

**OPERATION, MAINTENANCE, AND
MONITORING PLAN**

VOLUME 1

General Requirements and Surface Systems

Prepared for:

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Operation, Maintenance, and Monitoring Plan
Volume 1 – General Requirements and Surface Systems
Bridgeton Landfill
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The material and data in this report was compiled and/or prepared under the responsible charge, supervision, and direction of the undersigned.

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DOCUMENTS INCORPORATED BY REFERENCE

(MAINTAINED IN LANDFILL OFFICE)

- “Construction Quality Assurance Plan,” by dated Aquaterra Environmental Solutions, Inc., December 2004
- EVOH Cap System QA/QC Plan, Cornerstone Environmental Group, April 2013
- Construction Documentation Report, 2013 Temporary Cap and Cap Integrity System, by Weaver Boos, October 2013
- 2013 Stormwater Management System Record Documentation Report, by Weaver Boos, October 2013
- Gas System Monitoring Equipment Manual
 - Gem 2000 (or equivalent) Operating Manual
 - Water Level Meter User Manuals
 - Four-gas Personnel Monitoring Meters
 - Flame Ionization Detector
 - Fluke Temperature Probes
- Other documents are listed in the body of this OM&M Plan

1.0 INTRODUCTION

1.1 Background

Bridgeton Landfill LLC (Bridgeton Landfill) is located on a 214-acre parcel, of which approximately 52 acres has been permitted for municipal solid waste disposal under the conditions of Permit #118912. In accordance with the permit, waste was placed in former limestone quarries which were reportedly about 240 feet deep. The landfill ceased accepting waste at the end of 2004.

In December 2010 Bridgeton Landfill detected changes in gas extraction well conditions; specifically, elevated temperatures and elevated carbon monoxide levels. Further investigation indicated that the landfill was experiencing an exothermic subsurface reaction which, among other effects, increases fugitive emissions and odors from the facility.

Since the time that the subsurface reaction was confirmed, Bridgeton Landfill has worked with the Missouri Department of Natural Resources (MDNR) along with other local, state and federal agencies to respond. The State has defined this reaction as a “subsurface smoldering event” (SSE), and that term shall be adopted in this Plan to refer to the subsurface reaction.

On May 13, 2013, Bridgeton Landfill entered into an Agreed Order with the State of Missouri which requires actions to address the SSE. One of the requirements of the Agreed Order (Section 17.C) is the preparation of a “Final Operation Maintenance and Monitoring Program Manual” which will hereafter be called the Operation, Maintenance, and Monitoring (OM&M) Plan.

The OM&M Plan was initially proposed by Bridgeton Landfill as an effective means to establish and implement rigorous procedures required by the challenges presented by the SSE. A DRAFT Plan was submitted in the Fall of 2012, but was not finalized or approved. This updated Plan builds upon the earlier draft, but also reflects the substantial additional work performed to date.

Other requirements of the Agreed Order, the permit, or applicable law may require additional construction and/or monitoring activities at the landfill. However, it is expected that the OM&M Plan will be expeditiously approved by the MDNR with recognition that the Plan is a living document that will be modified as site infrastructure and conditions change. Section 6.0 of this volume describes the process for making future modifications to the OM&M Plan.

1.2 Purpose of Operation, Maintenance, and Monitoring Plan

The presence of an SSE requires enhanced monitoring and maintenance so that containment and control systems continue to operate efficiently. The purpose of this Operation, Maintenance and Monitoring (OM&M) Plan is to prescribe a detailed and rigorous set of procedures to:

- Create a document which can be implemented by in-house Bridgeton Landfill personnel and/or by a third party to maintain effective, safe, environmental management of the facility,
- Perform regular inspection and maintenance of environmental control, conveyance, and containment systems,
- Enable tracking of the status of the thermal event, and provide facility personnel with information needed to contain and manage its byproducts,
- Provide monitoring to assess: the reaction condition, issues that warrant agency notification and conditions that may require or be conducive to further remedial measures, and
- Present means for communication and reporting, and for revising the OM&M Plan as conditions warrant.

To meet these objectives, Bridgeton Landfill has prepared this three-volume OM&M Plan, supplemented by other on-site documents, structured as indicated below:

- **Volume 1 – General Requirements and Surface System (this volume)**
- Volume 2 - Gas and Subsurface Control Systems
- Volume 3 - Leachate Management Systems
- Miscellaneous documents/manuals incorporated by reference

This OM&M Plan document will extensively reference other documents that will be kept on site including: a Health and Safety Plan (specifically designed for activities related to this OM&M Program), as-built drawings, equipment operating manuals, etc. The O&M Plan will be part of the Bridgeton Landfill operations until it is determined that the thermal event is no longer presenting severe operational challenges and maintenance and monitoring of the landfill can revert to the approved permit.

1.3 Operation, Maintenance, and Monitoring Plan Management

The OM&M Plan will be managed and administered by the following Bridgeton Landfill personnel:

- Area Environmental Manager (AEM) –Authorized to approve significant modifications to the OM&M Plan,
- Environmental Manager – The primary person responsible for implementation of the OM&M Plan. Provides daily on-site management of the implementation of the Plan and is authorized to approve minor changes or deviations from the program. The Environmental Manager reports to the AEM,
- Environmental Specialists – Responsible for implementation of the OM&M Plan at the field level. The Environmental Specialists report to the Environmental Manager,
- Field Technicians – Bridgeton Landfill or third-party personnel that perform the operation and maintenance activities in the field. The Field Technicians report to the Environmental Specialists and to the Environmental Manager, and
- Data Manager – Bridgeton Landfill or third-party person responsible for maintaining, presenting, and publishing the data collected during the implementation of the program. The Data Manager reports to the Environmental Manager.

Implementation of this OM&M Plan will require repair, augmentation, extension, and/or major reconstruction of landfill features. For routine maintenance issues which do not fundamentally alter or extend a feature's purpose or function, maintenance records will be kept at the facility and available for inspection by MDNR. For major replacements, extensions, changes, and new installations, Bridgeton Landfill will consult with MDNR (unless such change needs to be made on an emergency basis to protect human health or the environment) and follow the applicable procedural requirements for changing, altering, or modifying governing documents.

Since site features may change and future remedial features may be required to further manage and mitigate the effect of the SSE, this OM&M Plan will be a living document that is amended, as necessary, as new features are installed. Significant changes to procedures or requirements of this OM&M Plan will be reflected in an updated document to be retained on site as described in Section 6.0.

Forms used to operate and maintain the facility may be revised before implementation as long as the information required by the version contained in this OM&M Plan is provided on a modified form/format.

2.0 COVER AND SURFACE WATER MANAGEMENT SYSTEMS

Prior to the current SSE conditions, the facility had installed the clay final cover required by its permit. However, in order to contain and manage symptoms of the SSE, Bridgeton Landfill has covered about 40 acres with high density polyethylene (HDPE) and synthetic ethyl vinyl alcohol (EVOH) exposed flexible membrane liner (FML) cap over the entire South Quarry Area.

Approximate current locations of final clay cover and of the FML cap, as well as the major site features are indicated on Figure 1 of this OM&M Plan. Detailed as-built locations and conditions of the FML cap are contained in construction record documentation on site.

Precipitation runoff from the cover system enters the surface water management system and is then conveyed off site. Schematic representation of the surface water management systems are illustrated on Figure 2. Detailed as-builts for these features are contained in the record documentation on site. The cover and surface water management system must work together to minimize surface water ponding on the landfill, and to prevent erosion and surface water contamination.

2.1 Daily Quad-Checks

As a matter of course, Bridgeton Landfill technicians perform a multi-system inspection early each workday morning. These inspections are called “Quad-Checks” and are meant to identify items that are, or could develop into immediate odor or environmental containment issues. As part of these checks, all inspection personnel carry marking paint or flagging to identify a hole or tear in the temporary FML, a torn penetration boot, missing boot clamp, or any other concern which could result in an odor or leachate release. Marking paint or flagging will be immediately placed at the problem area to identify the location for repair.

Issues which are particularly odorous or which are leaking liquids should be reported to the Environmental Specialist or Environmental Manager immediately, and Corrective Procedures in Table 1 followed. Unless a major repair or structural change is required, records of such identified issues and their resolution or repair are documented in technician field books which will be retained on site.

Formal procedures for periodic, focused, system-specific inspections and documentation of those inspections and resulting resolutions or repairs are described in the following sections.

2.2 Final Clay Cover Areas

Final clay cover at the facility is comprised of at least 24 inches of compacted clay over waste and 12 inches of soil for vegetation (this is the cover system that is currently on the North Quarry

area). The final clay cover is subject to normal erosion and vegetative stress. Table 1 presents the program for final cover inspections and maintenance activities. Appendix A contains a field form for inspections (this form will also collect all information required to satisfy the NSPS monthly cover integrity monitoring requirements). Table 1 also contains the recommended corrective action procedures for the final clay cover system where required. The facility will implement these procedures as necessary to maintain the final clay cover integrity.

Final clay cover (that is not capped with FML) repair QA/QC will be performed in accordance with the Aquaterra Environmental Solutions, Inc. document titled “Construction Quality Assurance Plan,” dated December 2004, and retained on site. This document includes the QA/QC requirements to achieve the requirements of the facility’s operating permit regarding final clay cover. Major repair areas, covering greater than 0.5 acres, will be documented and shown when appropriate on updated as-built drawings. Documentation and as-built survey are not required for minor repairs.

2.3 FML Cap Areas

“FML Cap” refers to exposed flexible membrane liner (FML) material placed over areas where control of gas and/or odors needs to be enhanced (this is the cover system that is currently on the South Quarry area). Table 1 presents the program for temporary FML cap inspections and maintenance activities. Appendix A contains a field form for the formal monthly cap inspections.

Major repairs or new installation of temporary FML cap QA/QC will be performed in accordance with the Cornerstone Environmental Group document titled “EVOH Cap System QA/QC Plan”. This document is retained on site and includes the QA/QC requirements for subgrade preparation, subcap leachate collection and landfill gas collection components, and geosynthetic materials and installation.

When applicable, the standard details included in the OM&M Plan will be used to guide the repair process. Major repair areas will be delineated with an as-built survey, documented, and added to the active as-built drawings of the FML cap. Documentation and as-built survey are not required for minor repairs.

2.4 Surface Water Management Systems

The term “surface water management system” refers to those ditches, swales, culverts, and ponds that are outside of the limits of waste disposal, but which convey stormwater runoff from the landfill proper. If any condition arises (e.g. a spill occurs) which creates a threat to the surface water, Bridgeton Landfill may construct a containment feature between the threat location and a surface water detention or retention pond (see Figure 2).

Two of the detention ponds (the east detention pond and north detention pond) are adjacent to the landfill and have been lined with FML material. In some cases, surface water discharge can be prevented using an isolation valve should a leachate leak or release be detected on the FML cap surface.

Table 2 presents the program for cover and surface water management system inspections. Appendix B contains the field form to be used to complete the inspections.

3.0 ODOR MONITORING AND ABATEMENT

3.1 On-Site Odor Monitoring

Odor observations are the responsibility of all employees on the site. Possible odor sources include:

- Gas and leachate extraction wells and wellheads,
- Well boots,
- Sumps,
- Flare compounds,
- Damage (holes) in the FML,
- Cracks in final clay cover,
- Leachate management facilities, and
- Above-grade fittings.

The most likely activities that could generate fugitive odors are operation and maintenance activities on gas and leachate extraction wells, well boots, well extensions, sumps, and landfill gas flares.

When an odor has sufficient intensity or volume that it could lead to detection off-site, it will be reported to an Environmental Specialist or the Environmental Manager who will investigate to determine the source. The investigator will then assign the proper staff to restore the source area to normal operation to eliminate the odor source. Such on-site investigation, reporting, and remediation are organic processes that are ingrained and inherent to the standard operating procedures. No formal documentation, tracking, or record keeping is required for these activities.

3.2 Off-Site Odor Investigation and Mitigation

All real-time odor complaints received at the facility will be investigated immediately during business hours and at the first possible opportunity during non-business hours. The goal of the investigation will be to determine if an odor originates from the landfill site and, if so, to determine the specific source and cause of the odor, and then remediate the odor.

An odor complaint will be investigated at the location of the complaint using a subjective odor ranking (a scale of 0-4) as indicated below:

- 0 – Not detectable.
- 1 – Very weak. Odor present but hard to distinguish. Not persistent.
- 2 – Distinct. Easily detectable and persistent.
- 3 – Strong. May be described as objectionable and people will try to avoid.
- 4 – Very strong. May be described as intolerable or overpowering.

Odor complaints and complaint investigations will be documented on the “Investigated Odor Complaint Form” contained in Appendix C, or equivalent method of documentation.

If a complaint is verified (the Bridgeton Landfill investigator confirms that an odor is present and that the landfill cannot be ruled out as a source), the investigator will be responsible for tracking back to the source of odor, requesting the necessary repair or mitigation, and documenting that the mitigation has occurred. The form contained in Appendix C shall be used for this process.

Monthly, a summary of odor complaints received will be compiled and presented in the Monthly Data Submittals as described in Section 5.0.

3.3 Odor Control Procedures

Some maintenance activities require intrusive work, exposure of waste materials, and possible fugitive emissions. To minimize odors during these activities, the procedures outlined in Appendix D should be employed.

3.4 Odor Neutralization

Odor neutralizing systems will be available for use in localized areas if a need arises. An inventory of neutralizer product will be maintained on-site for the portable neutralizer systems.

4.0 MONITORING AND DATA COLLECTION

4.1 Monitoring Program Objectives

The following monitoring objectives have been identified by Bridgeton Landfill:

- Monitor status/progression of reaction,
- Monitor characteristics and volume of leachate and gas,
- Maintain gas collection and leachate collection efficiency, and
- Assess conditions requiring notification, repair, further evaluation, or corrective action.
- NSPS – Title V air regulation compliance.

In addition, certain specific monitoring is required in order to meet the reporting requirements of the May 13, 2013 Agreed Order. Therefore, the monitoring requirements included herein have been devised to support Bridgeton Landfill's objectives as well as to be able to meet the reporting required by the Agreed Order. Upon termination of the Agreed Order, Bridgeton Landfill may modify the monitoring to focus on the monitoring and data that is important for the operation and maintenance of the landfill.

Note that perimeter environmental monitoring, (e.g., groundwater and gas migration monitoring) is not addressed in this OM&M Plan because it is governed by other facility permit and compliance documents.

Some of the monitoring described in the following sections is performed using instrumentation and procedures that are more thoroughly described or presented in Volume 2 or Volume 3 of the OM&M Plan.

4.2 Settlement Surveys

A third-party contractor will perform ground surveys on a minimum of a 100-foot grid on the landfill cover of the South Quarry at the frequency specified in Table 3. Survey measurements will be performed using GPS methods which will obtain northing, easting and vertical elevations with an anticipated accuracy of ± 0.1 ft. vertical and ± 0.05 ft. horizontal.

Lateral progression of atypical settlement rates may indicate in which direction the thermal event is advancing or retreating. This information can be valuable for the planning and installation of preemptive remedial measures; such measures could include adjustments to the operation and/or location of temporary cap system, gas collection piping, and leachate transmission piping.

The results of the survey will be presented on a figure in the Monthly Data Submittal as described in Section 5.0. Bridgeton Landfill personnel will compare the survey results with previous months to help determine the rate of settlement

4.3 Gas Well Field Data

Data collected in the field allows the operator to make immediate adjustments to gas wells for improving gas collection efficiency, and provides data that indicates the conditions within the landfill waste mass. Measurements are made in the field at the wellhead sampling port using a GEM 2000 device distributed by CES Landtec or equivalent. The device is calibrated daily (during use) according to the manufacturer's recommendations. This instrument provides temperature, pressure/vacuum, flow, methane, oxygen, carbon dioxide and balance gas readings. The GEM 2000 has the following accuracies within the referenced ranges:

- Temperature in the 14° to 167° F range with +/-0.4% accuracy (if gas temperatures exceed 167° F, an analog temperature gauge is inserted into the sample port and the temperature is manually input into the GEM 2000 data screen),
- Methane (CH₄) at 0 to 70% range by dual wavelength infrared cell with +/- 3% accuracy,
- Carbon dioxide (CO₂) at 0 to 40% range by dual wavelength infrared cell with +/- 3% accuracy,
- Oxygen (O₂) at 0 to 40% range by electrochemical cell at +/- 1% accuracy; and,
- Pressure at maximum – 70 inches water column vacuum and +/- 250 mbar from calibration pressure.

Ambient air temperature operating range for the GEM 2000 is 32° to 104° F. For operating temperatures outside these ranges, equipment will be swapped throughout the day and while in the field will be either shaded or insulated to keep the internal components within the manufacture's recommended operating range. Detailed procedures for instrument calibration, use, and data collection are provided in Volume 2 of the OM&M Plan.

Gas well field data results will be collected at the frequency specified in Table 3, and will be presented in the Monthly Data Submittals as described in Section 5.0.

4.4 Gas Well Lab-Analyzed Gas Parameters

4.4.1 South Quarry

Gas samples will be collected from each functional and accessible gas extraction well in the South Quarry area at the frequency specified in Table 3. Laboratory analyses will be performed

for hydrogen, carbon monoxide, methane, oxygen, carbon dioxide, and nitrogen using analytical testing method ASTM D-1946 (Standard Practice for Analysis of Reformed Gas by Gas Chromatography).

4.4.2 North Quarry

Gas samples will be collected from each functional and accessible gas extraction well in the North Quarry area if wellhead temperature result indicates greater than 145° F. The gas well will be sampled at the next scheduled gas sampling event if practical, and analyzed for presence of carbon monoxide using analytical test method ASTM D-1946. When the wellhead temperature has fallen to less than 140° F, sampling of the gas well for laboratory carbon monoxide analyses may be terminated.

Procedures for obtaining and analyzing these samples are contained in Volume 2 of the OM&M Plan. Results from these laboratory analyses will be presented in the Monthly Data Submittal as described in Section 5.0.

4.5 Leachate Collection Sump Liquid Levels

Leachate is removed from the landfill using leachate collection sumps (LCS) at six locations. These LCSs were designed for insertion of a pump near the base of the landfill. Further description of the operation of these pumps is provided in Volume 3 of the OM&M Plan.

When conditions allow, and a pump is present and operating within the LCS, leachate levels are indicated by pressure transducer readout at the pump location. These levels will be collected at the frequency specified in Table 3 and will be reported in the Weekly Data Submittals.

4.6 Gas Well Liquid Levels

Results of gas well liquid level measurements will be used to determine if sufficient gas extraction well screen perforations are exposed to allow for efficient gas extraction.

Measurements are to be made with industry-standard water level indicators. The water tape is introduced into the well via a dedicated sample location drilled and tapped into each well head assembly. This device signals water contact with a bright LED light and a buzzer. The manufacturer claims an accuracy of 1/100th of a foot. However, this reading can be highly inaccurate, even when extreme care is taken by the technician. The probe often clings to the side of a saturated gas well casing giving a false reading. Changes to the instrument may be made including additional weighting of the probe and/or constructing a small cage to prevent probe contact with the casing in an attempt to minimize erroneous readings.

Knowledge about historical readings can be helpful to the field technician when discerning false readings. Alternatively, other liquid monitoring manufacturing equipment and technology could be utilized to improve reliability to these measurements.

4.7 Vertical Temperature Profiles/Temperature Monitoring Probes

Bridgeton Landfill has installed a series of temperature monitoring probes (TMPs) which consist of a set of direct-buried Type T thermocouple strings at each location. Thermocouple tips are buried at 20-foot vertical intervals and the temperatures are used to develop vertical temperature profiles of the waste mass and/or gas within the localized waste mass. Used as a trigger for contingent actions, temperature readings from direct buried thermocouples will be made using the procedures described in Appendix E. These readings may be ceased once the associated contingent action has been completed.

Results of these readings will be presented on graphs showing temperature at each thermocouple depth interval in Attachment B of the Weekly Data Submittal.

4.8 Flare Field-Analyzed Parameters

Flow and temperature measurements are made continuously utilizing inline flow measurement devices at each operating flare. All of the flare systems at Bridgeton Landfill use a Thermal Mass flow meter manufactured by Fluid Components International LLC (FCI), Thermal Instrument Company or equivalent. These are continuous reading insertion probe instruments which log data via a data recorder. The data recorder saves the data to a flash card in accordance with NSPS regulation.

These flow meter devices use a constant temperature system which employs two sensors; one for temperature and one for flow. The flow sensor is heated to a precise temperature above the gas flowing by. The gas conducts heat off the sensor in direct proportion to the mass flow rate. Temperature corrections are automatically made.

In addition, a GEM 2000 meter (or equivalent) will be used to determine the gas quality (methane, oxygen, carbon dioxide, and balance gas) at each flare inlet.

Flow, temperature, and gas quality data obtained as described above will be presented in the Monthly Data Submittals as described in Section 5.0.

4.9 Flare Lab-Analyzed Parameters

Gas samples will be taken from the inlet of each functioning flare or flare series at the site. Analyses will be performed for hydrogen, carbon monoxide, methane, carbon dioxide, oxygen,

and nitrogen using laboratory testing analytical ASTM D-1946 Standard Practice for Analysis of Reformed Gas by Gas Chromatography.

Results of these analyses will be presented in the Monthly Data Submittal.

5.0 REPORTING

The May 13, 2013 Agreed Order requires certain information to be reported by electronic submittal at a weekly frequency (containing information collected in the previous calendar week) and other information to be reported on a monthly frequency (for the previous calendar month within 20 days of the end of the previous calendar month). Tables of contents for these respective reports are contained in Appendix F and G of this volume; future reports will follow the template and content of these reports.

Upon termination of the Agreed Order, Bridgeton Landfill may modify the monitoring and associated reporting to focus on the monitoring and data that is important for the operation and maintenance of the landfill, and will make associated changes to reports and reporting frequency.

6.0 MODIFICATIONS TO OM&M PLAN

It is expected that the OM&M Plan can be approved by the MDNR with recognition that the Plan is a living document that will be modified as site infrastructure and conditions change. Upon installation of new features or modification of existing features the Environmental Manager will review the OM&M Plan to identify potential modifications to the procedures, and then prepare a memorandum proposing substantive modifications that Bridgeton Landfill may make to the OM&M Plan and the proposed implementation schedule for the changes. Such modifications may include:

- Change in monitoring frequency,
- Adjustments of trigger levels,
- Change in reporting frequency, and
- Material changes to an inspection or maintenance procedure, etc.

Changes which affect a requirement of the Agreed Order or any of the Plans submitted and approved as required by the Agreed Order will be submitted to the MDNR.

In addition, many of the activities described in the OM&M Plan are self-implementing with no requirement for external authorizations; however, the MDNR shall be notified of significant potential or actual modifications. As such, significant changes to the procedures of this OM&M Plan will be reflected in an updated OM&M Plan document to be retained on site. Updated pages or sections of the OM&M Plan will include a revision date in the lower right corner of the page, and a running diary of changes and rationale for the changes will be kept in the front of the document (see Appendix H). Up-to-date as-built documentation will also be retained on site and provided to the MDNR upon request.

TABLES

Table 1 – Inspections and Maintenance for Final Clay Cover and FML Cap ⁽¹⁾

Item or Conditions to Be Inspected	Approximate Inspection Frequency	Criteria for Acceptance	Corrective Procedures
Non-uniform waste settlement in clay final cover	Quarterly	No damage or significant ponding	Fill the area of significant ponding to promote sheet flow, add topsoil and reseed.
Crevasses in clay final cover	Quarterly	No cracks wider than 3" and deeper than one foot	Fill opening with soil compacted to meet final cover specifications, restore topsoil and vegetation. Replace damaged piping if necessary.
Liquids (leachate) breaking out of clay final cover	Quarterly	No liquids or staining verified as attributable to leachate observed	Collect and remove liquid as soon as possible. Block liquid from entering stormwater collection channels if necessary. Once liquid is under control, excavate saturated area, install french drain if deemed necessary, and backfill with new clay and topsoil to restore original configuration. Document repairs in accordance with QA/QC Plan.
Crevasses or voids in the soil directly under the FML	Monthly	No significant cracks, stretched (trampoline) FML, separation, etc. observed	Determine the nature and extent of the crack upon discovery, and evaluate safety, extent, and if repair is required. If safe and required to maintain FML integrity, cut open FML, fill in cracks with soil or sandbags, and repair FML. Document repairs in accordance with FML QA/QC Plan.
Rips, tears, or punctures of the FML cap	Monthly	No rips, tears, punctures, or stress observed	Extrusion weld FML repair patch (or bead for small holes) as soon as practical upon discovery. Remove, adjust or protect temporary FML cap from objects causing stress point concentrations. Document repairs in accordance with FML QA/QC Plan.
FML boots connected to LFG wells or other penetrations	Monthly	No stress or damage observed	Repair the FML boot, patch, weld, or seal. Document repairs in accordance with FML QA/QC Plan.
Liquids (leachate) below the FML cap	Monthly	No bulging observed	Clean and jet the toe drain or subcap drain to which the collected liquid was designed to drain. Evaluate subcap drainage piping, and install additional subcap drainage piping or repair existing as necessary. Repair FML and document in accordance with FML QA/QC Plan.
LFG below the FML cap	Monthly	No gas build-up (pillowing) observed	Increase vacuum to subcap LFG collectors in the area of the pillowed FML. Install surface vacuum point (bubblesucker) if necessary.

Notes:

- 1) See Appendix A for Inspection Form to be completed in field.

Table 2 – Surface Water Management Inspection System ⁽¹⁾

Item or Conditions to Be Inspected	Approximate Inspection Frequency	Criteria for Acceptance	Corrective Procedures
Earthen Ditch Vegetation	Monthly	Grass healthy, good coverage, less than 6" long	Overseed and mulch
Earthen Ditch Riprap	Monthly	Pieces in place, no exposed subsoil	Move or add riprap
Ditch Clogging	Monthly	Sediment build up or other obstruction	Remove obstruction to original ditch line
Culvert Structural Integrity	Monthly	Near circular or original shape throughout length	Remove and replace if deformation affecting capacity or collapse is imminent
Culvert Clogging	Monthly	Top of corrugations visible and/or less than 3" sediment	High-volume water flush until clean
Culvert Head/Endwalls	Monthly	Headwall intact, retaining soil properly	Repair or replace
Clay Cap Temporary Erosion Controls	Monthly	Silt fences fully keyed in, mulch coverage in place	Restore as needed
Clay Cap Slope Erosion	Monthly	No erosion rills greater than 6" deep	Fill rill, reseed, and mulch
Clay Cap Vegetation	Monthly	Grass healthy, good coverage, less than 18" long. No shrubs or seedlings	Overseed and mulch as appropriate, remove shrubs or seedlings, irrigate as necessary.
Detention Pond Liner	Quarterly	No rips or seam separation	Extrusion weld FML repair patch (or bead for small holes) as soon as practical upon discovery. Document repairs in accordance with FML QA/QC Plan.
Detention Pond Valve	Quarterly	Valves are not clogged and exercise freely	Jet obstructions from valve closing, lubricate workings, exercise valve.
Detention Pond Sediment	Quarterly	Less than one foot accumulation	Remove with backhoe or water jet and vac
Detention Pond Outlet	Quarterly	Smooth transition from outlet pipe to ditch invert, erosion protection in place	Restore and regraded, add new rip rap as necessary

Notes:

- (1) See Appendix B for Inspection Form to be completed in field.

Table 3 – Proposed Data Collection

Proposed Data Collection	Location	Frequency
Settlement Survey	South Quarry Areas	Monthly
Gas Extraction Well Field Parameters (temperature, oxygen, pressure, methane, carbon dioxide)	Gas extraction features (gas extraction wells, subcap collectors, leachate risers, etc.)	Bi-Weekly
Gas Well Lab Analyzed Parameters	South Quarry GEWs	Monthly
Gas Well Lab Analyzed Carbon Monoxide	North Quarry GEWs*	Monthly
Gas Flow Volume Measurements	Operating Flare(s)	Continuous
Flare Field Parameters	Operating Flare(s)	Weekly
Flare Lab Parameters	Operating Flare(s)	Monthly
Leachate Collection Sump Liquid Levels	Operating LCSs	Weekly
GEW Liquid Levels	Accessible vertical gas extraction wells	Quarterly
Vertical Temperature Profile	All functioning TMPs	Weekly
Leachate Volume	Each leachate collection sump and at pretreatment plant	Continuous

* For GEWs with wellhead temperature greater than 145° F

FIGURES

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EXISTING DETENTION BASIN

NORTH
DETENTION
BASIN

MAIN FLARE
STATION

LCS-6B

LCS-5A

LCS-1D

LCS-3C

LCS-2D

EAST FLARE

EAST DETENTION BASIN

NORTH
QUARRY

SOUTH
QUARRY

SURFACE COLLECTOR HEADER

LCS-4B

MAINT.
BLDG

LEACHATE
PRETREATMENT
AREAS

TRANSFER
STATION

316,000 GAL.
LEACHATE
AST

96,000 GAL.
LEACHATE
AST

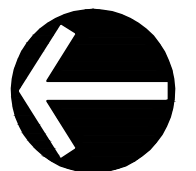
MSD INLET FOR
APPROVED
WASTEWATER

BOENKER LANE

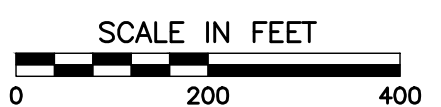
LEGEND

- SOLID WASTE PERMIT BOUNDARY
- ▭ FML CAP BOUNDARY
- > PERIMETER LANDFILL GAS HEADER
- - -> LANDFILL GAS JUMPER/LOOP
- > PERIMETER LEACHATE HEADER
- - -> LEACHATE TRANSMISSION PIPE

- NOTES**
- ADDITIONAL DETAIL REGARDING THE GAS COLLECTION SYSTEMS IS CONTAINED IN VOLUME 2.
 - ADDITIONAL DETAIL REGARDING THE LEACHATE MANAGEMENT SYSTEMS IS CONTAINED IN VOLUME 3.



NORTH



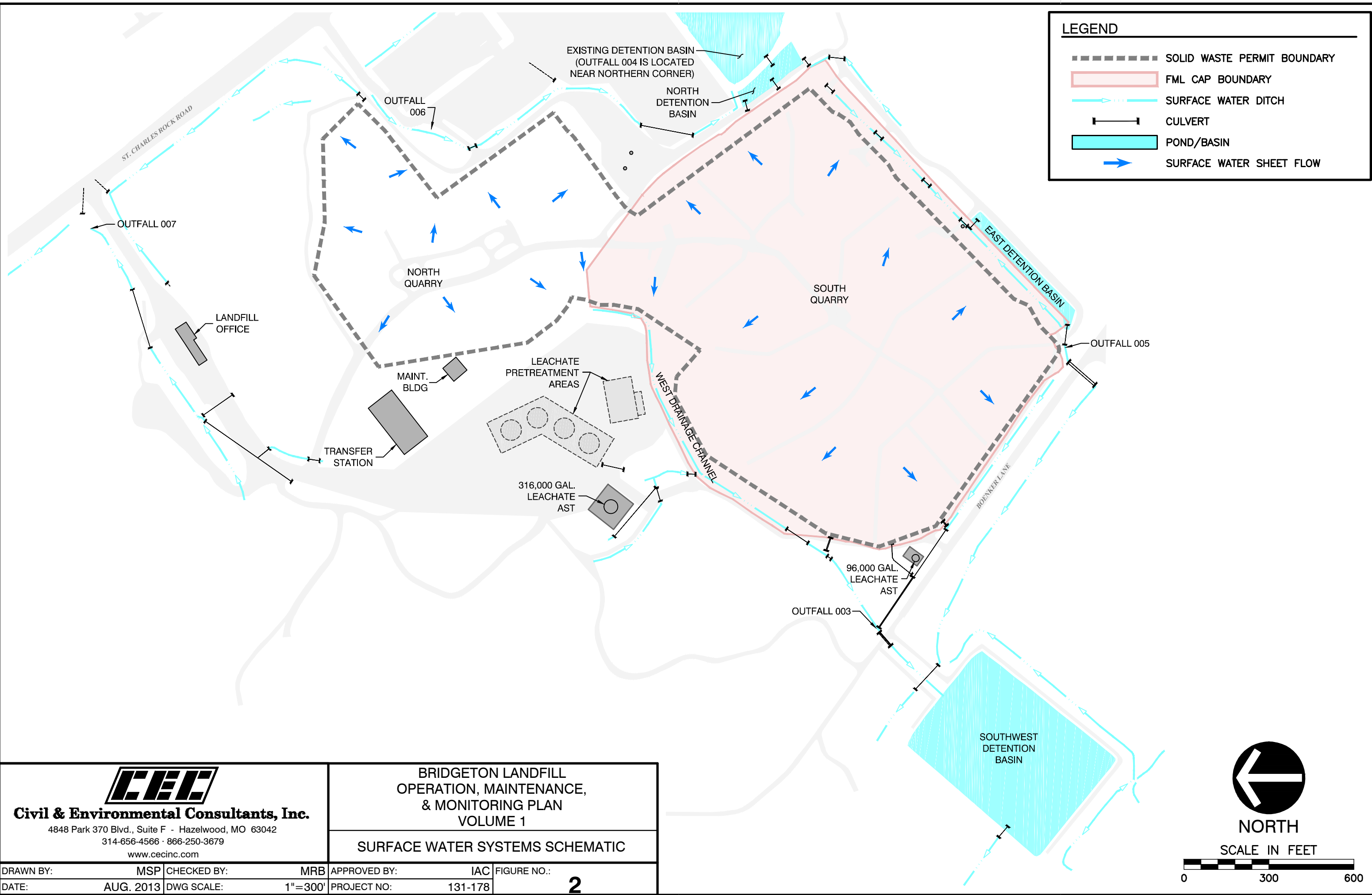
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Civil & Environmental Consultants, Inc.
4848 Park 370 Blvd., Suite F - Hazelwood, MO 63042
314-656-4566 · 866-250-3679
www.cecinc.com

BRIDGETON LANDFILL
OPERATION, MAINTENANCE,
& MONITORING PLAN
VOLUME 1

LANDFILL SYSTEMS SCHEMATIC

DRAWN BY:	MSP	CHECKED BY:	MRB	APPROVED BY:	IAC	FIGURE NO.:	1
DATE:	AUG. 2013	DWG SCALE:	1"=200'	PROJECT NO.:	131-178		

P:\2013\130-484 - CADD\DWG\SolidWaste\OM&M\131178-OM&M(V1)_Figures.dwg\FIGURE 2\LS:(9/10/2013 - mpeake) - LP: 9/11/2013 8:03 AM



LEGEND

- SOLID WASTE PERMIT BOUNDARY
- ▭ FML CAP BOUNDARY
- > SURFACE WATER DITCH
- ||| CULVERT
- ▭ POND/BASIN
- ➔ SURFACE WATER SHEET FLOW

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BRIDGETON LANDFILL
 OPERATION, MAINTENANCE,
 & MONITORING PLAN
 VOLUME 1

SURFACE WATER SYSTEMS SCHEMATIC

DRAWN BY: MSP	CHECKED BY: MRB	APPROVED BY: IAC	FIGURE NO.: 2
DATE: AUG. 2013	DWG SCALE: 1"=300'	PROJECT NO: 131-178	

NORTH
 SCALE IN FEET
 0 300 600

APPENDIX A

CAP AND COVER INSPECTION FORM

APPENDIX A

BRIDGETON LANDFILL

CAP AND COVER INSPECTION FORM

Date of Inspection: _____

Name of Inspector: _____

Inspection Item	Issue? (Y/N)	Item Tracking Number(s)
Temporary FML Cap (Monthly)		
Crack/Separation under FML		
Settlement from non-uniform decomposition		
Rips, tears, or punctures		
FML penetration boots		
Aged, brittle, heat affected		
Liquids below FML		
Leachate above FML		
Landfill gas buildup under FML		
Final Clay Cover (Quarterly)		
Crack or erosion rill deeper than 6 inches		
Settlement from non-uniform decomposition		
Leachate Outbreak		
Dead or stressed vegetation		

Note: See attached Cap and Cover Inspection Item Tracking Form (one per item indicated on the above form).

APPENDIX A

BRIDGETON LANDFILL

CAP AND COVER INSPECTION ITEM TRACKING FORM

Item Tracking No. _____ (e.g. MMDDYY-____)

Inspector's Name: _____

Inspection Item Noted:

Description: _____

Location: _____

Other: _____

Follow-up Technician's Name: _____

Incident Resolution Description: _____

Date of Resolution: _____

Follow-Up Technician's Signature

APPENDIX B

SURFACE WATER MANAGEMENT SYSTEM INSPECTION FORM

APPENDIX B

BRIDGETON LANDFILL

SURFACE WATER MANAGEMENT SYSTEM INSPECTION FORM

Date of Inspection: _____

Name of Inspector: _____

Inspection Item	Issue? (Y/N)	Item Tracking Number(s)
<u>Monthly</u>		
Ditch Vegetation		
Ditch Riprap		
Ditch Clogging		
Culvert Structural Integrity		
Culvert Clogging		
Culvert Head/Endwalls		
Temporary Erosion Controls		
Slope Erosion		
Slope Vegetation		
<u>Quarterly</u>		
Detention Pond Liner		
Detention Pond Valve Operation		
<u>Annually</u>		
Detention Pond Sediment		
Detention Pond Outlet		

Note: See attached Surface Water Inspection Item Tracking Form (one per item indicated on the above form).

APPENDIX B

BRIDGETON LANDFILL

SURFACE WATER MANAGEMENT SYSTEM INSPECTION FORM

Item Tracking No. _____ (e.g. MMDDYY-____)

Inspector's Name: _____

Inspection Item Noted:

Description: _____

Location: _____

Other: _____

Follow-up Technician's Name: _____

Incident Resolution Description: _____

Date of Resolution: _____

Follow-Up Technician's Signature

APPENDIX C

INVESTIGATED ODOR COMPLAINT FORM

APPENDIX C

BRIDGETON LANDFILL

INVESTIGATED ODOR COMPLAINT FORM

COMPLAINT

Tracking No. _____ (e.g. MMDDYY-____)

Date of Complaint: _____ Day of Week: _____

Time of Complaint: _____

Name of Complainant: _____

Address: _____

Complainant Descriptions:

Odor Level (0-4): _____ (see Note 1)

Duration of Odor: _____

Characteristic of Odor: _____

INVESTIGATION

Date: _____ Time: _____

Investigator: _____

Investigator Descriptions:

Odor Level (0-4) _____ (see Note 1)

Characteristic of Odor: _____

Wind Speed at Time of Complaint: _____

Wind Direction at Time of Complaint: _____

Temperature / Pressure / Conditions at Time of Complaint: _____

APPENDIX C

Odor Source On-Site Follow Up Investigation? Y/N

Results of Investigation: _____

Notes: _____

Note 1: Odor Level

- 0 Not detectable
- 1 Very Weak (odor threshold)
- 2 Distinct
- 3 Strong
- 4 Very strong

APPENDIX D

ODOR CONTROL PROCEDURES

APPENDIX D

Bridgeton Landfill Odor Control Procedures

Odor Management

Odor management and landfill gas management are inter-related. Odor management, for purposes of this Plan, will be the temporary measures employed during any work activity at the site that might generate odors such as excavation, significant well maintenance, etc.

Odor Management During Excavation

1. Minimize aerial extent of excavation to the extent required to maintain safe working conditions.
2. If necessary, install a portable odor control unit near the excavation site, and install a 1,500 gallon water tank on a suitable pad.
3. Use odor control neutralizers at a suitable concentration during the excavation and backfilling process. The concentration can be adjusted as necessary to achieve acceptable neutralization and to more fully neutralize aggressive odors.
4. Adjust concentrations and nozzle spacing as necessary during the activities to neutralize the odors.
5. During the backfill process, the neutralization process can be discontinued once more permanent landfill gas extraction methods are employed in this area; otherwise maintain neutralization until backfill is completed.

Odor Control During Transportation of Excavated Wastes

1. Excavated wastes will be placed in a roll-off container or dump truck to transport to the Bridgeton transfer station. The container or dump truck will be tarped following placement of waste.
2. In all cases, the waste must be covered with an odor control product in the container used for transport. If wastes require mixing, then a product can be applied following mixing if odors persist from these waste materials. The product must be applied to completely cover the wastes with a thin coating.

Odor Management During Gas Emission Activities

1. The wind location will be monitored during the course of the work to determine if odor modification (neutralizers) should be utilized.
2. Install a portable odor control system downwind of the work area.
3. Use an odor control neutralizer at a suitable concentration during the excavation and backfilling process. The concentration can be adjusted as necessary to achieve acceptable neutralization and to more fully modify aggressive odors.

APPENDIX E

TEMPERATURE MONITORING PROCEDURE

Procedures for Verification of TMP Readings

General

The strings of T type thermocouples at the site are quality controlled strings of thermocouple 20 gauge Copper/Constantan thermocouple wire, with factory fabricated sealed junctions at the ends in the ground. The resistance of the wire, in ohms per foot, is 0.298. The thermocouple wire is coated with Teflon, which provides protection up to 500° F. The thermocouple itself is rated to 750° F. At the ground surface the thermocouple wires (two per thermocouple unit within the TMP location) are connected to a rotary switch that is inside a NEMA weatherproof rated enclosure mounted above the ground surface. A readout device, purchased from Omega Engineering of the HH800 series is connected to the rotary switch to take readings. Resistance readings can also be taken for each unit through the rotary switch, which is low resistance. Temperature readings are actually voltage differences across the two sides of the thermocouple wire and are read to the nearest microvolt to achieve readings accurate to $\pm 2^\circ$ F. User manuals for the Omega readout device and the Fluke brand multimeter (model 175 true-RMS multimeter being used to measure resistance) are provided as Attachments A and B.

Temperature Data Information

The Omega readout device is set up to read temperature measurements through a T type connection. The readout display is set to output measurements in degrees Fahrenheit. These readings are currently recorded in a log book on a weekly basis. A spreadsheet is created with recorded data and temperatures are compared to previously recorded data. The same data logging process is performed for resistivity readings, only on a monthly basis, or more frequently if needed.

Potential Problem in Obtaining Accurate Readings

The following things can result in poor quality readings:

1. Not setting the thermocouple readout device to the correct setting. The device must be set to a type T thermocouple type. Failure to have the correct setting results in very different temperatures being associated with the voltage difference being converted by the readout device to temperature.
2. Not have clean connectors to the leads to the switch. This increases the resistivity at the readout end and can lead to erroneous readings. Make sure the contact surfaces are clean and dry.
3. Condensate or corrosion can occur within the rotary switch. This results in incorrect readings by raising resistance or even providing continuity across multiple thermocouples. The enclosure containing the switch must be well ventilated and dry. If condensate or corrosion is present the switch can be cleaned or replaced. Resistance readings at periodic intervals and whenever questionable readings are obtained can identify these problems.

4. Damage associated with abrasion or stretching or breaking of the thermocouple wire or its insulation can occur. This will result in either resistance that exceeds the nominal values foot of wire due to work hardening of the wire, very high resistance due to wire breakage or very low resistance do to insulation damage at shallower depth than the tips. Resistance readings at periodic intervals and whenever questionable readings are obtained can identify these problems.

Instrument Reading Verification

Verify Resistance Readings

Resistance readings should be taken at monthly intervals for each thermocouple probe. A multimeter calibrated with a quality resistor of 50 ohm should be used. Additional readings should be taken whenever readings appear questionable or a large change in readings occurs. Values will be plotted with depth and units exceeding 1.3 times the theoretical resistance are considered marginal. Units with 1.65 times the nominal resistance values, corrected for the switch, will be considered unacceptable for use.

If readings are high, the switch unit should be inspected and the resistance at the thermocouple lead (for one or two units that read high) be checked bypassing the switch. If the switch is seen to be the issue it should be cleaned or replaced to reduce the measured resistance in the switch to a few ohms or less.

Verifying Temperature Readings

If the resistance readings are acceptable, the temperature readings should be repeated within 24 hours to identify they are representative. This verification should include double checking the readout is set to the correct thermocouple type (in this case, a T type). A temperature measurement device should be calibrated using an ice bath technique or other approved method. To perform this type of calibration, a type T connection can be made to the readout device using the same thermocouple wires that are used in the TMPs. The bare wires at the end are twisted together and directly submerged in the center of the ice bath. The wire should be slowly rotated inside the ice bath to obtain the correct calibration temperature. Readings should stabilize at 32° F if done properly. Instructions for making an ice bath are included as Attachment C.

Identifying Unacceptable readings

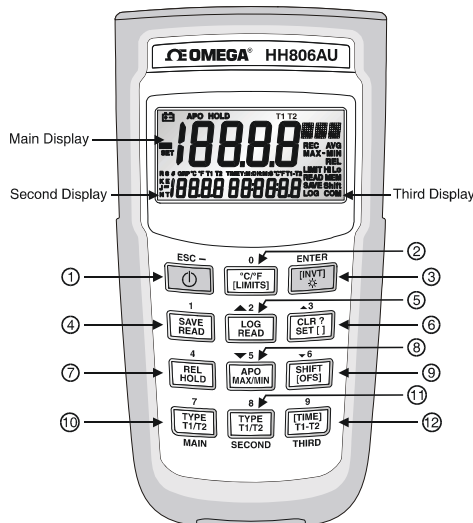
Readings that do not stabilize to within 4 degrees over a period of 30 seconds and show rapid fluctuation are not acceptable and should be indicated as readings failed to stabilize. In some cases this has been associated with problems with corrosion or moisture in the rotary switch and the switch should be cleaned or replaced. Verification that the switch is the problem can be obtained by reading the problem unit without the rotary switch, connecting directly to the leads.

ATTACHMENT A



HH806U/HH806AU MULTILOGGER THERMOMETER

INSTRUCTION SHEET
M4502/0711
Shop online at: omega.com e-mail: info@omega.com
For latest product manuals: omegamannual.info
MADE IN TAIWAN



OMEGAnet® On-Line Service
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Internet e-mail
info@omega.com

Servicing North America:

U.S.A.: One Omega Drive, Box 4047
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Tel: (203) 359-1660 FAX: (203) 359-7700
e-mail: info@omega.com

ISO 9001 Certified

Canada: 976 Bergar
Laval (Quebec) H7L 5A1, Canada
Tel: (514) 856-6928 FAX: (514) 856-6886
e-mail: info@omega.ca

For immediate technical or application assistance:

U.S.A Sales Service: 1-800-826-6342/1-800-TC-OMEGA®
Customer Service: 1-800-622-2378/1-800-622-BEST®

Canada: Engineering Service: 1-800-872-9436/1-800-USA-WHEN®
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e-mail: sales@omega.co.uk

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INTRODUCTION

The instrument is a portable digital thermometer that measures external thermocouples of type K, J, R, S, T, E, N. The thermocouples types comply with the N.I.S.T. – ITS 90 standard reference temperature/voltage tables. The thermometer features a dual thermocouple input, an adjustable T/C offset and an USB interface for uploading data to a PC using optional software and cable.

SAFETY INFORMATION

WARNING

To avoid electrical shock, do not use this instrument when working voltages at the measurement surface over 24V AC or DC.

WARNING

To avoid damage or burns, do not make temperature measurement in microwave ovens.

CAUTION

Repeated sharp flexing can break the thermocouple leads. To prolong lead life, avoid sharp bends in the leads, especially near the connector.

SPECIFICATIONS

ELECTRICAL

Temperature Scale: Celsius or Fahrenheit user-selectable
Measurement Range:

- K-TYPE (0.1°) -200°C to 1372°C (-328°F to 2501°F)
- J-TYPE (0.1°) -210°C to 1200°C (-346°F to 2192°F)
- T-TYPE (0.1°) -200°C to 400°C (-328°F to 752°F)
- E-TYPE (0.1°) -210°C to 1000°C (-346°F to 1832°F)
- R-TYPE (1°) 0°C to 1767°C (32°F to 3212°F)
- S-TYPE (1°) 0°C to 1767°C (32°F to 3212°F)
- N-TYPE (0.1°) -50°C to 1300°C (-58°F to 2372°F)

*Based on the ITS-90 temperature standard.
According to temperature standard ITS-90.

Accuracy:

K/J/T/E-TYPE

- ±(0.05% rdg + 0.3°C) on -50°C to 1372°C
- ±(0.05% rdg + 0.7°C) on -50°C to -210°C
- ±(0.05% rdg + 0.6°F) on -58°F to 2501°F
- ±(0.05% rdg + 1.4°F) on -58°F to -346°F

N-TYPE

- ±(0.05% rdg + 0.8°C) on -50°C to 0°C
- ±(0.05% rdg + 0.4°C) on 0°C to 1300°C
- ±(0.05% rdg + 1.6°F) on -58°F to 32°F
- ±(0.05% rdg + 0.8°F) on 32°F to 2372°F

R/S-TYPE

- ±(0.05% rdg + 2°C) on 0°C to 1767°C
- ±(0.05% rdg + 4°F) on 32°F to 3212°F

Temperature Coefficient:

0.1 times the applicable accuracy specification per °C from 0°C to 18°C and 28°C to 50°C (32°F to 64°F and 82°F to 122°F).

Input Protection:

24V dc or 24V ac rms maximum input voltage on any combination of input pins.

Reading Rate: 2.5 time per second.

ENVIRONMENTAL

Ambient Operating Ranges:

0°C to 50°C (32°F to 122°F) <80% R.H.

Storage Temperature:

-20°C to 60°C (-4°F to 140°F) <70% R.H.

GENERAL

Display:

There are three display areas on the HH806 series LCD (liquid crystal display). The Main and Second displays are 4 ½ digits with a maximum reading of 19999. These are used for displaying the value of T1 or T2. The Third display is for the date, time, or the differential value of T1 to T2.

Overload: “----.” or “OL” is display.

Battery: 1.5V x 4 PCS (SIZE AAA) UM-4 R03.

Battery Life: 120 hours typical with carbon zinc battery.

Dimensions: 160mm(H) x 83mm(W) x 38mm(D).

Weight: Approx. 365g including batteries.

Supplied Thermocouple:

1 meter (40”) type K insulated beaded wire thermocouple
Maximum insulation temperature is 482°C (900°F).
Thermocouple accuracy is ±1.1°C or 0.4% of reading (whichever is greater) from 0°C to 1250°C.

Wire Communication Protocol:

2400 baud rate. (HH806U)
19200 baud rate. (HH806A)

External Connections:

1. USB Port
2. DC power JACK(12V)



OPERATING INSTRUCTIONS

1. OPERATIONAL MODE

There are three operation modes-Normal, Shift, and Setup Mode.

NORMAL MODE:

This is the default mode, the operating functions for the normal mode are printed on the top of each button in white.

SHIFT MODE:

The operating functions for the shift mode are printed in gray on the buttons. While in the normal mode, press the SHIFT button to switch to shift mode. At the lower-right corner of the display, the word "Shift" is displayed to indicate shift mode. To switch back to normal mode, press the SHIFT button again.

SETUP MODE:

Press the set[] button in normal mode to switch to setup mode, the indicator "SET" is shown on the left side of the display. To switch back to normal mode, press SET[] button.

2. NORMAL MODE

The following functions can only be used in the normal mode.

(1) "⏻" Power Button

The "⏻" button turns the thermometer on or off. When the meter is in MAX/MIN record mode, the power off function is disabled.

(2) "[LIMITS]" Button (only Main display)

The limits function will alert the user when a measurement exceeds a specified limit. To set the limit values, refer to limits function in the setup mode. Press the [LIMITS] button to activate the limits function; the word "LIMIT" should be displayed on the LCD.

When the value of the main display exceeds the Hi limit, the word "Hi" will be displayed and the thermometer will beep in a pulsed tone. If the value of the main display is lower than the Lo limit, the word "Lo" will be displayed and the thermometer will beep in a continuous tone. To exit the limits function, press the [LIMITS] button.

(3) "☼" Button

The backlight function is represented by this button "☼". Pressing the button will turn on or off the LCD backlight. The backlight will turn off automatically after.

(4) "SAVE/READ" Button

The read data function works in conjunction with the save function in the shift mode, it is used for reading saved data. The save function can be activated in shift mode. Press the SAVE/READ button to read saved data; the word "READ" should be displayed on the LCD. To navigate around the save data table, press the overlay "SECOND" button until the "#" sign is displayed on the second display. The location of the read pointer within the saved data table will be displayed. The arrow buttons on the overlay are used for scrolling through the saved data. Press the smaller arrows "▲"

or "▼" to step through the data one at a time. Press the larger arrows "▲" or "▼" to step through the data ten at a time. Pressing the overlay "ESC" button deactivates the read data function.

(5) "LOG/READ" Button

The read log function works in conjunction with the log function. It is used for reading logged data. The log function can be activated in the shift mode. Press the LOG/READ button to activate the log read function; the word "READ" is displayed on the LCD. Press the overlay SECOND button to rotate through following display menus: T1, T2, GRP, and #. T1 and T2: Displays the T1 or T2 saved data. GRP: Displays the current group number. #: Displays the current location of the read pointer within a selected group. The arrow buttons on the overlay are used for scrolling through the data and groups. Press the smaller arrows "▲" or "▼" to step through the logged data or groups one at a time. Press the larger arrows "▲" or "▼" to step through the data or groups ten at a time. To navigate the logged data and groups, press the overlay SECOND button until GRP appears in the second display panel. Then select the group using the arrows. Press the SECOND button again until the "#" sign is displayed. The location of the read pointer in the selected group will be displayed. Use the arrows to scroll through the data. Pressing the overlay "ESC" button deactivates the read data function.

(7) HOLD Mode (only Main display)

When HOLD mode is selected, the thermometer holds the present readings and stops all further measurements. To activate the data hold mode, press the HOLD button, and "HOLD" is displayed on the LCD. Pressing the HOLD button again cancels the function, and the instrument will automatically resume measurements.

(8) MIN/MAX with Time record Mode (only Main display)

The MIN/MAX function records the highest and lowest value recorded, and it calculates the average reading, and the differences of MAX to MIN. Press MIN/MAX button to enter the MIN/MAX recording mode. The beeper emits a tone when a new minimum or maximum measurement is recorded. Press the MIN/MAX button again to rotate through the current readings: MAX: The highest measurement recorded. MIN: The lowest measurement recorded. MAX-MIN: The difference of the highest and the lowest measurement. AVG: The average values of the measurements. This mode works in conjunction with the hold function, pressing the HOLD button will stop the recording and measurements (Previously recorded readings are not erased). Press HOLD button again to resume recording and measurements. To prevent accidental loss of MIN, MAX and AVG data, the MIN/MAX function can only be cancelled by pressing and holding down the MIN MAX key for more than 2 seconds. The automatic power-off feature, and the power, °C/°F, REL, SET, Hi/Lo Limits, TYPE, T1/T2 buttons are also disabled.

(10) "T1/T2" Button (Main display)

The input selection button [T1/T2] selects the input for the main display, T1 thermocouple or T2 thermocouple. Press the T1/T2 button to switch between the two inputs. When meter is turned on, it is set to the display that was last in use.

(11) "T1/T2" Button (Second display)

The input selection button [T1/T2] selects the input for the second display, T1 thermocouple or T2 thermocouple. Press the T1/T2 button to switch between the two inputs. When meter is turned on, it is set to the display that was last in use.

(12) "T1-T2/TIME" Button (Third display)

The input selection button [T1-T2] selects the system time and date, or the differential between the two thermocouples (T1-T2) for the third display. Press the T1-T2 button to switch the display options. When meter is turned on, it is set to the display that was last in use.

3. SHIFT MODE

The following functions can only be used in the shift mode.

(2) "°C/°F" Button

Press the °C/°F button to select the temperature scale, readings can be displayed in Celsius (°C) or Fahrenheit (°F). When the thermometer is turned on, it is set to the temperature scale that was last in use.

(4) "SAVE" Button

The save function stores the T1, T2 data in a nonvolatile memory. Press the SAVE button to save the current data, the word SAVE is displayed to indicate the data has been saved. The built in memory can store up to 128 data (HH806U)/256 data (HH806AU). The data can be read using the read function in the normal mode.

(5) "LOG" Button (HH806U)

The data log function continuously records the data according to a specified time interval. The time interval can be set using the interval setup function [INVT] in the set up mode. Press the LOG button to activate the log function; the indicators "LOG" and "MEM" will be displayed on the LCD. There are 16 groups that are used for storing the log data, and each group uses 64 data slots. If the current log session exceeds 64 data, the log function will automatically use the next group to store the following data. A maximum of 1024 data point can be saved in one log session. Press the LOG button again to exit the data log function.

"LOG" Button (HH806AU)

The data log function continuously records the data according to a specified time interval. The time interval can be set using the interval setup function [INVT] in the set up mode. Press the LOG button to activate the log function; the indicators "LOG" and "MEM" will be displayed on the LCD. There are 16 groups that are used for storing the log data. A maximum of 16,000 data point can be saved in one log session. Pressing the LOG button again to exit the data log

function.

(6) "CLR ?" Button

The CLR button clears all the saved and logged data in memory. When the CLR button is pressed, indicator "MEM" is displayed and the "CLR" on upper-right of LCD will blink. Pressing the "ENTER" button printed on the overlay in white will clear all saved and logged data. Press "ESC" button to exit this function without clearing data.

(7) "REL" Button (Main display)

The relative value function can be used for comparing the saved reference value with other measurements. Press the "REL" button to store the current measurement as the reference value, and "REL" should be displayed on the right part of the LCD. The next measurement will display the current value compared to the reference value. Press "REL" button again to clear the reference value and deactivate the relative value measurement function.

(8) "APO" Button

Press the APO button to turn the "Auto power off" function on or off. When this function is enabled, the indicator "APO" is shown at the upper left part of the LCD. When APO (Auto power off) is enabled, it will automatically turn the thermometer off no button is pressed for a period longer than the set time interval (the default time for APO is 5 minutes). Press power button to resume operation.

(10) "TYPE" Button (Main display)

Press this button to change the type of thermocouple in the main display (K/J/T/E/R/S/N). If the inputs of the main and second display are the same, then pressing this button will change the thermocouple type for both displays.

(11) "TYPE" Button (Second display)

Press this button to change the type of thermocouple in the second display (K/J/T/E/R/S/N). If the inputs of the main and second display are the same, then pressing this button will change the thermocouple type for both displays.

4. SETUP MODE

The following functions can only be use in the setup mode.

(2) "[LIMITS]" Button (Hi/Lo limit setting)

Press the LIMITS button to enter the Hi/Lo limit setup function. The words "LIMIT" and "Hi" will be flash on the LCD along with the previous value for the Hi limit. Enter the new Hi limit value using the number keys printed in white on the overlay. The resolution of Hi/Lo limit setup is 1 count. The "-" button (same button as the ESC) can be used to enter negative values. Press the "ENTER" button to confirm the new limit. You will then be prompted to enter a new Lo limit value. Enter the new value and then press enter to finish setup of limits.

(3) "[INVT]" Button (Interval time setting)

To setup the time interval for the log function, press the [INVT] button. The indicator "INV" will blink on

the top-right of the LCD and the previous interval is displayed. Press the number buttons printed in white on the overlay to change the time interval. Setting is from left to right of the following format (HH:MM:SS). Press the overlay "ENTER" button to confirm. To exit this function, press the ESC button.

HH: interval Hour (0~23)
MM: interval Minute (0~59)
SS: interval Second (0~59)
MAX: 23:59:59
MIN: 00:00:01

(8) "APO" Button (Auto power off time setting, min. 1 minute)

Use this function to change the time for the auto power off (APO) function. Press the APO button in setup mode, and the indicator "APO" and the current time will flash on the LCD. The default time for APO is 5 minutes. Press the number button printed in white on the overlay to set the APO time. Press the overlay "ENTER" button to confirm. To exit this function without changing the setting, press the ESC button.

MAX: 19999 minutes
MIN: 0001 minutes

(9) "[OFS]" Button (Thermocouple offset adjust)

When the main display input is T1 and a thermocouple is connected, the instrument can adjust the offset of the thermocouple. The same can be done for T2 when on the main display. In the setup mode, press this button to enter the thermocouple Offset Setup Function (OFS) and the indicator CAL should be displayed on the top-right of the LCD and the current setting is also shown. Press the number buttons printed in white on the overlay to change the offset of the thermocouple. The resolution of the setup is 0.1°. Press the "." button to set a negative value. Press the overlay "ENTER" button to confirm. MAX: ±1999.9 °C/°F.

(12) "[TIME]" Button (System time setting)

To set the system time, press the [TIME] button in the setup mode. The third display should show the current date and time with the year flashing. Enter the new value from left to right in the following format YY:MM:DD and HH:MM:SS. Press the number buttons printed in white on the overlay to set the system date and time. Press the "ENTER" button to confirm. Exit this function by pressing ESC button.

Error messages:

When the meter appears wrong messages such as Err-01, Err-02 and Err-03.

Err-01: In the "SAVE" mode, if memory is full, the lower right display will show Err-01. If you would like to record the new value. Please clear all old records.

Err-02: In the "LOG" mode, if memory is full, the lower right display will show Err-02. If you would like to record the new value. Please clear all old records.

Err-03: In the "READ LOG" and "READ SAVE" mode, when the main display shows 6028 and the lower right display shows "OL, Err-03". Which means that there might appear two situations:

1. There is no data in the memory.
2. The memory is full, and the meter will warn the user this is the last sample.

OPERATOR MAINTENANCE

WARNING

To avoid possible electrical shock, disconnect the thermocouple connectors from the thermometer before removing the cover.

Battery Replacement

1. Power is supplied by 4pcs 1.5V (AAA SIZE) UM-4 R03.
2. The "🔋" appears on the LCD display when replacement is needed. To replace battery remove screw from back of meter and lift off the battery cover.
3. Remove the battery from battery contacts and replace.
4. When not in use for long periods remove battery.
5. Do not store in locations with high temperatures, or high humidity.

Cleaning

Periodically wipe the case with a damp cloth and detergent, do not use abrasives or solvents.

*Software Operation manual is in the Software disk.

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event for any liability or damage for consequential, incidental or special damages.

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RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence. The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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ATTACHMENT B

FLUKE®

Models 175, 177 & 179

True RMS Multimeters

Users Manual

May 2003 Rev. 1, 10/08

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Specifications are subject to change without notice.

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Lifetime Limited Warranty

Each Fluke 20, 70, 80, 170 and 180 Series DMM will be free from defects in material and workmanship for its lifetime. As used herein, "lifetime" is defined as seven years after Fluke discontinues manufacturing the product, but the warranty period shall be at least ten years from the date of purchase. This warranty does not cover fuses, disposable batteries, damage from neglect, misuse, contamination, alteration, accident or abnormal conditions of operation or handling, including failures caused by use outside of the product's specifications, or normal wear and tear of mechanical components. This warranty covers the original purchaser only and is not transferable.

For ten years from the date of purchase, this warranty also covers the LCD. Thereafter, for the lifetime of the DMM, Fluke will replace the LCD for a fee based on then current component acquisition costs.

To establish original ownership and prove date of purchase, please complete and return the registration card accompanying the product, or register your product on <http://www.fluke.com>. Fluke will, at its option, repair at no charge, replace or refund the purchase price of a defective product purchased through a Fluke authorized sales outlet and at the applicable international price. Fluke reserves the right to charge for importation costs of repair/replacement parts if the product purchased in one country is sent for repair elsewhere.

If the product is defective, contact your nearest Fluke authorized service center to obtain return authorization information, then send the product to that service center, with a description of the difficulty, postage and insurance prepaid (FOB Destination). Fluke assumes no risk for damage in transit. Fluke will pay return transportation for product repaired or replaced in-warranty. Before making any non-warranty repair, Fluke will estimate cost and obtain authorization, then invoice you for repair and return transportation.

THIS WARRANTY IS YOUR ONLY REMEDY. NO OTHER WARRANTIES, SUCH AS FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSED OR IMPLIED. FLUKE SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, ARISING FROM ANY CAUSE OR THEORY. AUTHORIZED RESELLERS ARE NOT AUTHORIZED TO EXTEND ANY DIFFERENT WARRANTY ON FLUKE'S BEHALF. Since some states do not allow the exclusion or limitation of an implied warranty or of incidental or consequential damages, this limitation of liability may not apply to you. If any provision of this warranty is held invalid or unenforceable by a court or other decision-maker of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision.

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The Netherlands

Visit the Fluke website at: www.fluke.com


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⚠⚠ Warning. Read before using the Meter:

To avoid possible electrical shock or personal injury, follow these guidelines:

- ⇒ Use the Meter only as specified in this manual or the protection provided by the Meter might be impaired.
- ⇒ Do not use the Meter or test leads if they appear damaged, or if the Meter is not operating properly. If in doubt, have the Meter serviced.
- ⇒ Always use the proper terminals, switch position, and range for measurements.
- ⇒ Verify the Meter's operation by measuring a known voltage.
- ⇒ Do not apply more than the rated voltage, as marked on the Meter, between the terminals or between any terminal and earth ground.
- ⇒ Use caution with voltages above 30 V ac rms, 42 V ac peak, or 60 V dc. These voltages pose a shock hazard.
- ⇒ Replace the battery as soon as the low battery indicator () appears.
- ⇒ Disconnect circuit power and discharge all high-voltage capacitors before testing resistance, continuity, diodes, or capacitance.
- ⇒ Do not use the Meter around explosive gas or vapor.
- ⇒ When using the test leads, keep your fingers behind the finger guards.
- ⇒ Remove test leads from the Meter before opening the Meter case or battery door.

Symbols

	AC (Alternating Current)		Fuse
	DC (Direct Current)		Conforms to European Union directives
	DC/AC		Canadian Standards Association
	Earth ground		Double insulated
	Important Information; see manual		Underwriters Laboratories, Inc. Meter in accordance with IEC 61010-1. 54CJ
	Battery (Low battery when shown on display.)		Conforms to relevant Australian standards
	Inspected and licensed by TÜV (Technischer Überwachungs Verein) Product Services		VDE (Verband Deutscher Electroniker)

Models 175, 177 & 179 True RMS Multimeters

The Fluke **Model 175**, **Model 177**, and **Model 179** are battery-powered, true-RMS multimeters (hereafter "the Meter") with a 6000-count, 3 3/4-digit display and a bar graph. This manual applies to all three models. All figures show the Model 179.

These meters meet CAT III and CAT IV IEC 61010 standards. The IEC 61010 safety standard defines four overvoltage categories (CAT I to IV) based on the magnitude of danger from transient impulses. CAT III meters are designed to protect against transients in fixed-equipment installations at the distribution level; CAT IV meters are designed to protect against transients from the primary supply level (overhead or underground utility service).

The Meter measures or tests the following:

- ◆ AC / DC voltage & current
- ◆ Resistance
- ◆ Voltage & current frequency
- ◆ Temperature (Model 179 only)
- ◆ Diodes
- ◆ Continuity
- ◆ Capacitance

Contacting Fluke

To contact Fluke, call:

- 1-888-993-5853 in USA
- 1-800-363-5853 in Canada
- +31 402-678-200 in Europe
- +81-3-3434-0181 in Japan
- +65-738-5655 in Singapore
- +1-425-446-5500 from anywhere in the world

Visit Fluke's web site at www.fluke.com.

Register your Meter at <http://register.fluke.com>.

Warning and **Caution** Statements

A "**Warning**" identifies hazardous conditions and actions that could cause bodily harm or death.

A "**Caution**" identifies conditions and actions that could damage the Meter, the equipment under test, or cause permanent loss of data.

Unsafe Voltage

To alert you to the presence of a potentially hazardous voltage, when the Meter detects a voltage ≥ 30 V or a voltage overload (**OL**), the ⚡ symbol is displayed.

Test Lead Alert

To remind you to check that the test leads are in the correct terminals, **LED** is momentarily displayed when you move the rotary switch to or from the **mA** or **A** position.

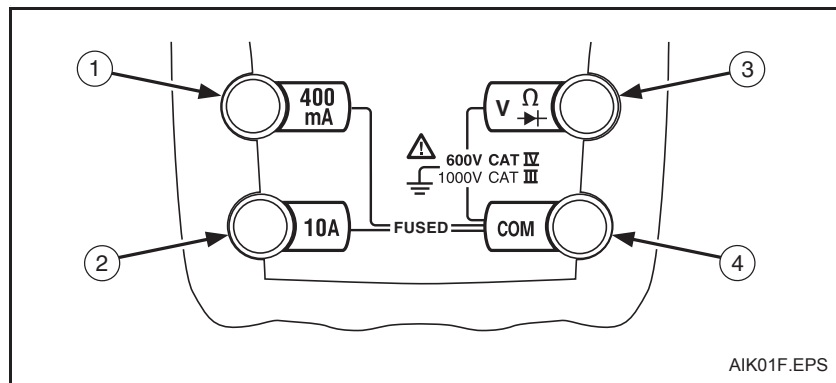
Warning

Attempting to make a measurement with a test lead in an incorrect terminal might blow a fuse, damage the Meter, and cause serious personal injury.

Battery Saver ("Sleep Mode")

The Meter enters the "Sleep mode" and blanks the display if there is no function change or button press for 20 minutes. To disable the Sleep mode, hold down the **YELLOW** button while turning the Meter on. The Sleep mode is always disabled in the MIN MAX AVG mode and the AutoHOLD mode.

Terminals



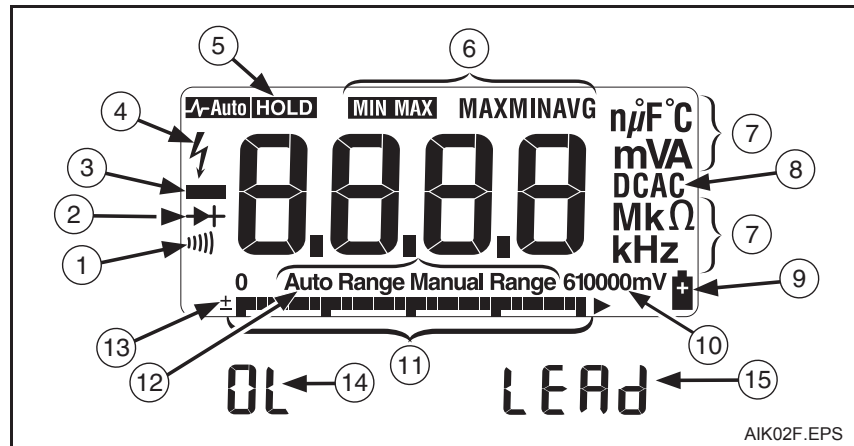
Item	Description
1	Input terminal for AC and DC milliamp measurements to 400 mA and frequency measurements.
2	Input terminal for AC and DC current measurements to 10 A and frequency measurements.
3	Input terminal for voltage, continuity, resistance, diode, capacitance, frequency, and temperature (Model 179 only) measurements.
4	Common (return) terminal for all measurements.

Rotary Switch Positions

Switch Position	Measurement Function
\tilde{V} Hz	AC voltage from 30.0 mV to 1000 V. Frequency from 2 Hz to 99.99 kHz.
\bar{V} Hz	DC voltage 1 mV to 1000 V. Frequency from 2 Hz to 99.99 kHz.
$m\bar{V}$ 	DC mV 0.1 mV to 600 mV. Temperature - 40 °C to + 400 °C - 40 °F to + 752 °F
Ω 	Ohms from 0.1 Ω to 50 M Ω . Farads from 1 nF to 9999 μ F.
 	Beeper turns on at <25 Ω and turns off at >250 Ω . Diode test. Displays OL above 2.4 V.
$\bar{m}A$ Hz	AC mA from 3.00 mA to 400 mA DC mA from 0.01 mA to 400 mA Frequency of AC mA 2 Hz to 30 kHz.
\bar{A} $\sim A$ Hz	AC A from 0.300 A to 10 A DC A from 0.001 A to 10 A >10.00 display flashes. >20 A, OL is displayed. Frequency of AC A 2 Hz to 30 kHz.

Note: AC voltage and current AC-coupled, true RMS, up to 1 kHz.

Display



No.	Symbol	Meaning
1)	Continuity test.
2	→ +	Diode test.
3	—	Negative readings.
4	⚡	Unsafe voltage. Voltage ≥ 30 V, or voltage overload (OL)
5	HOLD ⏏-Auto HOLD	Display HOLD is enabled. Display freezes present reading. In MIN MAX AVG mode, MIN MAX AVG recording is interrupted. AutoHOLD is enabled. Display holds present reading until it detects new stable input. Then the Meter beeps and displays new reading.
6	MIN MAX MAX, MIN, AVG	MIN MAX AVG enabled. Maximum, minimum, average or present reading.

No.	Symbol	Meaning
7	nµ F, °F, °C mVA, MkΩ, kHz	Measurement units.
8	DC, AC	Direct current, alternating current.
9	⚡	Low battery. Replace battery.
10	610000mV	All possible ranges.
11	Bar graph	Analog display.
12	Auto Range Manual Range	The Meter selects the range with the best resolution. The user selects the range.
13	±	Bar graph polarity.
14	OL	The input out of range.
15	LEAD	⚠ Test lead alert. Displayed when the rotary switch is moved <u>to</u> or <u>from</u> the mA or A position.

Error Messages	
bAtt	Replace the battery immediately.
diSC	In the capacitance function, too much electrical charge is present on the capacitor being tested.
EEPr Err	Invalid EEPROM data. Have Meter serviced.
CAL Err	Invalid calibration data. Calibrate Meter.
OPEn	Open thermocouple is detected.

MIN MAX AVG Recording Mode

The MIN MAX AVG recording mode captures the minimum and maximum input values, and calculates a running average of all readings. When a new high or low is detected, the Meter beeps.

Note

For DC functions, accuracy is the specified accuracy of the measurement function ± 12 counts for changes longer than 350 ms in duration.

For AC functions, accuracy is the specified accuracy of the measurement function ± 40 counts for changes longer than 900 ms in duration.

To use MIN MAX AVG recording:

- ⇒ Make sure that the Meter is in the desired measurement function and range. (Autoranging is disabled in the MIN MAX AVG mode.)
- ⇒ Press **MIN MAX** to activate MIN MAX AVG mode. **MIN MAX** and **MAX** light, and the highest reading detected since entering MIN MAX AVG is displayed.
- ⇒ Press **MIN MAX** to step through the low (**MIN**), average (**AVG**), and present readings.
- ⇒ To pause MIN MAX AVG recording without erasing stored values, press **HOLD**. **HOLD** is displayed.
To resume MIN MAX AVG recording, press **HOLD** again. **HOLD** turns off.
- ⇒ To exit and erase stored readings, press MIN MAX for 1 second or turn the rotary switch.

Display HOLD and AutoHOLD Modes

⚠ ⚠ Warning

To avoid electric shock, do not use the Display HOLD or AutoHOLD mode to determine if a circuit is live. Unstable or noisy readings will not be captured.

In the Display HOLD mode, the Meter holds the reading on the display.

In the AutoHOLD mode, the Meter holds the reading on the display until it detects a new stable reading. Then the Meter beeps and displays the new reading.


- ⇒ Press **HOLD** to activate Display HOLD. **HOLD** lights.
- ⇒ Press **HOLD** again to activate AutoHOLD. **Auto HOLD** lights.
- ⇒ Press **HOLD** again to resume normal operation.

To resume normal operation at any time, press **HOLD** for 1 second or turn the rotary switch.

YELLOW Button

Press the **YELLOW** button to select alternate measurement functions on a rotary switch setting, e.g., to select DC mA, DC A, Hz, temperature (Model 179 only), capacitance, diode test.

Display Backlight (Model 177 and 179 Only)

Press  to toggle the backlight on and off. The backlight automatically turns off after 2 minutes.

Manual Ranging and Autoranging

The Meter has both Manual range and Autorange modes.

- ⇒ In the Autorange mode, the Meter selects the range with the best resolution.
- ⇒ In the Manual Range mode, you override Autorange and select the range yourself.

When you turn the Meter on, it defaults to Autorange and **Auto Range** is displayed.

1. To enter the Manual Range mode, press **RANGE**. **Manual Range** is displayed.
2. In the Manual Range mode, press **RANGE** to increment the range. After the highest range, the Meter wraps to the lowest range.

Note

You cannot manually change the range in the MIN MAX AVG, or Display HOLD modes.






*If you press **RANGE** while in MIN MAX AVG, or Display HOLD, the Meter beeps twice, indicating an invalid operation, and the range does not change.*

3. To exit Manual Range, press **RANGE** for 1 second or turn the rotary switch.
The Meter returns to Autorange and **Auto Range** is displayed.

Power-Up Options

To select a Power-Up Option, hold down the button indicated while turning the Meter from OFF to any switch position.

Power-Up Options are cancelled when the Meter is turned OFF.

Button	Power-Up Options
AutoHOLD 	\tilde{V} switch position turns on all LCD segments. $\bar{\bar{V}}$ switch position displays the software version number. $m\bar{\bar{V}}$ switch position displays the model number.
	Disables beeper. (bBEEP)
	Enables "Smoothing" mode. (S---) Dampens display fluctuations of rapidly changing inputs by digital filtering.
 (YELLOW)	Disables automatic power-down ("Sleep mode"). (PoFF) Sleep mode is also disabled while the Meter is in a MIN MAX AVG Recording mode, or the AutoHOLD mode.
	Disables automatic 2-minute backlight timeout. (LoFF) (Model 177 and 179 Only)

Making Basic Measurements

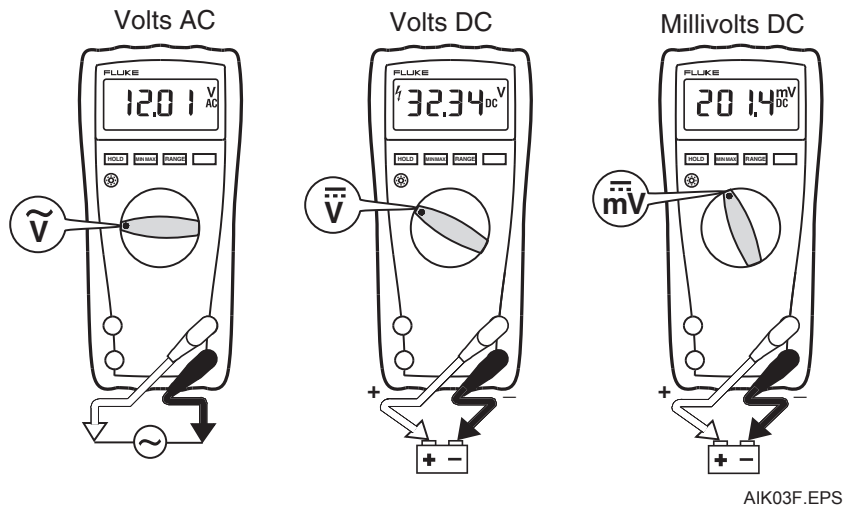
The figures on the following pages show how to make basic measurements.

When connecting the test leads to the circuit or device, connect the common (**COM**) test lead before connecting the live lead; when removing the test leads, remove the live lead before removing the common test lead.

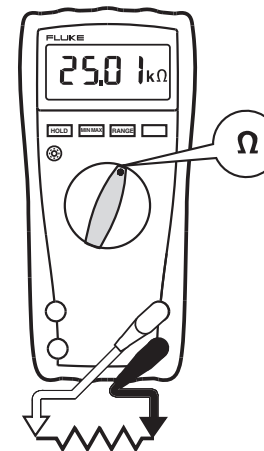
⚠ ⚠ Warning

To avoid electric shock, injury, or damage to the Meter, disconnect circuit power and discharge all high-voltage capacitors before testing resistance, continuity, diodes, or capacitance.

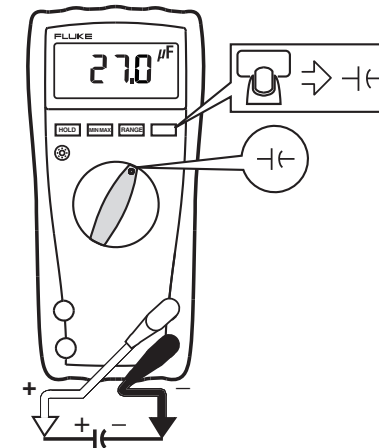
Measuring AC and DC Voltage



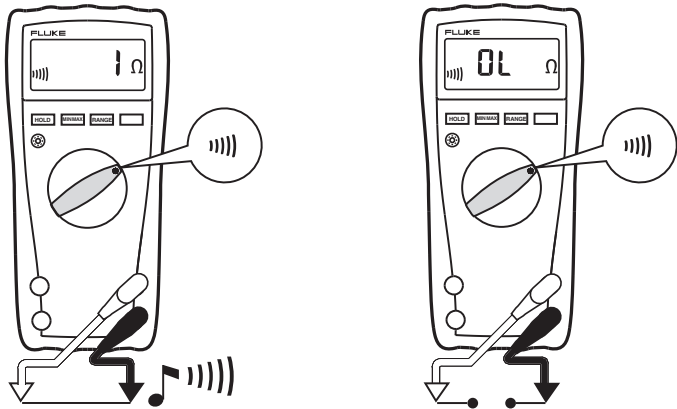
Measuring Resistance



Measuring Capacitance

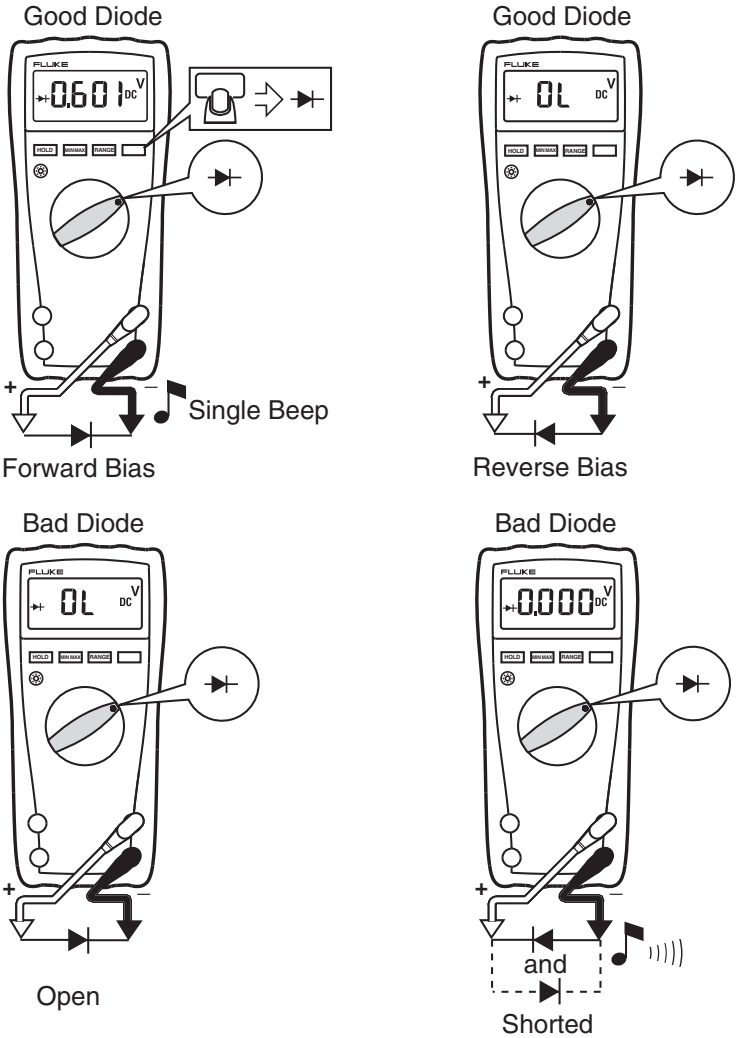


Testing for Continuity



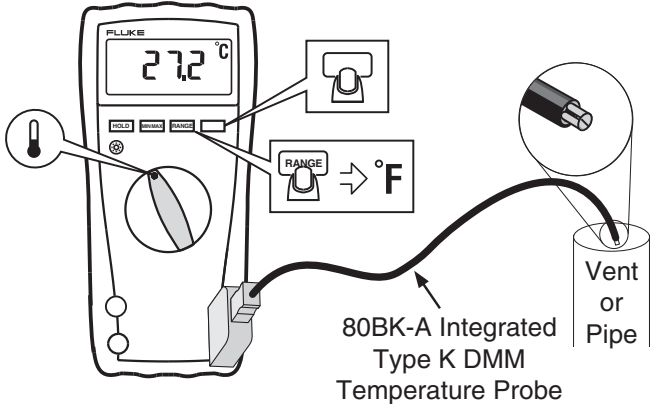
AIK06F.EPS

Testing Diodes



AIK07F.EPS

Measuring Temperature (Model 179 Only)



AIK10F.EPS

⚠️ ⚠️ Warning: Do not connect 80BK-A to live circuits.

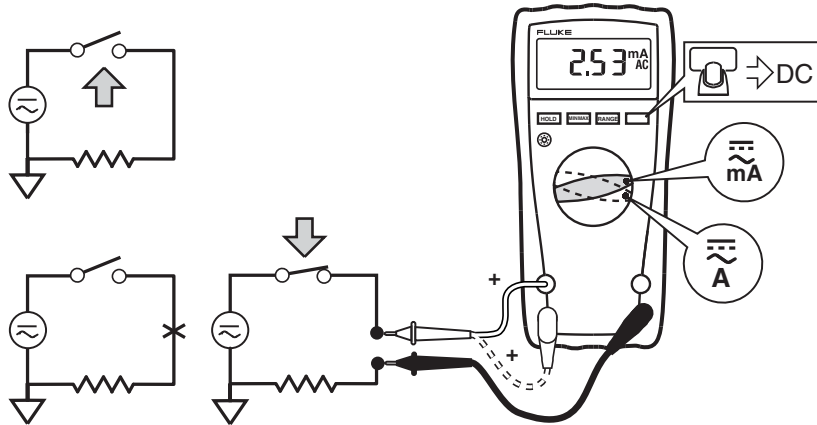
Measuring AC or DC Current

⚠ ⚠ Warning

To avoid personal injury or damage to the Meter:

- Never attempt to make an in-circuit current measurement when the open-circuit potential to earth is >1000 V.
- Check the Meter's fuses before testing. (See "Testing the Fuses".)
- Use the proper terminals, switch position, and range for your measurement.
- Never place the probes in parallel with a circuit or component when the leads are plugged into the current terminals.

Turn power OFF, break circuit, insert Meter in series, turn power on.



AIK08F.EPS

Understanding AC Zero Input Behavior of True RMS Meters

Unlike averaging meters, which can accurately measure only pure sinewaves, True RMS meters accurately measure distorted waveforms. Calculating True RMS converters require a certain level of input voltage to make a measurement. This is why AC voltage and current ranges are specified from 5% of range to 100% of range. Non-zero digits that are displayed on a True RMS meter when the test leads are open or are shorted are normal. They do not affect the specified AC accuracy above 5% of range.

Unspecified input levels on the lowest ranges are:

- AC voltage: below 5% of 600 mV AC, or 30 mV AC
- AC current: below 5% of 60 mA AC, or 3 mA AC

Measuring Frequency

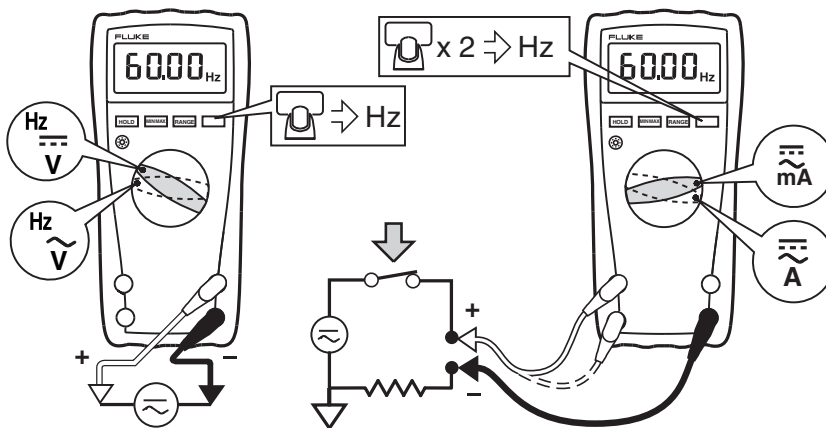
⚠️⚠️ Warning

To avoid electrical shock, disregard the bar graph for frequencies > 1 kHz. If the frequency of the measured signal is > 1 kHz, the bar graph is unspecified.

The Meter measures the frequency of a signal. The trigger level is 0 V, 0 A AC for all ranges.

AC/DC Voltage Frequency

AC Current Frequency



AIK09F.EPS

- ⇒ To exit frequency, press **YELLOW** button or turn the rotary switch.
- ⇒ In frequency, the bar graph shows the AC/DC voltage or AC current accurately up to 1 kHz.
- ⇒ Select progressively lower ranges using manual ranging for a stable reading.

Using the Bar Graph

The bar graph is like the needle on an analog Meter. It has an overload indicator (▶) to the right and a polarity indicator (±) to the left.

Because the bar graph updates about 40 times per second, which is 10 times faster than the digital display, the bar graph is useful for making peak and null adjustments and for observing rapidly changing inputs.

The bar graph is disabled when measuring capacitance or temperature. In frequency, the bar graph accurately indicates the voltage or current up to 1 kHz.

The number of lit segments indicates the measured value and is relative to the full-scale value of the selected range.

In the 60 V range, for example (see below), the major divisions on the scale represent 0, 15, 30, 45, and 60 V. An input of -30 V lights the negative sign and the segments up to the middle of the scale.



AIK11F.EPS

Cleaning

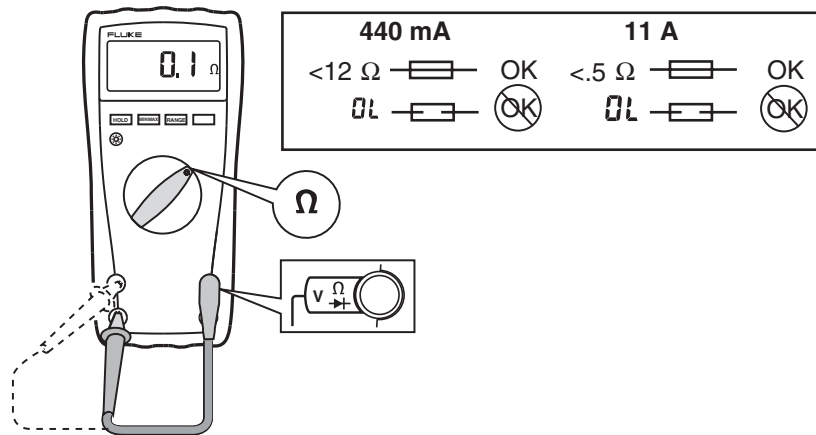
Wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents. Dirt or moisture in the terminals can affect readings.

Testing the Fuses

Warning

To avoid electrical shock or injury, remove the test leads and any input signals before replacing the fuse.

Test fuses as shown below.



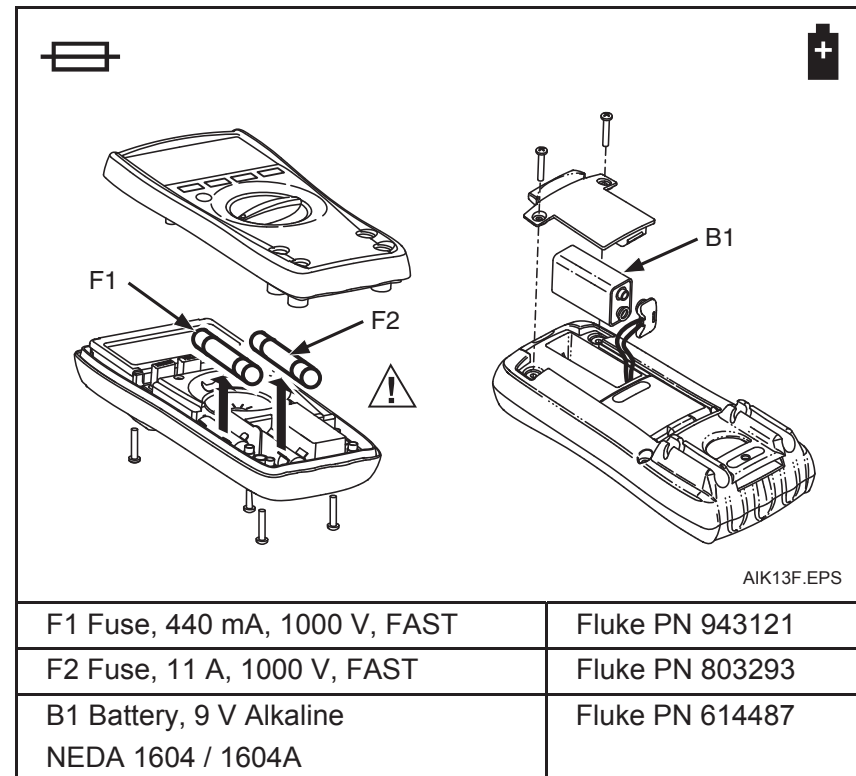
AIK12F.EPS

Replacing the Battery and Fuses

Warning

To avoid shock, injury, or damage to the Meter:

- Use **ONLY** fuses with the amperage, interrupt, voltage, and speed ratings specified.
- Replace the battery as soon as the low battery indicator (⚡) appears.



AIK13F.EPS

Specifications

Accuracy is specified for 1 yr after calibration, at operating temperatures of 18 °C to 28 °C, with relative humidity at 0 % to 90 %. Accuracy specifications take the form of: $\pm ([\% \text{ of Reading }] + [\text{ Counts }])$

Maximum voltage between any terminal and earth ground: 1000 V DC or AC RMS

Surge Protection: 8 kV peak per IEC 61010

⚠ Fuse for mA inputs: 440 mA, 1000 V FAST Fuse

⚠ Fuse for A input: 11 A, 1000 V FAST Fuse

Display: Digital: 6000 counts, updates 4/sec

Bar Graph: 33 segments;
Updates 40/sec

Frequency: 10,000 counts

Capacitance: 1,000 counts

Altitude: Operating: 2000 m; Storage: 12,000 m

Temperature: Operating: -10 °C to +50 °C;

Storage: -40 °C to +60 °C

Temperature coefficient: 0.1 X (specified accuracy / °C
(< 18 °C or > 28 °C))

Electromagnetic Compatibility In an RF field of 3 V/M, accuracy = specified accuracy except in temperature: specified accuracy ± 5 °C (9 °F)

(EN 61326-1:1997):

Relative Humidity: Maximum Noncondensing

90 % to 35 °C

75 % to 40 °C

45 % to 50 °C

Battery Life: Alkaline: 400 hrs typical

Size (H x W x L): 4.3 cm x 9 cm x 18.5 cm

Weight: 420 g

Safety Compliances: ANSI/ISA S82.02.01, CSA C22.2-1010.1, IEC 61010 to 1000 V Measurement Category III, 600 V Measurement Category IV

Certifications: CSA, TÜV (EN61010), UL, CE,  VDE

Models 175, 177 & 179
Users Manual

Function	Range ¹	Resolution	Accuracy ±([% of Reading] + [Counts])		
			Model 175	Model 177	Model 179
AC Volts ^{2,3}	600.0 mV 6.000 V 60.00 V 600.0 V 1000 V	0.1 mV 0.001 V 0.01 V 0.1 V 1 V	1.0 % + 3 (45 Hz to 500 Hz)	1.0 % + 3 (45 Hz to 500 Hz)	1.0 % + 3 (45 Hz to 500 Hz)
			2.0 % + 3 (500 Hz to 1 kHz)	2.0 % + 3 (500 Hz to 1 kHz)	2.0 % + 3 (500 Hz to 1 kHz)
DC mV	600.0 mV	0.1 mV	0.15 % + 2	0.09 % + 2	0.09 % + 2
DC Volts	6.000 V 60.00 V 600.0 V	0.001 V 0.01 V 0.1 V	0.15 % + 2	0.09 % + 2	0.09 % + 2
	1000 V	1 V	0.15 % + 2	0.15 % + 2	0.15 % + 2
Continuity	600 Ω	1 Ω	Meter beeps at < 25 Ω, beeper turns off at > 250 Ω; detects opens or shorts of 250 μs or longer.		
Ohms	600.0 Ω	0.1 Ω	0.9 % + 2	0.9 % + 2	0.9 % + 2
	6.000 kΩ	0.001 kΩ	0.9 % + 1	0.9 % + 1	0.9 % + 1
	60.00 kΩ	0.01 kΩ	0.9 % + 1	0.9 % + 1	0.9 % + 1
	600.0 kΩ	0.1 kΩ	0.9 % + 1	0.9 % + 1	0.9 % + 1
	6.000 MΩ	0.001 MΩ	0.9 % + 1	0.9 % + 1	0.9 % + 1
	50.00 MΩ	0.01 MΩ	1.5 % + 3	1.5 % + 3	1.5 % + 3
Diode test	2.400 V	0.001 V	1 % + 2		
Capacitance	1000 nF	1 nF	1.2 % + 2	1.2 % + 2	1.2 % + 2
	10.00 μF	0.01 μF	1.2 % + 2	1.2 % + 2	1.2 % + 2
	100.0 μF	0.1 μF	1.2 % + 2	1.2 % + 2	1.2 % + 2
	9999 μF ⁴	1 μF	10 % typical	10 % typical	10 % typical
AC Amps ⁵ (True RMS) (45 Hz to 1 kHz)	60.00 mA	0.01 mA	1.5 % + 3	1.5 % + 3	1.5 % + 3
	400.0 mA ⁶	0.1 mA			
	6.000 A	0.001 A			
	10.00 A ⁷	0.01 A			

1. All AC voltage and AC current ranges are specified from 5 % of range to 100 % of range.
2. Crest factor of ≤ 3 at full scale up to 500 V, decreasing linearly to crest factor ≤ 1.5 at 1000 V.
3. For non-sinusoidal waveforms, add -(2% reading + 2% full scale) typical, for crest factors up to 3.
4. In the 9999 μF range for measurements to 1000 μF, the measurement accuracy is 1.2 % + 2 for all models.
5. Amps input burden voltage (typical): 400 mA input 2 mV/mA, 10 A input 37 mV/A.
6. 400.0 mA accuracy specified up to 600 mA overload.
7. > 10A unspecified.

True RMS Multimeters
Specifications

Function	Range ¹	Resolution	Accuracy ±([% of Reading] + [Counts])		
			Model 175	Model 177	Model 179
DC Amps ⁴	60.00 mA 400.0 mA ⁶ 6.000 A 10.00 A ⁷	0.01 mA 0.1 mA 0.001 A 0.01 A	1.0 % + 3	1.0 % + 3	1.0 % + 3
Hz (AC- or DC-coupled, V or A ^{2,3} input)	99.99 Hz 999.9 Hz 9.999 kHz 99.99 kHz	0.01 Hz 0.1 Hz 0.001 kHz 0.01 kHz	0.1 % + 1	0.1 % + 1	0.1 % + 1
Temperature	-40 °C to +400 °C -40 °F to +752 °F	0.1 °C 0.1 °F	NA	NA	1 % + 10 ⁵ 1 % + 18 ⁵
MIN MAX AVG	For DC functions, accuracy is the specified accuracy of the measurement function ±12 counts for changes longer than 350 ms in duration. For AC functions, accuracy is the specified accuracy of the measurement function ±40 counts for changes longer than 900 ms in duration.				
<ol style="list-style-type: none"> 1. All AC voltage and AC current ranges are specified from 5 % of range to 100 % of range. 2. Frequency is specified from 2 Hz to 99.99 kHz in Volts and from 2 Hz to 30 kHz in Amps. 3. Below 2 Hz, the display shows zero Hz. 4. Amps input burden voltage (typical): 400 mA input 2 mV/A, 10 A input 37 mV/A. 5. Does not include error of the thermocouple probe. 6. 400.0 mA accuracy specified up to 600 mA overload. 7. > 10A unspecified. 					

Models 175, 177 & 179
Users Manual

Function	Overload Protection ¹	Input Impedance (Nominal)	Common Mode Rejection Ratio (1 kΩ Unbalanced)		Normal Mode Rejection
Volts AC	1000 V RMS	> 10 MΩ < 100 pF	> 60 dB @ DC, 50 Hz or 60 Hz		
Volts DC	1000 V RMS	> 10 MΩ < 100 pF	>120 dB @ DC, 50 Hz or 60 Hz		> 60 dB @ 50 Hz or 60 Hz
mV/μ	1000 V RMS ²	> 10 MΩ < 100 pF	>120 dB @ DC, 50 Hz or 60 Hz		> 60 dB @ 50 Hz or 60 Hz
		Open Circuit Test Voltage	Full Scale Voltage To: 600 kΩ 50 MΩ		Short Circuit Current
Ohms/Capacitance	1000 V RMS ²	< 8.0 V DC	< 660 mV DC	< 4.6 V DC	< 1.1 mA
Continuity/Diode test	1000 V RMS ²	< 8.0 V DC	2.4 V DC		< 1.1 mA
1. 10 ⁷ V-Hz maximum.					
2. For circuits < 0.3 A short circuit. 660 V for high energy circuits.					

Function	Overload Protection	Overload
mA	Fused, 44/100 A, 1000 V FAST Fuse	600 mA overload for 2 minutes maximum, 10 minutes rest minimum
A	Fused, 11 A, 1000 V FAST Fuse	20 A overload for 30 seconds maximum, 10 minutes rest minimum

ATTACHMENT C

Creating a Properly Made Ice Bath

The easiest way to test the accuracy of any thermometer is in a properly made ice bath. If you do this carefully, your ice bath will be 32.0°F within $\pm 0.1^\circ\text{F}$. If you are not careful, the ice bath can be off by several whole degrees. (Just a cup with ice water in it can be 12 or more degrees too high.)

Step One: Fill with ice

Making a proper ice bath is all about keeping a proper ice-to-water ratio. Fill a vessel all the way to the top with ice. Crushed ice is preferred because there are fewer gaps between the ice, however cubed ice will also work fine.

Step Two: Add Water

Slowly add water to fill the spaces between the ice. Fill about 1/2" below the top of the ice. Let the mixture sit for a minute or two to allow the temperature of the water to settle. If you see the ice starting to float off the bottom of the vessel, pour off some water and add more ice. Water below the ice will not be at 32°F.

Step Three: Insert the Probe

Once the mixture has rested for a minute or two, insert your probe (or thermometer stem) into the mixture and stir in the vertical center of the ice slurry. Stirring the probe keeps the sensor from resting against an ice cube, which will affect your reading. Keep the probe tip away from the side walls and don't allow it to rest against the bottom of the vessel. Doing so will give you inaccurate temperature readings. If the thermometer has an extremely fast and sensitive needle tip, like the ThermoMapen, you **MUST** gently stir the probe or you will find colder and warmer spots in the ice bath. Stirring equilibrates the temperature throughout the vessel.

Step Four: Confirm Calibration

Your thermometer should read 32°F (0°C) in the ice bath. Adjust your dial thermometer as directed by the manufacturer; however, before you attempt to adjust a digital, instant-read thermometer, check that the readings are within the manufacturers' accuracy specifications. (Look for a $\pm^\circ\text{F}$ on the documentation included with the instrument.) If it's within the specified tolerance, don't adjust.

Reference: Thermo Works website

http://thermoworks.com/learning/thermapen101_creating_an_icebath.html

APPENDIX F

EXAMPLE WEEKLY DATA SUBMITTAL

Bridgeton Landfill, LLC

Weekly Data Submittals

Required by Section 52.F of Agreed Order, Case No. 13SL-CC01088
Effective May 13, 2013

Contents:

Attachment A – Leachate Levels in Leachate Collection Sumps
Attachment B – Temperature Monitoring Probe Analytical Charts
Attachment C – Gas Interceptor Wellhead Temperature Graphs
Attachment D – Gas Well GEW-54 Wellhead Temperature

Provided Separately:

- Leachate Level in Leachate Collection Sump Raw Data Excel Spreadsheet
- Temperature Monitoring Probe Raw Data Excel Spreadsheet
- Gas Interceptor Well Reading Raw Data Excel Spreadsheet

August 20, 2013

APPENDIX G

EXAMPLE MONTHLY DATA SUBMITTAL

This report cover page provided only to memorialize the forward-going contents of periodic reports to be submitted to the MDNR during implementation of the OM&M Plan

Bridgeton Landfill, LLC

Monthly Data Submittals

Required by Section 52.E of Agreed Order, Case No. 13SL-CC01088
Effective May 13, 2013

Contents:

Commentary on Data

Attachment A	Daily Flare Monitoring Data
• A-1	Data Spreadsheet
• A-2	Data Graphs
Attachment B	Work Completed and Planned
Attachment C	Carbon Monoxide Maps
Attachment D	Hydrogen Maps
Attachment E	Settlement Front Map
Attachment F	Gas Wellfield Data
• F-1	GEM Data Spreadsheet
• F-2	Maximum Temperature Spreadsheet
• F-3	Lab Analyses Spreadsheet
Attachment G	Wellhead Temperature Maps
Attachment H	Summary of Odor Complaints
Attachment I	Liquid Characterization Data
Attachment J	Liquid Transport Manifest Logs
Attachment K	North Quarry Select Well Laboratory Data

Provided Separately:

- Flare Raw Data Excel Spreadsheet
- Gas Wellfield Raw Data Excel Spreadsheet

August 20, 2013

APPENDIX H

RECORD OF DOCUMENT REVISIONS
