M-Cal ™ Calibration Station

Operation Manual
(Rev 4)

Getting Started

After removing the M-Cal from the shipping box, place it on a flat surface. On the back of the instrument plug the power supply into the appropriate connector labeled *8VDC*. Using the supplied tubing and fitting, twist the fitting onto the calibration gas connection on the back of the unit. Place the free end onto the demand flow regulator of the calibration gas. A demand flow regulator must be used.

If using a serial printer to print out calibration certificates, plug the serial cable of the printer into the DB-9 connection labeled *Printer.*

To power the M-Cal, plug the unit into a wall outlet. Upon power up, the calibrator will run through an initialization routine. The LED's will flash, the pump will turn on and off, and the solenoids will open and close. If a printer is attached and the current draw of the system is out of specification, an error message stating "Check Component, current: XX", where XX can be the PC board, solenoid, or pump.

Connecting the M40

Connect the M40 to the calibration station by plugging the flying lead into the bottom of the M40, and then place the instrument in the calibration insert. To make sure the plug is inserted properly, line up the arrows on the instrument with the arrow on the flying lead.

Once the instrument is connected, the M40 will be communicating to the M-Cal.   If the M40's battery is low, the M-Cal will start charging the instrument. Charging is indicated by an illuminated Amber LED on the M-Cal, and a flashing battery icon on the M40. The M-Cal will stop charging when the M40's battery is full or the instrument is removed. Once charging is complete, the M-Cal will not maintain or trickle charge instruments that are continuous left in the unit.

Bump Testing the M40

To bump test the M40, press and hold the BUMP button for two seconds. The M-Cal will enter into a bump test mode and start applying gas to the M40. The M40 instrument will go into alarm.   If all of the gas readings are within 50% of the applied gas, the M40 passes the bump test. If any of the sensors do not reach 50% within 90 seconds, the M-Cal will fail the bump test. A passed bump test is designated by a flashing green LED on the M-Cal. A failed bump test is designated by a flashing red LED.

Once the bump test is completed, the M-Cal will charge the M40 battery. The LED's will continue to indicate the status of the bump test until the instrument is fully charged or removed.

If a serial printer is connected to the M-Cal, a bump test report will be automatically generated. The bump test report will contain the serial number, sensor type, date, and pass/fail indication for each sensor.

NOTE: If an M40 fails a bump test, calibration of the instrument is recommended.

Calibrating the M40

To calibrate the M40, press and hold the CALIBRATE button for two seconds. The M-Cal will enter into a calibration mode.   Fresh air is first applied to the instrument to zero it and calibrate the O2 sensor. Once zeroing is complete, the M-Cal will automatically start calibrating the M40. This process typically takes 2 minutes, but could last up to 4 minutes. If the M40 passes calibration, the green LED will turn on and stay illuminated. If the M40 fails calibration, the red LED will be illuminated. Once calibration is completed, the M-Cal will charge the M40 battery.

If a serial printer is connected to the M-Cal, a calibration certificate will be automatically generated. The calibration certificate will contain the serial number, sensor type, date, span, and pass/fail indication for each sensor. The calibration certificate also contains the next day the instrument is due for calibration. This date is defaulted to 30 days.

NOTE: The M-Cal will store 150 of the last bump and calibration reports in internal memory. To print the data stored in memory, restart the M-Cal with out a printer connected. After initialization is complete, plug the printer into the M-Cal. Once the printer is connected to the M-Cal, all saved reports will print automatically. If no printer is connected, the M-Cal will over-write the oldest certificates with new data.

NOTE: If an M40 fails either a bump test or calibration with low or zero span values check the pressure of the gas cylinder, it may need replaced.

NOTE: If a pump fault is displayed on an M40/SP40 combination during either a bump or calibration, check the pressure of the cylinder, it may need replaced.

NOTE: If an M40 fails a calibration without leaving the "apply gas screen" on the display of the M40, check the pressure of the cylinder, it may need replaced.

NOTE: The M-Cal uses ambient air to zero the instrument. Make sure the unit is operated in an environment with no background gases.

Changing Next Calibration Date

By default, the M-Cal will print the next calibration date as 30 days past the current date stored in the M40 instrument. To change the next cal date, press and hold the BUMP and CALIBRATION buttons during initial power-up until all three LED's are lit. The M-Cal will enter a mode to change the default value of 30 days. Pressing the BUMP button

decreases the value by 5 days with each press (zero is the lowest value you can set). Pressing the CALIBRATE button increases the value by 5 days with each press (365 is the maximum value). When finished changing the value, press and hold both buttons for two seconds. If a serial printer is connected to the M-Cal, the number of days until the next calibration will print out. The calibration certificate will add this number of days to the internal calendar of the M40 being tested and it will be added to the calibration certificate (when printed).

LED Status Indications

The LED status indications are as follows:

- Flashing Green – Passed bump test
- Flashing Red – Failed bump test
- Solid Green – Passed calibration
- Solid Red – Failed calibration
- Amber – Battery Charging
- Flashing Amber – Battery Charging Complete

NOTE: After a Bump or Calibration, if the M40 is charging, the amber LED will be lit while the green or red LED's are illuminated indicating a pass or fail status. The pass/fail LED's will continue to flash the status until the M40 is fully charged or the instrument is removed.

Stored Calibration and Bump Test Reports

The M-Cal has onboard non-volatile memory that automatically stores and holds the last one hundred and fifty (150) calibration and bump test reports. Once the memory is full, it will automatically start over-writing the reports from oldest to newest. To print the data stored in memory, restart the M-Cal with out a printer connected. After initialization is complete, plug the printer into the M-Cal. Once the printer is connected to the M-Cal, all saved reports will print automatically. To manually clear the entire memory buffer, press and hold the BUMP and CALIBRATE (while the M-Cal is running) simultaneously until the LED's turn on. Once the LED's turn on, release the buttons, and the memory will be cleared.

Connecting the M-Cal to a Serial Printer

The M-Cal can be connected to any serial data printer through the DB-9 connector on the back of the unit. If a printer is connected to the M-Cal, after each bump test or calibration, the M-Cal will automatically print a certificate.

NOTE: When connecting to certain serial printers, a NULL Modem cable may need to be used between the M-Cal and the printer. ALL printers supplied by ISC contain the proper cables.

NOTE: Industrial Scientific Corporation recommends the use of dot-matrix serial data printers over thermal printers. Thermal printer receipts will fade when exposed to heat.

NOTE: If a serial data printer is connected to an M-Cal after initial power up, the M-Cal will automatically print the entire memory buffer. If you do not want to print the entire buffer, Industrial Scientific recommends clearing the buffer before connecting a printer. To clear the buffer, please see the previous section of this manual.

# Connecting the M-Cal to a PC

The M-Cal can be connected to any PC running Hyper Terminal. Hyper Terminal is a standard software service offered on any Windows based operating system. When connected to a PC running the Hyper Terminal service, the M-Cal will automatically send bump test and calibration reports to Hyper Terminal where they can be saved in as a text file and printed.   When connecting the M-Cal to a PC, a serial NULL Modem cable must be used. Hyper Terminal must be up and running prior to connecting the M-Cal to the PC.

To view the M-Cal data in Hyper Terminal choose the COM port you are connecting to and set the port settings to the following:

Baud Rate: 9600
Data Bits: 8
Parity None
Stop Bits: 1
Flow Control: Hardware or None
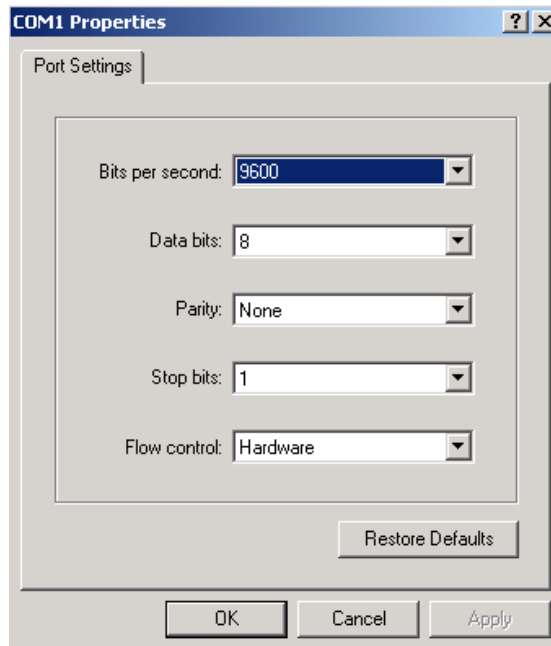
Under the Hyper Terminal menu, select the Properties Tab, and make sure that the Emulation type and terminal ID are set to ANSI.
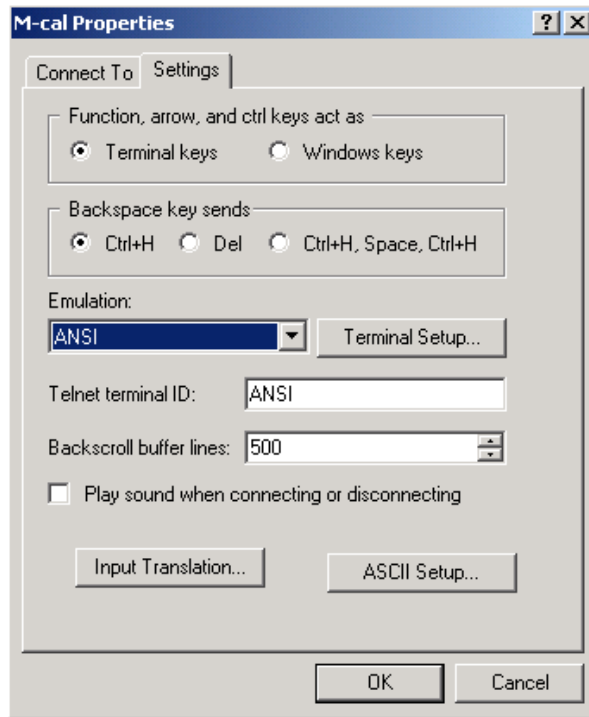
The last step in setting up Hyper Terminal is to specify where to save the bump test and calibration reports. Under the "Transfer" drop down menu, select "Capture Text". The Capture Text box will appear. This is where you specify the file name and location where the report will be stored.
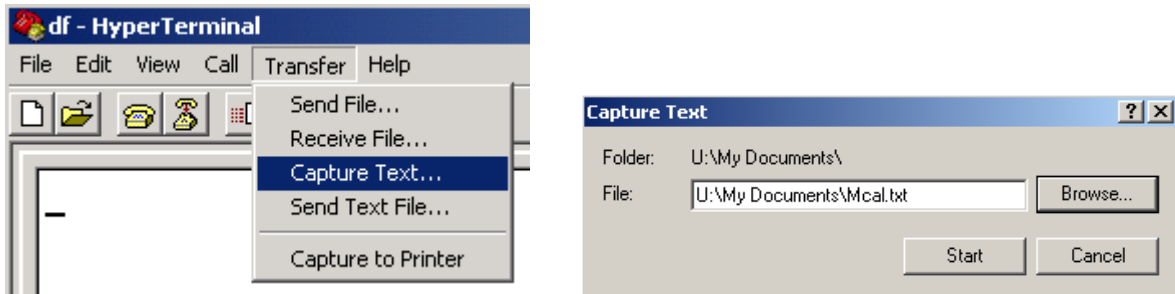
Once Hyper Terminal is set-up, it is ready to start receiving the bump and calibration certificate information from the M-Cal. Connect the M-Cal using a **NULL Modem cable** to the proper COM port of the PC. Once connected, all information that is stored in the internal memory of the M-Cal will be downloaded to the file specified. If the BUMP or CALIBRATE button is pressed, the M-Cal will perform the proper function. Once complete, a bump or calibration certificate will be generated and sent to Hyper Terminal. The text is captured as a serial text stream in the file previously specified.

Once all bump test and calibrations are completed, select "Transfer" from the drop down menu, and then "Stop" from the "Capture Text" window.   The text file will contain all the calibration and bump information.

NOTE: To save each calibration and bump test into its own file, independent files must be specified before each test is performed.
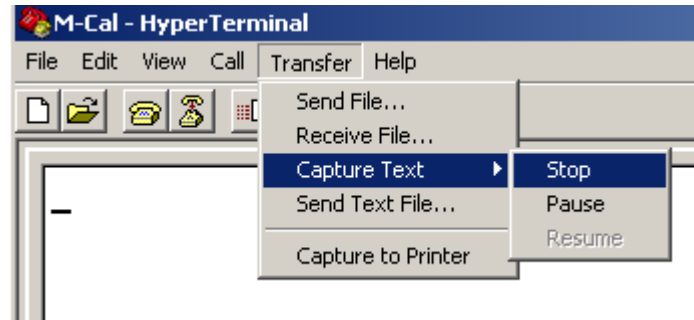
When each text file is opened, the calibration and bump test information will be in a serial ASCII stream. When printed, this material will be formatted as it would be if printed on the serial data printer.

Example Bump Test Report:

Industrial Scientific Corp.

M40   M-Cal   v1.X.X

Serial Number: 1111111111
1-10-03 21:17
Bump: PASS
Sensor 1: CO PASS
Gas Reading : 100
Sensor 2: H2S PASS
Gas Reading : 24
Sensor 3: O2   PASS
Gas Reading : 19.0
Sensor 4: LEL PASS
Gas Reading : 25

Service Tech _____
Lot Number _____

Performance Specifications:

Operating Temperature Range: 0ºC to +50ºC
Storage Temperature: -20ºC to +60ºC
Operating Humidity Range: 0 – 80% RH up to 31ºC,
                                                   decreasing linearly to 50% RH at 40ºC

External Power Supply Ratings:
         Supply voltage: 110-240 VAC
         Frequency range: 50/60 Hz
         Current Rating: 1.5A

CAUTION: Equipment is rated for indoor use only. Use only indoors at altitudes below 2000 meters (6000 feet).

Installation Category #2
Pollution Degree 2

NOTE: The M-Cal is designed and intended for indoor use only. After installation, the M-Cal should be cleaned only with a soft cloth. Do not use solvents or other liquids to clean the M-Cal. Upon visual inspection if there is any damage to the equipment please consult the factory for service and repair information.

NOTE: Per 30 CFR 75.320(b), the M-Cal bump Station tests for oxygen deficiency ….. of MSHA approved oxygen detectors compatitible with the CalPlus……that can detect 19.5 percent oxygen with an accuracy of ±0.5 percent

The M-Cal has an internal pump that controls the flow of gas being delivered to the system. As a result of the internal pump, a demand flow regulator must be used in conjunction with this calibration and bump test station.

CAUTION: Compressed gas cylinders and their contents may present specific hazards to the user. Use only in a well ventilated area. Use only in accordance with the instructions and warnings as marked on the cylinder and the appropriate Material Safety Data Sheets.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Operation of this equipment outside the intended use stated by the manufacturer may cause impairment. For questions concerning the operation and maintenance of this equipment, consult the factory.

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