAD						
MERCURY						
NICKEL						
ZINC						
ARSENIC						
BERYLLIUM						
BARIUM						
TOTAL CYANIDE						
pH (STANDARD UNITS)						
RESIDUAL CHLORINE						
SODIUM CHLORIDE						

PART I
ANALYTICAL RESULTS

SIU PERMIT NAME: _____

SIU PERMIT NO: _____

SAMPLE LOCATION (AS PER PERMIT) _____

	RESULTS ug / L		RESULTS LBS / DAY		ANNUAL AVERAGE ug / L	ANNUAL AVERAGE LBS / DAY
DATE SAMPLED						
24 HOUR FLOW IN MGD						
BENZENE						
CARBON TETRACHLORIDE						
CHLORODIBROMOMETHANE						
MONOCHLOROBENZENE						
DICHLOROBROMOMETHANE						
CHLOROFORM						
1,1 - DICHLOROETHYLENE						
1,2 - DICHLOROETHYLENE						
BROMOFORM						
DICHLOROPROPYLENES						
ETHYLBENZENE						
1,1,2,2 - TETRACHLOROETHANE						
TETRACHLOROETHYLENE						
TOLUENE						
1,1,1 - TRICHLOROETHANE						
1,1,2 - TRICHLOROETHANE						
TRICHLOROETHYLENE						
METHYLENE CHLORIDE						
MONOCHLOROTOLUENES						
MONOCHLOROBENZOTRIFLUROIDE						
VINYL CHLORIDE						
TETRAHYDRAFURAN						
XYLENE						

PART I
ANALYTICAL RESULTS

SIU PERMIT NAME: _____

SIU PERMIT NO: _____

SAMPLE LOCATION (AS PER PERMIT) _____

	RESULTS ug / L		RESULTS LBS DAY		ANNUAL AVERAGE ug / L	ANNUAL AVERAGE LBS / DAY
DATE SAMPLED						
24 HOUR FLOW IN MGD						
DIMETHYL PHTHALATE						
BUTYL BENZYL PHTHALATE						
DIBUTYL PHTHALATE						
NITROSODIPHENYLAMINE						
DICHLOROBENZENES						
DICHLOROTOLUENE						
ACENAPHTHENE						
FLUORANTHENE						
CHRYSENE						
NAPHTHALENE						
BENZO (a) ANTHRACENE						
PYRENE						
TRICHLOROBENZENE						
TRICHLOROTOLUENE						
HEXACHLOROBUTADIENE						
TETRACHLOROBENZENE						
HEXACHLOROCYCLOPENTADIENE						
HEXACHLOROBENZENE						
DICHLOROBENZOTRIFLUORIDE						

PART I
ANALYTICAL RESULTS

SIU PERMIT NAME: _____

SIU PERMIT NO: _____

SAMPLE LOCATION (AS PER PERMIT) _____

	RESULTS ug / L		RESULTS LBS / DAY		ANNUAL AVERAGE ug / L	ANNUAL AVERAGE LBS / DAY
DATE SAMPLED						
24 HOUR FLOW IN MGD						
PHENANTHRENE						
MONOCHLOROPHENOL						
DICHLOROPHENOL						
MONOCHLOROCRESOL						
TRICHLOROPHENOL						
PENTACHLOROPHENOL						
HEXACHLOROCYCLOHEXANES						
PCB'S						
ENDOSULFAN I + ENDOSULFAN II + ENDOSULFAN SULFATE						
MIREX						
DECHLORANE PLUS						
HEPTACHLOR + HEPTACHLOR EPOXIDE						

PART I
ANALYSIS RESULTS
(OCPSF SEMI - ANNUAL POLLUTANT LIST)

SIU PERMIT NAME: _____

SIU PERMIT NO: _____

SAMPLE LOCATION (AS PER PERMIT) _____

	RESULTS ug / L		RESULTS LBS / DAY		ANNUAL AVERAGE ug / L	ANNUAL AVERAGE LBS / DAY
DATE SAMPLED						
24 HOUR FLOW IN MGD						
1,2,4 - TRICHLOROBENZENE						
1,2 - DICHLOROETHANE						
1,1,1 - TRICHLOROETHANE						
HEXACHLOROETHANE						
1,1 - DICHLOROETHANE						
1,1,2 - TRICHLOROETHANE						
CHLOROETHANE						
1,2 - DICHOROBENZENE						
1,3 - DICHLOROBENZENE						
1,4 - DICHLOROBENZENE						
1,1 - DICHLOROETHYLENE						
1,2 - TRANS - DICHLOROETHYLENE						
1,3 - DICHLOROPROPYLENE						
METHYL CHLORIDE						
NITROBENZENE						
2 - NITROPHENOL						
4 - NITROPHENOL						
4,6 - DINITRO-O-CRESOL						
BIS (2 - ETHYLHEXYL) PHTALATE						
ANTHRACENE						
DIETHYL PHTHALATE						
FLUORENE						

20-Nov-95

PART I
ANALYSIS RESULTS
(OCPSF SEMI - ANNUAL POLLUTANT LIST)   CON'T

SIU PERMIT NAME: _____

SIU PERMIT NO: _____

SAMPLE LOCATION (AS PER PERMIT) _____

	RESULTS ug / L		RESULTS LBS / DAY		ANNUAL AVERAGE ug / L	ANNUAL AVERAGE LBS / DAY
DATE SAMPLED						
24 HOUR FLOW IN MGD						
1,2 - DICHLOROPROPANE						
VINYL CHLORIDE						
ACENAPHTHENE						
BENZENE						
CARBON TETRACHLORIDE						
CHLOROBENZENE						
HEXACHLOROBENZENE						
CHLOROFORM						
ETHYLBENZENE						
FLUORANTHENE						
METHYLENE CHLORIDE						
HEXACHLOROBUTADIENE						
NAPHTHALENE						
DI - N - BUTYL PHTHALATE						
DIMETHYL PHTHALATE						
PHENANTHRENE						
PYRENE						
TRACHLOROETHYLENE						
TOLUENE						
TRICHLOROETHYLENE						
TOTAL CYANIDE						
TOTAL LEAD						
TOTAL ZINC						

20-Nov-95

PART II
COMPLIANCE MONITORING

INDUSTRY NAME: _____

PERMIT NO. _____

VIOLATION PARAMETER	DATE	FLOW (MGD)	SAMPLE POINT LOCATION	ACTUAL* DISCHARGE	PERMIT LIMIT	TYPE LIMIT VIOLATED**

NOTE:

* - ACTUAL DISCHARGE - LIST ACTUAL ANALYTICAL RESULTS AND APPROPRIATE UNITS

** - TYPE LIMIT VIOLATED - LIST TYPE:

    A.A. = ANNUAL AVERAGE

    D.M. = DAILY MAXIMUM

    L.L. = LOCAL LIMITS (ORDINANCE 250.5.1)
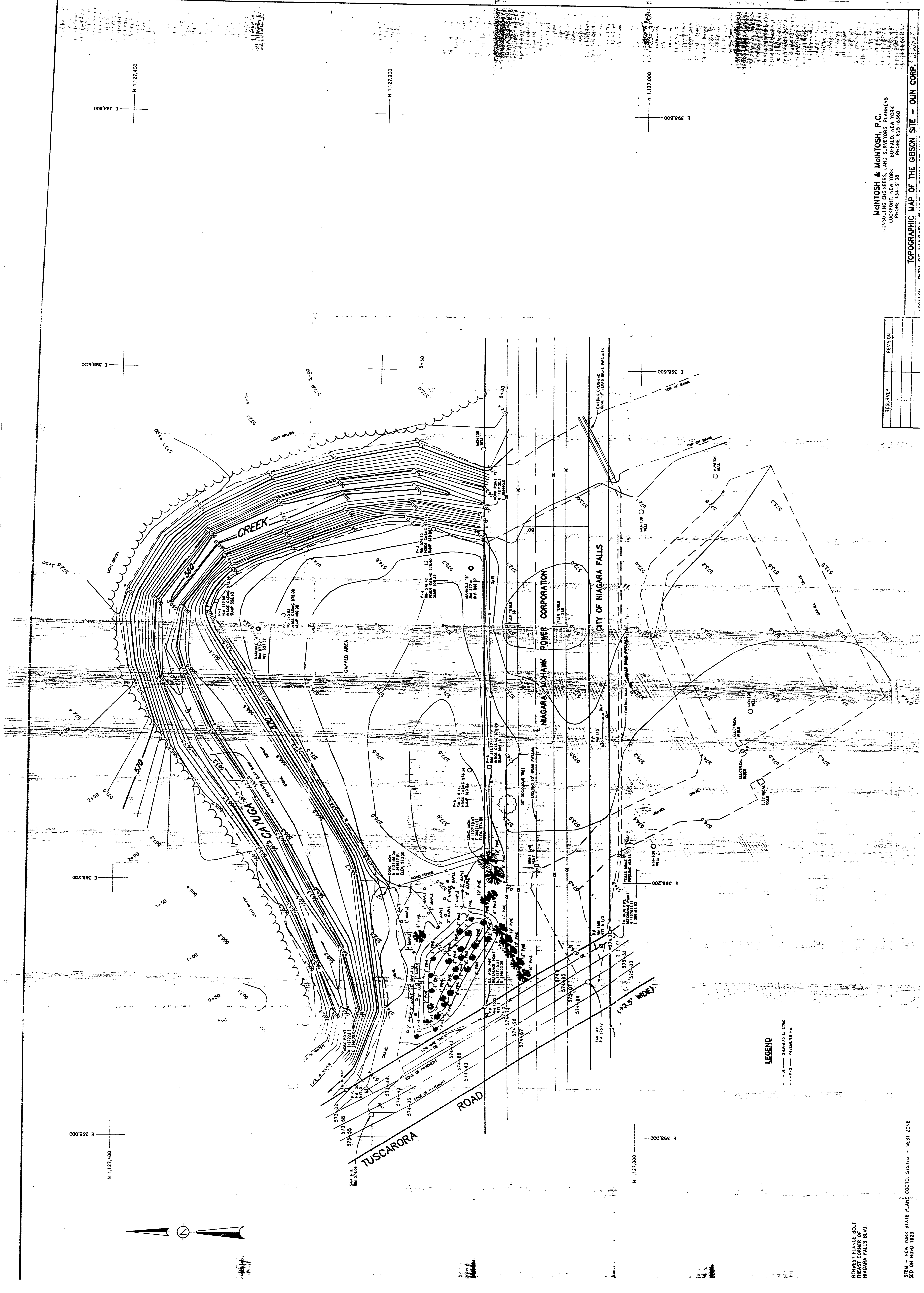
RESURVEY		
	REVISION	

LEGEND

TUSCARORA   ROAD   (43.5' WIDE)

CAYUGA

CREEK

NIAGARA MOHAWK POWER CORPORATION

CITY OF NIAGARA FALLS

STEM - NEW YORK STATE PLANE COORD SYSTEM - WEST ZONE
SED ON NGVD 1929

N

Olin CHEMICALS

P.O. BOX 248, 1186 LOWER RIVER ROAD NW, CHARLESTON, TN 37310

Phone: (615) 336-4000

September 25, 1995

Mr. Albert C. Zaepfel
Industrial Monitoring Coordinator
City of Niagara Falls
Department of Wastewater Facilities
Enforcement Division
1200 Buffalo Avenue
Niagara Falls, NY 14302-0069

RE: Charles Gibson Site - Olin Corporation
      Wastewater Discharge Permit No. 45

Dear Mr. Zaepfel:

This letter is provided to comply with the Wastewater Discharge Permit Requirements for: <u>Slug Control Plan</u> (Section C.2) of the above referenced permit.

Olin is committed to provide the manpower, equipment and materials required to expeditiously control and remove any harmful quantity discharged as a slug to the City Sewer System from the site.

Sincerely

OLIN CORPORATION

D. L. Cummings
Manager, Environmental Remediation

DLC/cp
lmm346
cc: J. W. Strassburg
      L. E. Murray
      J. E. Reed
      L. M. Miller
      M. J. Hinton - NYSDEC

OLIN CORPORATION

City of Niagara Falls, New York

P.O. Box 69, Niagara Falls, NY 14302-0069

September 12, 1996

Mr. James E. Reed
Olin - Charles Gibson Site
PO Box 748
Niagara Falls NY 14302-0748

Dear Mr. Reed:

Attached is a revised page of the Standard Self Monitoring Report form developed by the City. It has been brought to my attention that two (2) Base Neutral compounds were missing. Consequently, Diethyl Phthalate and Di-N-Octyl Phthalate have been added. The City has also taken the time to change Dibutyl Phthalate to Di-N-Butyl Phthalate. These changes accurately reflect the City's current SPDES Permit pollutant list.

Sincerely,
DEPARTMENT OF UTILITIES/WASTEWATER

Albert C. Zaepfel
Industrial Monitoring Coordinator

Att
ACZ:vr
cc: File - To All SIU's

PART I
ANALYTICAL RESULTS

SIU PER NAME: _____

SIU PERMIT NO: _____

SAMPLE LOCATION: _____

	RESULTS ug / L		RESULTS LBS / DAY		ANNUAL AVERAGE ug / L	ANNUAL AVERAGE LBS / DAY
DATE SAMPLED						
24 HOUR FLOW IN MGD						
BENZENE						
CARBON TETRACHLORIDE						
CHLORODIBROMOMETHANE						
MONOCHLOROBENZENE						
DICHLOROBROMOMETHANE						
CHLOROFORM						
1,1 - DICHLOROETHYLENE						
1,2 - DICHLOROETHYLENE						
BROMOFORM						
DICHLOROPROPYLENES						
ETHYLBENZENE						
1,1,2,2 - TETRACHLOROETHANE						
TETRACHLOROETHYLENE						
TOLUENE						
1,1,1 - TRICHLOROETHANE						
1,1,2 - TRICHLOROETHANE						
TRICHLOROETHYLENE						
METHYLENE CHLORIDE						
MONOCHLOROTOLUENES						
MONOCHLOROBENZOTRIFLUROIDE						
VINYL CHLORIDE						
TETRAHYDRAFURAN						
XYLENE						

FILE:\ANALYRES.XLS

PART I
ANALYTICAL RESULTS

SIU PER NAME: _____

SIU PERMIT NO: _____

SAMPLE LOCATION: _____

	RESULTS ug / L		RESULTS LBS / DAY		ANNUAL AVERAGE ug / L	ANNUAL AVERAGE LBS / DAY
DATE SAMPLED						
24 HOUR FLOW IN MGD						
PHENANTHRENE						
MONOCHLOROPHENOL						
DICHLOROPHENOL						
MONOCHLOROCRESOL						
TRICHLOROPHENOL						
PENTACHLOROPHENOL						
HEXACHLOROCYCLOHEXANES						
PCB'S						
ENDOSULFAN I + ENDOSULFAN II + ENDOSULFAN SULFATE						
MIREX						
DECHLORANE PLUS						
HEPTACHLOR + HEPTACHLOR EPOXIDE						

PART I
ANALYTICAL RESULTS

SIU PER NAME: _____

SIU PERMIT NO: _____

SAMPLE LOCATION: _____

	RESULTS ug / L		RESULTS LBS / DAY		ANNUAL AVERAGE ug / L	ANNUAL AVERAGE LBS / DAY
DATE SAMPLED						
24 HOUR FLOW, IN MGD						
DIMETHYL PHTHALATE						
BUTYL BENZYL PHTHALATE						
Di-N-BUTYL PHTHALATE						
Di-N-OCTYL PHTHALATE						
DIETHYL PHTHALATE						
NITROSODIPHENYLAMINE						
DICHLOROBENZENES						
DICHLOROTOLUENE						
ACENAPHTHENE						
FLUORANTHENE						
CHRYSENE						
NAPHTHALENE						
BENZO (a) ANTHRACENE						
PYRENE						
TRICHLOROBENZENE						
TRICHLOROTOLUENE						
HEXACHLOROBUTADIENE						
TETRACHLOROBENZENE						
HEXACHLOROCYCLOPENTADIENE						
HEXACHLOROBENZENE						
DICHLOROBENZOTRIFLUORIDE						

APPENDIX B

OLIN LEACHATE

INSTRUCTION, OPERATION AND MAINTENANCE MANUALS

- ANCHOR SCIENTIFIC ROTO FLOAT SST

- MICROTEL SERIES 1000 DIALER

- SPARLING TIGERMAG FM625

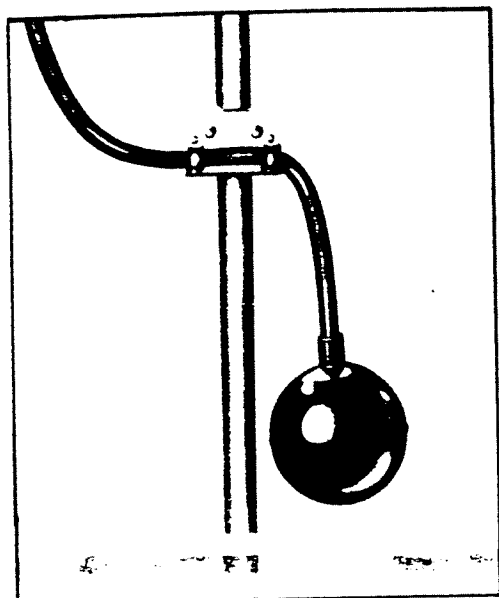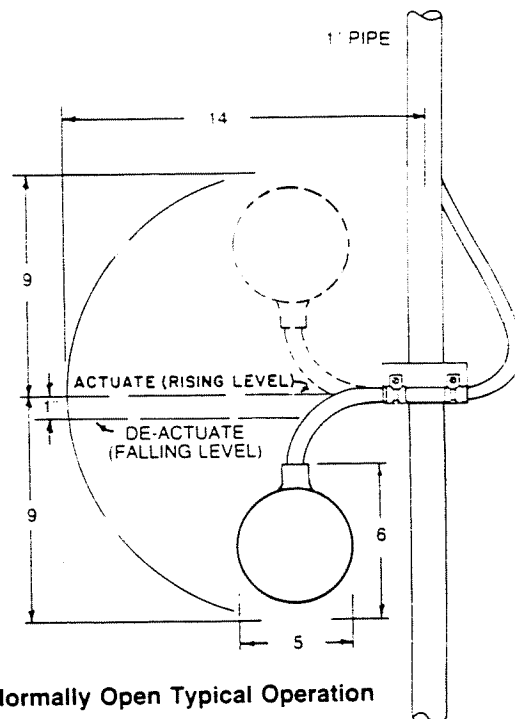- DRAWINGS 11596-JR-1
  103196-JR-1 (2 PAGES)

ROTO-FLOAT SST
(Teflon* coated)

APPLICATIONS:
- Sewage Lift Stations
- High Pressure Tanks
- Long Life Applications
- Severe Environments

Normally Open Typical Operation

GENERAL DESCRIPTION

The Roto-Float SST is a direct acting float switch. It has been designed and constructed for extremely long life in the most demanding applications. Each Roto-Float-SST contains a single pole mercury switch in a normally open or normally closed circuit configuration, which actuates or deactuates with changes in fluid level.

The mercury switch has been inserted into the #316 stainless steel, Teflon* coated housing, then encapsulated in epoxy, forming an impact and corrosion resistant unit. The cable used is a 14-3 conductor, type SO jacketed, with each conductor having 105 strands of copper for extra flexibility. Each float has a green wire as an internal ground and THIS MUST RUN TO A SUITABLE EXTERNAL GROUND, per N.E.C. The Roto-Float SST comes with a mounting clamp, which attaches to a 1" mounting pipe, (supplied by others). #316 stainless steel pipe stabilizing brackets for mounting the pipe are available and designated 'WSTB'.

SPECIFICATION DATA

Cable
105°C., SO type, 14-3 105 strand.
Oil and water resistant.

Float Housing
#316 stainless steel, 5" diameter, grounded. Teflon* coated.

Potting Material
Moisture resistant epoxy.

Electrical Data
Contact rating: 20A., 120 VAC
　　　　　　　10A., 230 VAC
Specify normally open or normally closed.

ORDERING INFORMATION

Specify mounting style P, cable length (20, 30, and 40 feet are in stock), circuit configuration, (NO for normally open, NC for normally closed). Add the suffix '-SST' to indicate stainless steel, Teflon* coated.

List Price

Model P20NO-SST　. . . . . .
Model P30NO-SST　. . . . . .
Model P40NO-SST　. . . . . .

GENERAL DESCRIPTION

The Roto-Float-SST is a direct acting float switch. Each Roto-Float-SST contains a single pole mercury switch which actuates when the longitudinal axis of the float is horizontal, and deactuates when the liquid falls 1" below the actuation elevation

The Float is a chemical resistant, Teflon* coated, 316 stainless casing, with a firmly bonded electrical cable protruding. One end of the cable is permanently connected to the glass enclosed mercury switch and the entire assembly is encapsulated to form a completely water tight and impact resistant unit

Roto-Float-SST can be mounted on a 1" support pipe (Type P) Advantages of the Roto-Float-SST are low cost, simplicity and reliability. Various circuit configurations other than the ones listed below, are available

SPECIFICATIONS:
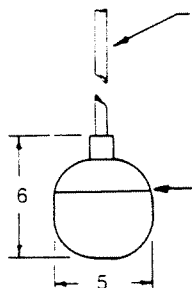
Type SO 14-3 AWG 105 Strand 600 V, 105 C
Conductors 20', 30', 40' lengths standard
Other lengths available
Cable Diameter .56
Temperature Limit 90 C (water)

Teflon* coated 316 Stainless Casing Contains
Hermetically Sealed Mercury Switch

- Electrical Rating
  20 A @ 115 VAC
  10 A @ 230 VAC

- Mounting Arrangement
  Type P — Pipe Mounted Model

```
USE  N.O. FOR PUMP OUT
     N.C. FOR PUMP IN
```

MODELS:

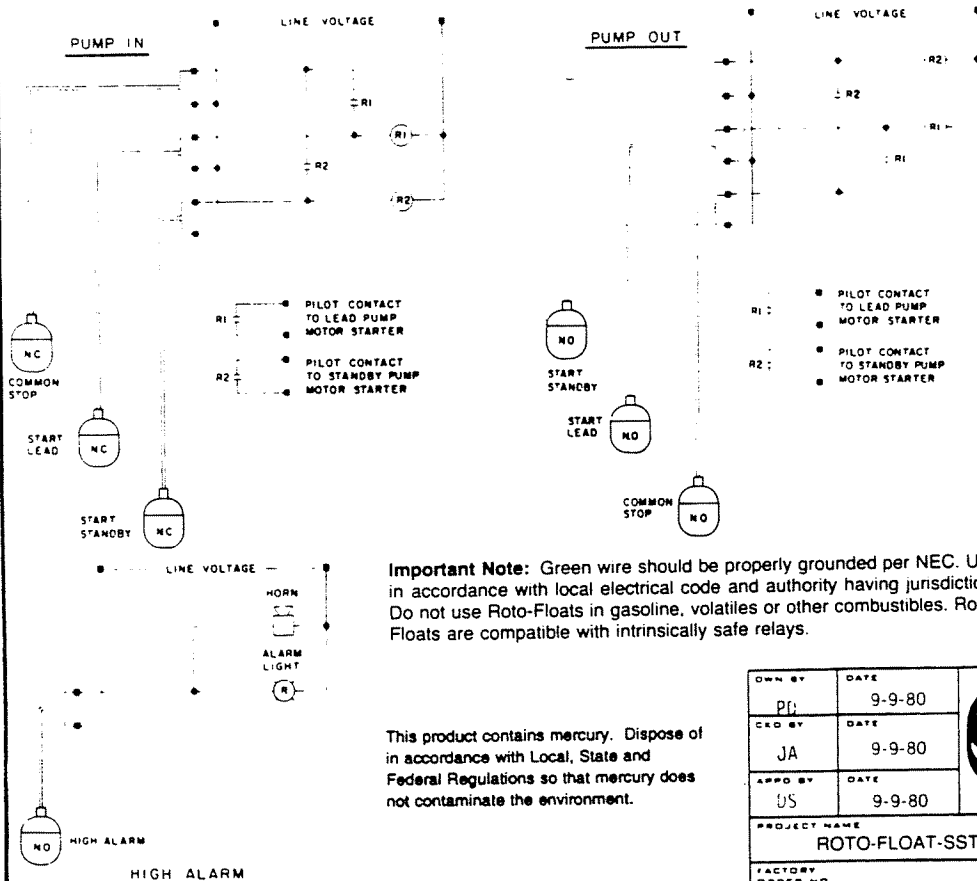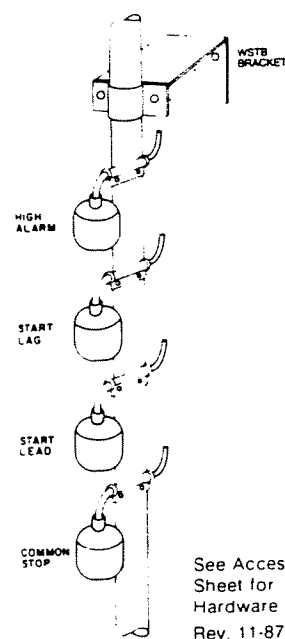| SWITCH ARRANGEMENT	CABLE LENGTH	PIPE MOUNTED TYPE P	
		MODEL NO.	SHIP WT.
NORMALLY OPEN	20	P20NO-SST	5 00
	30	P30NO-SST	6 25
	40	P40NO-SST	7 50
NORMALLY CLOSED	20	P20NC-SST	5 00
	30	P30NC-SST	6 25
	40	P40NC-SST	7 50

SUBMITTAL APPROVAL

NAME

DATE

APPLICATIONS:

For use in controlling pumps or other machines and measuring alarm levels in water, sewage and many other liquids. Roto-Floats may be used for pump in or pump out control, for low level cutout, or for low and high level alarms

TYPICAL 2 PUMP CIRCUITS

TYPICAL MOUNTING TYPE P

See Accessory Sheet for Hardware Rev. 11-87

Important Note: Green wire should be properly grounded per NEC. Use in accordance with local electrical code and authority having jurisdiction. Do not use Roto-Floats in gasoline, volatiles or other combustibles. Roto-Floats are compatible with intrinsically safe relays.

This product contains mercury. Dispose of in accordance with Local, State and Federal Regulations so that mercury does not contaminate the environment.

OWN BY	DATE	
PD	9-9-80	
CKD BY	DATE	
JA	9-9-80	
APPD BY	DATE	
DS	9-9-80	
PROJECT NAME		
ROTO-FLOAT-SST		
FACTORY ORDER NO		

anchor scientific inc.

Industrial Park, Loon Lake, Mn 55356

ROTO-FLOAT-SST
SPECIFICATION DATA AND
INSTRUCTION SHEET

LETTER	REVISIONS	DATE

DWG. NO.   2910-1

Microtel Series 1000 Dialer

Installation, Operation, and Maintenance

Manual

Doc 600R1000 Rev B
July, 1996

MICROTEL

Record of Changes

Rev	Date	Changes	Submitted By
-	March 1995	Original Document	Art Felgate
A	January 1996	Added the command **058n, updated the example FAX reports, updated some command description, updated the examples, added better chapter summaries. Also, made visual changes. Things are rearranged for easier use. The document was also reformatted.	Mike Freimanis
B	July 1996	Updated the command **c5MMSS. It now can have separate ON and OFF delay times for a channel. This change is included on new Fax Report and Testset pages. Cleared up an explanation of the Call On Alarm value for I/O Alarm Configurations. Identified default dialer Access Code. In the Callout Theory of Operation, clearly defined dialer callout procedures.	Mike Freimanis *M. Freimanis* *7/30/96* *B Ehnt* *7/34/96*

MICROTEL/TANO SERIES 1000 DIALER

QUICK START PROCEDURE

****_Necessary equipment: A touch-tone telephone is required._****

The following procedures allow quick set-up and operation of the S1000 Dialer. Please read the rest of this manual for additional information on programming and operating your S1000 Dialer.

I.   Plug the touch-tone telephone into the Dialer PHONE jack. Take the telephone off-hook.

II.   Turn on the Power Switch and verify the Dialer has power.

The red Power/Fault light will pulse with a 95% duty cycle indicating no errors. The Off Hook light should be ON (red) indicating the unit is ready to accept touch-tone commands from the local telephone.

III. Press the # key of your telephone to prompt system activation.

Listen for the Dialer to voice respond "System ready."

NOTE: If at any time while entering commands you wish to start over, simply press the # key and listen for the Dialer to voice respond "System ready."

IV.   Set Time and Date. (See Section 3.3, *Setting Time and Date*)

●   Enter the command **060HHMM, where the actual 24-hour time is substituted for HHMM. For example, if the time is 1:00 p.m., enter **0601300.

●   Listen for the Dialer to voice respond, "**The time is one three zero zero**" for the above example.

●   Enter the command **061MMDDYY where the actual date is substituted for MMDDYY. For example, if the date is January 2, 1995, enter **061010295.

●   Listen for the Dialer to voice respond, "**The date is zero one zero two nine five**" for the above example.

V.   Enter the telephone number of the Dialer. (See Section 3.2.9, *System Telephone Number*)

The FCC requires the telephone number of the Dialer to be entered for FAX transmission.

Enter the command **010p**, where p is the telephone number (up to 16 digits) of the Dialer telephone line. For example, the Dialer is connected to 504-243-2400.

Enter **0105042432400**.

Listen for the Dialer's voice response, "The system telephone number is 5042432400."

VI.   Enter Telephone Numbers to Call upon Alarm. (See Section 3.5, *Telephone Numbers*)

Enter **01np**, where n = 1,2,3....9, is the directory index of telephone numbers and p is the actual telephone number with optional escape codes of up to 60 digits.

Example: The second phone number of the directory is 555-1212.

Enter **012 5551212**.

Listen for the Dialer's voice response, "Telephone number two is 5551212."

Example: Sending a FAX. (See Section 3.5.4, *Telephone Number Command*)

Send an alarm status report to a FAX machine (for example, the third number on the list) at 555-1213 after the first two numbers have been called.

Enter **013 *991 5551213 **. (*991 is required to send a FAX.)

Listen for the Dialer's voice response, "Telephone number three is star 9915551213."

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

COMMAND SUMMARY PROGRAMMING GUIDE

Series 1000 COMMAND SUMMARY

*000	**000	Report system status
*001	**001-	Voice system name
*002	**002MM	Call spacing time
*003	**003nn	Ring count
*004	**004nnnn	Access code (0000 = Disabled)
*005	**005nn	Message repeat count
*006	**006n	Keyboard/Voice feedback delay

*01n	**01np**	Telephone n (n=1 to 9) (0=System)
*02n	**02nDDHHMM	Telephone n disable timer
*03n		Alarms armed for telephone n

050/051	Print status/Print config. report
052/053	Enable/Disable printing
054/055	Enable/Disable testset
056n/057n	Fax status/configuration to phone n
0580/0581	Answer Mode - Voice/Data

*060	**060HHMM	Time (24 hour format)
*061	**061MMDDYY	Date
*062	**062wHHMM	Call at time
*063	**063t*	System telephone list

**070	End call
**071	Acknowledge current alarms.
**072c	Acknowledge alarm on channel c
*074 **074DDHHMM	Snooze delay

*c0	**c0	I/O c status/clear counters
*c1	**c1-	I/O c voice name
*c2	**c2On	I/O c TYPE of module
	(0=Spare, 1=DI NO, 2=DI NC, 3=DO, 4=AO, 5=AI, 6=DOL)	
*c3	**c3nn	I/O c status REPORT format
	(00=None,01=State,02=Counts,04=RunTime,08=TimeInAlarm)	
*c41	**c41t*	I/O c telephone list
*c5	**c5nMMSS	I/O c delay (n=1 On/n=2 Off)
	c60/c61	I/O c output force OFF/ON
*c8	**c8n	I/O c alarm configuration
	(0=Status,1=Latch,2=COA,3=COA Latch,4=COA RTN)	
*c90	**c90aaa	I/O c analog input high setpoint
*c91	**c91aaa	I/O c analog input low setpoint
*c92	**c92aaa	I/O c analog output setpoint

Phone Number Escape Codes
*0	Tone dial (default)
*1	Pulse dial
*2	2 second pause
*3	Flash hook (go on hook for 100 milliseconds)
*4	Wait for voice or answer
*5n	Wait n seconds for tone
*6n	Wait n seconds for quiet
*7nn	Set wait time-out to abort call (nn seconds)
*8nn	Set wait time-out to continue (nn seconds)
*90	Auto acknowledge this call
*91	Dial '*' *92 Dial '#'
*93n	Turn ON output module n
*94n	Set this call alternate message repeat count
*95n	Set this call alternate voice interact delay
*96n	Turn OFF output module n
*980	Dial 'A' *981 Dial 'B'
*982	Dial 'C' *983 Dial 'D'
*984	Dial channel in alarm (digital pager)
*990	Modem Call
*991	Fax Call
*992	Peer to Peer Call

-	speech (# while recording - mic cut off)
MM	time value in minutes (00-99 minutes)
n	one digit numeric value (0-9)
nn	two digit numeric value (00-99)
nnnn	numeric value (0000-9999)
DDHHMM	time value in Days, Hours, Minutes format
MMSS	time value in Minutes, Seconds format
c	input/output channel number 1-8 (9=pf)
t	telephone selections (1-9) upto 9 digits
aaa	analog value 00.0% to 99.9%
w	day of week selection
	(1=Sunday-7=Saturday,0=all days)
p	0-60 digit phone number, with escape codes

MICROTEL
Technical Support & Service
504/276-0571

1.0 INTRODUCTION

Thank-you for choosing the Microtel *Series 1000* Dialer to implement your remote alarm monitoring solution. This manual contains instructions on installing, configuring, and operating your dialer. In addition, a couple of maintenance procedures are described. The *Series 1000* has been designed and manufactured to operate with minimal operator intervention once it has been set up to match your specific monitoring application. Any problems you might encounter are easily diagnosed in the *Troubleshooting* section. Supplemental information you might find interesting is included in the Appendices.

This manual is designed to be read beginning with the *Installation* procedure. followed by *Configuring the Dialer*. and *Operation*. The *Operation* section in particular should be read by any personnel who may be required to respond to alarm calls from the dialer. The additional sections can be read at a later time, or when necessary by authorized personnel to maintain the dialer or troubleshoot any problems you might encounter.

We ask that you *please* refer to **Section 5.0,** *Troubleshooting*, *before* calling **MICROTEL** for technical assistance. We believe the manual is very thorough, yet broken up into sections so that you can immediately find relevant information. An emphasis has been placed on cross-referencing additional information throughout its contents.

If, however, you encounter a difficulty that cannot be resolved using the information in this manual, then call **MICROTEL**'s Toll-Free 24 hour Technical Support line:
504/276-0571.

Thank-you, once again, for choosing **MICROTEL**.

Before sending a fax message, the sending telephone number must be programmed into the *Series 1000* Dialer as follows:

1. Plug a touch-tone telephone into the PHONE jack of the dialer.
2. Pick up the handset of the telephone, and press the '#' key.
3. Listen for the dialer to speak, "System ready".
4. Enter the telephone number of your *Series 1000* Dialer with the command, **010nnnnnnnnnn**, where two STAR keys are used to terminate the variable length telephone number (it may be up to 16 digits).
5. Listen for the dialer to speak back the number that you entered.
6. You may review the number entered again by pressing *010 (single star), and listening for the dialer to respond.

Please refer to **Section 3.2.8,** *System Telephone Number*(010), for additional explanation and example.

2.0 INSTALLATION

2.1 PHYSICAL INSTALLATION-ENCLOSURE MOUNT, FIGURE 1

DIMENSIONS = INCHES / [MILLIMETERS]
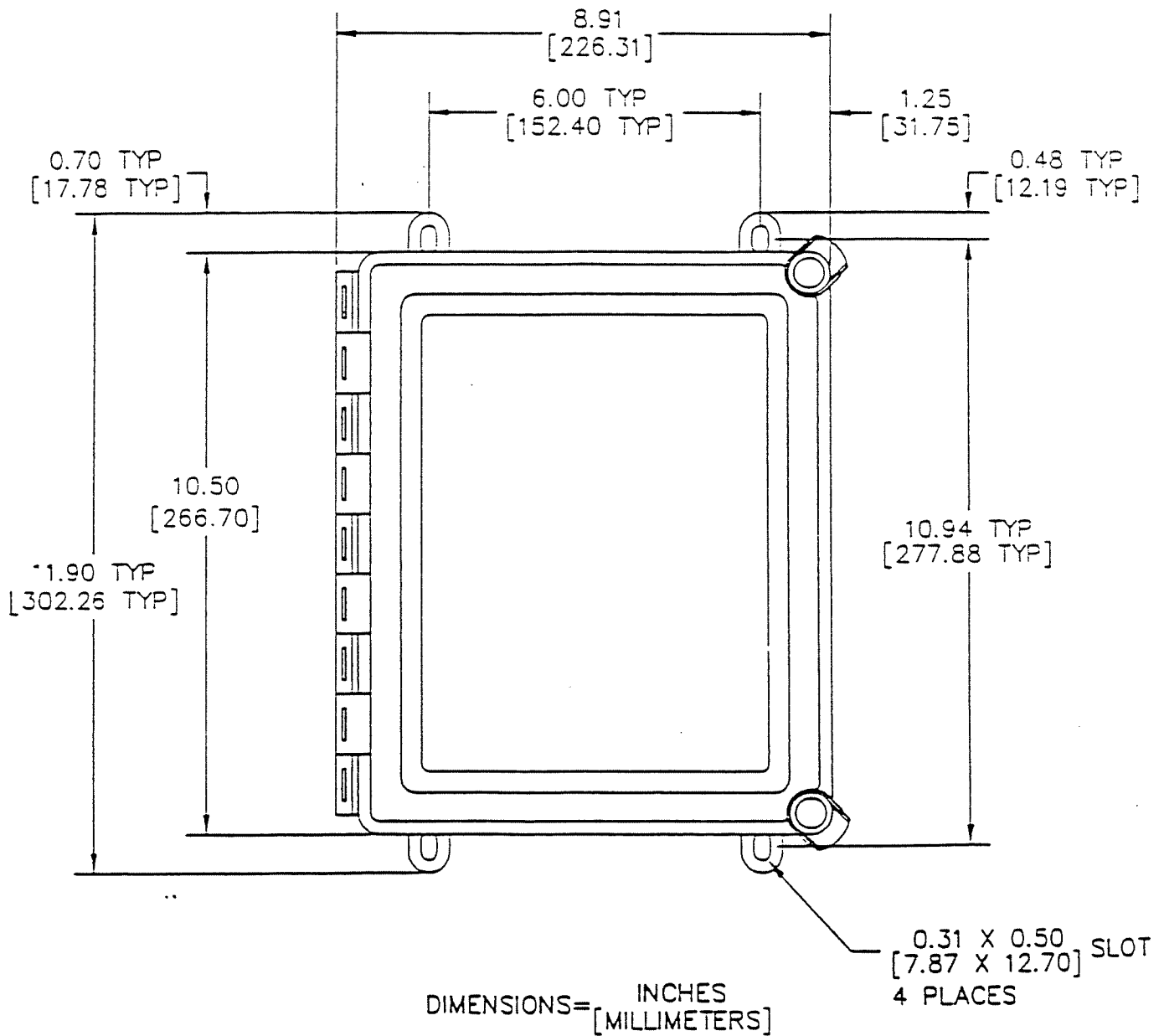
2.3 POWER SUPPLY CONNECTION

Connect the supplied external Stancor transformer to the **12 VDC** terminals as shown in the Figure below. Plug the transformer into a **MicroMax Surge Suppressor** (supplied with the dialer).

Alternatively, you may connect any **12 to 16 Volt DC** power supply (A **12 Volt DC** source might be a solar power system, for example). Connect the positive side of the voltage source to pin 1, and the COMMON lead to pin 2 of the power supply terminal block of the dialer.

NOTE: A power supply voltage greater than **12 VDC** is required to operate the *Series 1000* battery charger.
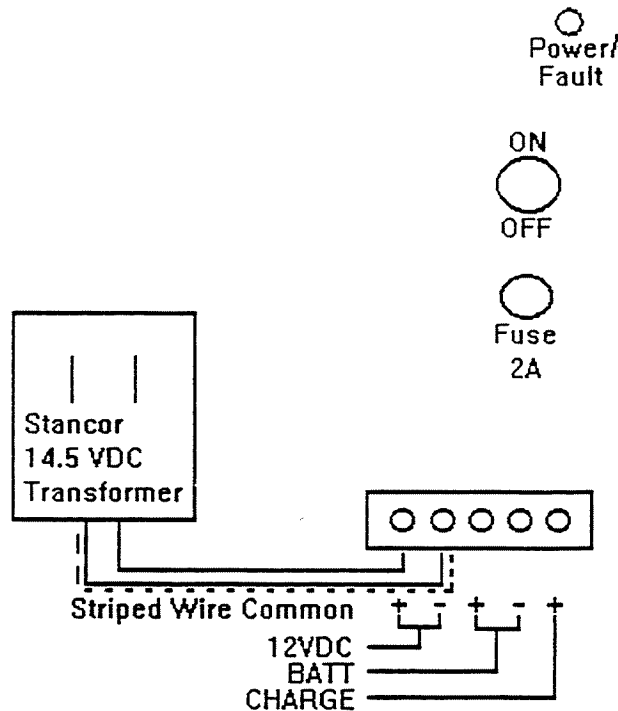
Figure 3. POWER SUPPLY CONNECTION

2.5 TELEPHONE CONNECTIONS

For protection of your *Series 1000* dialer from telephone line transients and surges which could damage the dialer, or disrupt its operation, use a MicroMax Surge Suppressor:

1. Connect the dialer's LINE jack to the EQUIPMENT Phone jack of the MicroMax Surge Suppressor using the cable supplied with your dialer.
2. Connect the Telephone LINE jack of the MicroMax Surge Suppressor to the RJ11 jack of your outside line using the cable supplied with the MicroMax Surge Suppressor.

Connect a local telephone (optional) to the dialer's PHONE jack, as shown in Figure 5 below.
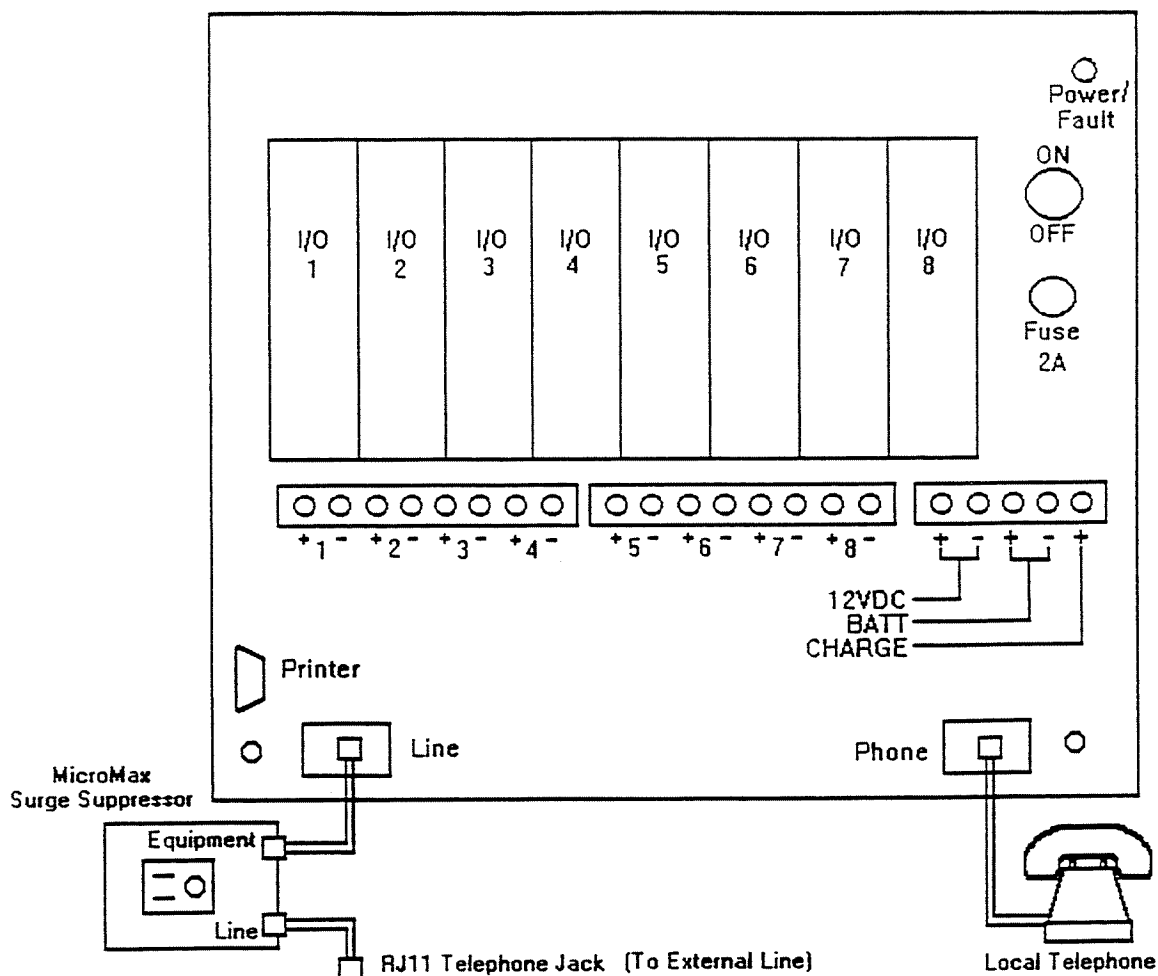
Figure 5. TELEPHONE CONNECTION AND LOCAL HANDSET CONNECTION

2.7 PRINTER INSTALLATION

2.7.1 Printer Interface and Handshaking

The *Series 1000* supports a serial printer interface **only**. Therefore. you must have a serial printer, or install a serial interface card in the printer you have. Serial printer interfaces are inexpensive and readily available at your local computer store.

The dialer transmits serial printer data at 2400 baud. 8 data bits. 1 stop bit. and no parity.

In addition. the printer's serial interface must support DTR (Data Terminal Ready) hardware handshaking. With this method. when the printer buffer level surpasses some high water mark. the printer asserts the DTR signal, telling the dialer to halt transmission. After the printer has emptied most of the data out of its buffer. it will de-assert the DTR signal. indicating to the dialer that it may resume data transmission. The DTR hardware handshaking protocol is a common method supported by most serial interfaces.

2.7.2 Cable Connections

Connect a DTE-to-DCE (Straight) RS232C cable with a 9 pin female D-SUB connector on one end to the dialer's PRINTER port. Connect the other end (25 pin female D-SUB) to the serial interface port of your printer.

NOTE: If you are using TERM8 to configure your dialer from a local computer, then you may use the same RS232 cable.

2.7.3 Configuring the Dialer to Print

Because the RS232 port on the *Series 1000* is used to support other features such as a local computer interface (**Testset**), it must be configured to support printing as follows:

1. Plug a touch-tone telephone into the dialer's PHONE jack.
2. Pick up the telephone handset and press the '**#**' key.
3. Listen for the dialer to speak. "**System ready**".
4. Enter ****052** on the telephone's keypad.
5. Listen for dialer's response, "**Printing Enabled**".

Turn the Printer power OFF, then ON again to reset it.

This completes the installation of a local printer. Refer to **Section 4.0,** *Operations* for commands to print reports and enable continuous event logging.

3.0   CONFIGURING THE DIALER

3.1   INTRODUCTION

The Microtel *Series 1000* features a single level, interactive command structure--there are no multi-level menu structures to navigate. Commands are sent to the *Series 1000* through your telephone either locally or during a call to or from the dialer, by pressing a sequence of touch-tones on your telephone. Each command entered is acknowledged with a spoken response from the dialer, providing verification that the command was entered correctly and understood by the dialer.

The configuration commands described in this section modify basic dialer operation and store information about the dialer's operational behavior in nonvolatile memory. You should only have to configure your dialer once -- all changes are saved permanently, even if AC and battery power are removed from your dialer. In addition to the configuration commands, there are several commands that may be used to initiate one-time events. These are described in **Section 4.0,** *Operation*.

All programming commands (commands that modify dialer configuration or cause an action to occur) begin with '******' (two stars). All review (report) commands begin with a '*****' (single star). After each command is entered, the dialer will respond with a voice message.

Most commands require exactly the same number of keys every time, but some commands have a variable data length. The end of variable length data commands is performed with the '******' (two stars).

An errant or unwanted command can be terminated at any time by pressing the '#' key. The dialer will respond, "System ready", indicating it is ready to accept a new command.

Throughout this manual, all commands are highlighted for quick reference as follows:

---

*nnn	Review item
**nnnddd	Configure item

If your telephone line is not yet installed, you can still configure your dialer:
1. With power to the dialer off, connect the telephone to dialer's PHONE jack.
2. Take the telephone off-hook.
3. Turn ON power to the dialer.
4. The telephone should now be connected to the dialer (indicated by the PHONE LED being ON and the Dialer reporting '**SYSTEM READY**').
5. You may now enter any of the touch-tone commands to query/configure the dialer.

3.1.2 Configuring the Dialer from a Local Computer

In addition to its interactive touch-tone/voice interface, the *Series 1000* may also be configured from a local computer. In this case a menu structure is presented on the computer screen, and menu navigation/data entry is accomplished from the computer keyboard. **If you wish to create custom text messages to be printed on FAX reports from the dialer (optional), you must use the local computer (or remote Windows Dialer Configurator) interface to enter them.** To configure the *Series 1000* from a local computer, obtain the TERM8 program to run on your PC. A separate document, *Microtel Series 1000 TERM8 Laptop Operation,* describes its use. The following two (2) commands pertaining to operating the dialer's resident testset are listed here for reference:

**054	Enable test set

This command will enable the testset on the printer (RS232) serial port, allowing local computer interface to the dialer for configuration. (The printer must be Disabled for this action to work (See **Section 4.8,** *Using a Local Printer*))

> **Example-**
> Command: ****054**
> Response: *Enabled.*

**055	Disable test set

This command will disable the testset.

> **Example-**
> Command: ****055**
> Response: *Disabled.*

3.1.3 Configuration Sections

Section #	Section Name	Description
3.2	System Info	Set/Query various system values
3.3	Time/Date	Set/Query the Dialer's Time and Date
3.4	Auto CallOuts	Set/Query the Dialer's independent Call At Times
3.5	Telephone Numbers	Set/Query each of the outgoing phone numbers
3.6	Configuring I/O Modules	Set/Query the Dialer's I/O Point configurations

3.2.1 Voice System Name (001)

*001	Play system name
**001~	Record system name

Once the command to Record the system name has been typed in. the Dialer will respond by saying 'Ready'. When you hear this. speak the message. Once you have finished speaking, you can either wait until it finishes recording or press the '#' key to trim off the end of the message. If the message is trimmed. type '*001' to replay the message.

Example voice responses-
Microtel SERIES 1000 (default in the normal system voice)
-or-
Jonesburg remote site number 6 (recorded)

3.2.2 Call Spacing Delay (002)

*002	Review call spacing
**002MM	Program call spacing

Time the dialer waits after an answered Callout before beginning another Callout (01-99 minutes).

Example-
Command: **00260
Response: *The call delay period is six zero minutes.*

3.2.3 Ring Count (003)

*003	Review ring count
**003nn	Program ring count

The number of rings the dialer will see before answering an incoming call.

Example-
Command: **00305
Response: *The ring count is five.*

3.2.7 Snooze Delay (074)

*074	Review snooze delay time interval
**074DDHHMM	Program snooze delay time interval

The snooze delay is the time in which the dialer will re-arm an acknowledged alarm and begin calling again as a reminder that the alarm condition still exists.

> **Example-**
> Command: **074001234
> Response: *The snooze delay is one two hours three four minutes.*

3.2.8 Answer Mode (058)

058n   Program the dialer's answer mode (n - 1=Data, 0=Voice**)

The Answer Mode is how the dialer answers an incoming call (**n=1** is **Data Mode** and **n=0** is **Voice Mode**). When in **Data Mode**, the dialer will answer the telephone as a modem by emitting a carrier tone. If the dialer doesn't connect within ~5 seconds, it will switch to **Voice Mode** for this call to allow users to still make callins while the answer mode is in **Data Mode**.

When the Answer Mode is set to **Voice Mode**, the dialer will answer a call with voice prompts. If the access code is enabled, it will then prompt the user for the access code. Once the correct access code is typed in, the user can then type in any of the user configuration and operational commands.

When the Answer Mode is set to **Data Mode**, the dialer will try to connect to an incoming call via modem. Once it connects, the dialer will respond to ascii commands that are sent to the dialer. Each command should start on a new line and followed by a carriage return.

Command	Response
SETUP	Reports the current setup for the Dialer
STATUS	Reports current readings of the I/O Points on the Dialer
ACK	Will acknowledge the current alarms on the Dialer

A call should be terminated by the party calling the dialer. Once the dialer loses carrier and is hung-up on, the dialer will continue to answer callins and make callouts as normal.

> **Example-**
> Command: **0581
> Response: *Data mode enabled.*

3.3 SETTING TIME AND DATE

The *Series 1000* has an onboard real-time clock used to Time/Date stamp dialer events. as well as allow status callouts to occur at specific times. Time and Date are maintained even if power is lost to the dialer. Use the following two commands to initialize your dialer's local time. or to set it back/ahead in conjunction with Daylight Savings Time.

Section #	Setting	Current Setting	Change Setting	Meaning
3.3.1	Time	*060	**060HHMM	Current time (24 hour format)
3.3.2	Date	*061	**061MMDD YY	Current date

3.3.1 Time (060)

*060	Report Time
**060HHMM	Set Time

Current dialer time in 24 hour format (military format).

> **Example-**
> Command: **0600327
> Response: *The time is three two seven.*

3.3.2 Date (061)

*061	Report Date
**061MMDDYY	Set Date

Current date in MMDDYY format.

> **Example-**
> Command: **061080394
> Response: *The date is eight zero three nine four.*

3.4.1 Call At Time (062)

*062	Report Next Call At time
**062wHHMM	Program Call At time

When a timer in the HHMM format matches the current time, a status update call will be placed to the system calling list (described below). The time that can be set as either once a week or once a day at a specified time. Once the command is entered, the response will report the next Call At Time.

Examples-
Command: **06210832
Response: *The Call At time is Sunday zero eight three two.*

If the current time is 11am on Wednesday,
Command: **06291210
Response: *The Call At time is Wednesday one two one zero.*
-or-
Command: **06291010
Response: *The Call At time is Thursday one zero one zero.*

w	0	1	2	3	4	5	6	7	9
Value	None	Sun	Mon	Tues	Wed	Thurs	Fri	Sat	Daily

3.4.2 Call At List (063)

*063	Report Call At telephone list
**063t*	Program Call At telephone list

A list of phone numbers to call when the Call At Time occurs. (**t** is a list of 0 to 9 digits followed by a *).

Example-
Command: **06328*
Response: *The system telephone list is two eight.*

When the system Call At Time is reached, phone calls will be placed to phone numbers 2 then 8, repeatedly, until the alarm is acknowledged.

3.5.2 Call Progress Decoding

When the dialer is off-hook, it has the capability to detect dial tone, busy, ringback, modem, and voice signals. This allows it to detect if a called party answered or not, thus reducing the time to alert authorized personnel of existing alarm conditions. If a call is not answered, or the called number is busy, the dialer will abort the call and begin calling the next number for that channel in its alarm's calling list. Call progress decoding is also useful for sensing pager terminal tones, or long distance service access prompts before continuing a dialing sequence. It is even possible for one *Series 1000* dialer to call another dialer, gain access to it, and actuate outputs on that dialer. The call progress features of the *Series 1000* is also flexible enough to traverse preset menus via touchtone commands.

The dialer implements a default 10 second *wait for dial tone* when going off-hook to place a call, and a default 30 second *wait for answer* after dialing the telephone number. In both default cases, the dialer will abort the telephone call if the condition does not occur. By using the telephone number escape codes defined for the *Series 1000*, these defaults can be overridden on a telephone number by number basis. Thus, it is possible to "blind dial" or continue dialing even if a specific call progress event does not occur.

3.5.3 Telephone Number Escape Codes

Code	Command
*0	Tone Dial (Default)
*1	Pulse Dial
*2	2-Second Pause
*3	Flash Hook (go on hook for 100 milliseconds)
*4	Wait for Voice or Answer
*5n	Wait for Tone (**n** seconds)
*6n	Wait for Quiet (**n** seconds)
*7nn	Set Wait Timer to Abort (if condition does not occur in **nn** seconds)
*8nn	Set Wait Timer to Continue (if condition does not occur in **nn** seconds)

*90	Auto Acknowledge this Call
*91	Dial '*'
*92	Dial '#'
*93n	Close (Turn **ON**) Digital Output Channel **n**
*94n	Set this Call Alternate Message Repeat Count of **n**
*95n	Set this Call Alternate Voice Interact Delay (See **Section 3.2.6**)
*96n	Open (Turn **OFF**) Digital Output Channel **n**

*980	Dial 'A'
*981	Dial 'B'
*982	Dial 'C'

Example 2-   Program phone number 1
                 Dial 9
                               Pause for 2 seconds
                                           Dial 555-1212
                                                            Terminate telephone entry

Command: **011 9   *2   5551212   **

Response: *Telephone one is nine STAR two five five five one two one two.*

Here, nothing comes after the actual dialed telephone number, so a default 30 second wait-for-answer will occur. In general, if the dialer must wait for some event to occur before continuing to dial the remaining digits, then you must program the Wait Timer and Wait For condition as shown in Example 1 above.

Example 3-   Program phone number 2
                 Key a P.A. (public address) with I/O channel 1
                               Repeat the status message one time
                                         Auto Acknowledge all alarms
                                                     Terminate telephone entry

Command: **012 *931   *941   *90   **

Response: *Telephone two is STAR nine three one STAR nine four one STAR nine zero.*

Example 4-   Program phone number 4
                 To send a Fax report
                               To 555-1212
                                                       Terminate telephone entry

Command: **014 *991 5551212   **

Response: *Telephone four is STAR nine nine one five five five one two one two.*

The *991 escape sequence shown must be embedded within telephone numbers of FAX machines. This tells the dialer to begin to generate a FAX report before it goes off-hook and dials the remote machine. Always put the *991 sequence, as well as any other non-call progress sequences (such as auto acknowledge), at the beginning of the telephone number string before the dialer goes off-hook to dial regular telephone digits.

3.6 CONFIGURING I/O MODULES

The *Series 1000* features true modularity--I/O channels operate completely independently of each other. Using the following commands, each I/O module in your dialer can be configured to operate uniquely to satisfy your application requirements. For each I/O module you may record a voice message, choose the format of spoken status reports, program an alarm integration delay, alarm call out operation, and telephone number calling sequence. Analog inputs also have user-selectable low and high alarm setpoints.

Always verify the I/O module TYPE before proceeding to configure any other values for that module. The dialer will reset the module's settings when a module's TYPE is modified. If you are adding a new I/O module to your dialer, you must configure the module's TYPE first (Section 3.6.2).

Input modules come from the factory configured as STATUS only. At the very least, you must configure your inputs to *Call On Alarm* (Section 3.6.6).

Section #	I/O Channel Setting	Current Setting	Change Setting	Meaning (c = Channel #)
3.6.0	Status/Clear Counters	*c0	**c0	Reports the channel status (See **3.6.3 Report Format**)
3.6.1	Voice Name	*c1	**c1~	User defined channel name
3.6.2	Type	*c2	**c20n	Type of module for this channel
3.6.3	Report Format	*c3	**c3nn	Selects the information that will be reported for a particular channel
3.6.4	Telephone List	*c41	**c41t	List of numbers to call when in alarm
3.6.5	Alarm **ON/OFF** Delay	*c5	**c5nMMSS	Waits this long for a channel to be in fault before reporting it
3.6.6	Open Digital Output (Force **OFF**)	*c6	**c60	Forces a Digital Output **OFF**
"	Close Digital Output (Force **ON**)	*c6	**c61	Forces a Digital Output **ON**
3.6.7	Alarm Configuration	*c8	**c8n	Determines how the Alarm operation for a channel should be handled
3.6.8	Analog Input High Setpoint	*c90	**c90aaa	High Setpoint for an analog input
3.6.9	Analog Input Low Setpoint	*c91	**c91aaa	Low Setpoint for an analog input
3.6.10	Analog Output Level	*c92	**c92aaa	Set an Analog output level

Selection of I/O channel type (c = 1 to 8 for I/O module index, starting at leftmost slot).

n	Setting	Meaning
0	SPARE	No Type Selected
1	Digital Input Normally Open	Contact closure Normally Open
2	Digital Input Normally Closed	Contact closure Normally Closed
3	Digital Output	Digital Output that is user definable to be Open or Closed
4	Analog Output (00.0 - 99.9%)	Analog Output that is user definable to be at some setting
5	Analog Input (00.0 - 99.9%)	Current Percentage of an input value
6	Local Alarm Output	Digital Output that Closes when there is a local alarm

Example-
 Command: **3201
 Response: *Channel three type is one normally open digital input.*

Note: Whenever the Type of Channel is changed, all of that channel's information is defaulted, I.e. all user programming is erased. Make sure this is your first step in programming a particular channel.

3.6.3 I/O Channel Report Format (c3)

*c3	Review I/O channel c status REPORT format
**c3nn	Program I/O channel c status REPORT format

Selection of spoken status Report Format. This entry selects which data is reported during an alarm call. More than one data item can be chosen at a time by entering a value that is the sum of the desired data items, (for example, to report the counter value and run time, use the value of **nn**=06, 2 for counter plus 4 for run time).

nn	Voice Response	*Spoken Status*/Meaning
00	None	*Channel c report format is zero none.* Will only report the name and if it's in alarm
01	Report Current Status	*Channel c report format is one status.* The current setting of the I/O Channel
02	Report Counter Value	*Channel c report format is two count.* For Digital, the number of transitions from Open to Closed
04	Report Run Time	*Channel c report format is four run time.* Total length of time this channel has been in a fault

To program the ON and OFF delays, the command **c51MMSS will be used (n=1). This will set both the ON and OFF delay times to the set time period (MMSS). To program the OFF delay, the command **c52MMSS will be used (n=2). This will set only the OFF delay time.

> Example-
> Command: **1510030
> Response: *Channel one alarm on delay is three zero seconds and off delay is three zero seconds.*

If then this command:

> Command: **1520004
> Response: *Channel alarm one on delay is three zero seconds and off delay is four seconds.*

3.6.6 I/O Channel Digital Output (c6)

*c6	Report I/O channel c Digital Output status
**c60	Program Digital Output channel c to be **OFF**
**c61	Program Digital Output channel c to be **ON**

Opens(Turns **OFF**) or Closes(Turns **ON**) a Digital Output Channel. If a non-latched channel is Closed, it will be a momentary closure.

> Example-
> Command: **560
> Response: *Channel five output is OFF.*

3.6.7 I/O Alarm Configuration (c8)

*c8	Review I/O channel c alarm configuration
**c8n	Program I/O channel c alarm configuration

Selection of channel c alarm operation. For instance, latched, call on alarm, etc.:

n	Value	Meaning
0	None	no alarms generated
1	LATCHED	no alarms generated
2	COA (call on alarm)	A call is placed when input changes from normal to alarm after the I/O delay time. If the monitored input goes back to a normal condition, no more alarm callouts will be made for that previous fault.

3.6.10 I/O Channel Analog Output (c92)

*c92	Review I/O c analog output setting
**c92aaa	Program I/O c analog output setting

The value the dialer will set the analog output to.

> **Example-**
>> Command ****292250**
>> Response: *Channel two analog output is two five point zero percent.*

4.0 OPERATION

4.1 ALARM CALLOUT THEORY OF OPERATION

When a new alarm event occurs, recognized by the dialer as an external event monitored by the I/O channels, it begins to place a series of telephone calls starting at the top of the individual alarm channel's calling list in an attempt to receive an acknowledgment for this alarm.

When the unit's outgoing call is answered, it reports the current alarm status on the dialer. It will report which channels are in alarm, which channels are in alarm that have been acknowledged, and which channels that are now normal (a channel that has gone into and out of alarm without being acknowledged).

Unacknowledged but **answered** alarm callouts are separated by the user programmed *Call Spacing Period.* This allows a called party the opportunity to acknowledge the alarm by calling the dialer back before it begins to call the next telephone number on the calling list. This feature is necessary if a called party does not have a touch-tone phone to enter the DTMF acknowledge code remotely. When the dialer is called back, it will report which alarms have been callback acknowledged.

Unacknowledged, **unanswered** alarm callouts are *not* separated by the Call Spacing period. The Call Progress features of the dialer allow it to determine if the called telephone number is busy or did not answer. In this case, the dialer will only wait a telephone network recovery period (10 seconds) before going off-hook and placing a call to the next number on the calling list.

If an alarm callout has been answered and the alarm is acknowledged by one of the following, then all current alarms that have the called telephone number on their individual calling lists are acknowledged:

    A. Entering the '*' key during message playback.
    B. Calling back the dialer during the Call Spacing Period (callback acknowledge).
    C. An auto acknowledge code embedded in the telephone number (***90**).

Any alarms which do not include the called number on their calling list are not acknowledged, and will cause independent alarm calls to be placed. This assures that acknowledgments only apply to alarms associated with each channel's own call list.

The user can arbitrarily acknowledge all alarms or a selection of alarms by entering the commads ****071** (all) or ****072n** (channel **n; 0**=System).

Each I/O channel has its own independent snooze timer. When an alarm is acknowledged, the snooze timer for that individual channel is started, and alarm calls for that channel are suspended until its snooze period expires. If the snooze delay expires before the alarm condition has been removed, then the dialer will begin a new alarm dialing sequence (starting with the first number on the specific channel's calling list).

If an incorrect or no access code is entered during a timed access code entry time (10 seconds), the dialer will disconnect and initialize the system Call Spacing delay timer. If the alarm condition(s) were acknowledged, then the snooze timer(s) associated with the reported alarm condition(s) will be initialized with a value equal to the programmed system Snooze Delay. If alarm conditions were not acknowledged, calls will continue to be placed to the next telephone numbers on the channel's calling list after the system Call Spacing delay has expired.

In addition to voice reporting of alarms, the Microtel *Series 1000* is capable of transmitting a hard copy alarm status report, or a report of all programmed setup data, to a FAX machine. To cause a FAX report to be sent during an alarm calling sequence, the special *991 dial sequence must be included in the telephone number of the FAX machine (refer to **Section 4.4,** *Forcing a Test Call or Sending a Fax*).

Any digital output configured as a local alarm type will be turned on whenever a new alarm condition exists within the dialer (regardless of whether the telephone line is in use or not). This output could be connected to a siren or bell to warn of an alarm existing.

4.2 LED INDICATOR MEANINGS

The *Series 1000* has three indicator LEDs (light emitting diodes) as shown in Figure 7 (see next page) as well as LEDs on any digital type I/O modules. The indicator LEDs indicate conditions from within the dialer.

The PHONE LED located adjacent to the PHONE connector is turned on whenever the dialer senses that a telephone connected to the phone jack is off-hook, or during FAX transmissions (If you have no external phone line, see **Section 3.1,** *Introduction* on how to use a phone locally).

The LINE LED located adjacent to the LINE connector indicates call progress while the dialer is off-hook and ring detection when on-hook.

The POWER/FAULT LED located in the upper right corner, above the power on/off switch indicates normal run status, I/O faults, power fail and dialer internal errors as follows:

Normal:	Flicker 95% ON	5% OFF
Power fail:	Blink 10% ON	90% OFF
Internal error or I/O fault:	Blink 50% ON	50% OFF

Refer to **Section 5.0,** *Troubleshooting* to diagnose Internal Errors indicated on the LED.

OUTPUT MODULE LEDS are ON when the module's output circuit is CLOSED.

Any LOCAL ALARM Output module will have its LED on when any unacknowledged alarm condition exists within the dialer.

Any DIGITAL INPUT MODULE will have its LED on when the external circuit it is monitoring is energized.

4.3 USING A LOCAL TELEPHONE ON THE OUTSIDE LINE

A telephone connected to the *Series 1000* PHONE jack can be used both as a normal telephone by pressing a '**9**' for a connection to the line, or as the human-to-machine interface to configure and inquire the *Series 1000* dialer.

To use the outside line:
1. Pick up the local telephone connected to the *Series 1000* jack labeled PHONE.
2. Dial '**9**'.
3. The telephone will now be connected to the outside phone line.
4. Listen for the dial tone.
5. You may now place a telephone call.
6. To get back to the *Series 1000*, hang-up the phone, then pick it up again.

When the local telephone rings, you may receive the call by picking up the handset before the dialer's answer delay (ring count) elapses.

4.5 RECEIVING AN ALARM CALL

When the *Series 1000* calls you, you may wish to respond to the call differently depending on what type of alarm has occurred and other factors such as who is on duty, the time of day, severity of the alarm, etc.

If you wish the dialer to go to the next phone number on its calling list, then:

1. Hang up the phone.
2. The dialer will continue on after the call spacing delay to the next phone number on the list until it receives an acknowledgment or the unlatched alarm goes away by itself.

If you wish to acknowledge the call from your touch-tone phone, then:

1. Press the '*' key on your telephone *while* the alarm message is being spoken.
2. If an access code is required, then enter the 4 digit access code.
3. After gaining access to the dialer, entering either of the following commands will acknowledge the alarm(s):

**071	Acknowledge alarms

Acknowledge all alarms (not just ones armed to call your telephone number), including any system errors that were enunciated.

Example-
Command: **071
Response: *Acknowledge alarms accepted.*

**072c	Acknowledge alarms on channel c

Acknowledge alarms for I/O channel **c**. If no other unacknowledged alarms still exist, then no additional calls will be made. If any unacknowledged alarm exists, the calls will be made to that alarm's telephone list. **c=0** would acknowledge only System alarms.

Example-
Command: **0721
Response: *Channel one alarm acknowledged.*

4.6 OBTAINING A SYSTEM STATUS REPORT

A spoken system status report can be received from the dialer by entering the following command from a touch-tone telephone either locally, or remotely after answering or calling the dialer:

---

*000   Report system status

The dialer will speak a voice message of system name, software version, system errors if present, current alarms, counter values and run time accumulators of individual I/O modules. The data spoken for each I/O channel will depend upon the user-configured status report format.

> **Example-**
> Command: ***000**
> Sample Response:
> > *MICROTEL SERIES ONE THOUSAND*
> > *two point zero*
> > *Channel one normally closed digital input in alarm*
> > *Channel two normally open digital input*
> > *Channel three normally open digital input is open*
> > *Channel nine power normal*

---

*c0   Report I/O channel **c** status

A spoken status message for I/O channel **c** only. The data spoken is dependent upon the user-configured **report format (3.6.3)** for channel **c**. This will also specify the current alarm condition for that channel. It will say if the channel is currently in alarm, in alarm acknowledged, or is now normal (an unacknowledge fault condition cleared).

> **Example voice messages-**
> Digital Input Type   *Channel one is Normal.*
> Digital Output Type   *Channel two is ON.*
> Counter Input   *Channel three is at one zero zero two counts.*
> Analog Input   *Channel four is at seven five point zero percent.*
> Power Fail   *Power Normal.*

**c0   Reset I/O channel **c counter and runtime

Clear I/O channel number **c** counter and runtime registers. (See **Section 3.6.3** to change the channel **report format**)

> **Example-**
> Command: ****10**
> Response: *Channel one normally closed digital input zero counts runtime is*
> *zero.*

4.8 USING THE DISABLE TIMERS

The disable timers provide a way to temporarily prevent unwanted calls to be placed.

When **disable timer 0** has been set to any non-zero value. no calls will be placed until either the timer counts down to zero or is programmed back to zero. Typical uses of this function would include disabling false calls during planned maintenance on equipment monitored by the dialer.

When **disable timer one through nine** is non-zero. then calls to that corresponding phone number alone are disabled. An example use would be disabling phone one for whatever time period required while the person responsible for responding to phone one calls is not available. Use the following command syntax to review/set disable timers:

*02n	Report disable timer current value
**02nDDHHMM	Set disable timer n

Disable the dialer from placing calls to this phone number **n** while this timer is non-zero (0-99 days. 0-23 hours. 0-59 minutes format). If **n=0** then calls to all phone numbers are disabled.

> **Examples-**
> Command: **020000105
> Response: *The system disable timer is one hour five minutes.*
> **-and-**
> Command: **021010105
> Response: *Telephone number one disable timer is one day one hour five minutes.*

Example of use:

The on-call person is going out of town for 3 days. He wishes his family not to be disturbed while he is gone. The dialer is instructed to skip his phone number during an alarm call-out sequence. In this case, the command **021030405 would prohibit alarm calls to be placed to phone 1 for 3 days, 4 hours, and 5 minutes beginning at the time the command is sent.

4.9.3 Enable Printing (052)

**052	Enable printing

This command will enable continuous printer logging of all dialer status changes (input and output state changes, callouts, alarm acknowledgments, power on/off cycles, etc.).

Example-
Command: **052
Response: *Printing Enabled.*

4.9.4 Disable Printing (053)

**053	Disable printing

This command will disable printing.

Example-
Command: **053
Response: *Printing disabled.*

5.0 TROUBLESHOOTING

Symptom: Voice data lost or clock and calendar lost.
    Cause: 3v battery replacement.
    Cause: Jumper J14 on processor board not installed.

Symptom: Unable to place telephone calls (Line LED comes on but no ring at called telephone number).
    Cause: Phone number not entered correctly.
    Cause: Call being placed to different number list than expected.
    Cause: Phone line not plugged-in, phone line broken or in use.

Symptom: Unable to program with local telephone.
    Cause: Incorrect command format (all commands begin with * or **). To clear out the message buffer at any time, press the '#' key.
    Cause: Touch-tone phone must be used (listen for tones when keys are pressed).
    Cause: Phone not plugged in correctly (local telephone must be plugged into PHONE jack, and OFF HOOK LED should be on).
    Cause: Dialer off-hook placing call (LINE LED is on).
    Cause: Very loud or noisy environment -- program from remote phone or use a mute button on the local phone.

Symptom: Not placing alarm call (Line LED does not come on).
    Cause: I/O channel not really in alarm or is not a new alarm.
    Cause: Channel is not configured to call(COA). See section **3.6.7**.
    Cause: Non-latched alarm is self clearing before call is made.
    Cause: Local telephone is off-hook.
    Cause: System or telephone disable timer set.
    Cause: Intercall (Snooze or Call-spacing) delay set.
    Cause: No valid telephone numbers to call.

Symptom: **Dialer is dead (Power LED is on steady, not flickering).**
    Cause: Non-recoverable CPU error (Call Toll-free Support number).

Symptom: **Dialer is dead (Power LED is off).**
    Cause: Check power to dialer. Make sure it is wired properly.
    Cause: Non-recoverable CPU failure (Call Toll-free Support number).

Symptom: **Dialer is dead (Power LED is blinking).**
    Cause: Enter *000 through local telephone. Listen to spoken status report. It should say "System Data Error" or "System Timer Error."

    System Data Error - Some configuration data was corrupted. Review all configuration data and reprogram errant items.

Symptom: **MicroMax Surge Protector - Dialer is not responding locally and seemingly hangs up the call right after the first ring (Power LED is blinking).**
    Cause: If you have a MicroMax surge protector on the line, the surge protector may be interfering with the dialer's operation. Possible Cure: Try unplugging the line connector from the dialer so it isn't connected to any device and then turn on and off the dialer a few times trying to get it to pick up locally (It may take a few times for it to work). If it still doesn't respond, try connecting the wall jack directly to the dialer and try cycling power a few times while trying to again connect locally. If none of this works, (Call Toll-free Support number).

6.0 MAINTENANCE

6.1 SYSTEM BATTERY

Battery life is dependent upon a number of factors, predominantly the number of power outages and the age of the battery. A battery in typical standby use will last approximately 2 to 4 years. A new battery should take no longer than 24 hours to gain full charge, capable of powering the system through a power outage of typically 6 hours. Because of the modular nature of the *Series 1000*, however, battery backup time may vary by a few hours. The battery backup time is proportional to the number and types of I/O modules you have installed in your dialer.

Check the System Battery by using a DC voltmeter to measure the open circuit (no-load) terminal voltage of the battery at room temperature (20 degrees Celsius). If the voltage is less than 12.5 volts, the battery has a residual capacity of less than 50%. If the voltage is less than 12.0 volts, the battery is completely worn out.

Refer to **Section 2.4**, *Battery Connection*, for instructions on installing a new battery and adjusting the dialer's battery charging circuit.

6.2 ONBOARD CLOCK

After initially setting time and date, periodically check the accuracy of your dialer's onboard clock. It may run a couple of minutes fast or slow per month. In addition, you will have to set the time back/forward to correspond with Daylight Savings Time. The time can be conveniently reviewed and adjusted over the telephone by entering the touch tone command with the new time in 24-hour format (**060HHMM). Refer to **Section 3.3**, *Setting Time and Date*, for additional explanation and examples.

An internal 3 Volt lithium cell maintains time/date when power to the dialer is removed. It has a capacity of approximately a year. If power to your dialer is to be removed for an extended period, consult the factory about removing an internal jumper to preserve battery energy.

6.3 FUSE REPLACEMENT

For:	Use the following:
Series 1000 Dialer	Littelfuse Micro 2A273 -- Microfuse 2A/125V
Grayhill Output Modules	Littelfuse Metric (5 X 20 mm) -- Use Amp/Volt rating of old fuse
Opto 22 Output Modules	Wickmann TR5 Sub-Miniature -- Use Amp/Volt rating of old fuse

APPENDICES

APPENDIX A: TECHNICAL SPECIFICATIONS

A.1 COMMUNICATIONS

Phone Interface:	FCC 68 Registration Number: IQEUSA-21532-AL-E Pass-through Phone Handset
Ringer Equivalence Number:	1.2B(ac)
LED Indicators:	Dialer Off-hook/Ring Detect/Call Progress Telephone Off-hook/FAX-in-progress System Status/Power-fail
Dialing Capacity:	9 Phone Numbers, 60 Digits Each Tone or Pulse Dial Special Sequences for Selection of Pulse/Tone, Pause, Call Progress Detection, Turning ON/OFF Output Modules, Auto Acknowledging Alarms, Communicating with FAX machines or Computers.
Call Progress Detection	Dial Tone Detect Busy Detect Ring Back Detection Quiet/Voice/Answer/Pager Terminal Tone detect
Answer Delay:	1-99 Rings (Call Back Acknowledge)
Fax:	Group 3 Fax Compatible Single-page Alarm Status or Dialer Configuration Reports

A.2   ELECTRICAL

Input Power:	120 VAC 14.5 VDC Plug in Wall Transformer or 12-16VDC @ 0.5 Amp (Dialer only) or 14.5-16VDC (Dialer with Battery) Solar Power Interface Compatible Power On/Off Switch Power-fail Indicator Externally Accessible Fuse

A.6 SPEECH

Type: Digitized Resident and User-Recorded Messages
                                   ADPCM

Recordable Message Lengths: 6 Seconds System Message
                                   3.25 Seconds Each I/O Name

A.7 I/O MODULES

Capacity: 8 I/O Socket Locations for Plug-in Modules

I/O Module Types:

MOD No.	Tin No.	Description
MOD-DI5	61558	Digital Input, Isolated, Dry Powered
MOD-DO4	61556	Digital Output Contact, Dry, N.O.
MOD-DO5	61557	Digital Output Contact, Dry, N.C.
MOD-AI1	61549	Analog Input, 4-20 mA, Isolated
MOD-AO1	61550	Analog Output, 4-20 mA, Isolated

Additional Modules Supported.

A.8 I/O FUNCTIONAL MODES

Discrete Status:	ON/OFF or OPEN/CLOSED
Discrete Alarm Inputs:	ALARM/NORMAL/STATUS
Analog Status Inputs:	0.0 to 99.9%
Analog Alarm Inputs:	High and Low Set Points
Analog Outputs:	0.0 to 99.9%
Counter Inputs:	32-Bit Accumulator
	(1 pps. Channels 1-7, 50 pps. Channel 8)
Run Time Inputs:	00:00:00 (DD:HH:MM)
Local Alarm Output:	Alarm/Normal
Power Fail Detection:	Power Fail/Normal

APPENDIX B: GLOSSARY OF DIALER TERMINOLOGY

Acknowledge	Telling the dialer that an alarm should not cause additional calls to be placed. Acknowledgment can be made by entering the '*' during alarm playback. with the acknowledgment command (**071.**072c). with call back acknowledge. or by an auto acknowledge phone escape sequence (*90) embedded within the telephone number.
Alarm condition	An event detected by the dialer usually causing a phone call.
Analog	An I/O channel type that uses a numerical value (0.0% to 99.9%).
Call-spacing	The time delay between successive answered unacknowledged telephone calls.
Interaction delay	A programmable time delay between a keyboard command and its voice message response. to allow the user to move the phone handset to the ear. If the keypad is located separately from the ear piece. then a 0 delay will speed Interaction delay.
I/O channel	A dialer to outside world connection.
Latched type	An I/O channel parameter that will store an alarm condition even if the alarm condition goes away. The alarm condition will be held until the alarm is acknowledged.
New alarm	Any alarm that has not yet initiated a call out sequence or an alarm still present after the snooze delay.
Phone list	A sequence up to 9 digits indicating which phone numbers to call from the telephone directory.
Phone number	A sequence of up to 60 digits used to dial a phone number or perform a dial escape sequence function.
Report format	A selection of what data is spoken during a call within a status message.
Snooze delay	The time between when an alarm is acknowledged and when it begins to cause calls again.
Unlatched type	An I/O channel parameter that causes an alarm to self-clear if the alarm condition goes away.

APPENDIX C: PERCENT/CURRENT/VOLTAGE/TEMPERATURE CONVERSIONS

%	ma	volts	°F	°C	%	ma	volts	°F	°C
0%	4.00ma.	1.00volts	-40°F	-40°C	50%	12.00ma.	3.00volts	50°F	10°C
1%	4.16ma.	1.04volts	-38°F	-39°C	51%	12.16ma.	3.04volts	52°F	11°C
2%	4.32ma.	1.08volts	-36°F	-38°C	52%	12.32ma.	3.08volts	54°F	12°C
3%	4.48ma.	1.12volts	-35°F	-37°C	53%	12.48ma.	3.12volts	55°F	13°C
4%	4.64ma.	1.16volts	-33°F	-36°C	54%	12.64ma.	3.16volts	57°F	14°C
5%	4.80ma.	1.20volts	-31°F	-35°C	55%	12.80ma.	3.20volts	59°F	15°C
6%	4.96ma.	1.24volts	-29°F	-34°C	56%	12.96ma.	3.24volts	61°F	16°C
7%	5.12ma.	1.28volts	-27°F	-33°C	57%	13.12ma.	3.28volts	63°F	17°C
8%	5.28ma.	1.32volts	-26°F	-32°C	58%	13.28ma.	3.32volts	64°F	18°C
9%	5.44ma.	1.36volts	-24°F	-31°C	59%	13.44ma.	3.36volts	66°F	19°C
10%	5.60ma.	1.40volts	-22°F	-30°C	60%	13.60ma.	3.40volts	68°F	20°C
11%	5.76ma.	1.44volts	-20°F	-29°C	61%	13.76ma.	3.44volts	70°F	21°C
12%	5.92ma.	1.48volts	-18°F	-28°C	62%	13.92ma.	3.48volts	72°F	22°C
13%	6.08ma.	1.52volts	-17°F	-27°C	63%	14.08ma.	3.52volts	73°F	23°C
14%	6.24ma.	1.56volts	-15°F	-26°C	64%	14.24ma.	3.56volts	75°F	24°C
15%	6.40ma.	1.60volts	-13°F	-25°C	65%	14.40ma.	3.60volts	77°F	25°C
16%	6.56ma.	1.64volts	-11°F	-24°C	66%	14.56ma.	3.64volts	79°F	26°C
17%	6.72ma.	1.68volts	-9°F	-23°C	67%	14.72ma.	3.68volts	81°F	27°C
18%	6.88ma.	1.72volts	-8°F	-22°C	68%	14.88ma.	3.72volts	82°F	28°C
19%	7.04ma.	1.76volts	-6°F	-21°C	69%	15.04ma.	3.76volts	84°F	29°C
20%	7.20ma.	1.80volts	-4°F	-20°C	70%	15.20ma.	3.80volts	86°F	30°C
21%	7.36ma.	1.84volts	-2°F	-19°C	71%	15.36ma.	3.84volts	88°F	31°C
22%	7.52ma.	1.88volts	-0°F	-18°C	72%	15.52ma.	3.88volts	90°F	32°C
23%	7.68ma.	1.92volts	1°F	-17°C	73%	15.68ma.	3.92volts	91°F	33°C
24%	7.84ma.	1.96volts	3°F	-16°C	74%	15.84ma.	3.96volts	93°F	34°C
25%	8.00ma.	2.00volts	5°F	-15°C	75%	16.00ma.	4.00volts	95°F	35°C
26%	8.16ma.	2.04volts	7°F	-14°C	76%	16.16ma.	4.04volts	97°F	36°C
27%	8.32ma.	2.08volts	9°F	-13°C	77%	16.32ma.	4.08volts	99°F	37°C
28%	8.48ma.	2.12volts	10°F	-12°C	78%	16.48ma.	4.12volts	100°F	38°C
29%	8.64ma.	2.16volts	12°F	-11°C	79%	16.64ma.	4.16volts	102°F	39°C
30%	8.80ma.	2.20volts	14°F	-10°C	80%	16.80ma.	4.20volts	104°F	40°C
31%	8.96ma.	2.24volts	16°F	-9°C	81%	16.96ma.	4.24volts	106°F	41°C
32%	9.12ma.	2.28volts	18°F	-8°C	82%	17.12ma.	4.28volts	108°F	42°C
33%	9.28ma.	2.32volts	19°F	-7°C	83%	17.28ma.	4.32volts	109°F	43°C
34%	9.44ma.	2.36volts	21°F	-6°C	84%	17.44ma.	4.36volts	111°F	44°C
35%	9.60ma.	2.40volts	23°F	-5°C	85%	17.60ma.	4.40volts	113°F	45°C
36%	9.76ma.	2.44volts	25°F	-4°C	86%	17.76ma.	4.44volts	115°F	46°C
37%	9.92ma.	2.48volts	27°F	-3°C	87%	17.92ma.	4.48volts	117°F	47°C
38%	10.08ma.	2.52volts	28°F	-2°C	88%	18.08ma.	4.52volts	118°F	48°C
39%	10.24ma.	2.56volts	30°F	-1°C	89%	18.24ma.	4.56volts	120°F	49°C
40%	10.40ma.	2.60volts	32°F	0°C	90%	18.40ma.	4.60volts	122°F	50°C
41%	10.56ma.	2.64volts	34°F	1°C	91%	18.56ma.	4.64volts	124°F	51°C
42%	10.72ma.	2.68volts	36°F	2°C	92%	18.72ma.	4.68volts	126°F	52°C
43%	10.88ma.	2.72volts	37°F	3°C	93%	18.88ma.	4.72volts	127°F	53°C
44%	11.04ma.	2.76volts	39°F	4°C	94%	19.04ma.	4.76volts	129°F	54°C
45%	11.20ma.	2.80volts	41°F	5°C	95%	19.20ma.	4.80volts	131°F	55°C
46%	11.36ma.	2.84volts	43°F	6°C	96%	19.36ma.	4.84volts	133°F	56°C
47%	11.52ma.	2.88volts	45°F	7°C	97%	19.52ma.	4.88volts	135°F	57°C
48%	11.68ma.	2.92volts	46°F	8°C	98%	19.68ma.	4.92volts	136°F	58°C
49%	11.84ma.	2.96volts	48°F	9°C	99%	19.84ma.	4.96volts	138°F	59°C

APPENDIX D: I/O MODULE WIRING DIAGRAMS

D.1   120 Vac INPUT
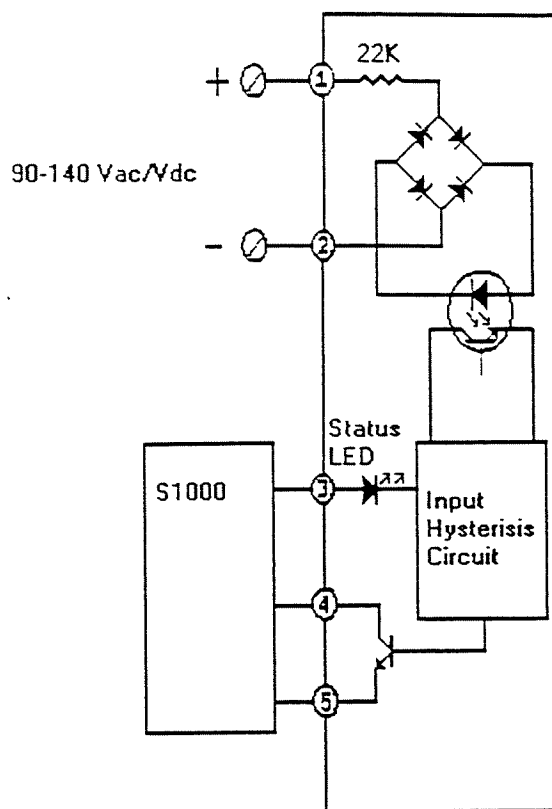
PART NUMBER:	CALL FACTORY
CASE COLOR:	YELLOW
INPUT VOLTAGE RANGE:	90-140 Vac
NOMINAL INPUT RESISTANCE:	22K Ohms
MAXIMUM PICKUP VOLTAGE(LOW)	90 Vac
MINIMUM DROP OUT VOLTAGE(HIGH)	25 Vac

D.3 4-20 mA ANALOG OUTPUT
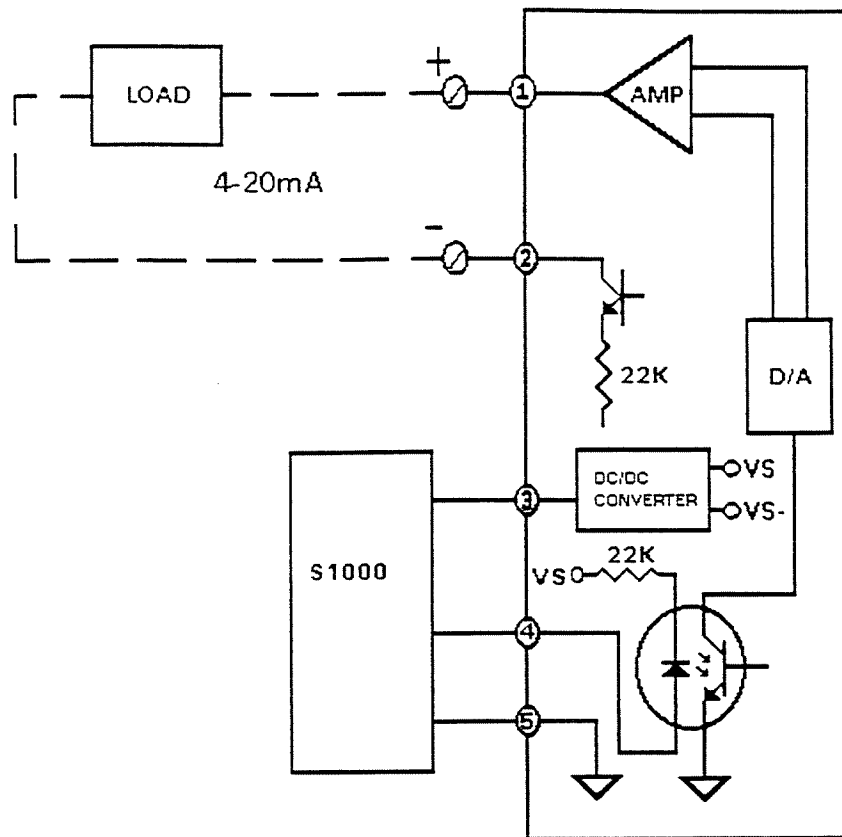
PART NUMBER:	MOD-AO1
COLOR:	ORANGE
MAXIMUM OUTPUT CURRENT (SOURCE):	20 mA,
	450 Ohm max. loop resistance
ACCURACY, FULL SCALE AT 25C:	±0.3%
RESOLUTION:	3.9uA (12 BITS)
ISOLATION:	2500 Vrms

D.5 ISOLATED DRY CONTACT INPUT
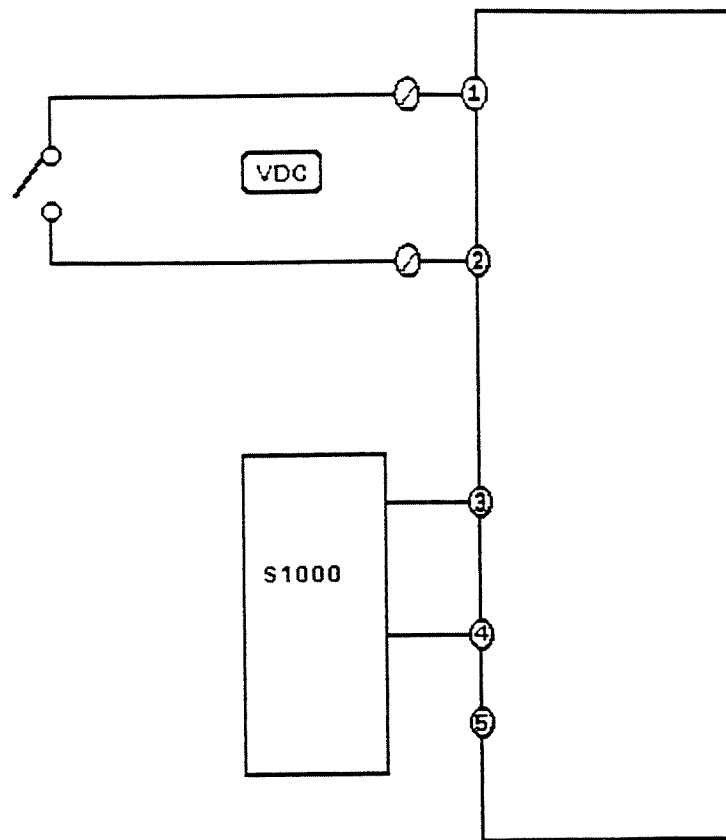
PART NUMBER:	MOD-DI5
COLOR:	WHITE
MAXIMUM DRY CONTACT VOLTAGE RATING:	25 Vdc
MINIMUM DRY CONTACT CURRENT RATING:	5 mA
CONTACT RESISTANCE (OUTPUT LOW):	≤ 1.25 K Ohm
CONTACT RESISTANCE (OUTPUT HIGH):	> 20 K Ohm
ISOLATION:	2500 Vrms

APPENDIX E: EXAMPLES OF FAX REPORT

The attached pages are actual FAX reports sent from a Microtel *Series 1000* dialer.

Notice the time/date stamp. custom system text message. and dialer's identifying telephone number printed at the top of each FAX report. Customized text messages must be configured using a local computer.

The **Status Report** indicates any system errors. current alarm conditions. and current State, Runtime. and Counter data for each installed I/O module.

The **Setup Report** lists all configured System parameters, the System Telephone Directory, Call At Schedule. and I/O Module Programmed Configuration Data. The example shown here lists default system and I/O configuration data.

Alarm calls send Status Reports only; you must enter a command to force the dialer to send a Setup Report (See **Section 4.4,** *Forcing a Test Call or Sending a Fax*).

Software Version: S1000 VER 2.2

Snooze delay:	00:01:00 (DD:HH:MM)
Call-spacing delay:	1 minute(s)
Rings before answer:	1
Message repeat count:	3
Remote menu access code:	1732
Voice interaction delay:	0.1 seconds
System telephone list:	53421
Answer Mode:	Data Mode

Printing: DISABLED   Testset: ENABLED

System Telephone Directory
----

1. *94018004545231*2*2*2*25042456229*91*984
2. *9404236957*2*2*2*22456229*91*984
3. *9902456300
4. 4524908
5. 4547291
6.
7.
8. *991105
9. *991*9402760574

Call At Schedule

Day:	Sun	Mon	Tue	Wed	Thu	Fri	Sat
HHMM	0700	0700	0700	0700	0700	0700	0700

I/O Module Programmed Configuration Data

I/O Channel	TYPE	Report Format	Delay (Secs)	Alarm Configuration		Setpoints Low	High	Calling List
1 HIGH WETWELL LVL	DI N.O.	01	0020/0005	COA				4521
2 PUMP #1 FAIL	DI N.C.	01	0020/0005	COA				451
3 PUMP #2 START	DO	01	0020/0005	STATUS	LATCH			123456789
4 VALVE POSITION	AO	01	0020/0005	STATUS		0.1%	100.0%	123456789
5 TEMPERATURE	AI PER	01	0020/0010	STATUS		10.0%	90.0%	123456789
6 LOCAL ALERT	DO LA	15	0020/0005	STATUS	LATCH			123456789
9 Power Fail	PF	01	0060/0010	COA				451

Software Version: S1000 VER 2.2

The Alarm Status is NORMAL

I/O Module Status Data

I/O Channel	State	Run Time DD:HH:MM	Current Alarm Time HH:MM:SS	Counter
1 HIGH WETWELL LVL	0	00:00:00	00:00:00	0000000000
2 PUMP #1 FAIL	1	00:00:00	00:00:00	0000000001
3 PUMP #2 START	0	00:00:00		0000000000
4 VALVE POSITION	0.0%	00:00:00	00:00:00	
5 TEMPERATURE	0.0%	00:00:10	00:10:38	
6 LOCAL ALERT	0	00:00:00	00:00:00	0000000000
9 Power Fail	1	00:00:00	00:00:00	0000000000

Software Version: S1000 VER 2.2

TIGERMAG EP ™

INSTALLATION
OPERATION & MAINTENANCE
MANUAL

Issue Date: November 1996

FM626

FM656
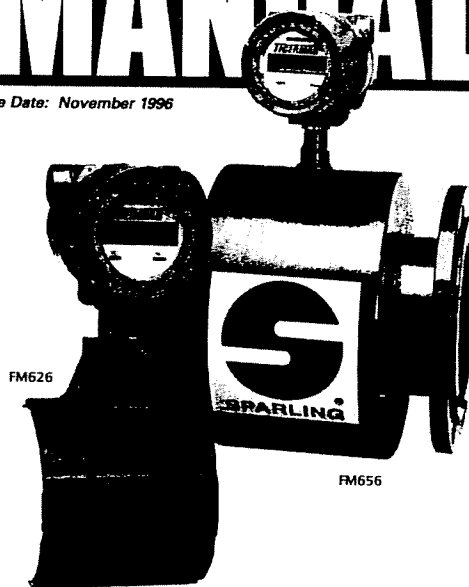
SPARLING

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cont'd.

1.0 General

1.1 Measuring System

The Sparling TigermagEP™ Model FM626 and FM656 flowmeters are obstructionless devices for monitoring the volumetric flow of conductive liquids in full closed pipes.

The flowmeter consists of a sensor (wafer or flanged) with a non-magnetic liner and a measuring transmitter.

1.2 Operating Principle

Operation is based on Faraday's Law of Magnetic Induction. An electrically conductive liquid flowing through a magnetic field induces a voltage which is perpendicular to this field and to the direction of the flow. This voltage is proportional to the average flow velocity. See Figure 1.1.

The mathematical formula describing Faraday's law reads:

$$E = B \times L \times V$$

E = Induced voltage
B = Magnetic field intensity (flux density)
L = Distance between the electrodes (pipe diameter)
V = Average flow velocity of liquid
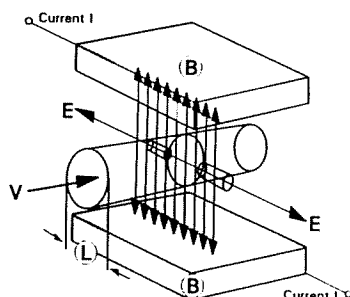
Measuring Principle
Figure 1.1

1.3 Application to Magnetic Flow Measurement

In a magnetic flowmeter the liquid acts as a moving conductor as it flows through the pipe. The induced voltage (E) in the liquid is measured by two sensing electrodes mounted opposite each other in the meter sensing head.

The length of the conductor is equal to the distance between sensing electrodes and also the internal diameter (D) of the pipe. The flux density is proportional to the coil current (I), times a constant (k). The above formula can be restated as follows:

$$E = I \times k \times D \times V$$

$$V = \frac{flow}{cross\ sectional\ area} = \frac{Q}{A}$$

$$E = \frac{Q \times I \times 4 \times k}{D^2}$$

Note that if I is held constant, E is proportional to Q or *the induced voltage is directly proportional to the average flow rate* (V).

1.4

Interference

1.4.1 Electrochemical Interference

The signal voltage is measured by two electrodes. Galvanic elements form on the surface areas between the ion-conducting liquid and the metal electrodes. The polarization voltages which result are dependent on temperature, pressure, and the chemical composition of the electrodes and liquid. These are direct voltages which cannot be predicted and which can be different at each electrode. The signal voltage must be separated from the interference direct voltage. Proper grounding eliminates these unpredictable voltages from interfering with the signal voltage.

1.4.2 Induction Interference (Quadrature)

Electrode cables connect the electrodes with the meter electronics. Because these cables must run within the magnetic field, a voltage is induced which is proportional to the rate of change of the magnetic field strength. The meter design minimizes the length of conductor within the magnetic field in order to keep the value of this interference as low as possible.

1.4.3 Other Interference Voltages

Pipes and the liquids within them are often used as a conductor for electrical grounding. This creates a voltage potential between electrodes which can be high relative to the signal voltage. Proper grounding of the flowmeter to the liquid is necessary to achieve correct meter operation. Grounding rings should be installed if the flowing medium has a voltage potential, if piping is non-conductive (plastic or *lined*) or if conductivity is below 20 micromhos/cm. See Section 3.8 – Grounding.

1.5

System Operation

The Sparling TigermagEP™ uses the autozeroing, bi-polar, pulsed-DC measuring technique. The circuitry in Figure 1.2 energizes the coil with 300 mA typical current at a frequency up to 100 Hz. The signal generated at the electrodes is measured near the end of each measuring cycle to eliminate the capacitive effects of coatings. The Hi-Z (10^{12} Ω) input impedance eliminates the resistive effects. The field current alternates to a positive and negative state and the two measured signals are averaged to eliminate the effect of a zero offset—auto-zeroing.

1. Measuring Sensor
2. Electrode Cable PCB
3. Input Amplifier
4. Summing Point
5. Autozero Circuit
6. Sample and Hold
7. Voltage to Frequency Converter
8. Non-volatile EEPROM (constants)
9. Coil Current Multiplexer
10. Built-in Simulator
11. Adjustable Empty Pipe Detection (in software)
12. Watchdog Timer
13. Microcontroller
14. LCD Display with Hall Effect Switches
15. Optocouplers
16. Frequency to Current Converter
17. Power Supply Section

Block Diagram
Figure 1.2

1.6
Construction

16.1 Sensor

The FM626 consists of a ceramic or optional *Teflon*® (PTFE) lined stainless steel sensor which is fitted into a steel housing. The FM656 flow sensor is a welded fabrication of 304 stainless steel, fitted with two carbon steel flanges. The flow sensor contains a non-conductive liner of ceramic, polyurethane, *Teflon*®, hard rubber, soft rubber, or neoprene. Both TigermagEPs™ are structurally sound waterproof assemblies capable of handling a wide range of highly corrosive and abrasive liquids.

Electrodes in ceramic-lined meters over 0.50" are sealed by a double "O"-ring seal. The primary O-ring seal is ethylene propylene. This seal is backed by a secondary seal of viton. The combination of seals makes the meter suitable for nearly all conductive liquids. In ceramic lined meter sizes from 0.10" to 0.50", one Viton "O" ring is used. The electrodes in all other liners are self-sealing.

All internal cavities of the FM626 sensor housing are filled with a high temperature silicone potting compound to prevent the possibility of moisture damage and to avoid the possibility of collection of explosive gases.

▼ WHEN PROPERLY CONNECTED WITH LIQUID-TIGHT CONDUIT, THE REMOTE FLOW SENSOR WILL WITHSTAND ACCIDENTAL SUBMERGENCE. SEE FIGURE 3.15 ON PAGE 21.

1.6.2 Integral Transmitter

The transmitter is housed in a CSA and Factory Mutual approved, NEMA-4X and NEMA-7 instrument enclosure. The power and signal electrical connections are made in a separate section of the housing which is isolated from the electronics.

1.6.3 Remote Transmitter

The transmitter is housed in a NEMA-4X enclosure.

Remote mounting of the electronics is required when process temperatures exceed 212°F (100°C), when pipe vibration is excessive or when flooding is possible. Remote mounting should be used when high process temperatures exist at high ambient temperatures.

The optional remote mounting kit includes interconnecting cable between the sensor and transmitter enclosure. The standard interconnecting cable length is 15 feet. Shorter or longer cables should be ordered from the factory. The cable may be shortened in the field.

⚠️
CAUTION

DO NOT MAKE CONNECTIONS WHILE POWER IS APPLIED. DISCONNECT POWER BEFORE PROCEEDING

1.7

Specifications

Power Requirements	See Nameplate
Fuses	Slo-Blo (12-60 Vdc).. 2.0 amp
	Slo-Blo (77-265 Vac) .... 1.0 amp
	Spare fuse provided on connector PCB.
Wire Size	Power .... 16 AWG; 14 AWG Max
	Signal .... 18 AWG
Ground Cable	Third wire ground of power cable

Accuracy
(Frequency Output)

0.1" - 0.5"
  0.5% of span (1-3 fps)
  0.25% of span (≤ 50% of span) (3-33 fps)
  0.5% of flowrate (≥ 50% of span) (3-33 fps)

1.0" - 12.0"
  0.25% of span (≤ 50% of span) (1-3 fps)
  0.5% of flowrate (≥ 50% of span) (1-3 fps)
  0.1% of span (≤ 20% of span) (3-33 fps)
  0.5% of flowrate (≥ 20% of span) (3-33 fps)

Reference Conditions	25°C, 6 fps full scale. Temperature effect, 0.025% Full Scale/°C. Accuracy statement based on digital outputs
Repeatability	Within ±0.1% full scale
Power Consumption	Less than 20 VA
Output Signals	Simultaneous isolated analog and digital (all referenced to the same isolated ground)

Analog: 0 to 20 or 4-20 mAdc into 800 ohms max.
Digital: Scaled pulse and frequency
    a. Scaled, 24 Vdc pulse with 12.5/25/50/100 ms on time, 0-60 Hz max into 150 ohm impedance min.
    b. Scaled frequency. 15 Vdc square wave, 50/50 duty cycle, 0 -1000 Hz max into 1000 ohms min.
    c. Fault, with open collector
    d. Two flow alarms
    e. Flow direction with open collector
    f. RS232 Communication

Fault	Open collector. Active on self test failure, empty pipe and during programming, low/no coil drive and failure of external totalizer to keep up with the flow (registration too small.
Input Signal	Positive zero return (PZR). Connect to remote dry contact to drive analog and digital outputs to zero when an empty pipe condition can occur.
Minimum Conductivity	5 micromho/cm
Flow Direction	Open collector (rating: 100mA at 30 Vdc). Active in reverse flow

1.7

Specifications
Cont'd.

Full Scale Velocity Ranges   0-3 to 0-33 fps (0-1 to 0-10 mps)

Ambient Temp Limits   -20° to 140°F (-30° to 60°C) (Display may darken above 158°F)

Process Temp

Integral Mount
Hard rubber, Soft rubber, Neoprene, Polyurethane .... -40 - 180°F
Teflon, Ceramic: .... -40 - 212°F

Remote Mount (opt)
Teflon, Ceramic: .... -40 - 266°F

High Temp Coils (opt)
Teflon: .... -40 - 350°F
Ceramic: .... -40 - 420°F

Temperatures above 212°F (100°C) require mounting the electronics separately (max. distance 15 feet at liquid conductivity of 5 micromhos and min. velocity of 1 fps).

Storage Temp Limits   -20° to 140° F (-30° to 60° C)

Construction

Metering Tube .... Model 626 – Steel
Model 656 – 0.5"-4" Steel, epoxy coated
Model 656 - 6"-12" 304 SS welded, epoxy coated
Flanges .... Carbon steel ANSI compatible
Lining .... Model 626 – Aluminum Oxide 99.5% or PTFE
Model 656 – Polyurethane, Aluminum Oxide 99.5%
PTFE, Hard Rubber, Soft rubber, Neoprene
Electrodes .... 316 SS. Others as required
Integral Housing (XMTR) ... Cast Aluminum, Hi-build Epoxy Coated
Remote Housing (XMTR) .... Fiberglass

Protection rating
Integral NEMA-4X, NEMA-7
Remote NEMA-4X

Electrical rating
Remote Mount - General Purpose
Integral Mount - Hazardous Locations
FM Approved* for Class I, Division 1, Groups B, C, D;
Class II Groups E, F, G
CE Approved
CSA Approved* for Class 1, Division 2, Groups A, B, C, D
Cenelec Approved (optional)
*FM and CSA applies to integrally mounted transmitters up to 150 psi only.

FM APPROVED   CE
(SA)   Ex

TigermagEP™

1.8

Interchangeability

The TigermagEP™ transmitter is designed to be used with any FM626 or FM656 sensor. Electronics are completely interchangeable. Meter identification (tube ID, Serial Number, K, Offset, etc.) is stored on an EEPROM chip independent of transmitter electronics. This provides universal compatibility between all Tigermag EP electronics modules, eliminating the need for reprogramming when switching modules. FM656 0.5"- 4" sizes have the same face to face dimensions as FM626 wafer-style meters (0.5"- 4") See Figure 1.3.
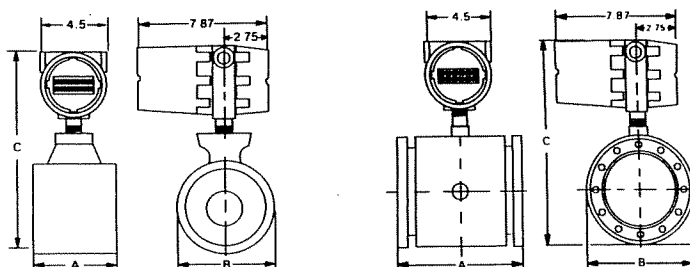
**Dimensions
Figure 1.3**

Table 1 – Flow & Dimensions Table

Nominal Meter Size		Nominal Flow Rates - Full Scale GPM						Dimensions (Inches)					Weight			
		Ceramic			Other			A	B		C		626		656	
		± 1 %	Min	Max	± 1 %	Min	Max	626/656	626	656	626	656	lbs	kg	lbs	kg
Inches	mm	1 FPS	3 FPS	33 FPS	1 FPS	3 FPS	33 FPS									
0.1	2.5	0.04	0.12	1.3	N/A	N/A	N/A	4.00	2.31	N/A	9.0	N/A	15	7	N/A	N/A
0.25	6	0.22	0.67	7.2	N/A	N/A	N/A	4.00	2.31	N/A	9.0	N/A	15	7	N/A	N/A
0.5	12	0.50	1.5	16.5	0.9	2.7	29	4.00	2.31	3.50	9.0	9.60	15	7	18	8
1.0	25	1.62	4.85	53.4	2.3	6.9	76	4.00	2.92	4.25	9.6	10.00	15	7	20	9
1.5	40	4.40	13.2	145.2	5.5	16.5	182	4.00	3.62	5.00	10.5	11.10	20	9	26	12
2.0	50	7.00	21.0	231.0	9.8	29.4	323	4.00	4.12	6.00	11.0	12.00	20	9	30	14
3.0	80	20.30	61.8	680.0	22.9	68.8	757	6.00	5.70	7.50	13.0	14.00	30	14	48	22
4.0	100	35.40	106.1	1168.0	40.4	121	1333	6.00	6.60	9.00	14.1	15.10	35	16	55	25
6.0	150	N/A	N/A	N/A	85	254	2800	13.00	N/A	11.75	N/A	18.25	N/A	N/A	75	73
8.0	200	N/A	N/A	N/A	145	436	4800	13.00	N/A	14.25	N/A	20.75	N/A	N/A	105	77
10.0	250	N/A	N/A	N/A	236	709	7800	17.75	N/A	17.13	N/A	23.63	N/A	N/A	155	86
12.0	300	N/A	N/A	N/A	333	1000	11000	19.00	N/A	20.13	N/A	26.63	N/A	N/A	235	117

Note 1: Dimensions and chart values for 150 lb. flanges (ANSI template).
Note 2: Allow 1/4" for 0.5 to 6" meters and 1/2" for 8" and larger meters for grounding rings and gaskets.

2.0 Pre-Installation

2.1 Receiving and Inspection

When the equipment is received, the outside of the package should be inspected for damage. If any damage or shortage is found, notation to that effect should be made on the carrier's delivery receipt.

Visually inspect the sensor and transmitter for damage from rough handling or faulty packaging. If concealed damage is discovered, notify the delivering carrier at once and request an inspection. Confirm telephone conversations in writing. If inspection is not made, prepare an affidavit stating that you notified the transportation company and that they failed to inspect. Save containers and packaging material.

It is essential that the carrier be notified within 15 days from the date of delivery in order to be in a position to present your claim. Make your claim promptly.

Unpacking and handling of TigermagEP™ Magnetic Flowmeters should be consistent with the procedures used to handle field instruments.

2.2 Storage

This equipment should be stored in a clean, dry environment. Do not store outside in an unprotected area. Observe the storage temperature requirements. Unpowered storage should not exceed two years.

2.3 Return of Equipment

Obtain an RGA *(Returned Goods Authorization)* number from the factory prior to returning any materials. The RGA number should be marked on the outside of the package. Failure to obtain authorization will unnecessarily delay any work to be performed at the factory.

3.0 Installation

3.1 Application Considerations

The TigermagEP™ can be used to accurately measure the volumetric flow rate of liquids having a conductivity of at least 5 micromho/cm.

The presence of entrained air or gases in the process liquid will not prevent meter operation, but will produce a positive (+) error equal to the % by volume gas entrainment.

▼ FULL SCALE FLOW RATES SHOULD BE SELECTED ABOVE 3 FEET PER SECOND (1 METER PER SECOND) FOR BEST ACCURACY.

3.2 Site Selection

Select a pipe location which will always be full of liquid. The equipment should be located where the flowmeter will be accessible for adjustment. Provide a minimum of 18" clearance to the electronics enclosure.

The meter may be located in any position from vertical to horizontal. Flow may be in either direction through the meter. Vertical installation with the liquid flowing upwards, minimizes the possibility of slurry separation and assures a full pipe condition.

FLOW

MINIMUM 3
PIPE DIAMETERS

Full Pipe Required
Figure 3.1
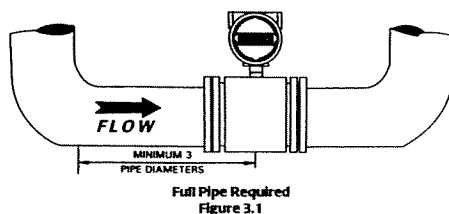
Horizontal installation requires that the sensing electrodes be positioned in the horizontal plane. See Figure 3.7.

Provide at least three pipe diameters of straight piping approach between an upstream elbow and the midpoint of the meter. In small meters this can be achieved within the meter itself. More straight approach should be provided after valves or multiple elbows. Provide at least 10 diameters after expanders or laterals which are smaller diameter than the line size.

3.3

Rotating the Transmitter Display

The Sparling TigermagEP's modular display is designed to allow you to rotate the display in four different orientations. By simply removing the two screws circled in Figure 3.2 below, the display assembly can be rotated, at 90° intervals, to the desired position for ease of reading.

The display features long lasting LCD numerals. The display may darken if ambient temperatures exceed its temperature rating of -4° to +158°F. Darkening usually occurs when the electronics are installed in direct sunlight. To avoid this problem install a sun shield when the flowmeter is in direct sunlight.

Display assembly can be replaced in the field without replacing the entire electronics, by following the same procedures as utilized for rotating the display.

Loosen & remove two screws to detach and rotate
the display assembly.
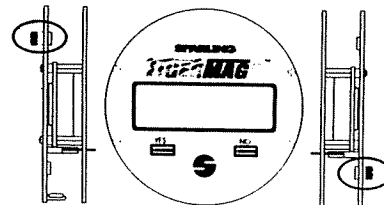
Removing the Rotatable Display
Figure 3.2

The transmitter enclosure can be rotated 90° in either direction. Loosen the lock nut securing the transmitter to the standoff. Rotate the transmitter by hand in the desired direction. DO NOT ROTATE THE TRANSMITTER MORE THAN 90° IN EITHER DIRECTION. DOING SO WILL DAMAGE INTERNAL WIRING. Tighten the lock nut to prevent further rotation and to prevent moisture entering the enclosure. Additional rotation can be achieved by removing the meter from the line, rotating the entire meter, reversing the flow through the meter.

Lock Nut & Seal

Front View

Rotate 90°

Top View
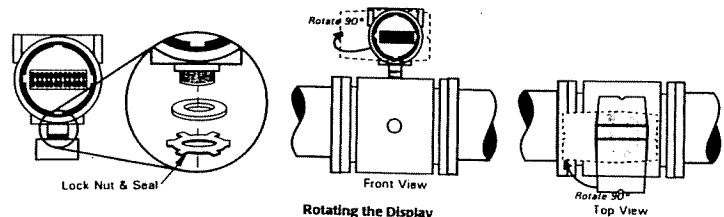
Rotating the Display
Figure 3.3

3.4

Removable Electrodes
(optional)

The line must be de-pressurized and drained in order to check and replace the removable electrodes.

3.4.1 How the Design Works

This design utilizes electrodes which are installed through an accessible parts provided on the sensor body. Electrodes are sealed using two o-rings. One o-ring acts as a primary seal while the other is a back-up seal. This redundant sealing approach provides back-up sealing.

To withdraw the electrodes, process line has to be de-pressurized and drained. The outer cover must be removed by unscrewing cap bolts using an 11/32 nut driver to allow access to the electrode cavity. Remove cables from electrodes by removing nuts and lock washers. Using a 3/4" socket, unscrew and remove electrode assembly.

3.4.2 The Need for Replacement

Sparling's flowmeter design utilizes High Impedance circuitry (Hi-Z) which is not affected by coating build-up on the electrodes. Replacement of the electrode only becomes neces sary when physical damage due to errosion or corrosion has occurred.

3.5

Hot-Tap Removable Electrodes
(optional)
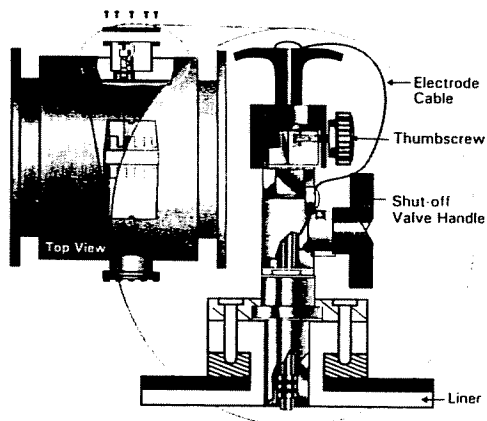
Hot-Tap Removable Electrode
Figure 3.4

Sparling's optional hot-tap removable electrode design allows the inspection or replace ment of electrodes without stopping the flow or depressurizing the line. The electrode assembly is sealed with multiple o-rings to maintain isolation from the pressurized medium. During removal of the electrode, a stainless steel ball valve is closed to keep the process fluid from leaking out while the electrodes are inspected or cleaned. The electrode housing, wired as a backup electrode, functions as a redundant electrode assembly providing the flow signal to the electronics. In other words, even when the electrode is withdrawn, the flowmeter keeps on providing important flow information.

3.5

Hot-Tap Removable Electrodes
(cont'd)

3.5.1 Electrode Removal

1. Use a cross recessed (phillips) screwdriver to remove the screw and lockwasher from the handle.

2. Gently remove the electrode cable (orange wire) and place aside.

3. Secure cable then loosen the side knob.

4. Using the handle on the electrode head, pull electrode straight to the point that the valve can be closed.

5. Close the ball valve clockwise.

6. Unscrew the hex plug from the valve counter-clockwise and remove the electrode assembly.

3.5.2 Electrode Installation

1. Install hex plug clockwise. Seal tight into closed valve assembly.

2. Open ball valve counter-clockwise).

3. Push electrode assembly in, aligning the slot in the cover with the screw, until firmly seated.

4. Tighten the side knob.

5. Place electrode cables on handle.

6. Install the lockwasher and screw, tighten.

7. Replace gasket, cover, cover screws and tighten securely.

Steps 1-3   Steps 4-5

CLOSED

Step 6

HEX NUT → PLUG

Removing the Electrode
Figure 3.5

⚠️ **CAUTION**

- *Avoid scratching or damaging the withdrawn electrode.*
- *Ball valve must be closed before the hex-head electrode assembly is unscrewed and removed.*
- *Electrode hex-head assembly must be replaced and secured tightly before opening the ball valve and re-inserting the electrode.*
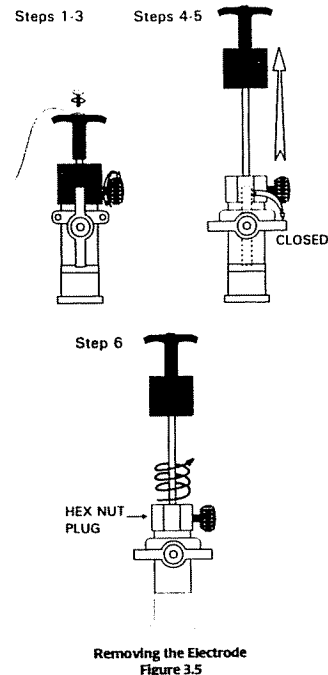
3.5.3 When to Replace

Sparling's flowmeter design utilizes High Impedance circuitry (Hi-Z) which is not affected by coating build-up on the electrodes. Replacement of the electrode only becomes necessary when physical damage due to errosion or corrosion has occurred.

TigermagEP™

3.6

Pipe Connections

MODEL FM626 FLANGELESS (WAFER) SENSOR

The flangeless sensor is installed between two process pipe flanges. The sensor contains a non-conductive ceramic or *Teflon®* liner. The integrity of this liner must be maintained for the flowmeter to function. *CARE SHOULD BE TAKEN DURING INSTALLATION TO INSURE THAT THIS LINER IS NOT DAMAGED.* Depending upon meter size, four (4) or eight (8) steel bolts are required for installation of the FM626. These bolts are used to install the meter between existing flanges. See Table 4. Gaskets are required between the meter and the pipe flanges and between grounding rings and the mating surfaces.

Install the two bolts at the bottom of the meter. Place the meter temporarily between the flanges to confirm correct positioning. The meter should rest directly on the bolts. Remove the meter.

▼ *REINSTALL THE METER TAKING CARE TO KEEP THE GASKET CENTERED. INSTALL ALL BOLTS AND TIGHTEN FINGER TIGHT. COMPLETE INSTALLATION WITH TORQUE WRENCH. IT IS IMPORTANT THAT THE BOLTS BE TIGHTENED ALTERNATELY SO THAT EXCESSIVE FORCE IS NOT APPLIED TO A CONCENTRATED POINT. SEE FIGURE 3.6. DO NOT EXCEED THE TORQUE LIMITS IN TABLE 4.*

MODEL FM656 FLANGED SENSOR

The flanged sensor is installed between two process pipe flanges. The sensing head tube interior is covered with an electrically non-conductive liner which overlaps the flange seal surfaces. The integrity of this liner must be maintained for the flowmeter to function. *CARE SHOULD BE TAKEN DURING INSTALLATION TO INSURE THAT THIS LINER IS NOT DAMAGED. FLANGE GASKETS MUST BE USED.*

▼ *THE GASKETS, METER FLANGES, AND MATING PIPE FLANGES SHOULD BE DUSTED WITH GASKET TALC PRIOR TO INSTALLATION TO PREVENT DAMAGE TO THE LINER. SHOULD IT BE NECESSARY TO REMOVE THE METER FROM THE LINE. DO NOT USE GRAPHITE TO DUST THE GASKET. A CONDUCTIVE FILM WILL COAT THE METER INTERIOR AND CAUSE A MALFUNCTION. DO NOT EXCEED THE TORQUE LIMITS IN TABLE 4.*

Gasket material should be selected which is compatible with the piping and process conditions. The table below contains typical satisfactory gasket materials. Do not use spiral wound metal gaskets as they may cause liner damage.

Table 2 – Gasket Material

LINER MATERIAL	GASKET MATERIAL
Ceramic	Teflon
Teflon	Teflon Coated Asbestos
Hard or Soft Rubber	Asbestos Neoprene Rubber
Neoprene	Asbestos Neoprene Rubber
Polyurethane	Asbestos Neoprene Rubber

Table 3 – Meter I.D.

Nominal I.D.	Actual I.D.			
	Ceramic		Other	
in	in	mm	in	mm
0.10	0.125	3.17	N/A	N/A
0.25	0.302	7.67	N/A	N/A
0.50	0.452	11.48	0.60	15 24
1.00	0.812	20.62	0.97	24 64
1.50	1.34	34.04	1.50	38 10
2.00	1.69	42.93	2.00	50 80
3.00	2.90	73.66	3.06	77 72
4.00	3.80	96.52	4.06	103 12
6.0	N/A	N/A	6.00	152 40
8.0	N/A	N/A	7.75	196 85
10.0	N/A	N/A	10 00	254 00
12.0	N/A	N/A	12 00	304 80

3.7

Special Mounting Bolts & Gaskets

Sparling provides carbon steel mounting hardware with wafer meter sizes 0.1"to 4". On flanged meters, *special* mounting bolts are provided for meter sizes 0.5", 1.5" and 3" only. Gaskets are provided for ceramic sensors only.

Optional 304SS mounting bolts for these sizes are available at extra cost.

▼ *FM656 METER SIZES 0.5" - 4" HAVE THE SAME FACE-TO-FACE DIMENSIONS AS FM626 WAFER-STYLE METERS (0.5" - 4") SEE FIGURE 1.3.*

Table 4 – Torque, Flange & Bolt Specifications

Nom. Meter Size(in)	Maximum Torque ft-lbs	kg-m	ANSI / AWWA Flange & Bolt Specs Mating Flange	Pressure Rating	OD Inch	Bolt Circle	Hole Dia	Bolt Size	DIN Flange & Bolt Specs Mating Flange	Pressure Rating	OD mm	Bolt Circle	Hole Dia	Bolt Size
0.1	17	2.3	0.5	150	3-1/2	2-3/8	4 @ 5/8	7/16-14 x 6-3/4	15	10	95	65	4 @ 14	M10 X 170
	17	2.3	0.5	300	3-3/4	2-5/8	4 @ 5/8	1/2-13 x 6-3/4	15	25	95	65	4 @ 14	M12 X 170
	17		0.5	600	3-3/4	2-5/8	4 @ 5/8	1/2-13 x 6-3/4						
0.25	17	2.3	0.5	150	3-1/2	2-3/8	4 @ 5/8	7/16-14 x 6-3/4	15	10	95	65	4 @ 14	M10 X 170
	17	2.3	0.5	300	3-3/4	2-5/8	4 @ 5/8	1/2-13 x 6-3/4	15	25	95	65	4 @ 14	M12 X 170
	17		0.5	600	3-3/4	2-5/8	4 @ 5/8	1/2-13 x 6-3/4						
0.5	17	2.3	0.5	150	3-1/2	2-3/8	4 @ 5/8	7/16-14 x 6-3/4	15	10	95	65	4 @ 14	M10 X 170
	17	2.3	0.5	300	3-3/4	2-5/8	4 @ 5/8	1/2-13 x 6-3/4	15	25	95	65	4 @ 14	M12 X 170
	17		0.5	600	3-3/4	2-5/8	4 @ 5/8	1/2-13 x 6-3/4						
1.0	17	2.3	1	150	4-1/2	3-1/8	4 @ 5/8	7/16-14 x 6-3/4	25	10	115	85	4 @ 14	M12 X 170
	17	2.3	1	300	4-7/8	3-1/2	4 @ 3/4	5/8-11 x 7-1/2	25	25	115	85	4 @ 14	M12 X 170
	17		1	600	4-7/8	3-1/2	4 @ 3/4	5/8-11 x 7-1/2						
1.5	17	2.3	1.5	150	5	3-7/8	4 @ 5/8	1/2-13 x 6-3/4	40	10	150	110	4 @ 18	M16 X 190
	17	2.3	1.5	300	6-1/8	4-1/2	4 @ 7/8	3/4-10 x 7-1/2	40	25	150	110	4 @ 18	M16 X 190
	17		1.5	600	6-1/8	4-1/2	4 @ 7/8	3/4-10 x 7-1/2						
2.0	17	2.3	2	150	6	4-3/4	4 @ 3/4	5/8-11 x 7-1/2	50	10	165	125	4 @ 18	M16 X 190
	17	2.3	2	300	6-1/2	5	8 @ 3/4	5/8-11 x 7-1/2	50	25	165	125	4 @ 18	M16 X 190
	17		2	600	6-1/2	5	8 @ 3/4	5/8-11 x 7-1/2						
3.0	24	3.3	3	150	7-1/2	6	4 @ 3/4	5/8-11 x 9-1/2	80	10	200	160	8 @ 18	M16 X 240
	24	3.3	3	300	8-1/4	6-5/8	8 @ 7/8	3/4-10 x 10-1/2	80	25	200	160	8 @ 18	M16 X 240
4.0	30	4	4	150	9	7-1/2	8 @ 3/4	5/8-11 x 9-1/2	100	10	220	180	8 @ 18	M12 X 240
	30	4	4	300	10	7-7/8	8 @ 7/8	3/4-10 x 10-1/2	100	25	235	190	8 @ 22	M20 X 260
6.0	92	12.7												
8.0	133	18.4												
10.0	70	9.7												
12.0	83	11.5												

All specifications per Customer requirements and in compliance with recognized standards such as: ANSI / AWWA/ DIN

FM626

Gasket Installation
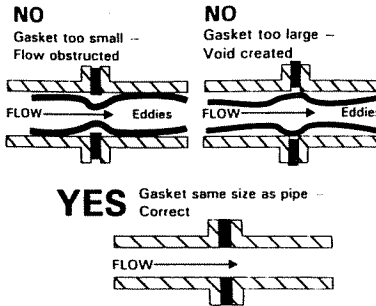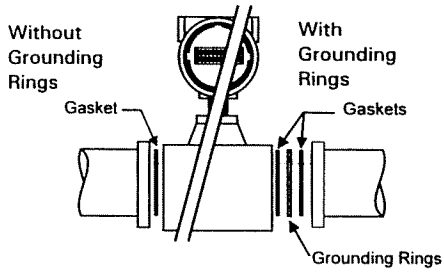
Without
Grounding
Rings

Gasket

With
Grounding
Rings

Gaskets

Grounding Rings

NO
Gasket too small —
Flow obstructed

FLOW

Eddies

NO
Gasket too large —
Void created

FLOW

Eddies

YES Gasket same size as pipe —
Correct

FLOW

1. Apply silicone grease or other viscous fixative to gasket for temporary positioning
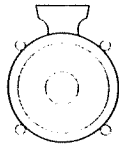
2. Fit gaskets, checking to ensure it is perfectly centered
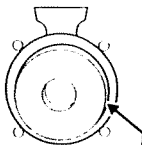
3. Poorly aligned gasket — can cause catastrophic leaks and flow errors
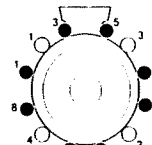
4. Carefully torque bolts with Bolt torque sequence above
   ○ 4 Bolt Pattern
   ● 8 Bolt Pattern
   See Table 3.1

Gasket Installation
Figure 3.6

Sensor Position

45 ° Max.

0 ° (Typical)

Vertical
(up-flow preferred to guarantee full-pipe condition)

Horizontal
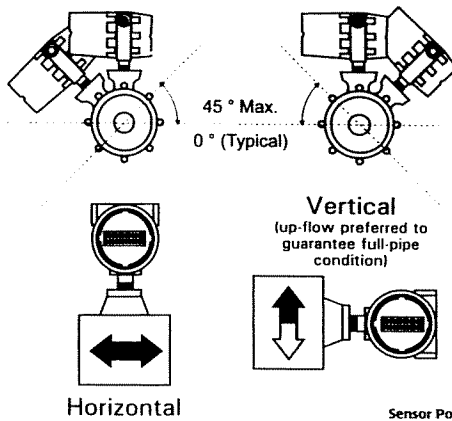
Sensor Position
Figure 3.7

Sensor Alignment

Sensor size Nominal Bore (in/mm)	Maximum Misalignment (in/mm)
2 / 50	059 / 1 5
2-12 / 50-300	079 / 2

FM656

Gasket Installation

Without
Grounding
Rings

Gasket

With
Grounding
Rings

Gaskets

Grounding Rings

NO
Gasket too small –
Flow obstructed

FLOW → Eddies

NO
Gasket too large –
Void created

FLOW → Eddies

YES Gasket same size as pipe –
Correct

FLOW →

1. Apply silicone grease or other viscous fixative to gasket for temporary positioning

2. Fit gaskets, checking to ensure it is perfectly centered

3. Poorly aligned gasket - can cause catastrophic leaks and flow errors

**Gasket Installation
Figure 3.8**

Sensor Position

45 ° Max.

0 ° (Typical)

**Sensor Position
Figure 3.9**

Vertical
(up-flow preferred to guarantee full-pipe condition)

Horizontal

3.8
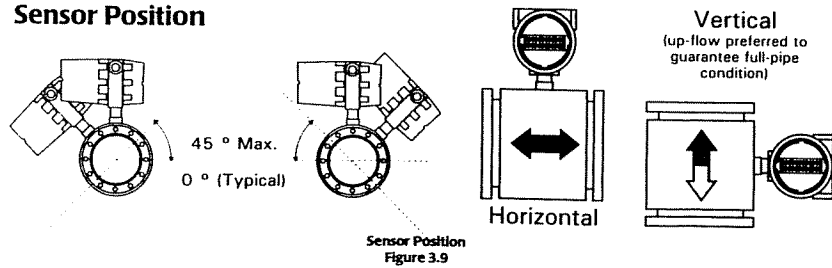
Grounding

Mounting in Unlined Metal Pipelines

Flange Type Sensors

Grounding cables

Wafer Type Sensors
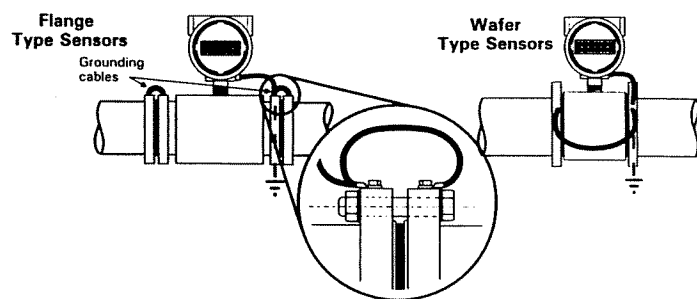
Mounting in Plastic or Lined Pipeline, or where Conductivity <20 micromhos/cm

Flange Type Sensors

Wafer Type Sensors

Grounding Rings

Grounding Rings
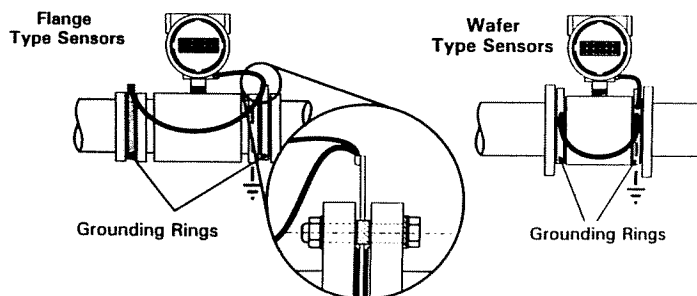
Mounting in Pipes with Cathodic Protection

Connecting wire (not included).
Must be adequately rated to carry cathodic currents

Flowmeter is electrically isolate from the piping

Grounding Rings   Grounding Ring

Insulating sleeve
(not provided)

Gasket

Grounding
Figure 3.10
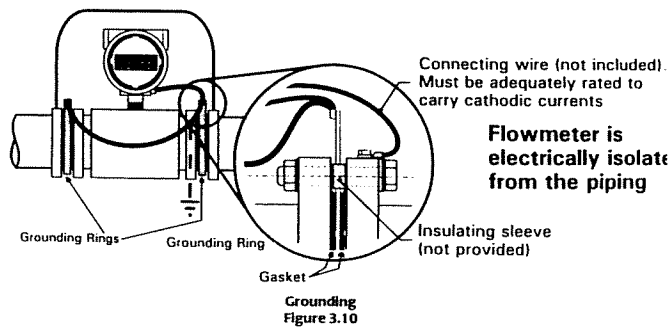
3.8

Grounding
Cont'd.

DC and AC voltages can be transmitted through conductive fluids which can lead to magnetic flow meter instrument errors. Adequate grounding between the liquid and the instrument is essential to ensure correct flow measurement. Magnetic flow meters should always be grounded at four places: 1) Flowmeter tube, 2) Transmitter, 3) Receiving instrument, 4) the fluid.

▼ **EXTERNAL GROUNDING RINGS SHOULD BE INSTALLED ON ANY METER WHERE THERE IS LINED OR NON-CONDUCTIVE PIPE OR CONDUCTIVITY IS LESS THAN 20 MICROMHOS/CM. SEE FIGURE 3.10.**

The grounding rings are in continuous contact with the process liquid providing a direct means for grounding electrical noise in the liquid. The electrical noise potential in the process liquid is at a similar level to the electrical ground plane to which the ac power supply ground is connected. This grounding method stabilizes the electrical field within the sensor measuring section permitting accurate flow detection. Grounding resistance must be less than 20 ohms.

▼ **CONTACT OUR TECHNICAL SUPPORT GROUP IF PROCESS LIQUID NEEDS TO BE MAINTAINED AT A POTENTIAL ABOVE OR OTHER THAN GROUND.**

3.9

Electrical Connections

Unscrew the small blind cover of the electronics enclosure to gain access to the I/O PCB. Separate 3/4" NPT conduit entrances are provided for power and signal wiring. Conduit connections should follow good practice and should be routed from below the meter. If conduit cannot be routed from below, provide moisture traps and seals to prevent moisture from entering the meter enclosure. See Figure 3.11. *Be sure to tighten conduit connections.*

CAUTION   *WATERTIGHT CONDUIT, FITTINGS AND SEALS ARE REQUIRED TO MAINTAIN THE MOISTURE-FREE INTEGRITY OF ALL ENCLOSURES AND ELECTRONICS IN THE SYSTEM. ENTRY OF MOISTURE MAY VOID SPARLING'S WARRANTY. ALL FITTINGS MUST CONFORM TO NEMA-6 CLASSIFICATIONS*

BEST

Input 3/4" NPT

Flow Sensor 3/4" Conduit Signal Wiring

Best conduit arrangement. Moisture can not enter the enclosure.

GOOD

Seal conduit with plugs or RTV, use seals to connect conduit

Moisture drain required.

BAD

Moisture will collect and cause damage to electronics Warranty may be voided.

Conduit Connections
Figure 3.11

TigermagEP™

3.9
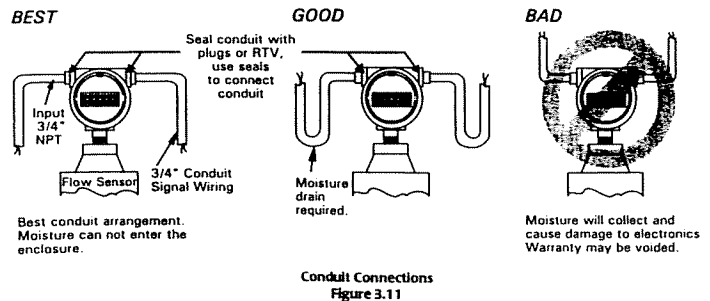
Electrical Connections

Cont'd.

A connection diagram is located in the cover of the connection section and in Figure 3.12. Determine which of the outputs (4-20 mA, fault, flow direction, pulse or frequency) are to be used. Connect the required outputs as shown in Figure 3.12. Install 1N4004 diodes across the load when driving inductive loads. If required, connect the Positive Zero Return (PZR) input. Note that meter outputs are forced to zero when terminals 1 and 2 are connected together through relay contacts.
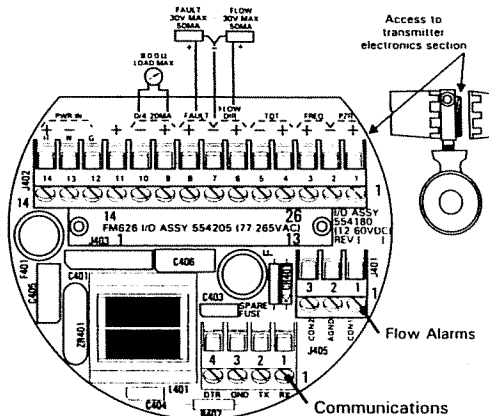
Electrical Connections I/O PCB
Figure 3.12

Connect power leads to terminals 13 and 14 on the terminal strip. Be sure to connect a good ground to terminal 12.

The external load on the outputs must be within the limits specified. Calculate the external load by summing the input resistance, including all interconnecting cable. Signal cable of 18-22 gauge is normally adequate.

External load limits	Analog output	800 ohms max. impedance
	Pulse output	150 ohms min. impedance
	Frequency	1000 ohms min. impedance

All outputs are floating and use the same isolated ground. If more than one output is used simultaneously, only one of the common legs can be grounded. If both are grounded, a ground loop will occur causing erroneous signals. *Do not ground any part of current loop if another output is already grounded.*

⚠️ **CAUTION**

ONLY ONE LOAD MAY HAVE A LEG STRAPPED TO GROUND UNLESS THE LOADS ARE ISOLATED FROM EACH OTHER

The TigermagEP™ series is equipped with a switching power supply (standard) which accommodates power sources of 77-265 Vac 50/60 Hz. An optional 12-60 Vdc power supply is available. No adjustments or jumpers are required.

3.10

Remote Mounted Transmitter
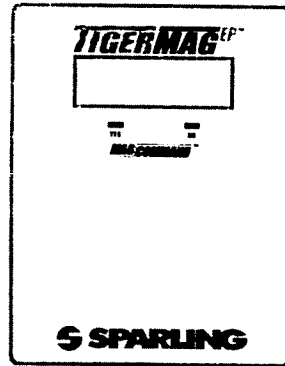
Figure 3.13
Tigermag EP Remote Display

Remote mounting of the electronics is required when process temperatures exceed 212° F (100° C), when pipe vibration is excessive or when flooding is possible. Remote mounting should be used when high process temperatures exist at high ambient temperatures.

A bracket for wall or pipe mounting is furnished as part of the optional remote mounting kit. Interconnecting cable is supplied between the sensor and transmitter enclosure. Also supplied is a sensor mounted NEMA-7 rated junction box and a transmitter-mounted junction box in which coil and electrode connections are made.

The standard interconnecting cable length is 15 feet. Shorter or longer cables should be ordered from the factory. The cable may be shortened in the field. DO *NOT* SPLICE CABLE IN THE FIELD.

Connect terminals 1 through 7 and ground both junction boxes with the special cable provided. See Figure 3.14. Installation in metal conduit is required for RFI protection as well as physical protection. See Figure 3.15. Also see Section 3.9 for electrical connections.

Junction Box

Remote PCB
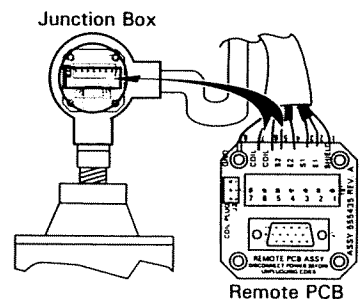
Sensor Wiring - Remote Transmitter
Figure 3.14

CAUTION

DO NOT MAKE CONNECTIONS WHILE POWER IS APPLIED. DISCONNECT POWER BEFORE PROCEEDING.

3.10

Remote Mounted Transmitter

Cont'd.
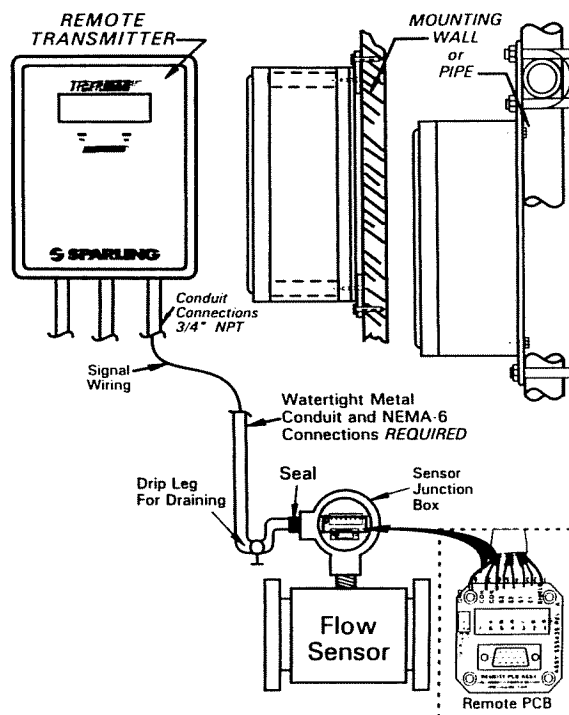
Remote Mounted Transmitter
Figure 3.15

WARNING

CONDENSATE DRAINING THROUGH CONDUIT CAN BE AVOIDED BY USING DRIP LEGS, DRAINS AND SEALS WHICH WILL NOT LET MOISTURE INTO THE ELECTRICAL ENCLOSURE.

WATERTIGHT METAL CONDUIT, FITTINGS AND SEALS ARE REQUIRED TO MAINTAIN THE MOISTURE-FREE INTEGRITY OF ALL ENCLOSURES AND ELECTRONICS IN THE SYSTEM. ENTRY OF MOISTURE MAY VOID SPARLING'S WARRANTY. ALL FITTINGS MUST CONFORM TO NEMA-6 CLASSIFICATIONS.

4.0 Start-Up

4.1

Start-Up Procedure

Prior to applying power, the following checks should be made:

a) Check the flowmeter nameplate to insure that the power supply voltage is correct.

b) Verify that all electrical connections are correct. See Figures 3.12 and 3.14. The power supply voltage rating will be marked on the I/O PCB See Figure 3.16.

c) Check the polarity of external loads connected to the outputs.

d) Check to see that the two hall effect switches on the front of the transmitter are in place with the dark side of the switch *facing up* towards the LCD display. Do not remove these switches unless authorized by factory personnel. If you suspect that one of the hall effect switches is defective, contact the factory.

VAC

VDC

FM626 I/O ASSY 554205 (77-265VAC)   I/O ASSY
554180
(12-40VDC)
REV [   ]
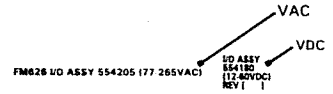
Power Supply Voltage Ratings
Figure 3.16

5.0 Calibration

5.1

Calibration

All flowmeters are calibrated before leaving the factory. No field recalibration is required.

The 4 and 20 mA current level may be checked if desired by following the procedure in Appendix I DIAGNOSTICS. The meter can be used as a current calibrator to *check connected equipment*. See Appendix1, para. 2.3.3.

6.0 Maintenance

No routine maintenance is required.

7.0 Troubleshooting

The following sections describe field tests and bench tests that can be performed on Sparling's magnetic flow meters.

7.1 General

Each flowmeter is rigorously tested during production. The final test stage is a wet flow calibration in a Sparling precision primary flow laboratory traceable to the National Institute of Standards and Technology (NIST).

Before troubleshooting, carefully verify the operating conditions of the meter:

1. Verify the interconnecting wiring by using a local milliammeter connected to the current output with no other load connected.
2. Verify that the sensor is completely filled with liquid. An empty or partially full sensor will continue to send an erratic flow signal even with no flow.
3. Verify that any flow test comparison is valid before assuming that the meter is in error.
4. If in doubt, verify the conductivity of the liquid to see that it exceeds 5 micromho/cm.

7.2 Trouble-shooting Chart

The following trouble shooting chart should assist in correcting meter malfunction. For additional assistance, contact Technical Support 800/800-FLOW (818/444-0571 in California).

⚠️ **WARNING**

a) "WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2";

"AVERTISSEMENT - RISQUE D'EXPLOSION- LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS DE CLASSE 1, DIVISION 2".

b) "THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS 1, DIVISION 2, GROUPS (AS APPLICABLE) OR NON-HAZARDOUS LOCATIONS ONLY".

Troubleshooting Chart

SYMPTOM	POSSIBLE CAUSE AND CURE

1. Erratic Reading (Output Wandering)	1. A. Installation
	    a. Is sensor properly grounded? A good liquid ground is required.
	    b. Empty pipe? Pipe must be full of liquid.
	    c. Air in pipe? De-aerate
	    d. Chemical being injected upstream of flowmeter? Change the chemical dosage downstream of the flowmeter.
	B. Electrical
	    a. VFD's? Need additional filtering and improved grounding.
	    b. Marginal Connection (particularly for remote units)? Rewire to insure good contacts.
	C. Moisture intrusion? Use leak tight fittings and keep the covers tight.

2. Inaccurate Reading	2. A. Run simulator test (47000/K) - Appendix 1, Section 2.3.6. B. Coil drive blown? Electronic module has to be returned to factory for repair C. Conductive coating? Clean sensor.
3. Output Incorrect (Pulse & Analog)	3. A. Disconnect wires and check circuit output with DVM. Reprogram current output. If program is OK, hardware failure, return to factory. B. For pulse output need oscilloscope. If there is flow no pulse output , hardware failure, return to factory.
4. Analog Output Zero	4. A. No external power required, unit is not loop powered. If external voltage was connected, electronics are damaged and should be returned back factory for repair.
5. Display Readings Locked	5. A. Program errors? Cycle the power off and on, then reprogram if necessary.
6. Meter Reads Zero	6. Did it ever work? A. Blown coil drive? Return for repair B. Not properly wired (remote units)? Re-wire correctly C. Conductive coating? Clean sensor.
7. Blank Display	7. A. Blown fuse? Replace Fuse B. Power supply damage? Return for repair.
8. Display is turning black around edges	8. Temperature is too high inside the enclosure. Relocate the meter or shield against the heat source. Continuing to power the meter in this condition will permanently damage the display.
9. Display is difficult to read	9. Improve the lighting conditions if ambient light is dim. Remove large cover and adjust the pot directly above the display for best contrast while viewing from the intended viewing angle.

If the above steps fail to correct the problem, try different flow rates and disconnecting loads temporarily and se if the problem persists. Perform simulator check and call the factory. *Please have the following information availab when you call:*

- Meter serial number; G, I, Z values from "SHOW METER DATA?".

- Description of the problem. (Display, current output, totalizer/frequency, all of the above.)

- When does the symptom occur or repeat?

- What are the flow rates, the orientation of the meter in tl pipeline, environmental conditions, output loads on tl meter, pipe material and grounding technique?

- How did you verify the discrepancy?

Contact Technical Support 800/800-FLOW (in California 818/444-0571) for additional assistance.

7.3

Electronics Self Test

Using the MAG-COMMAND™ magnetized screwdriver, enter programming mode by holding the magnet to the "NO" switch for five seconds. See Appendix 1 for detailed instructions. Answer NO to all prompts until the DIAGNOSTICS menu appears. Answer YES to the DIAGNOSTICS menu. Follow the menu instructions. See Appendix 1, Section 2.3.
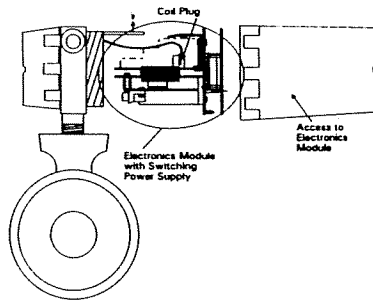
Access to Electronics
Figure 7.1

7.4

Electronics Module Replacement

To remove the electronics module, first unscrew the larger enclosure cover and remove the screw fastening the module bracket. Now unplug the coil cable converter. See Figures 7.1 and 7.2.

Grasp the module at each side and pull firmly while rocking the boards gently from side to side. *Do not pull the module out by the display.* See Figure 7.2

DO NOT REMOVE ELECTRONICS MODULE WHILE POWER IS APPLIED. DISCONNECT POWER BEFORE PROCEEDING

WARNING
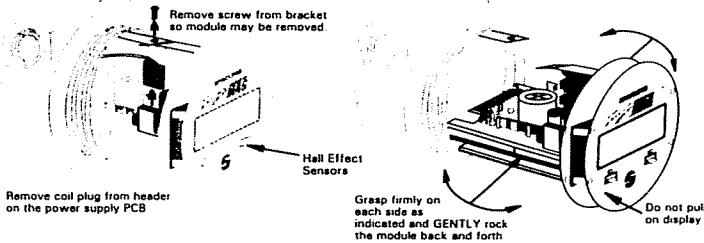
Removing the Electronics Module
Figure 7.2

▼ *METER ELECTRONICS ARE CONTAINED IN A PLUG IN MODULE. THIS MODULE CONTAINS NO USER SERVICEABLE PARTS.*

7.4

Electronics Module Replacement
Cont'd.
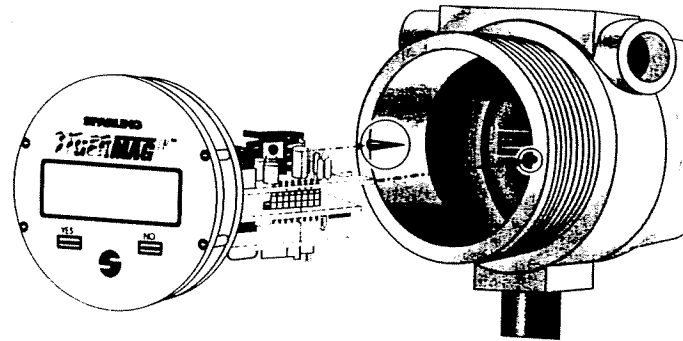
Aligning Electronics Module with Card Guides
Figure 7.3

When re-installing the electronics module, observe the connector in the bottom of electronics enclosure. Line up the electronics module with card guides and the connec See Figure 7.3. Plug in the replacement module. Plug in coil connector. Be certain the p wires are routed properly and will not interfere with the housing cover. Don't forge replace the screw that fastens the module to the bracket. See Figure 7.2

Apply power and observe display. Now, reprogram any values which were modified fr factory preset levels. To obtain factory settings, look at meter calibration record ship with meter. If sensor EEPROM chip is damaged or has lost its data, call factory with the se number and request another copy of the EEPROM chip programmed with constants in factory.

7.5

Sensor Testing

The sensor consists of a measuring section with electrodes and coils in a steel enclosu The following paragraphs describe field tests that can be performed by the instrum technician. Defective sensors should be returned to the factory for repair. OBTAIN RETURNED GOODS AUTHORIZATION (RGA) PRIOR TO RETURNING MATERIALS PREVENT DELAYS.

7.6

Coil Continuity Testing

WARNING

DO NOT MAKE OR BREAK COIL CONNECTION WHILE POWER IS APPLIED. DISCONNECT POWER BEFORE PROCEEDING.

Unplug coil cable plug. Using a short 22 gauge (or appropriate) test lead, connect ohmmeter between coil wires and measure resistance. See Figure 7.4.

▼ **COIL RESISTANCE SHOULD MEASURE 110 OHMS ±10% AT ROOM TEMPERATURE. HOT COILS MAY READ AS HIGH AS 150 OHMS.**

If the coil resistance is too high or low (including open and short circuits) the sensor must be returned to the factory for inspection and/or repair.
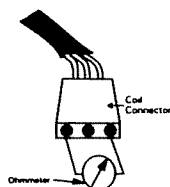
Coil Resistance Testing
Figure 7.4

7.7

Coil Insulation Test

Required test equipment: Insulation tester 10^{12} ohm

Disconnect power and signal cables. Disconnect coil connector, Figure 7.5. Connect insulation tester between coil wire and housing ground. Test the insulation at 500 Vdc. A reading below 10,000 meg ohms indicates moisture in the sensor. The sensor must be returned to the factory for inspection and/or repair.

Connect insulation tester between coil wire and housing ground. Test the insulation at 500 Vdc. A reading below 10,000 meg ohms indicates moisture in the sensor. The sensor must be returned to the factory for inspection and/or repair.
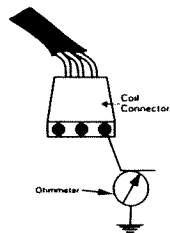
Coil Insulation Test
Figure 7.5

7.8

Electrode Circuit Insulation Test

Unplug coil and remove module from electronic enclosure.

▼ *Sensor must be empty and dry.*

Connect insulation tester three ways (see Figure 7.6.):

1. Between top post labeled E1A and S1A (shield)
2. Between center post labeled E1B and S1B (shield).
3. Between bottom post labeled E2 and S2 (shield).

Any leakage or fault indication will determine that the sensor should be returned to the factory for inspection and repair.
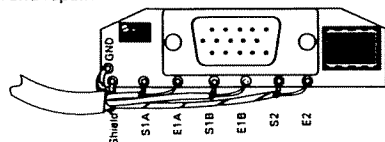
Electrode Circuit Insulation Test
Figure 7.6

8.0 Replacement Parts List

Your Tigermag B™ can be fitted with an optional digital communication capabil
utilizing HART* protocol. In order to operate this feature, you must have a Sparling mo
KP602 transmitter interface. Consult factory for more details.

A.1 Appendix 1– Programming Firmware Ver. 1.0

1.1 General

The 16 character 2 line alpha-numeric display is located directly above two magnetically operated Hall effect switches. The left switch is labeled "YES" and the right switch is labeled "NO". THESE SWITCHES ARE THE ONLY CONTROLS REQUIRED TO SELECT AND CHANGE PARAMETERS ON THE TigermagEP. DO NOT ADJUST POTS.

The TigermagEP is configured to the user's installation (programmed) using the MAG-COMMAND magnetic probe furnished with each meter. It can also be programmed with any high strength magnet. See Figure A1.1. Either switch is activated by momentarily holding the MAG-COMMAND probe close to the switch.

IT IS NOT NECESSARY TO OPEN THE ELECTRONICS COMPARTMENT IN ORDER TO CHANGE PROGRAM SETTINGS.

Refer to Figure A 1.2 to determine how to get to each section of the program.

1.2 Entering Data

Alphanumeric data is required for the password and to enter or change constants. When data is required, the cursor will be positioned under the first character. A "NO" answer will cause the next valid character to be displayed in turn. A "YES" answer accepts the displayed character or digit and moves the cursor to the next position. After answering "YES" to the last character, you will be prompted with the entire data just entered. Answer "NO" if you wish to change. Answer "YES" when it is correct.

MAG-COMMAND PROBE

Figure A 1.1
Tigermag EP Display

IDS-626/656

1.3
Batching Modes

If your TigermagEP is equipped with the optional batching function, answer "YES" whi the meter is in normal operation mode to display batching information. For detail, s(Appendix 2, Batch Programming.

1.4
Show Meter Data

Hold the MAG-COMMAND probe next to the "NO" switch for approximately 5 seconds. The meter will respond:

| SHOW METER DATA? |

a) Answer "YES" and the meter will display the model number, firmware version, serial number, tag number, K factor (pulses/gallon) liner and electrode material. The last three values, G, I, & Z, are useful when calling factory technical assistance when troubleshooting the meter. As each data line is displayed a "YES" answer will display the next item. A 'NO' answer at any item (or lack of response for 12 seconds) will return the meter to the operating display.

b) A failure to answer this prompt within a few seconds will automatically bring the PASSWORD menu. See Section 1.5.

c) Answer "NO" and the PASSWORD prompt appears. A failure to enter a correct password will return the meter to operation.
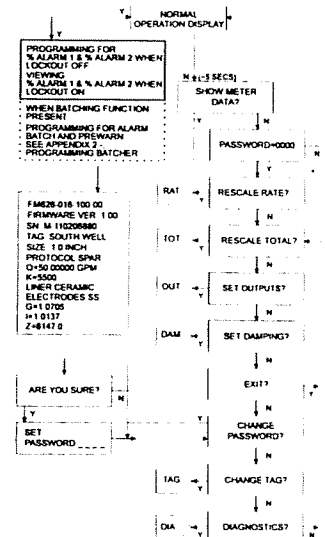
Figure A 1.2
Main Program

1.5
Password Entry

| PASSWORD=0000 |

To go beyond this point, a valid password is required. Every meter is shipped with th default password "0001". Any user with a valid password can change the password.

▼ Default Password "0001"

The meter password is entered by responding to each digit of the password with a "YE: or "NO". A "YES" moves the cursor under the next digit to the right. A "NO" scrolls to th next higher value for the underlined digit and then back to 0 again. The same 12 secon time limit applies to each digit selection, i.e., a lack of response advances the cursor to th next position. Upon entry of a valid password, the meter enters a program mode an activates the fault output to signal remotely that programming is taking place.

1.6

Rescale Rate

A "YES" answer enters the Rescale Rate loop. A "NO" answer continues to the next menu item.

A menu is presented to select the engineering units in which rate is displayed and scaled. By answering "NO" each menu selection is presented in turn. A "YES" selection chooses the unit displayed and moves on to the next item.

1.6.1   Select Rate Units

RATE UNITS=GPM

An answer of "YES" will display the rate in "GPM". Otherwise answer "NO". A "NO" answer will bring the other pre-defined choices in turn, i.e., liters/min., cu. ft./sec., liters/sec., cubic meters/hour, million gallons/day, ft./sec, meters/sec. and ???. Answer "YES" to the predefined rate units or to "???". A "NO" to each item brings you back to the beginning of the loop. *A "YES" answer is required to one of the selections to leave the loop.*

Select one of the presented units of measure by answering "YES" and skip to Sec. 1.6.2. If no appropriate choice is diaplayed, select "???" and define your own units in 1.6.1a.

1.6.1a   User Defined Rate Units

RATE UNITS=AAA

Note the cursor under the first A. Select the three alphabetic or numeric characters which you want displayed for your selected rate units by answering "NO" until the correct   character is displayed in the current cursor position. A "YES" answer then accepts that character and moves the cursor one position to the right. A "YES" to the last character brings the conversion factor menu.

1.6.1b   Conversion Factor

1=1.200000 GPM?

The conversion factor is defined as U.S. GPM/user unit. Enter the number of GPM which is equal to 1 of your selected units.

Example: To set the conversion factor for gallons per hour, enter the number of gallons per minute which is equal to 1 gallon per hour. One gallon per minute is equal to 0.016666 gallons per hour (1 ÷ 60). In this case, enter 0.0166666.
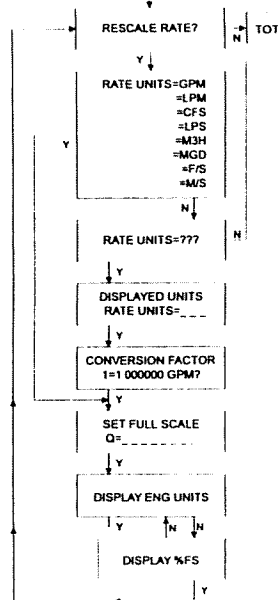
Figure A 1.3
Rescale Rate Flowchart

1.6

Rescale Rate
Cont'd.

1.6.2 Set Full Scale

The full scale flow rate defines only the flow rate at which the current output is set to
mA and at which the frequency output is set to 1000 Hz. *It does not affect the displa*
the accuracy of the frequency or pulse output.

Q=5.000000 GPH?

In the case above, entering 5.0 GPH here will set the current output to 20 milliamps
the frequency to 1000 Hz when the fluid flow reaches 5.0 GPH. Full scale flow is sele
in the units defined in 1.6.1 above. Thus, if "GPH" were defined, full scale would
defined in GPH not GPM. By answering "YES" or "NO" to each digit, it is possible to e
the full scale flow rate. A full scale below 1 FPS or above 35 FPS will receive a warnin
"OUT OF RANGE LOW" or "OUT OF RANGE HIGH". Unit is still functional, but is opera
out of recommended range.

1.6.3 Select Rate as Percent of Full Scale

DISPLAY:RATE UNITS

A "YES" answer will display flow in engineering units as
defined in 1.6.2 "NO" displays rate as a percentage of full
scale. Either choice will affect only the format of the dis-
play and nothing else.

1.7

Rescale Total

If your TigermagEP is equipped with the optional remote
batcher, refer to Appendix 2.

RESCALE TOTAL?

A "YES" answer enters the Rescale Total loop. A "NO"
answer continues to the next menu item.

1.7.0 Lockout

LOCKOUT: ON

LOCKOUT: OFF

LOCKOUT: OFF allows you to reprogram the high and low
flow alarms when the "YES" key is activated while in nor-
mal operating mode. No password is required.

LOCKOUT: ON will only allow the viewing of high and low
flow alarms while in normal operating mode. To repro-
gram these values you will need to enter the Mag-Com-
mand Rescale Total menu which requires a password.

After choice is made select "YES" to continue.
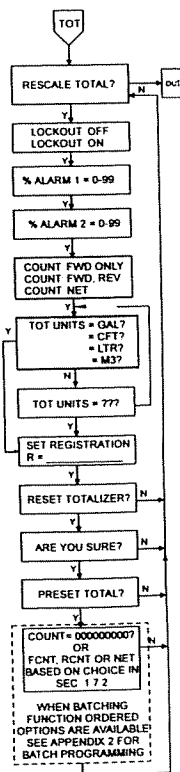
Figure A1.4
Rescale Total Flow Ch:

Tigerm

1.7

Rescale Total
Cont'd.

1.7.1 Alarms

> % ALARM 1 = 0-99

> % ALARM 2 = 0-99

Using Mag-Command, you can set these alarm contacts to activate when flow rate exceeds the set value in percent of full scale desired, from 0 through 99%. These contacts enable you to activate alarms, small relays, equipment, etc. at a preset percentage of full scale. Most commonly used as high and low flow alarms (through complementary contacts of externally supplied relays), these can be set to warn you of conditions outside your process parameters.

1.7.2 Count Direction

The internal totalizer can be programmed to totalize in the forward direction, to totalize separately for forward and reverse or provide you with net flow.

> COUNT:FWD ONLY

Answer "YES" to count in the forward direction *only* (shown in the "operate" mode as "COUNT=")

> COUNT:FWD,REV

Answer "YES" to have separate internal counters for forward and reverse flow (displayed as "F CNT=" and "R CNT=" respectively).

> COUNT:NET

Answer "YES" to count net flow *only*.

1.7.3 Select Total Units

A menu is presented to select the engineering units in which totalization or frequency is displayed and scaled. By answering "NO" each menu selection is presented in turn. A "YES" selects the unit displayed and moves on to the next item.

> TOT UNITS=GAL

Answer "NO" to view the available pre-defined totalization units. Select "YES" to the preferred engineering units for totalization. One of the options will be ???. This permits the definition of any desired units. A "YES" must be selected to one of the options to exit this loop.

1.7.3a User Defined Totalizer Units

> TOT UNITS = AAA

Select the desired 3 character abbreviation as in 1.6.1a on the previous page.

1.7.3b Conversion Factor

> 1=1.2500000 GAL?

Enter the number of U.S. gallons which is equivalent to 1 of your selected units.

For example, the conversion factor from U.S. Gallons to Imperial Gallons is 1.25 because there are 1.25 U.S. Gallons to each 1 Imperial Gallon.

1.7

Rescale Total
Cont'd.

1.7.4   Set Registration

| R=100.000 GAL? |

Enter the number of your engineering units of totalization which is equivalent to one co of the internal totalizer and external "TOT" output. This is normally an even number su as 0.1, 1, 10, 100, etc. In the above case 100 gallons will produce one totalizer pulse

1.7.5   Reset Totalizer

Allows you to zero or reset the starting number on the totalizer.

| RESET TOTALIZER? |

Answer "YES" to advance, "NO" to return to RESCALE TOTAL?

| ARE YOU SURE? |

Answer "YES" to perform the reset of totalizer(s), "NO" to return to RESCALE TOT (This is your last chance to abort before you lose your present value of totalizer(s).)

| PRESET TOTAL? |

Answer "YES" to be able to initialize the new nonzero beginning total, "NO" to return to RESCALE TOTAL? with totalizer(s) already reset to zero in the last step.

| COUNT=.000000000? |

Enter new beginning total. If counting FWD, REV or NET were selected earlier (1.7.2) then FCNT and RCNT can be preset to their starting values.

1.8

Set Outputs

| SET OUTPUTS? |

A "YES" answer enters the Set Outputs loop. A "NO" answer continues to the next menu item.

| OUTPUT:4-20 MA |

This permits the selection of 4-20 or 0-20 mA dc outputs. Answer "YES" to the output desired. Most North American installations will use 4-20.

1.8.1   Select Pulse Width

| ONTIME:12.5 |

This selects the totalizer output of 0-60 Hz 12.5/25/50/ 100 ms, 24 Vdc. The choise is based on the external device requirement as well as your values of Q (Sect. 1.6.2) and R so that pulses don't run together at the maximum flow. The frequency output of 0-1000 Hz, 50/50 duty cycle is always available (Section 1.6.2). See Figure 3.12, Electrical Connections.
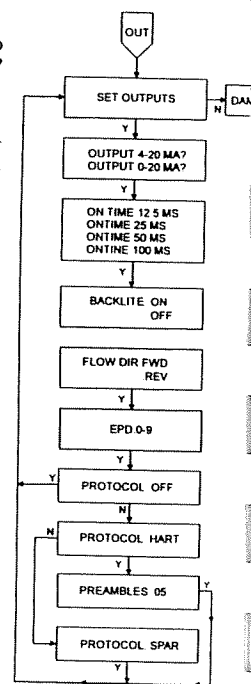
Figure A 1.5
Set Outputs Flow Chart

Tigermag

1.8

Set Outputs
Cont'd.

1.8.2   Backlite

BACKLITE:ON

BACKLITE:OFF

This allows you to turn the the display backlight on or off. "NO" toggles between the choices. "YES" selects and advances.

1.8.3   Set Flow Direction

FLOW DIR: FWD

FLOW DIR: REV

This allows the user to reverse the *normal flow direction.* The default flow direction is from left to right as you face the display. *If flow is in the opposite direction a minus sign (-) will appear in the display, the flow direction output will be active and the internal totalizer will be inhibited in the count forward direction.* Apart from that, the meter will operate properly in either direction. Both pulse and analog outputs will operate in both directions. Answer "NO" to reverse the normal flow direction.

1.8.4   Empty Pipe Detection

It allows the user to set the EPD control between 0 (=off) and 9 as part of "SET OUTPUTS?" menu. Numerically, this represents approximate delay in seconds before the activation of EPD state (outputs driven to zero, totalizer on hold, message "OUTPUT INHIBITED" on display). Note EPD setting functions like a "volume" control, with "0" serving as an "EPD-off" click and "1" thru "9" enabling various levels of detection. Typical setting may be between 3 and 6, the lower the number, the higher the possibility of "false" detection of a single air bubble. Factory setting is "0" (off).

1.8.5   Protocol

Selects between "SPAR"-Sparling Mag-Command and "OFF"-no programming interface. "HART" will also appear if meter has been equipped with the optional HART interface and will allow you to set the number of HART's preambles in a message..

1.9

Damping Adjustments

SET DAMPING?

Display and current output are damped *independently*. Answer "YES" to enter this loop.

1.9.1 Display Damping

DISP DAMPING - 5

A "NO" answer scrolls from 0 (no damping) through 9 (maximum damping). Answer "YES" to the desired degree of display damping. Some experimentation may be necessary to obtain optimum results.

1.9.2 Current Damping

CURRENT DAMP=15

Current damping may be selected from 0-99 seconds. This corresponds approximately the number of seconds to respond 90% of the way to a step change in inp

1.9.3 Low Flow Cutoff

% ZERO CUTOFF=2

This is the minimum flow rate below which meter outputs are forced to zero. The numb entered corresponds to the selected percentage of full scale as set for "Q" in Secti 1.6.2. Choices range from 0 (low flow cutoff disabled) through 9%.
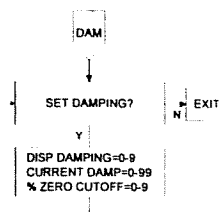
Figure A 1.6
Set Damping Flow Chart

2.0

Exit Programming

EXIT?

A "YES" answer stores the changes which have been made and returns the meter operation. A "NO" goes to the next menu item.

2.1

Change Password

CHANGE PASSWORD?

ARE YOU SURE?

Answer "NO" to return to CHANGE PASSWORD. Answer "NO" again to continue to t next item.

A "YES" answer permits changing the password by scrolling through the four availab digits. Be sure to record the new password.

▼ *FAILURE TO RE-ENTER THE NEW PASSWORD WILL RESULT IN NOT BEING ABLE REPROGRAM AT A LATER DATE.*

2.2
Change Tag

| CHANGE TAG? |

Answer "YES" to change the tag. Default is "SPAR".

| TAG=_ _ _ _ _ _ _ _ _ _ _ |

A "NO" answer scrolls through your character choices. Answer "YES" to skip to next letter. When you have finished the tag name, "YES" will bring you back to the "CHANGE TAG" menu. "NO" will advance to "DIAGNOSTICS", "YES" will enter the TAG loop again.

Figure A 1.7
Change Tag

2.3
Diagnostics

| DIAGNOSTICS? |

Answer "YES" to enter the diagnostics loop. A "NO" answer returns to the RESCALE RATE menu.

⚠️ **WARNING**

IT IS RECOMMENDED THAT DIAGNOSTICS NOT BE PERFORMED UNLESS MALFUNCTION IS SUSPECTED. REFER TO THE TROUBLE-SHOOTING SECTION FOR COIL AND ELECTRODE TESTS WHICH CAN BE PERFORMED.

WARNING—THE METER TOTALIZERS AND RATE WILL CEASE TO BE UPDATED WHILE YOU ARE IN THIS LOOP. OUTPUTS WILL BE AFFECTED BY SOME TESTS AS WELL AS TOTALIZER COUNT. USE CAUTION.

2.3.1A Check HART Transmission

This option is only available if your meter is equipped with HART® communications. Toggle between MARK and SPACE by selecting "NO". Enter next box by selecting "YES".

2.3.1B Check Coil Current

| STOP COIL DRIVE? |

Answer "YES"

| COIL=HIGH |

Note the value on the second line of the display. To test low coil, enter "NO"

| COIL=LOW |

Again, note its value. Both values should match closely. The typical coil current should range around 1/4 to 1/3 amp. Coil currents are affected by temperature. Unit is operating correctly unless currents don't match and are widely out of this range. To test high coil again, enter "NO". To end this test, enter "YES".
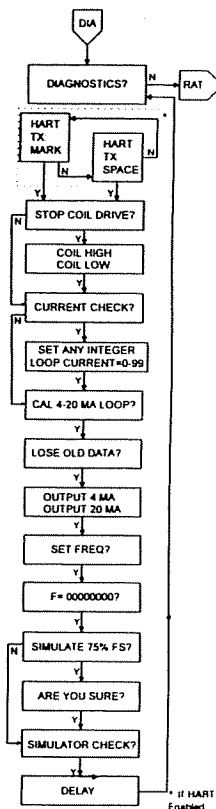
Figure A 1.8
Diagnostics Flow Chart

2.3

Diagnostics
Cont'd.

2.3.2 Check Current Loop

| LOOP CURRENT=04 |

By answering "NO" the loop current can be scrolled by 1 mA increments, from 4 mA up
mA and then back to 4. Answer "NO"to step to the next desired value. Answering "YE:
any time will exit the loop. Check the 4 mA and 20 mA positions with a digital milliamm
Each should be accurate within ±0.02 mA (no damping is used).

The current output can also be used to test other equipment in the current loop su
recorders and controllers.

2.3.3 Calibrate 4-20 mA Loop

| CAL 4-20mA LOOP? |

Answer "YES" to enter the calibrate mode. You must leave your recently calibr
milliammeter connected in series with the 4-20 loop at this time.

| LOSE OLD DATA? |

Answer "YES" to continue, "NO" will exit leaving calibration unchanged. This is your
chance to abort if your setup is not ready.

| OUTPUT: 4mA? |

Answer "YES" if your meter reads 4.00 mA. "NO" will allow you to calibrate freque
for zero flow.

| I= 4.0000000? |

Enter in the actual reading value from your digital milliammeter to calibrate zero flow.
Answer "YES" to continue.

| OUTPUT: 20mA? |

Answer "YES" if your meter reads 20.00 mA. "NO" will allow you to calibrate freque
for full scale.

| I= 20.000000? |

Enter in the actual reading value from your digital milliammeter to calibrate full scale.
Answer "YES" to continue.

2.3.4 Set Frequency

Set frequency can be used to verify or set the frequency received by other device
insure compatibility.

| SET FREQ? |

Select "YES" to enter the set frequency mode, select "NO" to continue.

| F = .000000000 |

Enter desired frequency in the 1-1250 Hz range to appear as the frequency output or se
"YES" to zero value and end this test.

2.3.5 Simulate 75% FS

This step will drive all outputs to 75% of full scale rate including the display.

⚠️
CAUTION

THIS TEST WILL ALTER THE TOTALIZER COUNTS. ON EXIT FROM THIS TEST, RESET OR PRESET TOTALIZERS TO THEIR PROPER VALUE.

Enter "YES" to get last chance to abort "ARE YOU SURE?" Enter "YES" only if you wish to continue at which point the meter will begin simulated 75% of its full scale (as signified by the letter "S" in the third from the last position on the top line of display (just before "12" for alarms - See figure A 1.9). To end, re-enter diagnostics and reply "NO" to either "SIMULATE 75% FS?" or "ARE YOU SURE?" that follows.

2.3.6 Simulator Check

Simulator Check is used to verify that electronics are working satisfactorily by comparing actual values to the factory pre-set values. Testing is done internally.

| SIMULATOR CHECK? |

Select "YES" to enter the simulator check mode, select "NO" to continue.

| PLEASE WAIT |

"PLEASE WAIT" is displayed while electronics self-check.

| SELF TEST PASSED |

The electronics are working satisfactorily.

| SELF TEST FAILED |

The electronics are not working satisfactorily. Replace electronics module. The second line of the display will show a 47000 + K value as GPM. Obtain K from meter record and calculate 47,000/K to check for match.

In Simulate Mode when "S" is displayed

SPARLING

TigerMAG ™

```
 37.50 GPM S12
COUNT=0000000018
```

YES   NO
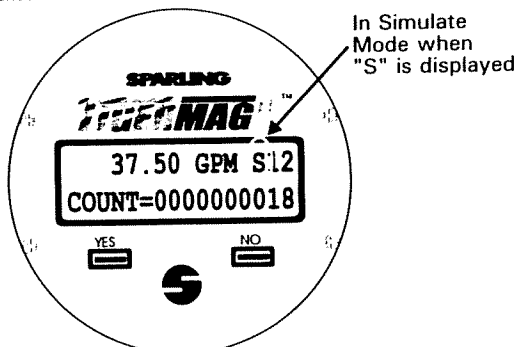
Figure A1.9
Simulate Mode

A.2

Appendix 2
Batch Programming & Operation - Firmware Ver. 1.0

This section of the manual covers only the batching function. For programming of ot
loops not associated with the batching function, see Appendix 1.

1.1

General
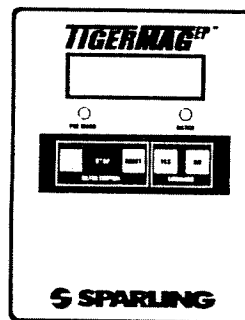
Figure A 2.1
Enclosure for TigermagEP with Batching

The TigermagEP Batcher utilizes a touch pad
programming both meter and batch operations. The "Y
and "NO" buttons are the only controls required to sel
and change parameters on the TigermagEP. Nothing e
is required for programming the meter with M
Command. IT IS NOT NECESSARY TO OPEN T
ELECTRONICS COMPARTMENT IN ORDER TO CHAN
PROGRAM SETTINGS.

1.2

Programming

The batching mode is activated in the Rescale Total menu. Refer to Figure A1.2 to
determine how to reach this section.

```
| RESCALE TOTAL? |
```

"YES" to enter the Rescale Total menu.

1.2.0 Lockout

```
| LOCKOUT: ON |
```
```
| LOCKOUT: OFF |
```

LOCKOUT: OFF allows you to reprogram batch size and prewarn levels while in norr
operating mode. No password is required.

LOCKOUT: ON will only allow you to view batch size and prewarn levels while in norn
operating mode. To reprogram these values you will need to enter the Mag-Comma
Rescale Total menu which requires a password.

After choice is made select "YES" to continue.

1.3

Rescale Total

1.3.1 Batch On/Off

BATCH: ON

BATCH: OFF

"NO" toggles between 'Batch On' and 'Batch Off'.

BATCH: ON
1) gives you access to TigermagEP's batching functions while in normal operation mode
2) disables Alarms 1 and 2.
3) batch size and prewarn levels become accessible for viewing or reprogramming while in normal operation mode.

BATCH: OFF
1) turns off the TigermagEP's batching functions.
2) allows access to TigermagEP's Alarm 1 and Alarm 2
3) % Alarm 1 and % Alarm 2 become accessible for viewing or reprogramming while in normal operation mode.

1.3.2 Alarms

% ALARM 1 = 0-99

% ALARM 2 = 0-99

Using Mag-Command, you can set these alarm contacts to activate at any percent of full scale desired, from 0 through 99%. These contacts enable you to activate alarms, equipment, etc. at a preset percentage of full scale. Most commonly used as high and low flow alarms, these can be set to warn you of conditions outside your process parameters.

Alarms 1 & 2 are only available when batch mode is turned off (BATCH: OFF). Alarm 1 and Alarm 2 can be set to activate at the percentage of full scale specified here. After setting, "YES" accepts selection of Alarm 1 and advances to Alarm 2. When lockout status is on (LOCKOUT: ON) you will be able to view % Alarm 1 and % Alarm 2 values from normal operation mode. When lockout status is off (LOCKOUT: OFF) you will be able to change the values of % Alarm 1 and % Alarm 2.

1.3.3 Count Direction

The internal totalizer can be programmed to totalize in the forward direction, to totalize separately for forward and reverse or provide you with net flow.

COUNT:FWD ONLY

Answer "YES" to count in the forward direction *only* (shown in the "operate" mode as "COUNT=")

COUNT:FWD,REV

Answer "YES" to have separate internal counters for forward and reverse flow (displayed as "F CNT=" and "R CNT=" respectively).

COUNT:NET

Answer "YES" to count net flow *only*.

Figure A 2.2
Rescale Rate - Batcher

1.3

Rescale Total
Cont'd.

1.3.4 Select Total Units

A menu is presented to select the engineering units in which totalization or frequen displayed and scaled. By answering "NO" each menu selection is presented in tu "YES" selects the unit displayed and moves on to the next item.

TOT UNITS=GAL

Answer "NO" to view the available pre-defined totalization units. Select "YES" to the ferred engineering units for totalization. One of the options will be ???. This permit definition of any desired units. A "YES" must be selected to one of the options to exi loop.

1.3.5a User Defined Totalizer Units

TOT UNITS = AAA

Select the desired 3 character abbreviation as in 1.6.1a on the previous page.

1.3.5b Conversion Factor

1=1.2500000 GAL?

Enter the number of U.S. gallons which is equivalent to 1 of your selected units.

For example, the conversion factor from U.S. Gallons to Imperial Gallons is 1.25 bec there are 1.25 U.S. Gallons to each 1 Imperial Gallon.

RESCALE TOTAL

A "YES" answer enters the Rescale Total loop. A "NO" answer continues to the next m item. See Section 1.7.5 for details.

RESET TOTALIZER?

A "NO" answer ends this loop.

If batch is on (BATCH: ON) display will read:

GRAND = 000000000?

Enter

If batch is off (BATCH: OFF) display will read:

COUNT = 000000000?

1.4

Description of Operation

1.4.1 Description of Operation

This option, if available, can be either enabled (BATCH: ON) or disabled (BATCH: OFF) in users menu of "RESCALE TOTAL?" When enabled, the batch menu offers the choice of display direction of counting (up or down) and the limits of the prewarn (relay #2) and the batch (relay #1). The status of the relays will be displayed on line 1 (last two places) as digits 1 and/or 2 whenever the corresponding relay coil gets energized. Line 2 wil show GRAND total, batch size, and the status of the batch.

Once the programming is in place, the cycle starts when RESET is pushed. The display line 2 will stop toggling between GRAND and BATCH and show 'BATCH=xxxxxx PZR' indicating that PZR input has reset the 626 for the next batch. Pushing START activates both relays (shown in line 1 and changes 'PZR' to 'RUN' as the batch starts counting off. Reaching PREWARN level drops out relay #2 and 'PRE' replaces 'RUN' in line 2. At the end of the batch, relay #2 drops out and line 2 reverts to toggling between Grand and 'BATCH=XXXXXX HLD' as the batching is on hold until RESET starts it again. To abort batch in progress, push STOP. This overrides relays ON command dropping them out (noteline 1 will report them as ON). The flow and the count off will stop, at which point one can resume this batch by pushing START or abort it via RESET for another batch (note however that GRAND will include any flow that went into the batch prior to pushing STOP).

A.3 Appendix 3 – Comunications

1.1

RS232 Sparling Protocol

Wiring (3-wire cable less than 50 ft.

Connect as follows:

PC "COM" Port 25 pin		626 J405 on I/O PCB
2-TX	to	1-RX
3-RX	to	2-TX
7-GND	to	3-GND
4-RTS to 5-CTS		4 - No Connection

Set up the PC communications software (any 3rd party dumb-terminal emulator i.e.
BitCom, XTalk, Procom, etc.) as follows:

E.G. Windows Terminal
1200 baud
8 data bits
1 stop bit
Odd Parity
(Flow control = none)

Conversation
Control-Q (II hex) starts it (626 will reply; PZR/PGM on the PC screen),
Control-U (15 hex) ends it (626 - no reply, its display - back to run mode).
Menu follows MagCommand.
Keyboard exceptions (for compatibility with existing programmers):
(Space Bar) steps over existing characters
(Backspace) clears characters
(Enter) or "Y" key serves as "yes", anything else as "no".

Burst mode
Control-S (13 hex) starts it.
The 626 will continuously copy its 2-line display to RS232 line.
Press and hold Control-U to end it.

Problems checklist:
• Check wiring
• Check PC setup
• Verify that 626 in its "SHOW METER DATA?" menu (or user's "SET OUTPUTS?) has
PROTOCOL: SPAR and not PROTOCOL: OFF nor PROTOCOL: HART.

1.2

RS485 (one-on-one only, no multidrop, less than 4000 ft.)
On digital PCB, U105 should be removed and U108 installed.

RS485

Wire and use as RS232

Line 485		626 (J405 on I/O PCB)
(+) or A	to	2-TX (also line load)
(1) or B	to	1-RX (also line load)
Shield	to	3-GND

Problems checklist:
• See Section 1.1, RS232
• Line must terminate in its characteristic impedance at BOTH ends, eg. for 24 AWG twisted pair install terminating 120-ohm resister between 1 & 2 of J405 as well as across the other end. See Figure 3.12.

Sparling Instruments, Inc.
4097 N. Temple City Blvd · El Monte, CA 91731 · Ph (818) 444 0571 · Fax (818) 452 0723

SYMBOL	REQ'D	CAT. NUMBER	MANU.	DESCRIPTION
ENCL	1	2P363012	HAMMOND	36X30X12 NEMA 4X ENCL
ENCL	1	18P3327	HAMMOND	33X27 BACK PANEL
ENCL	1	1481S30K	HAMMOND	30" DRIP SHIELD
ENCL	1	1481FC12K	HAMMOND	12" MOUNTING FEET
ENCL	1	2QPL	HAMMOND	ENCLOSURE LOCK HASP
BREAKER PNL	1	BR1220B100	WESTINGHOUSE	CIRCUIT BREAKER PANEL
CB-1	1	BR2100	WESTINGHOUSE	100 AMP 2 POLE CB
CB-2,4,5,6	4	BR115	WESTINGHOUSE	15 AMP 1 POLE CB
CB-3	1	BR120	WESTINGHOUSE	20 AMP 1 POLE CB
HEATER	1	040100C1-EV11M	WATLOW	100W HEATER W\T-STAT
AUTODIALER	1	MODEL 1000	MICROTEL	PHONE AUTODIALER
TB'S	AS REQ	3001035	PHOENIX	TERMINAL BLOCK

MAIN PANEL C.B.

INCOMING POWER
120VAC
1 PHASE
60 HERTZ

N
L
G

CB-1
100 AMP

PANEL
GFCI

CB-2
15 AMP

TO
PUMP & FLOW
TRANS

CB-3
20 AMP

PANEL HEATER

CB-4
15 AMP

SPARE

CB-5
15 AMP

AUTODIALER
PWR SUPPLY

CB-6
15 AMP

TB 1234
1+ 1- 2+ 2-

1+ 1- 2+ 2-

FIELD ALARM LINES
DIRECTLY TO
AUTODIALER

NOTES:

1. ENCLOSURE TO BE INSULATED
   WITH 1" STYROFOAM INSULATION

2. USE COPPER WIRE ONLY

3. MAIN BREAKER TO BE 100 AMP 2 POLE

4. ☐ INDICATES TERMINAL BLOCKS

TITLE	120VAC EQUIPMENT PANEL			
JOB#	OLIN CHEMICAL			
		CUSTOMER		
		C.I.R. ELECTRIC		
TYPE	NEMA 4X			
DR	JR	DATE 11/15/96		
CHKD	SG	DIV	SIZE B	DRAWING NUMBER	REV
APPRVD	SG	SCALE		103196-JR-1	1

120VAC EQUIPMENT PANEL

TITLE	120VAC EQUIPMENT PANEL		
JOB#	OLIN CHEMICAL		REV
	CUSTOMER		
	C.I.R. ELECTRIC		
TYPE	NEMA 4X		
DR	JR	DATE 11/15/96	SIZE	DRAWING NUMBER
CHKD	SG	DIV	B	10110C...IP 1
APPRVD SG	SCALE			

GFCI

TB'S

BREAKER PANEL

27"

20"

12"

DUCT

10"

AUTODIALER

12"

PHONE JACK

PANEL STRIP HEATER / WITH T-STAT

TB'S

33"

30"

36"

12"

NOTES:

1. ENCLOSURE TO BE INSULATED WITH 1" STYROFOAM INSULATION

2. USE COPPER WIRE ONLY

3. MAIN BREAKER TO BE 100 AMP 2 POLE

OLIN CORPORATION

CHARLES GIBSON SITE
LEACHATE TRANSFER SYSTEM

TOWN OF NIAGARA, NEW YORK
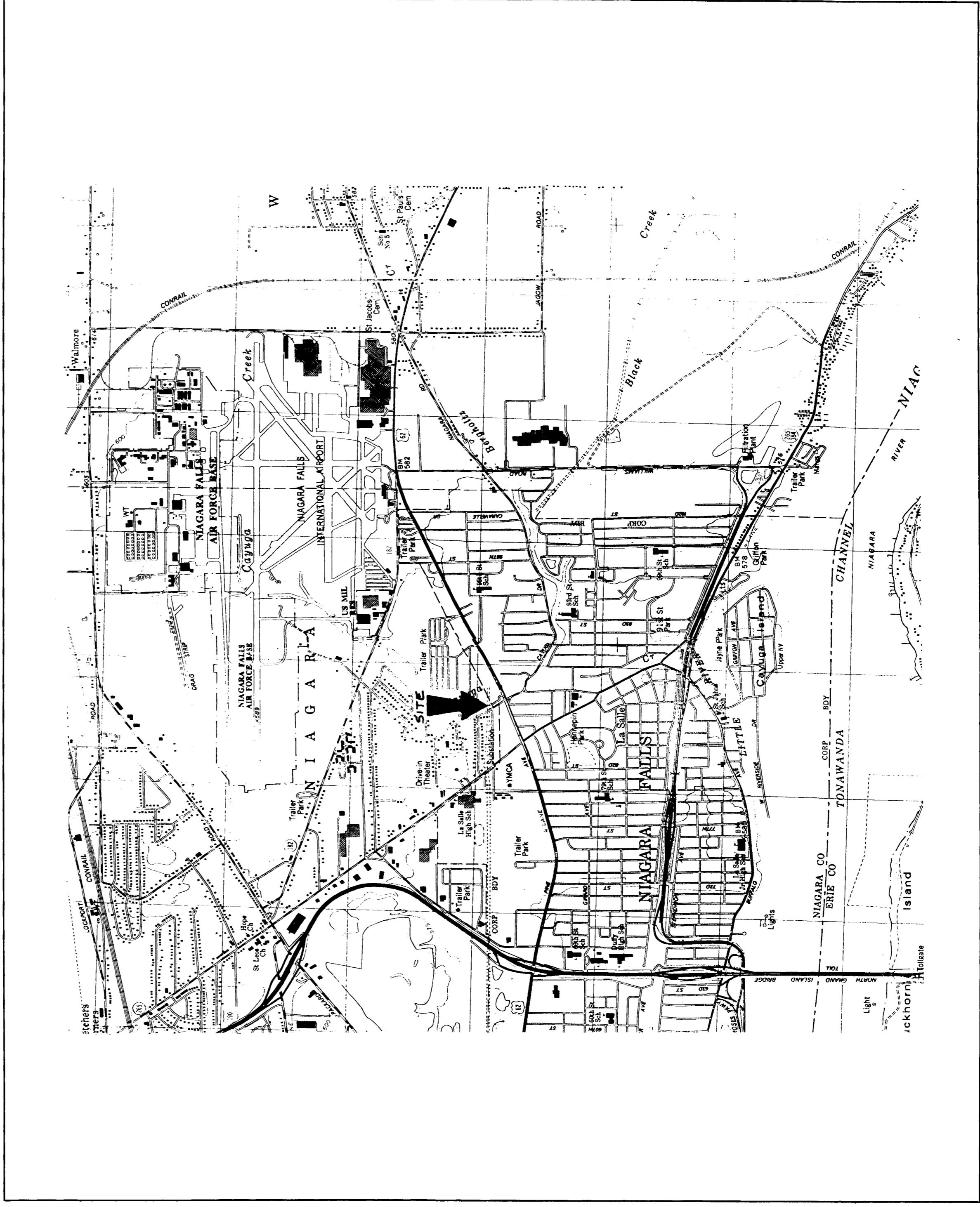
DRAWING SCHEDULE

DWG. NO.	DESCRIPTION
1	COVER SHEET (SHEET 1 of 4)
2	SITE PLAN (SHEET 2 of 4)
3	CIVIL/MECHANICAL DETAILS (SHEET 3 of 4)
	ELECTRICAL DETAILS (SHEET 4 of 4)

LOCATION PLAN

SCALE: 1" = 2000'

RUST ENVIRONMENT &
INFRASTRUCTURE

BUFFALO, NEW YORK
Quality through teamwork

CADD FILE: 43061TIL.DGN   PLOT DATE: 2/22/96

NOTES:

1. CONTRACTOR SHALL COORDINATE LOCATION OF NEW UTILITY POLE WITH NIAGARA MOHAWK. NIAGARA MOHAWK SHALL INSTALL UTILITY POLE.

2. MINIMUM 4'-0" OF EARTHEN COVER SHALL BE MAINTAINED OVER 4" DIA. HDPE PIPE.

3. SCOPE OF WORK

A. CONNECT EXISTING 6" ACP AND 4" x 2" HDPE LEACHATE FORCE MAIN.

B. INSTALL 4" x 2" HDPE LEACHATE FORCE MAIN FROM EXISTING MANHOLE B TO EXISTING ACP HOUSE CONNECTION. CONTRACTOR TO TEMPORARILY MOVE EXISTING FENCE SURROUNDING CAP AREA DURING INSTALLATION OF FORCE MAIN AND CONDUIT AND WIRING. FENCE SHALL BE REPLACED WHEN WORK IS COMPLETED

C. INSTALL NEW POWER POLE. UTILIZE EXISTING POWER POLE(S).

D. INSTALL NEW EQUIPMENT PANEL ADJACENT TO EXISTING POWER POLE.

E. INSTALL NEW CONDUIT AND WIRING FROM NEW POWER POLE TO NEW EQUIPMENT PANEL.

F. INSTALL CONDUIT AND WIRING FROM NEW EQUIPMENT PANEL TO NEW SPLICE BOX AT EXISTING MANHOLE B. INSTALL WIRING FROM NEW SPLICE BOX TO PUMP, FLOAT SWITCH AND FLOWMETER.

G. INSTALL NEW SUMP PUMP, PIPING, MAGNETIC FLOWMETER AND FLOAT SWITCH IN EXISTING MANHOLE B.

CHARLES GIBSON SITE

CAYUGA CREEK

EXIST. GRAVEL DRIVE

NEW LEACHATE FORCE MAIN

2:1 BANK AROUND CAP (TYP.)

TOP OF CAP

TOE OF CAP

EXIST. SLURRY WALL

MARKER POST

NIAGARA MOHAWK POWER CORP. R.O.W.

10" DIA. BRINE LINE

20" W

CITY OF NIAGARA FALLS

ELEC. TOWER

ELEC. TOWER

MANHOLE B SEE DETAIL

PROPERTY LINE

TYPICAL TRENCH SEE DETAIL

EQUIPMENT PANEL SEE DETAIL

UTILITY POLE SEE NOTE 1 SEE DETAIL

CONCRETE HOUSEKEEPING PAD (3' x 3' x 6")

(SEE NOTE 3)

TUSCARORA ROAD

PROPERTY LINE

EXIST. 10" ACP SEWER LINE

APPROXIMATE LOCATION OF 6" ACP SEWER TIE-IN. CONTRACTOR TO FIELD VERIFY LOCATION BY SURVEY PRIOR TO EXCAVATION

SEWER TIE-IN SEE DETAIL

EXISTING UTILITY POLE SEE NOTE 1 SEE DETAIL

N

SCALE IN FEET
0   20   40

PLOT DATE: 8/1/96

RUST ENVIRONMENT & INFRASTRUCTURE

PROJECT NUMBER 34986.000   DATE 2/1/96
RUST DWG NUMBER 1   FILE NUMBER 4986RP01.DGN
CLIENT DWG NUMBER   SHEET NUMBER 2 of 4

CHARLES GIBSON SITE
LEACHATE TRANSFER SYSTEM
SITE PLAN

OLIN CORPORATION

NIAGARA FALLS   NEW YORK

	NAMES	DATE
DRAWN:	JWH	2/1/96
DESIGN:	SBW	2/1/96
CHECKED:	JG	2/1/96
PE:	DBW	3/7/96
APP'D:		
APP'D:		

NO.	REVISIONS	MADE	CHK	DATE
1	AS-BUILT	JAG	5/21/97
0	ISSUED FOR CONSTRUCTION	KAP	DBW	8/1/96

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SECTION C (2/2) — NTS

- AIR RELEASE VALVE VAL-MATIC MODEL 15 1/2" INLET MPT BY G.A. INDUSTRIES (FIG. 910)
- STEEL PIPE SUPPORT BRACKET
- 1 1/2" FISHER-PORTER SERIES 10D1475 MAGNETIC FLOWMETER W/ FLANGED CONNECTIONS
- 1 1/2" SPARLING MAGNETIC FLOWMETER (TIGERMAG) MODEL #FM625-0631000
- MANHOLE COVER
- 1 1/2" UNION
- PIPE

MANHOLE B DETAIL (3 — 1/2) — NTS

- EL. 577.5
- EXISTING MH 'B'
- EXISTING 6" DIA. HDPE
- HINGED LOCKABLE WEATHERPROOF LID (EXISTING)
- EXISTING HDPE LINER
- TOPSOIL (EXISTING)
- COMMON (EXISTING)
- CLAY (EXISTING)
- BACKFILL (EXISTING)
- INV. EL. 557.0
- EXISTING 6" DIA. PERFORATED CPVC
- EXISTING 1 1/2" THICK HDPE BOTTOM
- STEEL HDPE PIPE SUPPORT BRACKET W/ U-BOLT, BRACKET TO BE ATTACHED TO INSIDE OF HDPE MANHOLE
- SEAL CONTAINMENT (EXTRUSION) PIPE AT MANHOLE (WELDED) PENETRATION
- 4" DIA. HDPE SDR 17 PIPE (CONNECTING PIPE) (8'-10' SECTION)
- 2" DIA. HDPE SDR 11 PIPE
- 2"x1 1/2" HDPE REDUCER SOCKET OR BUTT
- 2" HDPE 90° ELBOW SOCKET OR BUTT
- FLOAT SWITCH (Pon=564.474)
- FLOAT SWITCH (Poff=561.00)
- CLAY (EXISTING)
- BACKFILL (EXISTING)
- S.J. ELECTRO-SYSTEMS, INC. DOUBLE FLOAT PUMP SWITCH U.S. PATENT # 4,262,216 AND 4,291,261
- 1 1/2" DIA. HDPE SDR-11 PVC PIPE W/FLANGE CONNECTION TO PUMP OUTLET AND 2" FLOW METER, SUPPORT TO MH WALL EVERY 5 FEET USING STEEL SUPPORTS
- 1/2 hp-120 VAC, SINGLE-PHASE-EFFLUENT PUMP W/AUTOMATIC OPERATION-AND-CAST-IRON CONSTRUCTION MYERS 1/2 hp EFFLUENT PUMP W/AUTOMATIC OPERATION MODEL # ME50S-11, 115V, 60Hz, SINGLE PHASE

SECTION B (1/2) — NTS

- 6" TOPSOIL
- SEED, FERTILIZER AND MULCH SEE NOTE 1
- COMMON EARTHEN FILL, THICKNESS VARIES, MUST MAINTAIN 1'-0" MIN. OVER CONDUIT
- 6" TOPSOIL (EXISTING) REMOVE AND REUSE AS NECESSARY
- COMMON FILL (EXISTING) THICKNESS VARIES FROM 1'-6" ON CAP TO 6" ON 2H:1V
- 40 MIL HDPE LINER (EXISTING)
- CLAY THICKNESS VARIES FROM 2'-0" ON CAP TO 0'-0" AT TOE OF 2H:1V SLOPE (EXISTING)
- BACKFILL (EXISTING)
- EL. 568.00
- 4" DIA. HDPE SDR 17 PIPE
- 2" DIA. HDPE SDR 11 PIPE

SECTION A (1/2) — NTS

- 4' MIN.
- 1'-0"
- 6"
- TOPSOIL SEE NOTE 1
- EXISTING LINER
- COMMON EARTHEN FILL
- EXIST. SLURRY WALL
- EXISTING FENCE
- APROX. GRADE EL. 572
- 2'-0"
- 1'-6"
- TO MANHOLE B
- TO SEWER TIE-IN
- 4" x 2" HDPE INV. EL. 568.0

SEWER TIE-IN DETAIL (2 — 1/2) — NTS

- OMIT PER COUNTY IN LIEU OF 4" PVC C.O. @ TEE SECTION (6" CHARLOTTE PVC PIPE W/4" TEE)
- 4" CONTAINMENT PIPE
- 2" CARRIER PIPE
- STEEL
- 4" PVC CLEAN-OUT
- INSET BRASS SCREW CAP
- EXISTING GRADE EL. 574±
- 4" x 6" FENCO COUPLING
- 4" X 6" FENCO COUPLING (PVC REDUCER)
- 2" PIECE OF 4" PVC PIPE
- 2 2" ELBOW (4" PVC)
- FLOW
- RUBBER SLEEVE COUPLER (4" HDPE TO 4" PVC) WITH S.S. BANDS
- 6" PIECE OF 4" PVC PIPE
- 4" TEE
- 45° ELBOW (6" PVC)
- 6" CHARLOTTE PVC PIPE W/4" TEE (TYPE 401 PVC)
- STEEL BANDED RUBBER CONNECTION = MISSION RUBBER COMPANY = MR56- 66 ARC = 6CI/PL TO 6CI/PL (1406032)
- FINAL ELEVATION TBD IN SPRING '97 BY OLIN CORP.
- I.E. 565.34
- S.S. BANDS
- 6" HOUSING CONNECTION (EXISTING)

TYPICAL TRENCH DETAIL (1 — 1/2) — NTS

- TOPSOIL SEE NOTE 1
- WARNING TAPE SEE NOTE 2
- 2" PVC CONDUIT FOR FLOW SIGNAL
- 2" PVC CONDUIT FOR POWER SEE NOTE 3
- BACK FILL FROM EXCAVATION OR EQUAL SEE NOTE 4
- NYSDOT NO. 2 STONE SEE NOTE 4
- 2" DIA. HDPE SDR 11 PIPE
- 4" DIA. HDPE SDR 17 PIPE
- CONDUIT ELEVATION VARIES
- 6"
- 1'-2"
- VARIES
- 1'-0" MIN.
- 6"
- 4"

NOTES:

1. TOPSOIL SHALL BE FRIABLE LOAM CONTAINING LIBERAL AMOUNTS OF HUMUS, HAVING A pH BETWEEN 5.5 AND 7.6, AND SUITABLE FOR GROWTH OF GRASS. CONTRACTOR SHALL SUPPLY AND PLACE FERTILIZER MEETING REQUIREMENTS OF SECTION 713-3.03, NYSDOT STANDARD SPECIFICATIONS. CONTRACTOR SHALL SUPPLY AND PLACE GRASS SEED MIXTURES NOS. 1 OR 2A MEETING REQUIREMENTS OF SECTION 610-2.02, NYSDOT STANDARD SPECIFICATIONS. CONTRACTOR SHALL MULCH IN ACCORDANCE WITH SECTION 610-3.03, NYSDOT STANDARD SPECIFICATIONS. CONTRACTOR SHALL WATER AND MAINTAIN SEEDED AREAS UNTIL 2 INCHES VERTICAL GROWTH OF ACCEPTABLE INITIAL STAND OF GRASS IS ESTABLISHED.

2. UNDERGROUND LINE WARNING TAPE, BRIGHT COLORED, VINYL, TAPE, MADE FOR DIRECT BURIAL WITH EMBEDDED CONTINUOUS METALLIC STRIP.

3. POWER CONDUIT SHALL BE PLACED 6-INCHES, MINIMUM FROM CONDUITS FOR TELEPHONE AND FLOAT SWITCH LINES.

4. COMPACT TRENCH BACKFILL MATERIAL TO ELIMINATE FUTURE SUBSIDENCE. CONTRACTOR SHALL REGRADE AND SEED ANY AREAS WHERE SUBSIDENCE OCCURS.

5. CONTRACTOR SHALL BE RESPONSIBLE FOR UTILITY ACCESS AND BURIED UTILITY CLEARANCE.

6. NYSDOT NO. 2 STONE SHALL BE PLACED AROUND SEWER TIE-IN TO AN ELEVATION 6-INCHES ABOVE THE 4-INCH HDPE PIPE AND THE 6-INCH ACP.

			MADE	CHK	DATE	REVISIONS
1	AS-BUILT		KAP	JAG	5/21/97	
0	ISSUED FOR CONSTRUCTION		KAP	JAG	8/1/96	
NO.	REVISIONS		MADE	CHK	DATE	

INSTRUMENTATION AND CONTROL RISER DIAGRAM

INSTALLED IN MANHOLE B

ANCHOR SCIENTIFIC, INC./ROTO/ FLOAT STAINLESS STEEL TYPE X PIPE MOUNTED FLOAT SWITCH

S.J. ELECTRO SYSTEMS, INC. DOUBLE FLOAT PUMP SWITCH U.S. PATENT #4,262,216 & 4,291,261

INSTALLED IN MANHOLE B

FLOAT SWITCH

FLOW METER/ TRANSMITTER

2#14, 2" PVC CONDUIT 1 TWISTED SHIELDED PAIR

INSTALLED IN EQUIPMENT PANEL

AUTO DIALER

2 TWISTED PAIR TELEPHONE CABLE 2" PVC CONDUIT

INSTALL AT ELECTRIC UTILITY SERVICE POLE

TELEPHONE SERVICE BOX

MICROTEL SERIES 1000 DIALER AND PROGRAM TO CALL PLANT WHEN HIGH LEVEL FLOAT SWITCH IS ACTIVATED. ALSO PROGRAM DIALER TO SEND A FAX WITH FLOW TOTAL EVERY NIGHT AT MIDNIGHT. PROVIDE OWNER WITH 1/2 DAY OF INSTRUCTION ON DIALER FUNCTIONS. PROVIDE DIALER WITH DIGITAL CARD 6155B.

1 1/2" SPARLING MAGNETIC FLOW METER (TIGER MAG); MODEL #A620S-0631000 FISHER-PORTER-MAGNETIC-FLOW-METER-SERIES 10D14+75 WITH SERIES 50XM1000 SIGNAL CONVERTER (TRANSMITTER). PROGRAM METER FOR PULSE OUTPUT FOR PHONE DIALER EQUAL TO ONE PULSE FOR EACH 10 GAL. OF FLOW. PROVIDE DIALER RINGS TO WITH METER INSTALLATION. TRANSMITTER ENCLOSURE SHALL BE NEMA 4X

GENERAL ELECTRICAL NOTES:
1. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE AND ANY APPLICABLE LOCAL CODES.
2. ABOVE GROUND CONDUIT SHALL BE GALVANIZED RIGID STEEL. USE SCHEDULE 40 PVC CONDUIT BELOW GRADE.
3. INSTALL TYPE THWN STRANDED SINGLE CONDUCTOR NO. 12 AWG MINIMUM FOR BRANCH AND FEEDER CIRCUITS.
4. CIRCUIT BREAKER SHALL PROVIDE THERMAL AND MAGNETIC PROTECTION AND BE RATED FOR 10,000 SYMMETRICAL AMP MINIMUM OF FAULT CURRENT.
5. INSTALL GROUND RODS AND GROUNDING AT THE ELECTRIC SERVICE AS REQUIRED BY THE NATIONAL ELECTRIC CODE.
6. PROVIDE A WATER TIGHT CONDUIT SYSTEM BELOW GRADE.
7. INSTALL ALL WIRE IN CONDUIT.
8. ELECTRICAL WORK PERFORMED BY CIR ELECTRICAL CONST. CORP.: BUFFALO, NY (716) 822-1416. CONTACT (ROGER KETCH)

120 VOLT, SINGLE PHASE POWER DISTRIBUTION RISER DIAGRAM

2#12,#12 GROUND, 1/2" CONDUIT — DIALER

IN NEMA 1 BOX IN EQUIPMENT PANEL

15 AMP 1 POLE	— DIALER
15 AMP 1 POLE	— RECEPTACLE
15 AMP 1 POLE	
15 AMP 1 POLE	— PANEL HEATER
20 AMP 1 POLE	— PUMP & FLOW TRANSMITTER

2#6,1#8 GROUND, 3/4" CONDUIT

50 AMP 1 POLE

MAIN DISCONNECT AT POLE PANEL

50 AMP 1 POLE

NEUTRAL GROUND

2#8, 1#10 GROUND, 2" PVC CONDUIT

ELECTRIC METER AT PANEL

2#3, 1" CONDUIT @ BOX/PANEL

TO UTILITY CONNECTION

3#3, 1 1/2" CONDUIT (1 1/2"-2")

EXISTING NEW SERVICE POLE DETAIL ①|3

NTS

NOTES: ABOVE GROUND CONDUIT SHALL BE GALVANIZED RIGID STEEL CONDUIT.

POLE INSTALLED BY ELECTRIC UTILITY ALL OTHER EQUIPMENT INSTALLED BY CONTRACTOR

WEATHERHEAD

INSTALL 2' OF WIRE FOR UTILITY TO CONNECT TO

TELEPHONE SERVICE BOX CONNECTION COORDINATE WITH TELEPHONE COMPANY TO OBTAIN A TELEPHONE SERVICE AND PROVIDE EQUIPMENT AS REQUIRED BY TELEPHONE COMPANY FOR SERVICE

TO EQUIPMENT PANEL

2-2" PVC CONDUIT

GALVANIZED RIGID STEEL TO PVC CONDUIT ADAPTOR

TINNED COPPER, SOLID, 2 TWISTED PAIRS TELEPHONE CABLE IN HIGH DENSITY NEOPRENE JACKET IN 2" CONDUIT

METER SOCKET AS REQUIRED BY ELECTRIC UTILITY

50 AMP SINGLE POLE LOCKABLE CIRCUIT BREAKER RATED USE AS A SERVICE DISCONNECT

2#8, 1#10 GROUND #4-2" CONDUIT

GROUND ROD

EQUIPMENT PANEL MOUNTING DETAIL ②|3

NTS

PLASTIC BUSHING LOCATED ABOVE HDPE LINER

CABLE SUPPORT AND STRAIN RELIEF AT HATCH

CABLE FURNISHED WITH PUMP AND FLOW METER AND FLOAT SWITCH

3'-6" HDPE MANHOLE B TYPICAL (EXISTING)

TO PUMP AND FLOW METER

METER SOCKET AS REQUIRED BY ELECTRIC UTILITY

TELEPHONE HANDSET (PER OLIN CORP.)

DUPLEX RECEPTACLE

TELEPHONE TERMINAL

KARLON NEMA 3R PLASTIC WEATHERPROOF SPLICEBOX SPLICEBOXES (2)

EXPLOSIONPROOF SEAL-OFF FITTING

CONCRETE PAD

GRADE

2-2" PVC CONDUITS

CONCRETE HOUSEKEEPING PAD (3' X 3' X 6") WITH MESH REINFORCING

2 - 2" PVC CONDUITS

HAMMOND NEMA 4X (36"H X 30W X 12"D) HOFFMAN-OR-EQUAL-NEMA-3R ENCLOSURE WITH DRIP SHIELD OVER DOORS. A 15 AMP SINGLE POLE CIRCUIT 3 POINT LATCH. INSULATE WITH STYROFOAM INCLUDING DOORS AND BEHIND SUB-PANEL

50 AMP, 1 POLE CIRCUIT BREAKER DISCONNECT FOR PANEL WITH A 15 AMP, 1 POLE CIRCUIT BREAKER FOR EACH OF THE FOLLOWING DEVICES:
1. DIALER
2. RECEPTACLE
3. HEATER

TELEPHONE (MICROTEL DIALER DIALER SERIES 1000-PM6)

LOW DENSITY 120V HEATER W/ADJUSTABLE THERMOSTAT SET AT 40 DEGREES

1/2" CABINET CORNERS BOLTS PER LEG

6" COMPACTED NYSDOT NO. 2 STONE

TO POWER POLE

NOTES:
1. CONCRETE PAD SHALL BE A MINIMUM OF 6" THICK AND SIZED AS REQUIRED FOR ENCLOSURE. CONCRETE PAD SHALL BE REINFORCED WITH #4-0-12-0-C-EW- MESH
2. FOR LOCATION OF EQUIPMENT ENCLOSURE AND MANHOLES SEE SITE PLAN, DWG. NO. 1.