

# EX-12 EXTERNAL BATTERY KIT OPERATION MANUAL

EX-12-9800 REV C



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**BAM 1020 Particulate Monitor Operation Manual** - © Copyright 2020 Met One Instruments, Inc. All Rights Reserved worldwide. No part of this publication may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any other language in any form without the express written permission of Met One Instruments, Inc.

## About this Document

This document describes the setup and use of the EX-12 external battery power kit for the Met One Instruments model E-BAM V1, E-BAM V2 (with color touch screen), or E-Sampler particulate monitors. Also refer to Section 3 of the E-Sampler manual, or Section 4 of the E-BAM manuals.

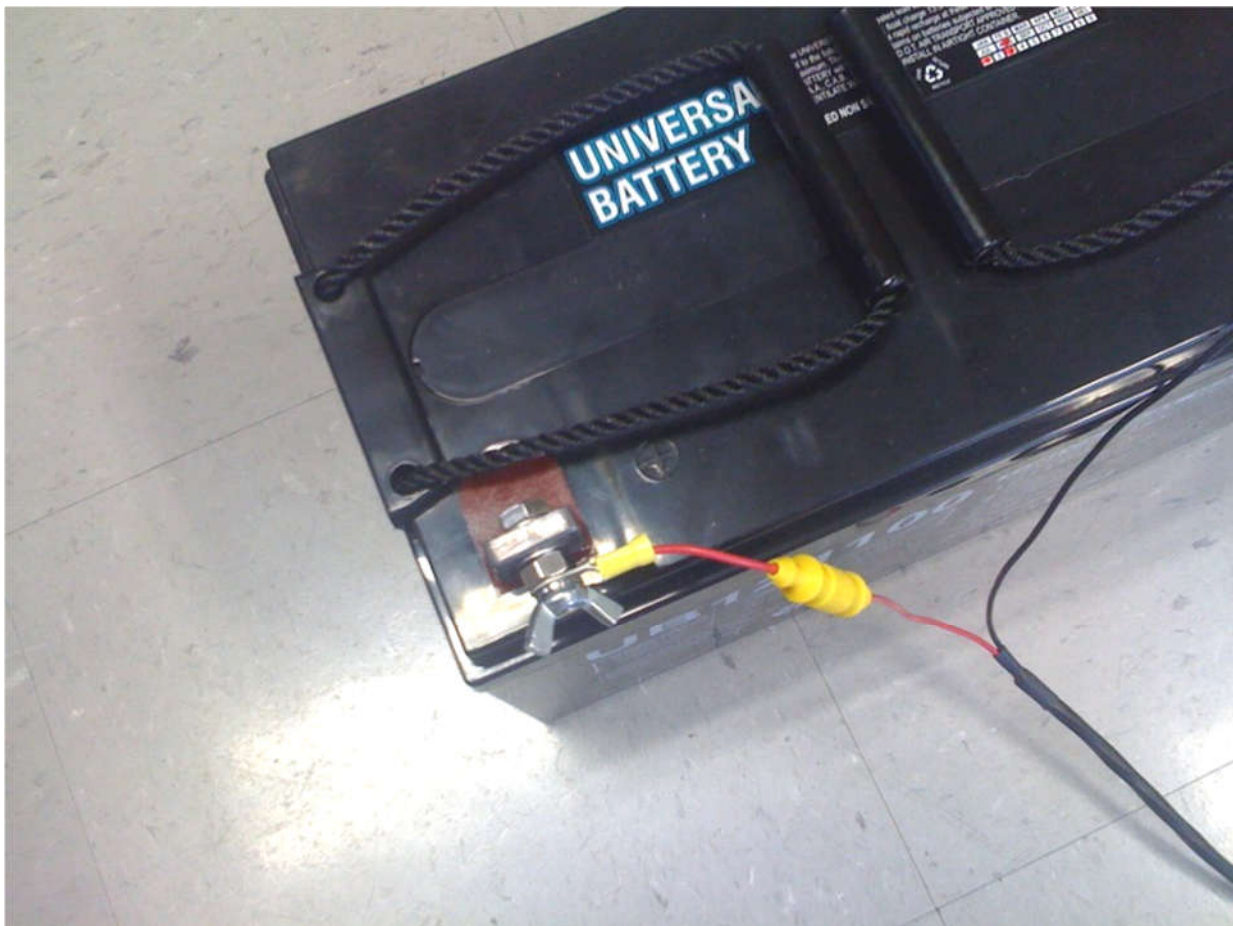
The EX-12 kit provides battery power for temporary instrument deployments in remote areas where AC power is not available and where solar power is not feasible. Due to the high cost of shipping batteries, some users may find it preferable to configure their own battery power kit based on locally available parts. In this case this document can be used as a free guide.

## Battery Kit Parts

The EX-12 kit consists of heavy-duty, industrial grade items which are specifically selected for continuous use and long life under a wide variety of field conditions.

**12V Batteries:** Part 390092 is a Universal Battery UB121100 (or equivalent) 12V, 110 Amp-hour, deep cycle, sealed AGM type battery which weighs 67 lbs. The standard EX-12 kit includes two of these batteries. They are D.O.T. approved for air transportation.

The batteries each come with two M8 terminal bolts and nuts. Met One supplies additional M8 wing nuts (part 601277). Install an M8 bolt onto each terminal with two flat washers and a hex nut as shown. When you are ready to connect the battery to the instrument, use the split washers and wing nuts to fasten the ring terminals on the battery power cable to the bolts.



**Battery Charger:** Part 390093 is a Samlex SEC-1230UL 12V, 30A, microprocessor controlled battery charger which can charge and maintain a single battery, multiple batteries in a parallel bank, or even up to three separate batteries independently at the same time.

It can also be configured as a 12V power supply to run a load directly with no battery, or as backup UPS to both run a 12V DC load and charge a backup battery at the same time. The charger is supplied with its own detailed manufacturer's manual.

It can be configured for 120V 60Hz or 230V 50Hz AC input with an internal jumper. The default setting should be 120V.

The charger has two small configuration switches on the bottom. When used to charge the supplied AGM batteries, S1 should be OFF and S2 should be ON.

**Battery Box:** Part 390058 is a basic plastic battery box to keep the battery clean and dry in the field. The box comes with a nylon strap that should be used to secure the lid when used outdoors. Spare boxes of this type are available from marine, RV, or auto parts stores.

**Battery Cables:** Part 81489 is a basic set of alligator clip battery charging cables (8 AWG) that connect the output of the charger to the battery. For basic battery charging, install the black cable into the negative (-) output, and the red cable to the positive (+) output on the bottom of the charger.

Part 9638 is an included external power cable which is required in order to connect the power input of the E-BAM V1 or E-Sampler instrument to the battery. **NOTE:** The E-BAM V1 includes a 9638 cable as a standard accessory. The cable has an inline 3AG size, 15 Amp, slow-blow fuse (part 590842) near the battery end of the red positive wire.

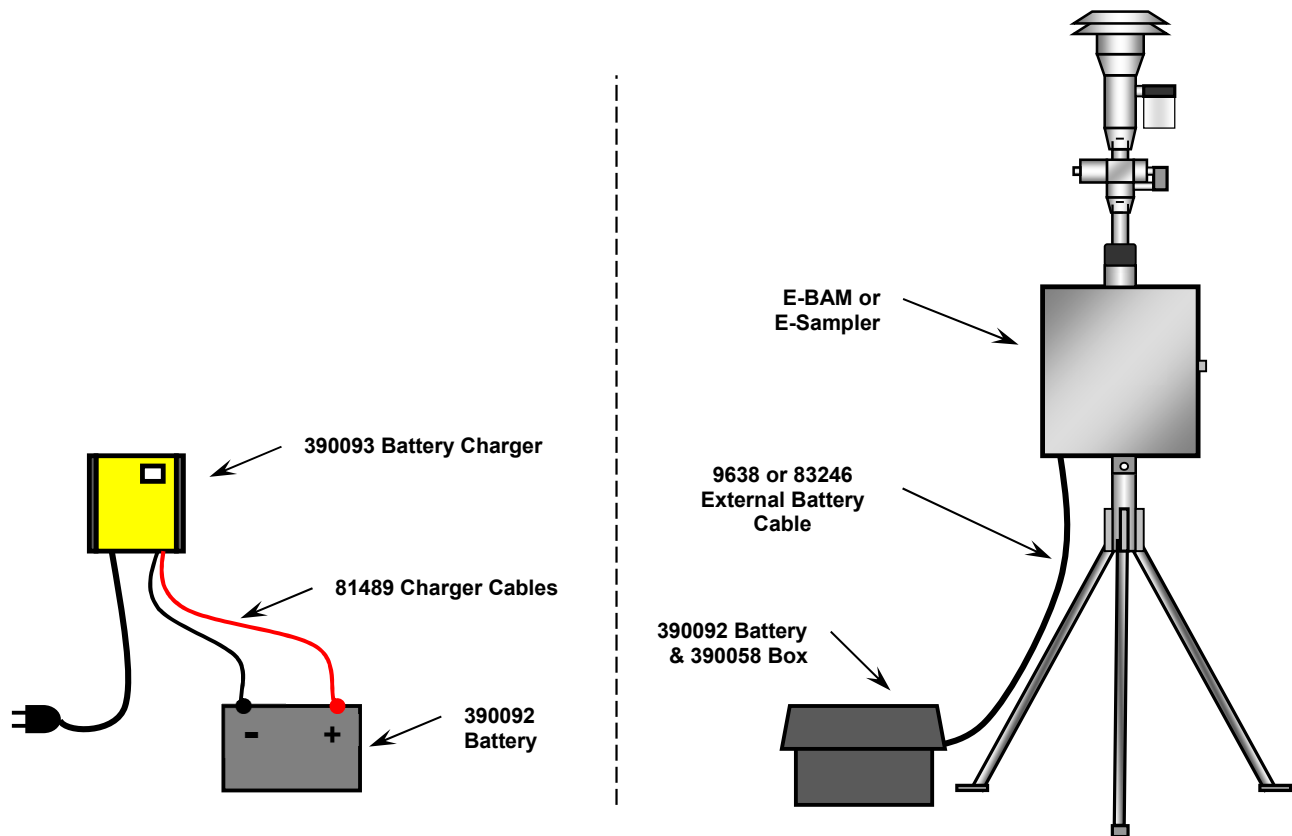
Part 83246 is an external power cable which is required to connect the power input of the E-BAM V2 instrument to the battery. **NOTE:** The E-BAM V2 includes an 83246 cable as a standard accessory. The cable has an inline 3AG size, 10 Amp, slow-blow fuse (part 590869) near the battery end of the red positive wire.

## Standard Battery Power Configuration

In the standard EX-12 kit configuration, one of the batteries is located inside the battery box on the ground and is connected to the E-BAM V1 or E-Sampler power input with the 9638 external battery cable or connected to the E-BAM V2 power input with the 83246 external battery cable. The second battery is located in a shop or lab where it is recharged with the battery charger. When the field battery is exhausted, the two batteries are manually swapped by the site operator.

1. Make sure the charger is configured for the appropriate line voltage, battery type, and charging mode. In a dry, well-ventilated area, connect the negative (–) output of the charger to the battery negative with the black alligator clip cable, and the positive (+) output to the battery positive with the red cable. Plug in the charger and charge the battery for about 24 hours or until fully charged.
2. Disconnect the charged battery from the charger. Place the battery inside the battery box. Connect the red wire of the external battery power cable to the battery positive with a wing nut and split washer. Connect the black wire to the battery negative. Route the cable out of the box and close the lid. Plug the connector on the external battery cable into the power input on the bottom of the E-BAM or E-Sampler. The instrument should power up immediately. Configure and operate the instrument as desired.

3. Connect the second battery to the charger and begin charging. It is usually best to leave the second battery connected to the charger even after it is fully charged. The advanced charger will not overcharge or degrade the battery if left connected.
4. Based on the estimated run time of the instrument and battery, swap the freshly charged battery for the depleted battery and place the depleted battery on the charger. This cycle can be repeated continuously. The charger is capable of charging the depleted battery faster than the E-BAM or E-Sampler can deplete the charged one.



**Tech note:** The E-BAM will lose power and turn off for a moment when the battery is disconnected for replacement. This will result in a small data gap and a power failure alarm in the instrument. To prevent loss of power, the batteries can be swapped without losing power as follows:

Before disconnecting the low battery, jumper the ring terminals on the battery end of the External battery Cable over to the terminals on the fresh battery (red to red, black to black) with a pair of double ended alligator clip jumpers. This temporarily wires the two batteries in parallel. Then carefully disconnect the External Battery Cable from the low battery without dislodging the alligator clips. Connect the cable to the fresh battery terminals, then remove the alligator clip jumpers. If done carefully, power should be supplied to the instrument throughout the battery swap process.

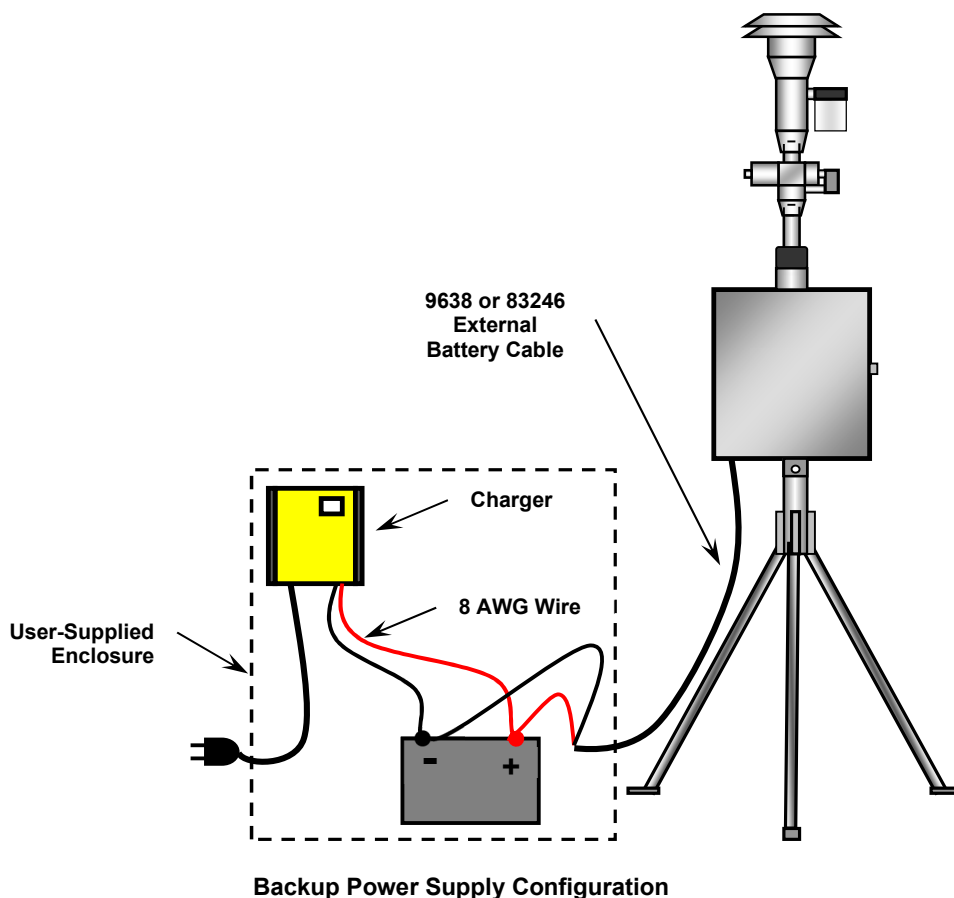
## Backup Power Supply Configuration

In the backup uninterruptable power supply (UPS) configuration, the battery charger is set in power supply mode (switches S1 and S2 both OFF, see charger manual). Both the charger and the instrument are connected to the battery at the same time. The charger will charge the

battery and run the instrument simultaneously. If AC power is lost, the battery will automatically keep the instrument running until it is depleted or until AC power is restored.

If this setup is to be used long term, we recommended replacing the supplied alligator clip battery charger cables with appropriate 6 or 8 AWG battery cables with ring terminals.

The charger is not weatherproof, so the user will need to provide some kind of shelter. The manufacturer does not recommend locating the charger in very close proximity to the battery, or in a small enclosed area without proper ventilation. See the charger manual.



## Battery Run Time and Extended Run Time

The 110 Amp-hour deep-cycle batteries will last a very long time if they are not regularly discharged by more than about 2/3 of their rated capacity, so for the run time calculations we use a conservative value of **73.3** Amp-hours of available capacity per battery. Also be aware that the current capacity of the batteries tends to reduce in cold weather when the temperature is below about 40F or 5C.

**E-BAM V1:** The E-BAM V1 runs at about 2.9 Amps @ 12VDC (35 Watts) when sampling in normal air with the inlet heater running. Run time per battery, per charge would be **25 hours** (73.3 / 2.9). One of these batteries will run the E-BAM for at least one day under most conditions. In worst-case conditions with high dust concentrations where the pump is running at full speed, the E-BAM draws about 4.0 Amps (48W) and one battery would last **18 hours** (73.3 / 4.0).

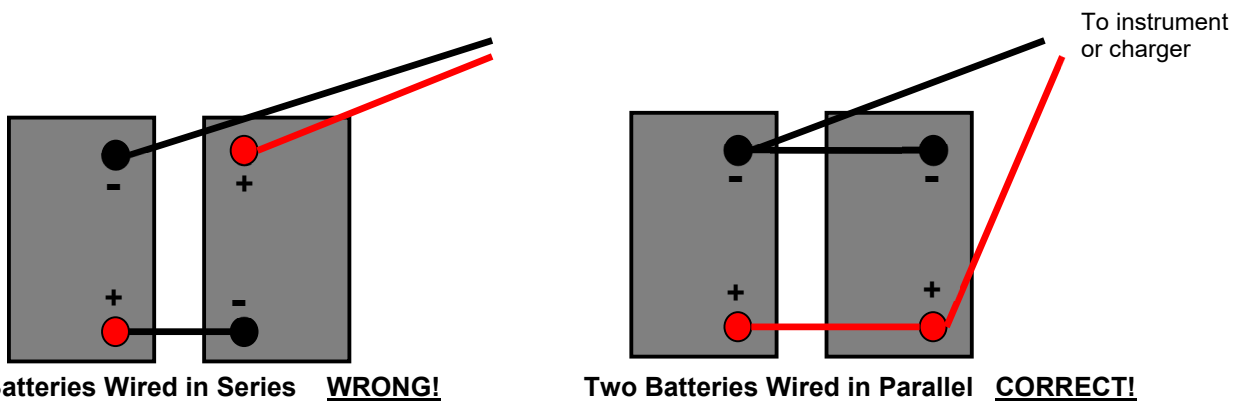
**E-BAM V2:** In worst-case conditions, the E-BAM V2 draws about 5.5 Amps (66W) and one battery would last **13 hours** (73.3Ah / 5.5A). The E-BAM V2 draws about 3.65 Amps @ 12VDC (44 Watts) when sampling in light particulate concentrations with maximum inlet heat (high humidity conditions). Run time per battery, per charge would be **20 hours** (73.3Ah / 3.65A). With light particulate concentration in low humidity environments, up to **27 hours** of 12V battery operation is possible.

**E-Sampler:** The E-Sampler runs at a worst-case continuous draw of about 1.1A @ 12VDC (14W) when sampling with the inlet heater running. Run time per battery, per charge would be **67 hours** (73.3 / 1.1). **Note:** The E-Sampler has the option of using a small internal 12V battery. If an external battery is to be used with an E-Sampler, remove the internal battery so that it does not try to charge itself from the external battery, possibly resulting in damage.

**Using Multiple Batteries:** Multiple batteries can be wired together in a parallel battery bank to increase the run time of the instrument. The batteries must be of the exact same type, voltage rating, and amp-hour rating, and should all be at similar charge levels when initially connected together.

Connect the batteries together in **parallel only**. Use short red 6 AWG cables with appropriate ring terminals to connect the positive terminals of all batteries together, and similar black cables to connect the negative terminals of all batteries together. Connect the black wire of the instrument external battery power cord to any of the battery negatives, and the red wire to any of the battery positives. Any number of batteries can be wired in parallel, because the total voltage will remain at the proper 12V, but the amp-hour current capacity values will add together.

**⚠ WARNING! Never wire the batteries together in series by connecting the positive of one battery to the negative of another, because this will add the battery voltages together, resulting in a total voltage level that will damage the instrument and/or charger.** If you are not sure how to correctly wire batteries together, consult an electrician or electronic technician.



## Storage and Maintenance

Lead-acid batteries like the ones in the EX-12 kit slowly self-discharge when stored for long periods, even when completely disconnected. Eventually stored batteries can discharge to a state where they cannot be recovered. Unused batteries should be recharged every few months, or they can simply stay connected to the Samlex charger indefinitely. The batteries are otherwise maintenance-free.